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TREAARSEXPEDITIONEN TIL CHRISTIAN DEN X's LAND 1931-34

UNDER LEDELSE AF LAUGE KOCH

ON *ERIOPHORUM CALLITRIX* CHAM.
IN GREENLAND

BY

GUNNAR SEIDENFADEN AND THORV. SØRENSEN

WITH 4 PLATES AND 5 FIGURES IN THE TEXT

KØBENHAVN

C. A. REITZELS FORLAG

BIANCO LUNOS BOGTRYKKERIA/S

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INTRODUCTION

During the Danish East Greenland Expedition in 1929 under the leadership of Dr. LAUGE KOCH an *Eriophorum* species was found in some few localities in about 73°30' N. lat. which, though from a distance it was rather like the common *Eriophorum Scheuchzeri* HOPPE, attracted attention because it grew in small tufts and not scattered like *E. Scheuchzeri* and because on the whole it was more insignificant than the last-mentioned species. After the return of the expedition it was determined by the late Professor OSTENFELD (39) as *E. callitrix* CHAM. The following year the plant was likewise found in about the same districts (40).

In the year 1932 VAAGE published a paper (51) concerning the investigations of the Norwegian expeditions in 1929 and 1930 in the same regions. In this paper the author records the occurrence of *Eriophorum opacum* (BJØRNSTR.) FERNALD in fourteen localities between 72° and 75° N. lat. This plant had not been found either in 1929, 1930, or during the investigations of the Danish wintering botanists in 1931—32, so we thought that the determination of our *Eriophorum*-plants must be erroneous. This was evidently also the opinion of VAAGE, who simply says in his paper (51, p. 64): "About the 10th it [*E. opacum*] was found in about the same place by SEIDENFADEN"; we do not know whether he has seen the Danish specimens.

As, however, *Eriophorum callitrix* CHAM. is a very interesting species as to its geographical distribution, we decided to undertake a revision of the determination made by OSTENFELD, our material having now been augmented by the collections made by the botanists wintering in East Greenland in 1931—32.

A comparison with the material of *Eriophorum opacum* (BJØRNSTR.) FERNALD and *Eriophorum callitrix* CHAM. in the Botanical Museum of Copenhagen has been made, and this added to the excellent description given by FERNALD (9, p. 203 ff.) made us realise that our specimen was really the *Eriophorum callitrix* of CHAMISSE (31).

Our examination of the two species convinced us that the confusion of *E. callitrix* with *E. opacum* and other species has been fairly common among botanical authors, especially in former times, and for this reason we decided to give a more detailed description of the two species and to point out the differences between them. For this purpose we undertook a revision of the material in the Botanical Museum of Copenhagen, and as it seemed strange to us that none of the former expeditions to Arctic regions should have brought back any samples of this species, one of us visited the botanical museums at Uppsala, Stockholm, and Oslo, where the greater part of the European collections, except those of the recent Russian expeditions, are kept. During the stay at Oslo it became evident that VAAGE's determinations, too, were in reality based on the usual confusion of *E. opacum* with *E. callitrix*. However, in the other museums, too, interesting observations were made which have brought to light new data as to the distribution of the species, for which reason we have added to our systematical characterisation of the species a brief statement of what we have been able to find out about the distribution of the two species within the circumpolar zone.

The present account appears as one of a series of publications which owe their origin to the Danish three year expedition to East Greenland in the years 1931—34. For the facilities afforded to us for carrying out our work our warmest thanks are due to the leader of the expedition, Dr. LAUGE KOCH. At the foreign museums we have been received and helped in the best way, and for this we are indebted to Dr. HARRY SMITH and Dr. G. ALM, Uppsala, Professor SAMUELSSON, Stockholm, and Professor HOLMBOE and Dr. LID, Oslo.

Of considerable value to us has been the aid given by Professor TOLMACHEW at Leningrad through written information. At present, when practically all Russian scientific papers are printed in Russian, it is extremely difficult for foreigners to obtain reliable information about the vast tracts of land along the northern coast of Sibiria. We therefore wish to express our most cordial thanks to Professor TOLMACHEW for his kind help.

Pls. 3 and 4 have been reproduced after photographs taken by Mr. KAJ GRAM, to whom we are indebted for his valuable and kind assistance.

Botanical Museum, Copenhagen, February, 1933.

SYSTEMATICAL REMARKS ON THE TWO SPECIES

As stated in the introduction, ever since CHAMISSE (31) in 1831 erected the species *Eriophorum callitrix* on the basis of the collections made by MERTENS on the St. Lorenz Island in the Bering Strait, there has been some difference of opinion among botanists as to the identification of this species. These difficulties began in 1857 when ANDERSON (2) advanced the opinion that the *Eriophorum* species, described the year before by BJØRNSTRØM (4) as *E. vaginatum* L. var. *opacum*, was identifiable with CHAMISSE's above-mentioned species. This view was adopted by numerous Scandinavian authors, and the name *E. callitrix* for *E. vaginatum* var. *opacum* BJØRNSTR. was still employed as late as 1905, when FERNALD (7) showed that we were here concerned with two species, viz. BJØRNSTRØM's slender plant, occurring principally in Scandinavia, (which, however, differed rather considerably from *E. vaginatum*, and for this reason received the name *E. opacum* (BJØRNSTR.) FERNALD), and a smaller, more *E. vaginatum*-like form, which had, in the course of time, been described under various names, but which, in FERNALD's opinion, was justly entitled to the name of *E. callitrix* CHAM.

On an excursion to New Foundland in 1925, however, FERNALD found, in company with the plant he had called *E. callitrix*, an *Eriophorum* species unknown to him. On close inspection this species proved to correspond exactly to CHAMISSE's characterisation of the species and the specimens figured, and FERNALD therefore concluded (9) that this new plant was identical with *E. callitrix* CHAM., while for the plant that had for the past 20 years borne this name, he proposed the name *Eriophorum spissum*.

We have thought it appropriate, in this paper, to disregard *Eriophorum spissum* FERNALD, which does not occur either in Greenland or in Scandinavia, and in the following we shall confine ourselves to the discussion of the two species *E. callitrix* CHAM. and *E. opacum* (BJØRNSTR.) FERNALD, the two species most frequently confounded by Scandinavian botanists.

In his treatise (9, p. 206 et seq.) FERNALD has given an excellent key, by means of which it is comparatively easy to distinguish the two species. We have made as thorough an investigation as our material allowed of, and our results agree in all essentials with those of FERNALD. Below the characters of importance in the distinction of the species are given.

1) The most conspicuous difference is to be found in the colour of the wool. While this is bright white in *Eriophorum callitrix*, in *E. opacum* it has a sordid-reddish tinge never found in *E. callitrix*.

2) A fairly good practical mark of identification is the length of the culm and the whole habitus of the plant. While the culm is about 20 cm long in *E. callitrix*, it attains a length of about 40 cm in the Arctic specimens of *E. opacum*. We have measured about 100 culms of full-grown individuals, whose length proved to vary from 8 to 25 cm (average length 16.96) with the extremes of 6 cm for the shortest and 28 cm for the longest specimen. In contrast to this, the length of the culm of *E. opacum* ranges from 30 to 50 cm (average length 41.75) with the extremes 17 cm and 71 cm. Fifty specimens of this species have been examined, all collected in Arctic regions, and a superficial inspection of the Scandinavian forms would seem to show that in these latter the culm is still longer. It should further be noted that in *E. opacum* the culm is considerably more slender and more flexible than in *E. callitrix*.

3) The length of the leaf also differs somewhat in the two species. While the rigid leaves of *E. callitrix* only attain a length of about one-third of that of the culm, at any rate never exceed half that length, the more flexible filiform leaves in *E. opacum* are always about half as long as the culm or even more. This difference has presumably some connection with the conditions prevailing in the localities of the plants, which will be briefly discussed below.

4) A good distinguishing character is the number and position of the sheaths on the culm proper. Of about 140 culms of *E. callitrix* 72 per cent. had only one sheath, the others two sheaths, but, what was of particular importance, in by far the greater part of the culms (94 per cent.) the sheath was situated below the middle (cf. plates 1 and 3).

Eriophorum opacum, on the contrary, has nearly always (82 per cent. of the specimens examined) two sheaths, quite exceptionally three, and even in those rare cases when the specimen had only one sheath, this was situated above the middle of the culm. In altogether 87 per cent. of the plants examined the uppermost sheath was situated above the middle of the culm (cf. plates 2 and 4).

5) FERNALD (9, p. 207) mentions as a distinguishing character that in *E. callitrix* this sheath always has a blade, while such a blade is lacking in *E. opacum*. It is sometimes difficult to decide whether or not there

is a blade. However, in an examination of our material we came to the result that about 76 per cent. of *E. opacum* lacked a blade, while a larger or smaller blade was distinguishable in all specimens of *E. callitrix* (see figs. 1 and 2).

6) A character rather commonly found, and likewise pointed out by FERNALD (9, p. 207), is the more or less inflated, urceolate shape of the sheath nearly always found in *Eriophorum callitrix*, while in *E. opacum* it is always more regularly infundibular or closely surrounding the culm. In figs. 1 and 2 some typical examples are shown. It should, however, be noted that the character in question may be rather difficult to ascertain, especially in herbarium material (cf. pls. 3—4).

7) Finally there may be some difference in the fruits of the two species, though such a difference could not be established with certainty on the basis of the very scanty material at our disposal. Our observations tend to show that there is some difference both as regards size, colour, and shape. The length of the fruit of *E. callitrix* ranges from 1.8 to 2.3 mm, most frequently it is about 2 mm. The measured fruits of *E. opacum* had a length of 2—2.5 mm, in most cases approaching the upper limit. Thus there seems to be some difference in size between the fruits of the two species. As regards the colour, our material is rather varyable. It seems to be the rule, however, that the fruits of *E. opacum* are light reddish-brown, while those of *E. callitrix* are generally of a chocolate- or blackish-brown colour (a character in which *E. callitrix* approaches *E. spissum* FERNALD, whose fruits are almost black). The difference in shape is most distinctly displayed in the distal end of the fruit and in cross-section. It would seem as if the fruit of *E. opacum* is somewhat tapering without any marked beak, while in *E. callitrix*, according to our view, there is a true though somewhat diminutive beak. Thus in *E. callitrix* the shape of the fruit is rather obovoid, while in *E. opacum* it may be termed elipsoid-obovoid. In cross-section the fruit of *E. opacum* is often rhomboid, while that of *E. callitrix* is equilaterally triangular.

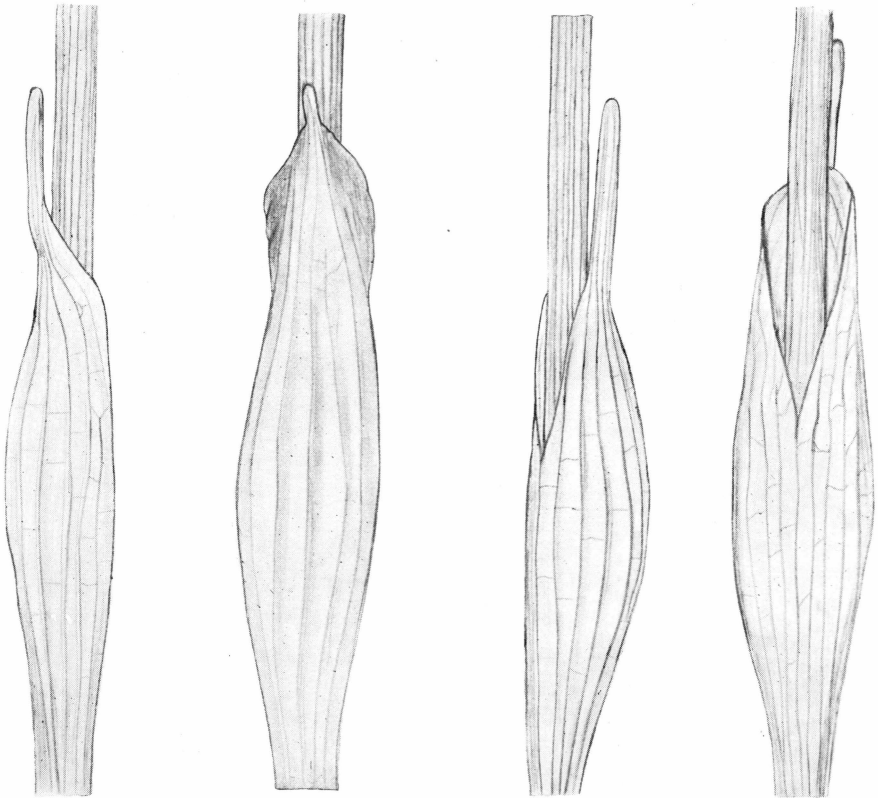
The authors have sought in vain for further marks of difference between the two species. Stomata and other anatomical details show no difference, nor does the outer morphology of the wool or the bracts furnish unmistakable distinctive characters. As mentioned by FERNALD (9, p. 201 et seq.), conditions as regards the membranous margin and the nervation of the sheaths seem to be very doubtful; this is, at any rate, the case with the herbarium specimens which have been at our disposal.

Hence a brief characterisation of the two species must in our opinion be as follows:—

Eriophorum callitrix CHAM.

(Fig. 1; pls. 1 and 3).

in C. A. MEYER: Mem. Sav. Etrang. Acad. St. Petersb. t. 2 (1831) p. 203 (31), — FERNALD in *Rhodora* 1925 p. 203 (9), — SEIDENFADEN, Medd. om Grønl. LXXIV 1930 p. 374 (39), — SEIDENFADEN, Medd. om Grønl. Bd. 87 No. 2, 1931, p. 15, 20 (40). — Non *Eriophorum callitrix* by Scandinavian authors, e. g. OSTENFELD, *Flora arctica* 1902, p. 41 (in part) (33), — HARTMAN, 1879 (14), — NEUMAN, 1901, p. 678

Fig. 1. Cauline sheaths of *Eriophorum callitrix*. ($\times 5$).

(32), — HJELT, pars II, 1892, p. 208 [*callitrix*] (15) (dealing with *Eriophorum opacum* (BJØRNSTR.) FERNALD). — Non *Eriophorum callitrix* by FERNALD, 1905, p. 85 (7) in part), — FERNALD, 1925, p. 266 (8) (in part) (dealing with *Eriophorum spissum* FERNALD).

A loosely caespitose plant without stolons and with comparatively few upright rather rigid obtuse-angled glabrous culms, of a length of 8—25 cm. The culms bear one sheath (very rarely two) always situated below the middle of the culm, frequently at the base. Only very rarely (i. e. in some of the specimens with two sheaths) is the upper sheath situated about the middle of the culm or slightly above.

The sheaths proper are more or less, slightly but always distinctly, inflated, and are furnished with a large number of equally strong nerves,

converging towards the apex into a subulate upright bluntly triangular blade 1—15 mm long (rarely more). FERNALD (9, p. 207) states that the nerves extend nearly to the margin. However, this character appears to be of little value, since a lead-coloured membranous margin of rather varying width seems always to be present.

In a fresh condition the leaves are of a slight bluish-green colour,

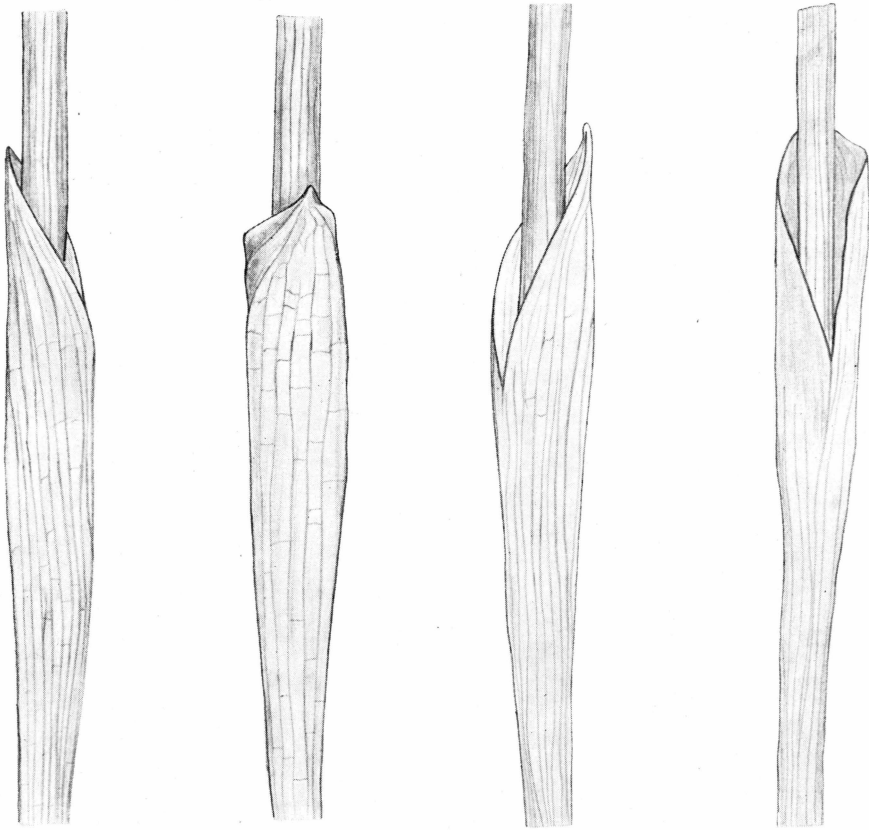


Fig. 2. Cauline sheaths of *Eriophorum opacum* ($\times 5$).

and of a length of one third to one half that of the culm. They are rigid, trigonous-channelled, glabrous, and broadly sheathing at the base.

Each culm bears a single upright spike. The mature rachis measures 8—12 mm, with pits opening obliquely upwards. The mature head is turbinate-obovoid, with a diameter of about 25—35 mm and a height of 20—27 mm.

The scales are very conspicuous, the outermost sterile ones seeming to enclose the spike infundibularly. They are of a uniform dull black colour, the outermost scale is broadly ovoid, forming like a sheath, and larger than the other scales.

The anthers have a length of 0,7—1,0 mm.

The cariopses are obovoid, with a minute beak, 1.8 to 2.3 mm long. In cross-section they are equilaterally triangular. The colour ranges from chocolate-brown to blackish-brown.

The bristles are shining white.

The plant occurs in Greenland in moving-soil-marshes which in the summer, as a rule, are subjected to a more or less intense drought. The investigations of the authors have proved that it is most frequent in localities where the soil is rather rich in lime, even if they have encountered it, though more rarely, on gneissic ground, too. As to this point we agree with FERNALD, who states (9, p. 208) that in the locality at the south side of the Strait of Belle Isle, New Foundland, it occurs in "peaty margins of pools in limestone barrens". The St. Lorenz Island, where the species was first found by MERTENS, is indicated on geological maps as being entirely made up of Quaternary deposits, whereas on the mainland just opposite, at Port Clarence, another locality of the species (see below p. 17), we find calcareous Mesozoic deposits. As regards the locality at Kumach Sur (see below p. 17) the whole lower course of the Lena cuts through Mesozoic deposits, chiefly boreal Jurassic, and thus this locality is likewise made up of calcareous rocks.

For the distribution of the species, see p. 14.

Eriophorum opacum (BJØRNSTR.) FERNALD.

FERNALD 1905, p. 85 (7), — BRITTON and BROWN, Ill. Fl. N. V. S. Can. & Br. Pos. vol. 1, 1913 p. 324 (50), — LINDMAN 1926 p. 126 (26), — HOLMBERG 1926 p. 293 (16). — *Eriophorum vaginatum* var. *opacum* BJØRNSTRØM: Grunddr. af Piteå Lappmarks Växtfysiologi 1859 p. 35 (4), — FRIES, Bot. Not. 1857 p. 11 (11). — *Eriophorum callitrix* ANDERSON Bot. Not. 1857 p. 60 (2), — FRIES, Bot. Not. 1858 p. 63 (12), — BLYTT, Norges Flora 1861, p. 270 (5), 1903, p. 181 [*callitrix*] (00), — LIEBMANN & LANGE, Fl. Danica Suppl. pl. 122, 1874 [*callitrix*] (25), — HARTMAN, Skandnaviens Flora 11. Edit. 1879, p. 450 (14), — KJELMANN, Vega Exp. iaktt. 1882, I, p. 316, 564, II, p. 58 (19, 20, 21), — PALLA, Bot. Zeit. liv. ab. I, 1896, p. 148, 151 (34), — FEILDEN, Journ. Bot. 1898, p. 21 (6), — OSTENFELD, Flora arctica 1902, p. 41 (33). — *Eriophorum vaginatum*, MACOUN, Cat. Can. Pl. II, 1888, p. 103 (28). — *Eriophorum vaginatum* β HOOKER, Fl. Bor. Am. II, 1840, p. 231 (17)¹⁾.

Loosely caespitose, without stolons, forming small tufts with relatively few upright slender culms, which attain a length of 30—60 cm. In Arctic regions the average height is about 40 cm, in the more southerly parts of the area of distribution of the species generally somewhat higher, probably about 55 cm.

The culms are terete and smooth, bearing two (occasionally three) sheaths, the uppermost of which is nearly always situated above the middle of the culm. The sheaths proper closely surround the culm or, in the upper part, are infundibularly widened but not actually inflated.

¹⁾ See Appendix p. 24.

The sheath contains a rather large number of equally strong nerves, often weakening towards the apex, which lends to the margin a somewhat membranous aspect, but the margin proper of the membrane is not more prominent than in *Eriophorum callitrix* CHAM. A greater difference is presented by the character of the blade, in that the sheath of *Eriophorum opacum* lacks a blade. It should be mentioned here that according to LINDMAN (26, p. 120) the uppermost sheath has often a short blade. As stated above, the authors have examined a large number of individuals, all of them from Arctic regions, and as a rule the blade was lacking. Thus it seems quite possible that a blade may develop in individuals in more southerly tracts. FERNALD (7, p. 85) states that the cauline sheaths have often a short blade. He seems, however, to have changed his opinion later, for in his next treatise (9, p. 207) he says that the sheaths are bladeless.

The leaves are filiform, soft, and smooth, and their length about half that of the culm.

Each culm bears a single upright spike. The mature rachis has a length of about 10 mm with pits opening obliquely upward. The mature head is turbinate obovoid with a diameter of about 20—30 mm and a height of about 15—20 mm, in the Scandinavian specimens, however, as a rule somewhat larger.

The scales are as in *Eriophorum callitrix*, but of a paler colour.

The anthers are 1.0—1.5 mm long.

The cariopses are elipsoid-obovate without a distinctly differentiated beak, in cross-section as a rule flatly rhomboid, sometimes, however, more or less triangular.

The bristles are sordid-white with a remarkable reddish tint.

Judging from the herbarium specimens the species seems mainly to grow on wetter ground than *Eriophorum callitrix* CHAM.

As to the distribution of the species, see below p. 19.

GEOGRAPHICAL DISTRIBUTION

A. *Eriophorum callitrix* CHAM.

In 1831 CHAMISSE (31) erected his species on the basis of individuals collected by MERTENS on the St. Lorenz Island in the Bering Strait.

Through a number of years this locality was the only known locality of the species. This was the cause of the confusion prevailing during a long period, since more or less deviating specimens from other Arctic localities were referred to this species. In 1925 FERNALD (9) summed up the various views concerning *Eriophorum callitrix* through the times (cf. also above p. 7). The publication of his treatise was due to the fact that on an excursion in 1925 FERNALD had found an *Eriophorum* species that agreed exactly with CHAMISSE's description (31, p. 203), but deviated in several characters from the species usually designated *Eriophorum callitrix*. This locality, the south coast of the Strait of Belle Isle, New Foundland, where it was observed in a large number of localities, frequently in company with the related species *Eriophorum opacum* (BJØRNSTR.) FERNALD and *Eriophorum spissum* FERNALD, thus marks the second area of *Eriophorum callitrix*.

As mentioned in the introduction, it was subsequently found by SEIDENFADEN, in 1929 (39) and 1930 (40), on the east coast of Greenland, and has later been found in a large number of localities in the area between 73° and 75° N. lat., partly in 1931—32 by the wintering botanists GELTING and THORV. SØRENSEN, partly in the summers of 1929 and 1930 by VAAGE (57), who further states that the species was found in 1927 by Norwegian hunters. There is, however, some doubt as to the locality; VAAGE (l. c. p. 64) takes it to be the Sopbukta on the south coast of Clavering Island.

A list of the localities will be found below. (S) refers to SEIDENFADEN's find in 1929—30, (V) to the find of VAAGE in the same years, (G) to GELTING's in 1931—32, (K) and (TS) to the Danish botanists KØIE's in 1932 and SØRENSEN's in 1931—32.

1. At the Eskimo settlement, Mt. Herschell..... lat. 74°16' (G)
2. Rust Plateau, Clavering Island lat. 74°14' (G)
3. Granat River, Clavering Island lat. 74°10' (G)
4. Sopbukta, Clavering Island lat. 74°10' (V)
5. Eskimonæs, Clavering Island lat. 74°07' (G)
6. Eskimobugt, Clavering Island lat. 74°07' (G)
7. Baadsted, Clavering Island lat. 74°07' (G)
8. Dødemandsbugt, Clavering Island lat. 74°08' (G)
9. Cape Stosch..... lat. 74°05' (V,K)
10. The eastern side of the outer part of Loch Fyne lat. 74°00' (V)
11. The southern edge of Wordie Glacier, Hudson
Land..... lat. 74°07' (S)
12. Mt. Anker, Hudson Land..... lat. 77°38' (S, V)
13. West of Mt. Høgbom lat. 73°37' (V)
14. Gauss Peninsula S. of Mt. Wiman..... lat. 73°26' (G)
15. Myggbukta, Mackenzie Bay lat. 73°28' (V)
16. Blomsterbugt, Ymer Island lat. 73°20' (S)
17. Carl Jacobsen Bay, Ymer Island..... lat. 73°10' (TS)
18. Botaniker Bay, Ymer Island lat. 73°10' (TS)
19. Sanddal, Geographical Society Island..... lat. 73°03' (V)
20. 15 km W. of No. 19, Geogr. Soc. Isl. lat. 73°05' (V)
21. 5 km W. of Husbukta, South coast of Geogra-
phical Society Island..... lat. 72°49' (V)
22. 15 km W. of Husbukta, South coast of Geogra-
phical Society Island lat. 72°49' (V)
23. Marie Island lat. 72°57' (V)
24. Cape Elisabeth, Ella Island lat. 72°73' (S, V)
25. East side of Ella Island lat. 72°52' (TS)
26. Cape Oswald, Ella Island lat. 72°53' (TS)
27. Cape Hedlund, Kempe Fjord lat. 72°45' (TS)
28. Dickson Fjord lat. 72°52' (V)
29. Cape Petersens, Segelsällskapet Fjord..... lat. 72°27' (V)

The localities in Greenland have been marked on the map in p. 16.

The localities mentioned above represent all our knowledge of the distribution of *Eriophorum callitrix*, obtained from the recent Danish investigations and contained in the available literature.

It seemed singular to us, however, that expeditions that had visited regions where the species occurs, should not have brought back any specimens of it. We supposed that the individuals that might have been collected had been referred to other species by erroneous identification. We therefore examined several closely related species of *Eriophorum* kept in the botanical museums at Copenhagen, Uppsala, Stockholm, and

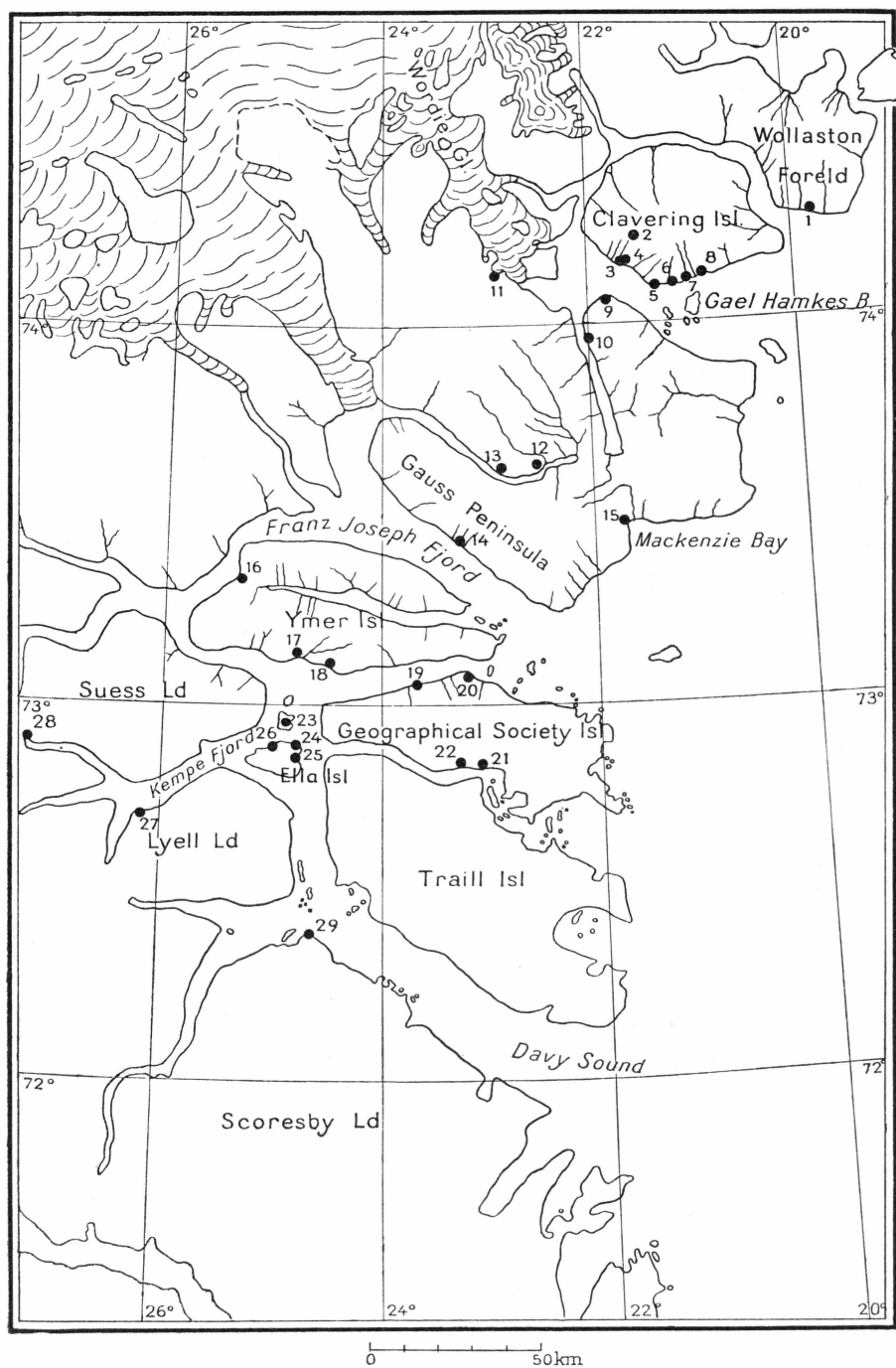


Fig. 3. Map of the East Greenland localities of *Eriophorum callitrix*.

Oslo, viz. *Eriophorum intercedens* LINDB. FILS, *E. opacum* (BJØRNSTR.) FERNALD, *E. russeolum* FR., *E. Scheuchzeri* HOPPE, *E. spissum* FERNALD, and *E. vaginatum* L.

We did not succeed in finding any specimens of *Eriophorum callitrix* in the Arctic Herbarium of Copenhagen, nor was this to be expected, since as late as 1926 OSTENFELD had gone through the whole collection and made the corrections necessitated by FERNALD's treatise (9) published in 1925. However, by looking through part of the material left by OSTENFELD we found a collection of *Eriophorum* from Baffin Island. The greater part of this material was referable to *Eriophorum spissum* FERN., but even OSTENFELD was aware that the specimens from three localities were *E. callitrix*.

On inspecting the material of the Botanical Museum of Uppsala several specimens were found, collected by the Vega Expedition and determined in 1922 by G. SAMUELSSON as *E. opacum*. Among these some specimens from Port Clarence in Alaska were referable to *E. callitrix*, and further we referred some peculiar forms from the St. Lawrence Bay, Chukchi Peninsula, to this species, though with some doubt; with their nearly horizontal pits these forms seem to be transitional between this species and *E. spissum* FERN.

An examination of the material kept in the Arctic Herbarium of the Botanical Museum of Stockholm proved that this, too, contained specimens of the plants collected on the Vega Expedition at Port Clarence, determined in 1925 by N. BLOMGREN as *Eriophorum opacum* (BJØRNSTR.) FERNALD. In this case also there is no doubt that the plant is identical with *Eriophorum callitrix* CHAM.

Finally, the Stockholm herbarium contained several specimens collected in 1898 by N. H. NIELSSON, marked "Sibiria oblastia, Kumach Sur". There can be no doubt that these forms, too, should be referred to *Eriophorum callitrix*.

Apart from the plants collected by VAAGE (51) and mentioned above, the Botanical Museum of Oslo contained no new material of the species.

Since, however, we supposed that the Russian museums might contain some specimens from Sibiria, we asked Dr. TOLMATSCHEW, Leningrad, to furnish us with possible information about the occurrence of the species in this region.

Dr. TOLMATSCHEW states as follows: "Ich habe überhaupt unzweideutige *E. callitrix* nur als von MERTENS auf der St. Lawrence-Insel gesammelt aufgefunden. Dr. JUSEPCZUK meint, es sei eine dem Bering-meergebiete eigene Art, die jedenfalls nicht weit nach Westen verbreitet sein kann.

Obwohl Dr. JUZEPCZUK es für entschieden hält, dass in Jakutien und westlich davon kein *E. callitrix* vorkommt, darf ich nicht versäumen, dass die von STAROKADOMSKI an der Nordküste Jakutiens, von BIRKENHOF an der Indigirka und von I. P. TOLMATSCHEW am Jessei-See (im Chatanga-Becken) gesammelten Pflanzen doch dem *E. callitrix* sehr

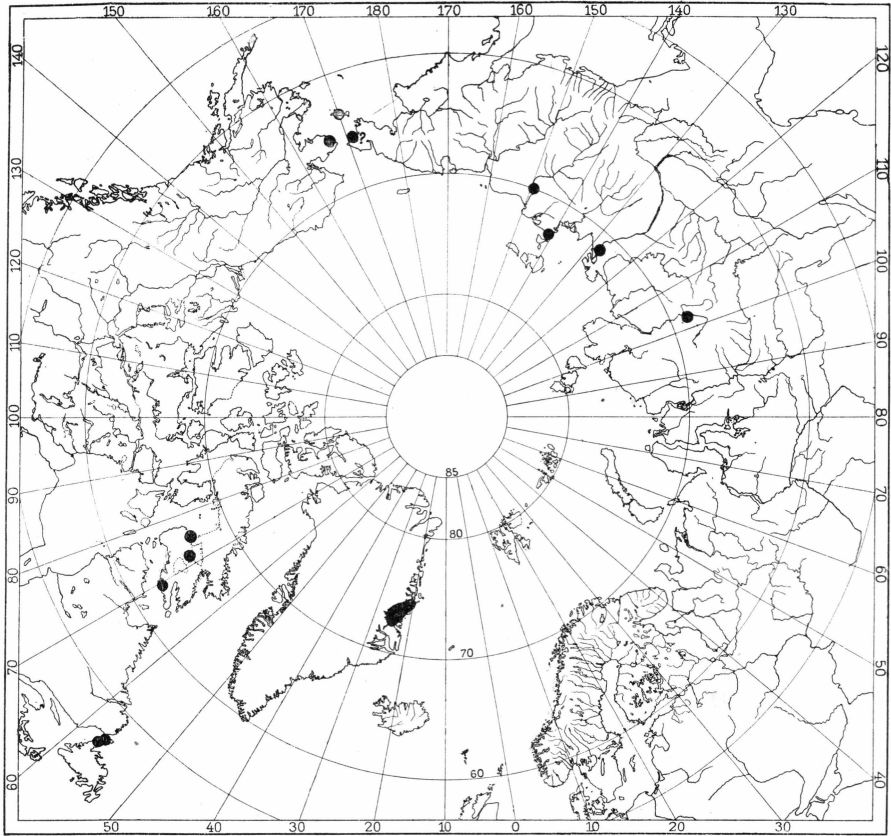


Fig. 4. The geographical distribution of *Eriophorum callitrix* CHAM.

nahe stehen und mit dem reichlich vorliegenden *E. opacum* vom unteren Jenissei nicht identisch sind."

Thus we can further add three localities of the species in Siberia, even if TOLMATSCHEW is not quite certain about its identity. There is, of course, a possibility that the plants mentioned by TOLMATSCHEW are identical with the above-mentioned specimen from St. Lawrence Bay (Asia), which seems to differ somewhat from the other forms of *E. callitrix*, but are still more closely related to these than to any other species known by us.

Thus at present the following localities of *Eriophorum callitrix* CHAM.

are known (a point of exclamation indicates that we have seen the particular specimen):

Arctic America:

East Greenland: From 72°27' to 74°22' N. lat.!. — Baffin Land: Lake Harbour! (leg. MALTE 1927); Koadjuak River! (leg. DEWEY SOPER

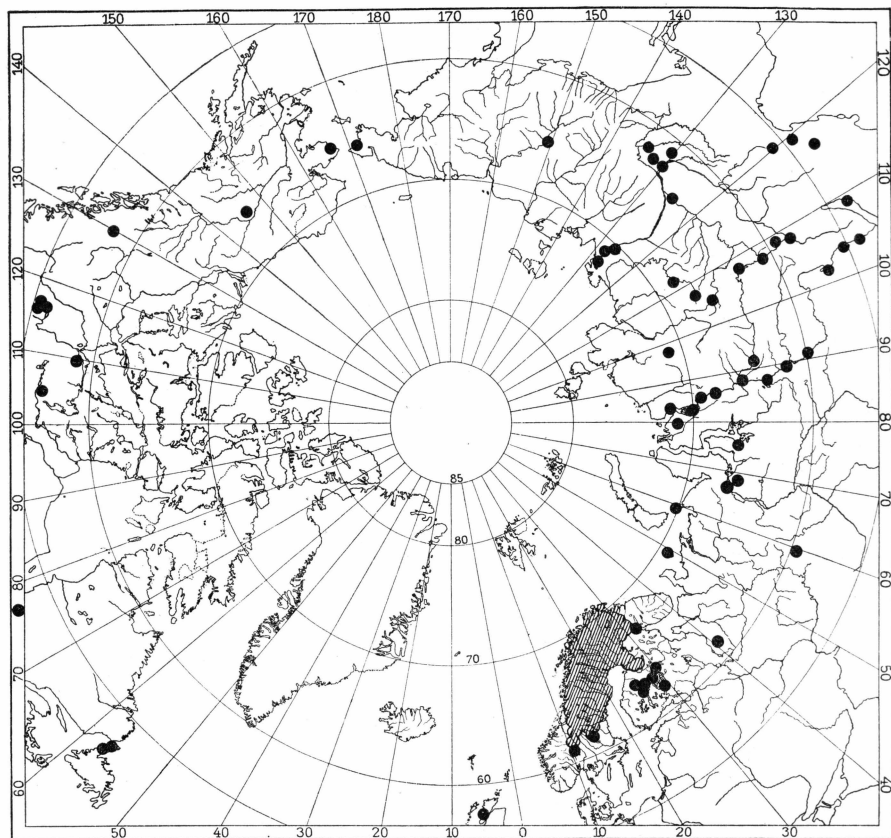


Fig. 5. The geographical distribution of *Eriophorum opacum* (BJØRNSTR.) FERNALD.

1925); Nettling Lake! (leg. DEWEY SOPER 1925). — New Foundland: On the south side of the Strait of Belle Isle!. — Alaska: Port Clarence! (65°05' N. lat., 156° E. long.); — Bering Strait: St. Lorenz Island. (The specimens from the last-mentioned locality is found in the Museum of the Botanical Institute in Leningrad).

Arctic Asia:

Chukchi Peninsula: St. Lawrence Bay! (cf. p. 17); — Indigirka River: Ossinino (leg. BIRKENHOF); — Jakutia: Cape Swiatoi

Noss (leg. STAROKADOMSKY); — Lena River: Kumach Sur! (leg. NIELSSON); — Chatanga: Jessei Lake (leg. I. P. TOLMATSCHEW).

The distribution of the species within the circumpolar zone is shown in fig. 4.

FERNALD (9, p. 205), after finding *Eriophorum callitrix* CHAM. at the Strait of Belle Isle, New Foundland, includes it in his list of plants (8, p. 275), which divide their ranges between the region of the Gulf of St. Lawrence (America) and the Bering Sea area.

In view of the information given above as to the occurrence of the species it will be of great interest to examine whether the species actually, as maintained by FERNALD, is still to be referred to the category of plants, whose discontinuous area must be explained as relict occurrences in non-glaciated areas during the last glaciation. In our opinion the new localities strongly support this assumption, especially when viewed in connection with the most recent investigations in Siberia by ANTEVS and TOLMATSCHEW.

The authors reserve the right to return, in a later paper, to this interesting problem in connection with an investigation of the distribution of a number of other East Greenland species.

B. *Eriophorum opacum* (BJØRNSTR.) FERNALD.

Even if the area of distribution of *Eriophorum opacum* falls outside Greenland, where, judging from careful examinations of the various herbariums, it does not seem to occur, we have, by comparing the two species with each other, collected so many data concerning the distribution of this species that we have thought it appropriate that they should be published, all the more so since the distribution of this species is somewhat peculiar.

The difficulties encountered during the investigation are due to the circumstance that we have not considered the statements in the literature as regards the distribution of the species as fully reliable, at any rate not the information contained in papers published before the difference between the three species, *Eriophorum callitrix* CHAM., *Eriophorum spissum* FERNALD, and *Eriophorum opacum* (BJØRNSTR.) FERNALD, had been ascertained. We therefore dared not make use of the literature published before 1925. If then we compare our own investigations in the four museums mentioned above with the recent literature, we shall have the following distribution of the species (cf. fig. 5):—

Arctic America:

Alaska: Port Clarence!; Ontario: Hastings County; Saskatchewan: North of Prince Albert; Athabasca: Clearwater River; Alberta: Canmore, Banff, Lake Louise; Yukon: Hunker creek, Independence

Creek, Five Finger Rapids!; British Columbia: Stewart's Lake, Fraser River; New Foundland: Strait of Belle Isle; North West Terr.: Churchill!.

Among the above-mentioned localities some have not been published before, the specimens being found under other names in the Scandinavian herbariums. These are marked with a!, the others are taken from FERNALD (7,9).

Europe:

Iceland and Jan Mayen: Absent (13, 42); Spitzbergen: Absent (1, 52); Scotland: Kinlochewe in Loch Maree (57°37' N. lat., 5°15' W. long.) (10, p. 9); Norway: From North and South Varanger southwards to Dovre: rather common!; Hedmark: Alvdal!; Oppland!; Aurdal!; Torpen!; Sweden: From Torne Lappmark to Pite Lappmark: In many localities!; Lycksele Lappmark: Malå, Lycksele; Åsele Lappmark: Rather common!; Jämtland: In 10—20 localities!; Härjedalen: Funäsdal, Medskogen, Lillhärdal; In the coast region from Norrbotttn to Ångermannland: In many localities!; Medelpad: Ångel, Amundsjö!, Grannsjö!, Edsele!, Parteboda!, Torp!; Hälsingeland: Loos!; Finland: Enare Lappmark to Norra Österbotttn: In several places!; Kajana-Österbotttn: In several places!; Norra Tavastland: Kivijärvi, Viitasaari, Saarijärvi; Norra Savolaks: Nilsä; Norra Karelen: Nurmest; Ladoga Karelen: Hiisijärvi in Salmis.

The statements of localities from Scandinavia have in part been taken from HOLMBERG (16) and HJELT (15). To a great extent we have seen specimens from the localities mentioned, in which case we have marked the localities in question with a !.

Russia: HOLMBERG (16) states, that the plant is found throughout the whole of Kola Peninsula and in one place in Keretinsk Karelen. We have, however, seen only a single specimen from Chibiny on the Murman railway, and some specimens collected by BROTHÉRUS in the Kola Peninsula, without any closer indication of the place. The species does not seem to occur on Kanin Peninsula (3), and the same probably applies to the Petschora region (36, 37, 38) and the Polar part of Ural (41). TOLMATSCHÉW records only a few localities (in litt.) so that altogether we have the following localities in Russia (a ! indicates that we have seen the specimens, a (T) that the statement is due to Dr. TOLMATSCHÉW): Kola Peninsula: Station Chibiny on the Murman railway (leg. SAVICZ)!, (T); Kola (leg. BROTHÉRUS); — GOUV. WOLOGDA: On the road Konoscha-Welsk (leg. POHLE) (T); — GOUV. PERM: Suchoi Kamen in N. Ural (leg. KRYLOW) (T); — Arctic Russian Islands: Waigatsch (leg. FEILDEN)!, Waigatsch, Cape Greben (leg. A. TOLMATSCHÉW) (T); Kolgufjew Island (T).

Asia:

In order to get a correct idea of the distribution of the species in Siberia we applied to Dr. TOLMATSCHEW for information, who kindly gave us the following reply: "Nahezu alle aus dem Norden von USSR stammende Pflanzen die als *E. callitrix* CHAM. bestimmt worden waren, gehören sicher zu *E. opacum* (BJ.) FERN. Im Jenissei-Becken und westlich davon, ebenso wie in mässigen Teilen von Jakutien, kommt nur *E. opacum* vor. Es scheint aber, dass diese Art kaum von *E. brachyantherum* TRAUTV. zu unterscheiden ist. Dr. JUZEPCZUK meint jedenfalls, dass *E. opacum* und *E. brachyantherum* als Synonyme betrachtet sein müssen"¹⁾. Dr. TOLMATSCHEW further gives a list of the Siberian localities in which the species has been found. In connection with those located by us we thus get the following localities in Siberia:

Ob district: Obdorsk (leg. POHLE & ROSHDESTWENSKY) (T); Poluy River (leg. GORODKOW) (T); Halmer-Sede near the mouth of Tas River (leg. POOLE & ROSHDESTWENSKY) (T); — Yenissei district: Lower Yenissei: Gyda (leg. SCHMIDT) (T); Goltshicha (leg. KUSNETZOW & REWORDATTO) (T); Mouth of Yenissei (leg. LUNDSTRØM)!; Dudinka, Tolstaja (leg. A. TOLMATSHAW) (T); Potapowskoje (leg. KYTMANOW) (T); Potapowaskoje (leg. BRENNER) !; Chantaika (leg. KUSNETZOW & REWORDATTO) (T); Plachino (leg. ARNELL) !; Plachino (leg. BRENNER) !; Upper Yenissei: Lebjedovo (leg. ARNELL) !; Mjelnitsa (leg. ARNELL) !; Jeniseisk (leg. SAHLBERG)!; Verschinintkoje (leg. BRENNER)!; Asinovo (leg. ARNELL)!; Between Pit River and Podkamennaja (leg. MARKJELLOW) (T); Taimyr Peninsula: Boganida River! (T); Lower Tunguska: Central Loukan Mts. (leg. CZEKANOVSKY & MÜLLER) (T); Baliuna Mts. (leg. CZEK. & MÜLL.) (T); Erbohatschon (leg. CZEK. & MÜL.) (T); — Kirensk: On the road between Lower Tunguska and Tschona (leg. DROBOW) (T); Kirensk (leg. KOULIN) (T); — Baikal area: Padun on the Angara River (leg. CZEKANOWSKY) (T); Bascheewskoje in Balagansk District (leg. MALZEW) (T); Marichta River (leg. GANESCHIN) (T); Kitoi Mts. (leg. NASAROW) (T); Bargusin at Baikal Lake (leg. STUBBENDORFF) (T); — Jakutia: Bulun (leg. NIELSSON)!; Watershed between Wiluj and Monjerokan (leg. CZEKANOWSKY & MÜLLER) (T); Olenek River, Upper Tomba (leg. CZEK. & MÜL.) (T); Olenek River between Argassala and Gaingna (leg. CZEK. & MÜL.) (T); Adostia Lenae (leg. ADAMS) (T); Ajakit on the Lower Lena (leg. CZEKANOWSKY) (T); Kumach Sur (leg. NIELSSON)!; Wiluj (leg. MAACK) (T); Amga Valley, Ochotsk-Road (leg. DROBOW) (T); Ochotsk-Road 45 km from Jakutsk (leg. DOBROW) (T); Ochotsk-Road, 120 km from Jakutsk (leg. DROBOW) (T); Amga-Road, St. Konkujukinskaja, st. Bestiach

¹⁾ See Appendix p. 24.

(leg. DROBOW) (T); Werchne-Kolymsk (leg. AUGUSTINOWITSCH) (T); Amur area: Tungir Basin (leg. SUKACZEW & POPLAWSKA) (T); Between Nertscha River and Kuenga (leg. SUKAC. & POPL.) (T); Between Schilka River and Tschornyj Urjum (leg. BLAGOWESTSCHENSKY & POPLAWSKA (T); Chucki Peninsula: St. Lawrence Bay (leg. KJELLMANN)!.

As will appear from the above, the species has a nearly circumpolar distribution. It should, however, be noted that it is by no means common; even in Scandinavia, where it seems to occur most frequently, it is stated to be rare and of scattered occurrence.

APPENDIX

Unfortunately *Eriophorum brachyantherum* TRAUTV. has hitherto escaped our attention. We agree, however, with Dr. JUZEPČUK in his view that *E. brachyantherum* and *E. opacum* should doubtless be regarded as synonymous. The specimen brought back from Eastern Siberia by MIDDENDORFF is described as follows (MIDDENDORFF: Reise Bd. I, Teil 2, 1856. Florula Ochotensis Phanerogama by E. R. v. TRAUTVETTER & C. A. MEYER, p. 98): “*Eriophorum brachyantherum* nob., caespitosum; vaginis superioribus 2—3 aphyllis, inflatis; foliis radicalibus sublaevibus; spica terminali, solitaria, subovata; squamis longe acuminatis; antheris oblongis. Species haec habitu prorsus cum *Er. vaginato* L. congruit, differt autem ab hoc foliis sublaevibus, spicis subovatis, squamis multo angustioribus, intense cinereis, antheris oblongis, triplo brevioribus quam in *Er. vaginato* L. — Quod ad antheras attinet *Er. brachyantherum* maxime appropinquat *Eriophoro Scheuchzeri* HOPPE, a quo tamen discedit calamis duplo triplove altioribus, caespitosis, vaginis superioribus 2—3 aphyllis, inflatis”.

TRAUTVETTER & C. A. MEYER's work was published in 1856, the same year as BJØRNSTRØM's (4). Thus it might be disputed which name should be applied. As, however, TRAUTVETTER & MEYER's paper is indicated to have been printed in December, 1855, while BJØRNSTRØM did not take his doctor's degree on the basis of the said paper until December, 1856, it would possibly be most correct to apply the name *E. brachyantherum*. For practical reasons, however, we have found it most convenient at the present to maintain the name given by BJØRNSTRØM-FERNALD, partly on account of FERNALD's valuable work for the elucidation of the relation between the Arctic *Eriophorum* species, partly to avoid further confusion of the species in question.

April 5th, 1933.

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PLATES

Plate 1.

Eriophorum callitrix CHAM.

Reproduction (in the size of the original) after CHAMISSE's figure Tab. II in C. A. MEYER: *Cyperaceae novae descriptionibus et iconibus illustratae* (31). — A: Apex folii; C: pistillum et stamina, lana cincta; D, d: figura eadem, lana destituta; E, e: caryopsis matura; F: eadem, transversa secta.

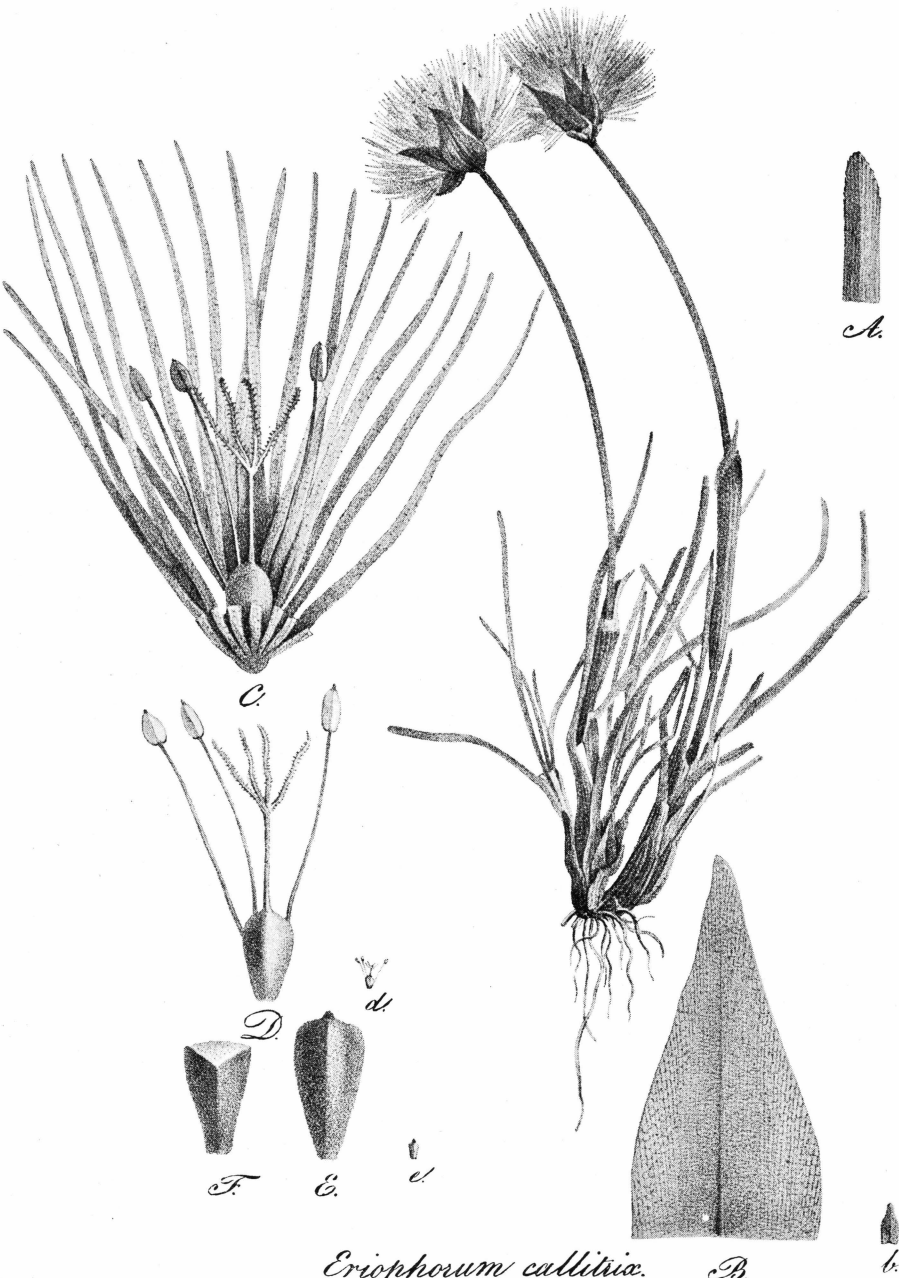


Plate 2.

Eriophorum opacum (BJØRNSTR.) FERNALD.

Reproduction (ca. $\frac{2}{3}$ the size of the original (nat. size?)) after LIEBMANN & LANGE: Supplementum Floræ Danicæ Tab. CXXII 1874 (25). — Fig. a, b: Vagina folii cum basi laminæ involuta; c: apex folii; d: bractea inferior; e: superior; f: axis speciei cum bracteis folibusque nonuntis (mediis desumptis); g: fructus maturus setis inclusis m. a.; h; i: caryopsis a dorsi et a ventre, m. a.

Supplementum Florae Danicae Tab. CXXII

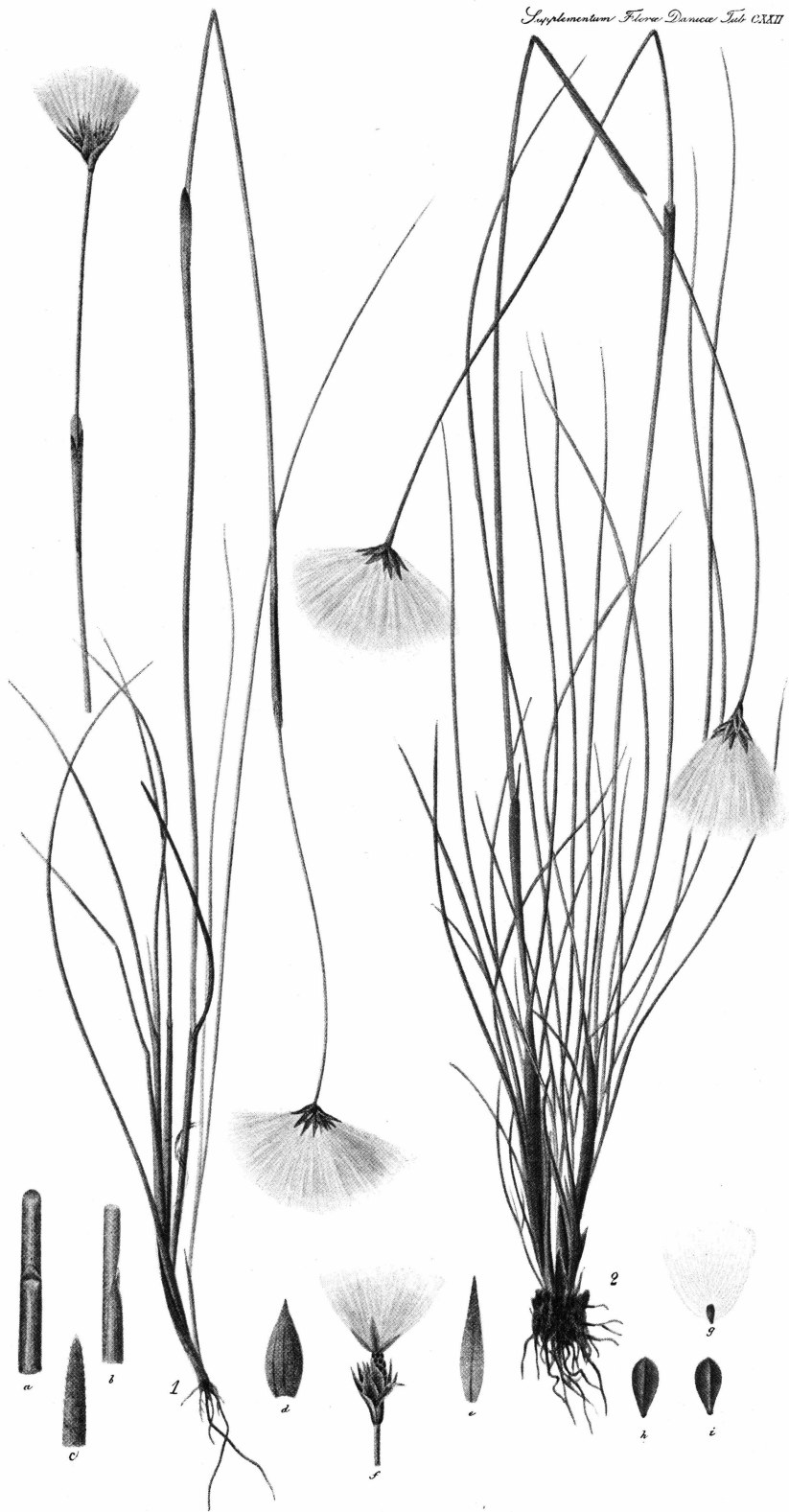


Plate 3.

Eriophorum callitrix CHAM.

Photograph ($\frac{2}{3}$ size) after specimens kept in the Arctic herbarium of the Botanical Museum, Copenhagen. Figs. 1—3 from the locality at the head of Musk-ox Fjord, northern bank (SEIDENFADEN No. 276). Fig. 4 from the locality Cape Oswald, Ella Island (THORV. SØRENSEN No. 1217), both from East Greenland.



Plate 4.

Eriophorum opacum (BJÖRNSTR.) FERNALD.

Photograph ($\frac{2}{3}$ size) after specimens in the herbarium of the Botanical Museum, Copenhagen. Fig. 1 from the locality "Lille Elvedal, Norge" (leg. E. HAGLUND et J. KÄLLSTRÖM; Herbarium normale editum ab I. DÖRFLEDER Nr. 4786); — Fig. 2: From the locality "Boggy limestone barrens south of Flower Cove, Straits of Belle Isle, Northwestern Newfoundland" (leg. A. S. PEASE, BAYARD LONG et F. A. GILBERT JR. Nr. 27547). — Fig. 3: From the locality "Foden af Tronfjæld, Sump i Skov, Norge" (leg. EUG. WARMING). [The base of Tronfjæld, swamp in a forest, Norway]. —

To the specimen represented in fig. 3 belongs a label marked as follows: "*Eriophorum vaginatum*, LINN. (*E. callitrix*, Fl. Dan. Suppl. t. 122 non C. A. MEYER) C. B. CLARK Sept. 1892", which seems to show that as early as in 1892 CLARK was aware that CHAMISSE's *E. callitrix* was not identical with Flora Danica's figure of this name; obviously he has considered it as closely related to *E. vaginatum*. Also other specimens of *E. opacum* kept in our herbarium have been determined by CLARK in 1892 as *E. vaginatum*. Thus it would seem that CLARK has not known BJÖRNSTRÖM's treatise from 1856 (4).

