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STRAY CONTRIBUTIONS TO THE FLORA OF GREENLAND XIII–XVII

BY

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WITH 9 FIGURES IN THE TEXT

KØBENHAVN
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XIII.

WHAT IS ANTENNARIA HANSII KERN.?

While holding a professorship at the University of Innsbruck, Tyrol, the eminent Austrian botanist A. KERNER wished to investigate, how an arctic plant, not indigenous in the Central European mountains, would behave if grown there. For this purpose he obtained, in 1867, live specimens of *Antennaria alpina* (L.) GAERTN. from the Dovre Mts. of Norway and planted them in the rock garden of the Botanical Garden of Innsbruck, before the intended transfer to Mt. Blaser, 2200 m alt. KERNER noticed that all his specimens were pistillate and, therefore, did not expect to obtain viable fruits.

From a visit of the Norwegian botanist Professor AXEL BLYTT, KERNER learned that male specimens of *Antennaria alpina* were extremely rare, in fact unknown to LINNAEUS[1]), WAHLENBERG[2]), and BLYTT, and —to BLYTT's knowledge—found but once, namely by L. L. LÆSTADIUS, at Karesuando, Torne Lappmark[3]). Remembering that parthenogenesis had been demonstrated in *Chara crinita* by ALEX. BRAUN, KERNER now sowed the mature achenes of his cultivated plants. Some achenes germinated and he thus obtained two new individuals, exactly matching the parent plants. As a pollination by *Antennaria dioica* from his own garden or from elsewhere seemed out of question, KERNER deducted the revolutianary fact that parthenogenesis might also occur in higher plants. His report on his experiments and results, in Sitzungsber. K. Ak. Wiss. (Wien) I. Abth. 1876, Nov. p. 469—476, now classic. Many years later the cytological evidence of the apogamy in *Antennaria alpina* was demonstrated by H. O. JUEL (Bot. Centralbl. 74. (1898) p. 369—372 and K. Sv. Vet. Ak. Handl. (Stockholm 33.5 (1900) p. 1—39).

[1]) "Marem nullus adhuc observavit" Sp. Pl. p. 1199.

[2]) "Vix dubito sit [Gn. alpinum] sola degeneratio alpina praecedentis [Gn. dioici] atque eodem mare gaudeat". Fl. Lapp. p. 203.

[3]) In recent papers TH. C. E. FRIES (Sv. B. T. 13. (1919) p. 182—183 and ELISABETH EKMAN (ibd. 21. (1927) p. 93—94) have reported on 22 subsequent collections from Sweden and 26 from different parts of arctic or alpine Norway.

In the above quoted paper KERNER further states [p. 475]:

"Da mit *Antennaria alpina* die zunächst verwandte *Antennaria dioica* im hohen Norden häufig an gleichen Standorten wächst und dort allenthalben sowohl in weiblichen als männlichen Stöcken angetroffen wird, so war im Vorhinein zu erwarten, dass dort auch ab und zu die weiblichen Stöcke der *Antennaria alpina* durch den Pollen männlicher *A. dioica* befruchtet werden und sich daher in gewissem Sinne WAHLENBERGS im Eingange erwähnte Bemerkung bestätigen werde. — In der That liegt [476] mir auch eine Pflanze in vier schön getrockneten Stöcken vor, welche ich für einen durch Befruchtung der ♀ *A. alpina* mit dem Pollen der *A. dioica* in der freien Natur entstandenen Bastart halte. Dieselbe wurde von RÖZEL im Jahre 1861 bei Upernavik in Grönland gesammelt, und ich habe diesen der Combination: *alpina* × *dioica* entsprechenden Bastart, welchen ich, wie so viele andere in den hochnordischen Gegenden in Grönland, Labrador etc. gesammelten Pflanzen meinem werthen Freunde HANS in Herrnhut verdanke, *Antennaria Hansii* genannt. Im Zuschnitte und in den Ausmassen der grundständigen Blätter stimmt diese Pflanze fast ganz mit *A. alpina* überein; es sind diese Blätter nämlich verkehrtlanzettlich oder lineallanzettlich, spitz, viel schmäler als jene der *Antennaria dioica* und nichts weniger als spatelförmig; die Anthoidalschuppen dagegen sind nicht wie jene der *A. alpina* lanzettlich und in eine lange bräunliche Spitze vorgezogen, sondern länglich, stumpf, trockenhäutig und roth gefärbt wie jene der *A. dioica*; sie unterscheiden sich aber doch auch wieder von diesen durch ein geringeres Breitenausmass, wodurch jedenfalls wieder *A. alpina* anklingt. Die vier Stöcke, welche mir von diesem muthmasslichen Bastarte vorliegen, sind sämmtlich weiblich."

The specimens were distributed by HANS as *Gnaphalium dioicum* L. *β*, *hyperboreum* D.C. evidently in accordance with JOH. LANGE's authoritative review of the plants of Greenland in RINK: Grønland Vol. II (1857) App. p. 123:

"*Antennaria dioica* R. BR. *β hyperborea* DON 60°—66°50′.
A. alpina R. BR. 60°43′—72°48′
- — *glabrata* J. VAHL Mscr. 69°—71°.

When LANGE, in 1880, published his more elaborated "Conspectus Flora Groenlandicae" he did not know KERNER's paper[1]). But in his "Pars secunda" 1887 he quotes KERNER's plant on p. 276 as *A. alpina* *ε*, *Hansii* KERN., however, without having seen the type, adding: "Forma huc forsan pertinens, fol. obovato-lanceolatis, utrinque niveis, pericl. foliolis erectis, rufo-stramineis ad Kekartarsuak pr. Upernivik legit

[1]) Neither does "Index Kewensis" mention KERNER's plant.

cl. Ussing (Ryd. Exped.)!" To this L. K. Rosenvinge objects in his "Andet Tillæg" (1892) p. 698:

A. Hansii Kern., sec. cl. Kerner inter *A. alpinam* et *dioicam* intermedia, mihi potius *A. dioicae β, hyperboreae* appertinere videtur; in hac var. nempe folia radicalia nonnumquam angusta, oblanceolata, et fol. periclinii quam in f. typica angustiora. *A. Hansii* hybridam [699] esse, ut e sententia Kerneri, valde dubitandum est, quum ab utraque specie in Groenlandia adhuc plantae femineae tantum lectae sunt. Specimen in Kekertarsuak lectum. a cl. Lange cum dubio huc relatum (Consp. p. 276), a planta Kerneriana foliis periclinii acutis differt; forma *A. alpinae* sistit.

In 1915 the present writer demonstrated (On the genus *Antennaria* in Greenland. Medd. om Grl. 51 p. 274) that the Greenland plant, which has passed as "*Ant. dioica* var. *hyperborea*", differs from the European plant so named, not only by its apogamic reproduction, but also by numerous external morphological characters, and the novum nomen *Antennaria groenlandica* was proposed for it. This paper was written in Greenland where Kerner's paper was inaccessible.

When, in 1927, the late Mrs. Elisabeth Ekman described her *Ant. angustifolia* nov. spec. (Sv. Bot. Tidskr. 21. p. 53) she suggested that Lange's *A. alpina ε, Hansii* might possibly be synonymous, but at the same time, different from Kerner's species, which, according to the description, "only can apply to *A. groenlandica* Porsild". But as this species was known from the southern parts of Greenland only, Mrs. Ekman supposed that there must be some confusion as to where Kerner's plant was actually found. Mrs. Ekman, and before her also Lange, as a matter of course, identified the "Upernavik" mentioned by Kerner with the colony of the same name in lat. 72°48′ N. in West Greenland. There are, however, in West Greenland, hundreds of Upernaviks, as almost every settlement has one of his own. The Eskimo word "Upernavik" means "a place of early spring" i. e. a place where open water with marine life is to be found early in the season.

A brief perusal of the archives of "North Greenland" reveals that no person of the name Rözel had ever been employed here. The colony of Upernavik was, in 1861, visited by the American explorer J. J. Hayes on his return. But among his crew was no Rözel. Besides, Hayes made botanical collections himself, and in the enumeration of his plants (Proc. Ac. Nat. Sc. Philadelphia 1863) no *Antennaria* is mentioned.

Kerner in his paper states that he obtained this plant—and many others — from Greenland and Labrador from his friend Hans of Herrnhut, the headquarters of the missions of the Moravian Brethren, thus pointing directly to South Greenland where all the

Greenland missions of the Brethren were located. As so many times before I had to resort to the ever diligent and patient help of Rev. Mr. G. A. FREYTAG of Herrnhut about biographical dates of Messrs. HANS and RÖZEL.

W. HANS was wellknown in Herrnhut. He was born in 1840, the son of a steel engraver. From his school days in Herrnhut he became very interested in botany and started a collection, specializing in arctic plants obtained from the Moravian missionaries. In 1874 he took up market-gardening for a living, but continued collecting, and had connections with numerous botanical institutes and persons. He died in Herrnhut in 1896. After his death his collections, contained in four large cabinets, were acquired by the University of Budapest, Hungary.

The name RÖZEL, however, was totally unknown in the archives of the mission, but Mr. FREYTAG made the bold, but lucky suggestion that "RÖZEL" was a misreading for KÖGEL, of which name there had been three missionaries of the Brethren in Greenland, namely:

1) JOHANNES KÖGEL, born 1793, missionary at Lichtenfels, 63°5′ N. from 1824 to 1829, at Lichtenau. 60°30′ N. from 1830 to 1861, when he left Greenland. Died 1873 at Niesky, Silesia.
2) CASPAR KÖGEL, his brother, born 1801, missionary in Greenland 1829—62. His last years were spent at Lichtenau, where he died.
3) HEINRICH AUGUST KÖGEL, the son of JOHANNES, born in 1834 at Lichtenau, educated in Germany. At the pedagogic college of Niesky he became a keen botanist; in 1867 he was appointed a missionary at Lichtenau, and in 1871 became superintendent of the Greenland stations, left Greenland in 1896 and died in 1918 at Niesky.

According to Mr. FREYTAG this man must have been an acquaintance of W. HANS, and as he was well aware of the general interest of scientific circles in collections from Greenland, he may have suggested that his father and uncle collect plants, for his own studies and for the benefit of the mission as well. He cannot have collected the type of *Antennaria Hansii* himself, unless in 1861 he made a visit to his parents and his home in Greenland, which would not be unreasonable, but which cannot now be verified.

Of "Upernaviks" in the district of Julianehaab two places are well known to everybody and often mentioned in books, namely:

1) Upernavik Næs, 60°34′ N., a rocky promontory of the mainland NE. of the settlement of Sârdloq.
2) Upernavik Ø, 60°46′ N., a fair-sized island at the mouth of Brede Fjord. Both places are situated along the customary route of travel for small coasting craft and often resorted to for shelter or rest. At

that time the only local means of travel were by open rowing boats, chiefly umiaks. The first mentioned place is on the route between Lichtenau and Julianehaab, from where the missionaries received their provisions and mail, the second is on the much longer route between the missions of Julianehaab district and their northern stations: Lichtenfels, Herrnhut etc. in Godthaabs district.

The next step was to locate KERNER's plant, which was obligingly done by Dr. K. RONNIGER of Vienna. Of the original four "Stöcke" only three are left, with a total of 10 inflorescences. Dr. RONNIGER also most kindly supplied a photograph and—with permission of the curator Dr. H. NEUMAYER—with an abnormal single-headed small stem. Also he was good enough to copy a remark in KERNER's handwriting found on the sheet, saying:

"Ist nicht *Gnaphalium hyperboreum*. Dieses ist eine im nördlichen Britannien vorkommende "Varietät", welche sich von dem typischen *G. dioicum* dadurch unterscheidet, dass die Blätter nur in der Jugend behaart sind und im Alter ganz kahl werden, auch wird sie als viel höher und kräftiger (im Vergleich zu *dioicum*) angegeben. Vorliegende Pflanze halte ich für einen Bastart aus ♀ *G. alpinum* u. ♂ *G. dioicum* und nenne dieselbe nach Freund HANS:

Antennaria (*Gnaphalium*) *Hansii* (*alpinum* × *dioicum*). Weiteres in einer Schrift: Parthenogenesis in den Akademieschriften.

Oct. 1876. KERNER."

As will be seen from fig. 1 the original label, written by HANS, plainly shows the collector's name as: KÖGEL, even though misreading it as "RÖZEL" is quite pardonable.

KERNER's description quoted above is not as detailed as we might wish it in our days, but nothing in it contradicts the diagnosis of *A. groenlandica* PORSILD. The fragment received is about 7 cm high. The basal rosette, of about 18 leaves, is withered. There are about a dozen stem-leaves with subulate points and seemingly a solitary head; upon soaking several undeveloped heads were seen in the upper axils. The upper scariose parts of the involucral bracts when dry are cream-coloured with a faint purplish hue, but after soaking shows distinctly purple. The indument of the stem-leaves and involucre is a dense ash-grey tomentum. The corollas are still unexpanded and much exceeded by the pappus. Pappus-bristles 3.6 mm long, 0.024 mm in diameter. Immature achenes 0.8—0.9 mm long, 0.28 mm wide, glabrous.

The habit of the type well matches a specimen illustrated in my former paper (fig. 6, pag. 276).

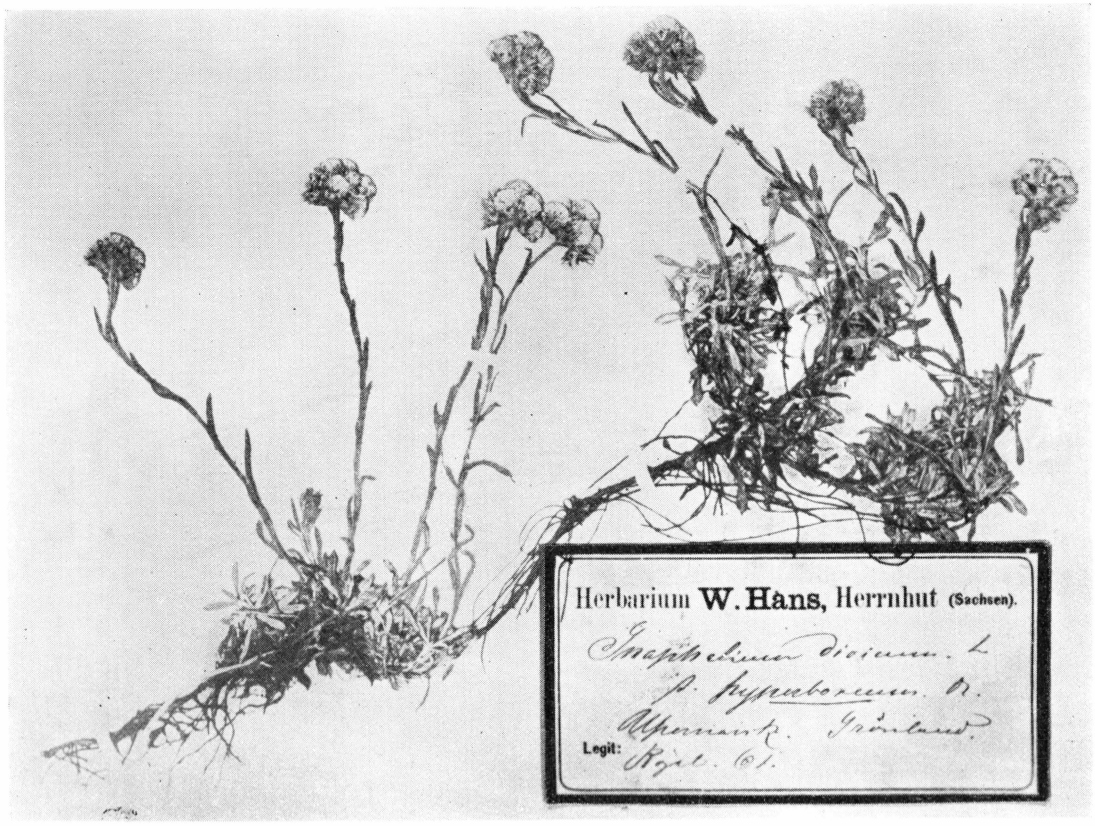

Fig. 1. Photograph of the type of *Antennaria Hansii* KERNER in KERNER's Herbarium, now in the Botanical Department of Naturhistorisches Museum, Vienna. Ca. 0.6 natural size. Enlarged from a photo by K. RONNIGER.

The synonymy of the plant is:

Antennaria Hansii KERNER: Sitzungsber. K. Ak. d. Wiss. Wien, B. 74. I. Abtheil. (1876) p. 475; type from "Upernavik" Greenland, leg. KÖGEL, in Herbarium KERNER, Naturhist. Museum, Vienna. *Gnaphalium dioicum* HORNEMANN Oec. Plantel. 3. Udg. 2. Deel (1837) p. 246, not L.

Antennaria dioeca β, hyperborea LANGE: ap. RINK: Grønland 2. B. (1857) App. p.123; LANGE: Conspectus Fl. Groenl. (1880) p.100 not *Gnaphalium dioicum* DON (nor *A. alpina ε, Hansii* LANGE: Consp. II (1887) p. 276) or numerous authors on Greenland plants following him.

Antennaria groenlandica PORSILD: Medd. om Grønland 51 (1915) p. 274 fig. 6, and subsequent authors.

On somewhat barren sandy ground and on gneissic rocks common in SW. Greenland 60°—65° N.; isolated occurrences at 65°20′, 60°45′ and at Engelskmandens Havn, S. Disko, 69°15′, also the last on gneiss only. Specimens distributed and labelled *A. groenlandica*, from Sinigfik on S. Disko, 69°25′ leg. R. T. PORSILD and from Atanikerdluk 70°2′ on Nûgssuaq Peninsula leg. A. E. PORSILD are not quite typical; in neither of these places Archæan rocks occur.—In E. Greenland five scattered localities are known, the northernmost at 66°10′ (KRUUSE).

After examination of the specimen I agree with ROSENVINGE l. c. that the plant which LANGE named *A. alpina ε, Hansii* (from Qeqertarssuaq leg. N. V. USSING) is but a form of *A. canescens* (LANGE) MALTE, which formerly passed as *A. alpina*.

It has been a pleasure to call attention to an important paper, lest it be forgotten, and to restore a name properly given to a Greenland plant by a great botanist notwithstanding his sketchy description of the plant and his erroneous conjecture as to its origin. Only by the kindly help of Messrs G. A. FREYTAG, Herrnhut, and K. RONNIGER, Vienna it has been possible to do so from Greenland, and I thank them sincerely.

Nov. 1939.

XIV.

POTENTILLA HYPARCTICA MALTE

Before his premature death, in Aug. 1933, my friend Dr. M. O. MALTE, curator af the National Herbarium of Canada, accompanied, in successive years, Canadian Government ships going North on the "Arctic Patrol" to police and trading posts in the Canadian Eastern Arctic. From these expeditions he brought back enormous botanical collections from a number of rarely visited places. In working up these collections he made critical notes on the taxonomy and nomenclature of certain arctic plants, some of which were posthumously published by Professor M. L. FERNALD in "Rhodora" 1934. One of these studies deals with the various forms of *Potentilla emarginata* which MALTE saw and collected, in flower, in the high-arctic stations, and, in fruit, around Hudson Strait and Bay. MALTE thought it most probable, although he lacked proof, that the southern and taller form was the typical *P. emarginata* PURSH, because PURSH' type, collected by KOHLMEISTER, came from somewhere in Labrador. The lower form, from southern Ellesmere Land and other high-arctic stations he believed was specifically distinct, and for this he proposed, l. c. p. 177, *P. hyparctica* n. sp.

With a letter, dated July 6. 1932, MALTE sent me his preliminary diagnoses of both forms and asked for my comment. His letter arrived here by the last mail of the season and I could but answer him briefly that year, but by the first mail of the next year I wrote him more fully.

In his letter MALTE had proposed to call the northern plant *P. groenlandica* R. BR. which I dissuaded, partly because of the confusion about this *nomen nudum*, partly because of the later *P. groenlandica* SER. (of the *P. Anseriana* complex). By the epithet actually published MALTE clearly intended to emphasize the high-arctic range of his plant. If this proposal had passed the opportunity for my commenting I should myself have preferred a slight change, *ὑπο-* being the Greek equivalent of *sub-*, *ὑπερ-* that of *super-*, *supra-*, *ultra-*.

In last-mentioned letter brought to MALTE's attention an earlier attempt at separating from the low, high-arctic form of *P. emarginata* the taller southern one by ABROMEIT, in 1899 (Bot. Ergebn. etc. Bibliotheca Botanica H. 42, B, p. 8 tab. IV fig. 1—3). ABROMEIT considered the low northern form the real *P. emarginata* of PURSH, while the taller southern form, he described as var. *elatior* n. var.; the taller he suggested might prove inseparable from *P. fragiformis* WILLD., which it indeed resembles somewhat. ABROMEIT no doubt knew the writings and illustrations of LEHMANN. Several years later TH. WOLF, studied the type of *P. fragiformis*, represented by a single sheet in WILLDENOW's her-

barium[1]), and found that this species was further distinguished from *P. emarginata* by its long style, which is much longer than the mature nutlet, whereas in *P. emarginata* the style is but half as long as the mature fruit. According to WOLF *P. fragiformis* is found on the coasts and islands of Bering Sea only and the then very obscure *P. nana* SCHLECHTENDAL, according to him, is nothing but a dwarfish form of it. The so-called *P. fragiformis* var. *parviflora* TRAUTV., of Nova Zemlya and Spitsbergen, has long ago proven to be identical with *P. emarginata* of Greenland and Arctic N. America.

While, in my opinion ABROMEIT's var. *elatior*, was well justified, I felt very doubtful as to the justification of MALTE's proposed new species. His chief distinguishing character, as emphasized in his letter, were in the length of the petioles of the basal leaves and their pilosity. However conspicuous these seemed to me of doubtful value in this genus. But my gravest objection was to the geographical distribution of the proposed species, especially within Greenland.

P. "hyparctica", which has hitherto passed as *P. emarginata*, is in Greenland—and elsewhere—a high-arctic type, found as far north as plant life has been met with, and its route of migration into Greenland is clearly by way of the adjacent parts of arctic N. America. If the taller plant, which MALTE considers the true *P. emarginata*, in Eastern N. America were to be restricted to such subarctic regions as Labrador and Hudson Bay coasts only, its occurrence in West Greenland would be unparallelled and quite unaccountable.

MALTE further wrote of the distribution of the latter plant: "Greenland, north to Disko Island", but as I informed him, Disko Island is practically the southern limit of both forms. No more than three or four stations are known farther south—and moreover all belong to his *P. "hyparctica"*—the southernmost at about 67°, on the top of a 555 m high hill. All told about 11.5 per cent of the vascular plants of Greenland, are southern types of American origin[2]), found in the

[1]) Thus also the type for the first illustration in LEHMANN: Monogr. Potent. t. 15, 1820. The first illustration of *P. emarginata* is in the same work t. 17.

[2]) American types of southerly distribution in Greenland are the following: *Athyrium angustum*, *A. alpestre* var. *gaspense*, *Agropyrum trachycaulum*, *A. latiglume*, *Elymus arenarius* var. *villosus*, *Carex gynocrates*, *C. Macloviana*, *C. praticola*, *C. deflexa*, *C. stylosa*, *Juncus subtilis*, *Streptopus amplexifolius*, *Sisyrinchium angustifolium*, *Orchis rotundifolius*, *Leicorchis stramineus*, *Limnorchis major*, *Salix Uva-ursi*, *S. arctophila*, *Betula glandulosa*, *Minuartia groenlandica*, *Coptis groenlandica*, *Anemone Richardsoni*, *Halerpestes Cymbalaria*, *Draba aurea*, *D. crassifolia*, *D. lanceolata*, *Arabis Holboelli*, *Parnassia Kotzebuei*, *Sorbus decora*, *Sibbaldiopsis tridentata*, *Potentilla Ranunculus*, *Lathyrus maritimus* var. *aleuticus*, *Callitriche anceps*, *Viola labradorica*, *Myriophyllum exalbescens*, *Cornus canadensis*, *Ramischia secunda* var., *Ledum groenlandicum*, *Andromeda glaucophylla*, *Vaccinium minus*, *Primula egaliksensis*, *Lomatogonium rotatum*, *Veronica Wormskjoldii*, *Pedicularis groenlandica*, *P. labradorica*, *Plantago glauca*, *Galium Brandegeei*.

southern half of the country only, especially on the western coast. Of these about $^3/_8$ reach as far north as Disko Bay, but we have no examples of southern types occurring around Disko Bay that are absent from the southerly regions. Why should then P. *emarginata*, in the sense of MALTE, not conform to this distributional pattern?

Before discussing the characters used by MALTE in separating these plants his diagnostic characters are given below side by side:

	P. emarginata PURSH	*P. hyparctica* MALTE
Stems	softly pubescent below, villous above, from a few cm to 2 dm high or more, 1- to several-flowered	softly pubescent below, villous above, rarely exceeding 1 dm in height, mostly 1-flowered
Petioles of basal leaves	becoming conspicuously elongated after flowering, those of the adult leaves pubescent with soft, irregularly spreading but generally ascending hairs of unequal length	short, not at all or inconspicuously elongated after flowering, those of the adult leaves pubescent with stiff, very long hairs which generally, and particularly in the basal parts of the petioles, are horizontally spreading
Free part of the stipules	ovate, obtuse or abruptly acute at the apex	lanceolate, acute to long-attenuate
Leaf-blades	distinctly coriaceous, ternate, pilose on both sides when young, glabrous or glabrate or occasionally pilose above when adult	not coriaceous, ternate, pilose on both sides even when adult
The teeth	generally very obtuse, evenly pilose along the edges	acute or rarely obtusish, conspicuously tipped with a tuft of hairs
Terminal leaflet	broadly obovate, frequently almost as wide as long, from almost sessile to long-stalked	narrowly obovate, generally about twice as long as wide, stalked
Calyx bracts	elliptic, often broadly so, becoming about as long as the calyx lobes and horizontally spreading after anthesis	narrowly elliptic, not conspicuously enlarged after anthesis, shorter than the calyx lobes
Flowers	18—20 mm wide; the petals pale yellow, obcordate, emarginate	somewhat smaller than in *P. emarginata*, the petals rich yellow, obcordate, emarginate
Styles	much shorter than the smooth carpels	much shorter than the smooth carpels

In testing MALTE's diagnoses of the two forms the writer has examined duplicates distributed by MALTE supplemented by characteristic specimens from West Greenland, and from other parts of the Arctic.

List of specimens examined (in the writer's herbarium).

Potentilla emarginata PURSH, tall form (= var. elatior ABROMEIT).

Nr.	Locality	Collector	Date	Stage
1	Frobisher B., Baffin Ld.. 63°	C. S. SEWALL No. 321	Aug. 1929	fr.
2	Lake Harbor, Baffin Ld.. 62°49′	M. O. MALTE No. 119102 ..	Aug. 26. 1927	fr.
3	Chesterfield Inl., Keewatin 63°40′	— No. 120525 ..	Aug. 11. 1928	fr.
4	Port Burwell, Hudson Str. 60°22′	— No. 120067 ..	July 28. 1928	fr.
5	Wakeham B., Hudson Str. 61°40′	— No. 126964 ..	July 24. 1933	fr.
6	Schade's Isl., W. Grl. ... 71°22′	M. P. PORSILD	Aug. 3. 1911	fl.
7	Jakobshavn, W. Grl. .... 69°13′	P. H. SØRENSEN		fr.
8	Igdlorpait, Disko, W. Grl. 70°14′	M. P. PORSILD Nos. 371, 372 b	July 26. 1902	fr.
9	Qagssimavit, Disko W. Grl. 70°6′	— No. 436	July 31. 1902	fr.
10	Qamavit, Disko, W. Grl.. 69°56′	— No. 542	Aug. 1. 1902	fr.
11	Qasigigssat, Disko, W. Grl. 69°52′	A. E. PORSILD	Aug. 10. 1923	fl.
12	Mellemfjord, Disko, W. Grl. 69°45′	M. P. PORSILD Nos. 736, 737	Aug. 13. 1902	fr.
13	Mellemfjord, Disko, W. Grl. 69°43′	—	Aug. 9. 1911	fl.
14	Ivigssârqut, Disko, W. Grl. 69°43′	—	July 20. 1909	fl.
15	N. Eqaluit, Disko, W. Grl. 69°38′	—	Aug. 16. 1902	fr.
16	Disko Fjord, Disko, W. Grl. 69°34′	— Nos. 778, 780	Aug. 18. 1902	fr.
	P. emarginata low form (*P. hyparctica* MALTE).			
17	Craig Hb., Ellesmere Ld. 76°26′	M. O. MALTE No. 119077 ..	Aug. 2. 1927	fl.
18	Dundas Hb., N. Devon.. 74°30′	— No. 119092 ..	Aug. 3. 1927	fl.
19	Albert Hb., Baffin Ld... 73°10′	— No. 119094 ..	Aug. 14. 1927	fl.
20	Advent B., Spitsbergen.. 78°15′	C. A. HANSSON	June 21. 1896	fl.
21	Waigatsch Isl..... 69°40′	H. STEFFEN.....	Aug. 16. 1926	fl.
22	Bjeluschja Guba, N. Zemlya ..... 73°20′	R. POHLE	1904	defl.
23	Camden B., Alaska ..... 70°	F. JOHANSEN No. 98803...	June 30. 1914	fl.
25	Inglefield Ld., N. Grl.... 78°30′	R. A. ROBINSON	July 1924	fl.
26	N. Star B., N. Grl..... 76°30′	W. E. EKBLAW No. 563 ...	Aug. 16. 1913	defl.
27	Giesecke Valley, Disko, W. Grl. ..... 70°15′	M. P. PORSILD No. 300....	July 23. 1902	fl.
28	Disko Fjord, Disko, W. Grl. 69°38′	—	Sept. 1. 1898	fr.
29	Godhavn, Disko, W. Grl.. 69°15′	R. T. PORSILD No. 1414 ...	July 1911	fl.
30	Godhavn, Disko, W. Grl.. 69°15′	M. P. PORSILD	July 23. 1934	fl.
31	Godhavn, Disko, W. Grl.. 69°15′	— No. 279....	July 2. 1898	fl.
32	Mudderbugt, 800 m, Disko, W. Grl. ..... 69°39′	— No. 966....	July 11. 1898	fr.
33	Ingigssôq, 800 m, Disko, W. Grl. ..... 69°46′	— No. 218 b ..		
34	Scoresby Sd., E. Grl..... 70°30′	A. PEDERSEN	June 21. 1925	fl.
35	Scoresby Sd., E. Grl..... 70°25′	—	Sept. 12. 1924	fr.
36	Scoresby Sd., E. Grl..... 70°30′	—	1925	fl.

The petioles of the basal leaves are decidedly longer in the tall form, than in the low one, namely:

tall form	flowering	3.0 — 4.6 — 6 cm
— —	fruiting	3.5 — 5.3 — 8 cm
low —	flowering	1.0 — 1.8 — 4.0 cm
	deflowered or fruiting	1.5 — 2.5 — 4.0 cm

As will be seen from these figures the postfloral elongation in both forms is but slight; even before anthesis the petioles of var. *elatior* are much longer than those of *P.* "*hyparctica*".—As to the pilosity MALTE correctly emphasized the long spreading hairs of the petioles in *P.* "*hyparctica*" as, indeed, LEHMANN did for the species (Revis. Pot. 1856 p.161). MALTE also correctly states that the hairs of the petioles—and of the leaf-blades as well—in the tall form are scarcer. But it seems very likely that also the material upon which his observations were based was in the fruiting stage only, since the expeditions in which he took part visited the southern stations late in the season. Towards maturity the leaves of var. *elatior* are glabrescent to almost glabrate, but when young the indument is much ampler. In several specimens the persisting withered petioles from previous years, on the bases of the shoots, exhibit the same ample pilosity of spreading hairs as is so characteristic in *P.* "*hyparctica*".

The free part of the stipules may be ± acutish or obtusish in both forms. Abruptly acuminate apices are not common but, at any rate, a constant difference of ovate free stipules versus lanceolate ones I have been unable to verify.

The leaf-blades of the tall form are certainly not "distinctly coriaceous" as claimed by MALTE. The leaves—and flowers—of both forms develop during the fall and winter in an advanced bud-state, but function one season only.—K. JESSEN has studied the leaf-anatomy of *P. emarginata*, probably of the common low form (Struct. & Biol. Arct. Pl., M. o. Gr. 37, p. 39 ff.). He found the leaves to be "most nearly mesophilous", their total thickness being about 0.17 mm, the outer wall of the epidermis not thickened, stomata occurring on both surfaces, of which those of the upper side were level with the neighbouring cells, those of the lower side even slightly projecting. The writer has made sections of the basal leaf-blades of two of MALTE's specimens of the tall plant which, according to his diagnosis, should be "distinctly coriaceous", namely fully developed green leaves of No. 120,067 and withered ones of No. 119,102. The interior structure of both: the amount of palisade- and spongy tissues, and the occurrence and form of the stomata,

exactly match JESSEN's illustration l. c. p. 40. The total thickness of the leaves, measured on different sections near the median rib, was in the plant from Port Burwell 0.17—0.18 mm, in that from Lake Harbour 0.16—0.17 mm.

Neither can I find a constant difference in the teeth of the leaflets. In both forms they are rather obtuse, or rarely acutish, but the tufts of long hairs projecting from the tips of the teeth are very characteristic in the low form. Similar, but less conspicuous tufts may, however, be seen on the leaves of the tall form, when young.

A constant difference in the ratio between length and width of the terminal leaflet as claimed by MALTE cannot be verified as the following measurements will clearly show:

Length and width of the terminal leaflet of the basal leaves in *Potentilla emarginata* PURSH.

the tall form: var. *elatior* AROMEIT					the low form: *P. hyparctica* MALTE				
Nr.	Stage	mm	ratio		Nr.	Stage	mm	ratio	
1	fr.	24:12	2.0		17	defl.	8: 4	2.0	
	fl.	14:11	1.3				8: 6	1.3	
2	fr.	18:14	1.3		18	defl.	12:10	1.2	
		17:15	1.1		19	fl.	10: 8	1.3	
		15:10	1.5		21	fl.	12:10	1.2	
3	fr.	17:15	1.1		22	defl.	7: 5	1.4	average
4	fr.	16:13	1.2		26	defl.	13: 8	1.6	ratio of
5	fl.	13:11	1.2	average	27	fl.	14:10	1.4	deflowered
6	fl.	12:12	1.0	ratio of	28	fr.	11: 8	1.4	specimens
		14: 9	1.6	flowering	29	fl.	12: 7	1.7	**1.34**
7	fr.	25:16	1.6	specimens	30	fl.	12:10	1.2	of fruiting
		18:12	1.5	**1.34**			15: 9	1.7	**1.45**
8	fr.	21:10	2.1	of fruiting			13: 9	1.4	of all
		16:14	1.1	**1.46**	33	fr.	11: 8	1.4	**1.39**
		15:10	1.5	of all	34	fl.	11:10	1.1	
10	fr.	10: 4	2.5	**1.42**			12: 9	1.3	
		16:14	1.1				11:10	1.1	
11	fl.	26:18	1.4		35	fr.	13: 8	1.4	
		26:17	1.5				10: 7	1.4	
		12:10	1.2		36	fl.	7: 5	1.4	
12	fr.	18:16	1.1						
		14:10	1.4						
14	fl.	18:12	1.5						
15	fr.	17:13	1.3						

l. = 10 — **17** — 26 mm
w. = 4 — **12** — 18 —

l. = 7 — **11** — 15 mm
w. = 4 — **8** — 10 —

Most of the calyx bracts in both forms are broadly elliptic, and, during anthesis, almost equalling the calyx lobes. These are also, as a rule obtuse, or sometimes more acute than the bracts. Regarding their direction may be said that bracts and sepals together closely envelop the flower in the bud-state. During the last phases of anthesis bracts, sepals and petals are flatly expanded. After fecondation bracts and sepals together form a cup-shaped postfloration, protecting the young ovaries, the petals remaining for a long time. Towards maturity of the nutlets the cup is somewhat distended and the bracts ± horizontally spreading, whereas the sepals still form a cup, until the fruits are dispersed.

The flowers of the low form are, as correctly stated by MALTE, as a rule somewhat smaller than those of the tall form. Measurements of a number of fully expanded flowers give the following extremes:

in the low form between 12—18 mm,
in the tall form between 16—20 mm.

Of the colour of the petals little is to be said. They are in both forms paler than in most other potentillas. It may be true that the petals of the tall form are slightly paler, but this may be due to local conditions.

Ovaries and fruits. I have found no important differences in the size and shape of anthers, styles and ovaries of either form, the style being about $1^1/_2$ times as long as the ovary, when in functional state, and slightly thickened upwards (*claviculiformis*). But the style is but half as long as the mature, smooth and glabrous nutlet which, as said before, is an important specific character for *P. emarginata* PURSH. Each of the following figures represent an average of about 10 individual measurements:

Tall form	No. 3.	1.27	by 0.96 mm	
— —	- 4.	1.28	- 1.05 -	
— —	- 11.	1.36	- 1.01 -	
— —	- 15.	1.37	- 1.03 -	
Low form	- 35.	1.27	- 0.77 -	thus decidedly narrower
— —	L. Diomede	1.22	- 0.97 -	

Isl. Alaska (coll. A. E. & R. T. PORSILD, No. 1713).

Conclusion. The commonest and widest ranging form of *Potentilla emarginata* PURSH is a high-arctic, low, but rather large-flowered, densely cespitose to pulvinate plant with flowering stems, in anthesis barely exceeding the basal leaves, at maturity about 1 dm high. The

whole plant is pilose with long spreading, faintly yellowish hairs, especially on the radical leaves where the hairs of the lower side project brush-like beyond the tips of the leaf-teeth. Bracts and sepals are mostly elliptic, the latter somewhat acutish, their upper halves mostly purple. The petals are broadly obcordate, emarginate, the margins not touching each other, pale yellow, without dark spots. Style $1^1/_2$ times as long as the ovary, but half as long as the mature, glabrous and smooth nutlet.

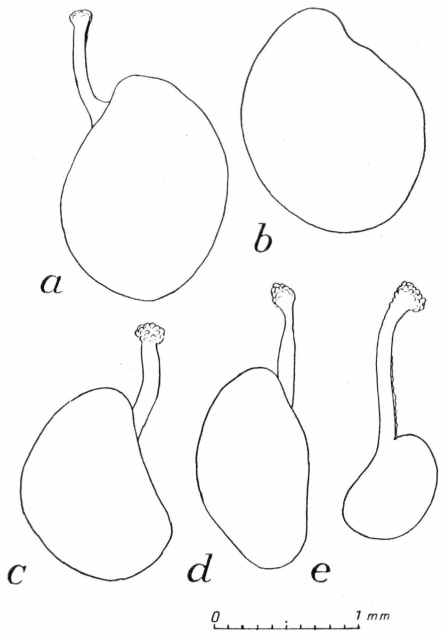

Fig. 2. *Potentilla emarginata* PURSH: outlines of fruits. *a, b*, Disko, N. Eqaluit, Aug. 16, 1902 = Nr. 15. *c, d*, Scoresby Sound, East Grl., Sept. 12, 1924 = Nr. 35. *e*, Craig Hb., Ellesmere Island, Aug. 2, 1927 = Nr. 17; the last one immature.

In the southern parts of its range, in West Greenland and in Atlantic N. America, a taller non-pulvinate form occurs, with radical leaves almost twice as large and twice as long petioles. The flowering stems are generally forked and two-flowered, in anthesis about 1 dm, at maturity about 2 dm high. It is densely pilose when young, but becomes ± glabrescent in age, to almost glabrate on the upper side of the leaves. The flowers are slightly larger, but the sexual organs and mature fruits show no difference. The latter may prove to be merely an edaphic form of sheltered and more fertile stations, but until more closely studied in the field it should retain the varietal rank and name assigned to it by ABROMEIT.

March 1940.

Postscript. After this was written the writer had the opportunity to go with a schooner to North Greenland and to make some brief excursions around the following trading and mission stations:

Savigssivik (Meteorite Island), Melville Bay, 76°3′ N.
Thule, North Star Bay, 76°32′ N.
Siorapaluk, Robertson Bay, 77°48′ N.

And on the return we stayed a couple of days at Upernavik, the northernmost colony in West Greenland, 72°48′ N. In all these places *Potentilla emarginata* was the commonest species of its genus, and to my astonishment nearly always represented by the tall form: "var. *elatior* ABROMEIT". From the northernmost place I brought home specimens 24 cm high, with petioles 7—8 cm long. The low and condensed form ("*P. hyparctica* MALTE") was much rarer and only to be found on exposed places with scanty covering of snow during the winter. For instance typical specimens of this were taken on the very summit of the highest accessible hill within Savigssivik, at an altitude about 460 m. On the gentle slopes of the same hill the tall form ascended to 150 m, i. e. to the point where the hillside became steep and consequently devoid of snow in winter.

Almost all specimens were during the last weeks of August in the state of second flowering, while at the same time the fruits from the spring flowers were near maturity.

To the writer's view the assignment of even varietal rank to these forms seems unjustified.

Aug. 1945.

XV. POTAMOGETON GROENLANDICUS HAGSTRÖM

In 1870 the Swedish botanist Sv. BERGGREN collected a narrow-leaved, sterile *Potamogeton* in a pond on a low hill near Christianshaab, 68°49′ N. recording it as *P. pusillus* L. (Öfv. K. Sv. Vet. Ak. Förh. 1871, p. 873). This species had escaped JENS VAHL and later Danish collectors and was thus new to Greenland. In 1883 his fellow countryman A. BERLIN found it again in four new stations (Öfv. 1884, p. 65); these also were sterile. At present 22 stations are known from West Greenland, between 60°43′ to 70° N. (none from East Greenland), namely 17 from the shores of Disko Bay, two from Godthaab fiords and three from the Ivigtût-

Julianehaab districts in the south. The vast stretches of ice-free land between the areas mentioned are not as well explored botanically as the rest of the coast, and, as the plant is easily overlooked, we may expect that intermediate stations are yet to be found. It grows among aquatic mosses in small freshwater lakes or ponds, mostly on gneiss, but sometimes also on basalt. However, in none of its known stations the water was brackish.

Of the 22 collections known but two had young flowers (Orpigssûp Qingua, 68°30′, middle af July 1890 (HARTZ) and Sinigfik on S. Disko, 69°25′, Aug. 15. 1929 (R. T. PORSILD)). The plant apparently has no persisting rhizome and thus survives by its winter-buds. During winter the ice in small lakes becomes well over one meter thick and vegetation along the borders, therefore, is imbedded in solid ice. But in spring the edge of such ponds thaw early, and during the growing season the temperature of the shallow water is relatively high. The winter-buds sprout and develop rapidly so as to produce shoots 2—3 dm long. But already in August, or even in July, new winter-buds are formed in the upper leaf-axils. Also the rare flowering stems, which have much longer internodes and shorter leaves, produce some winter-buds from the upper axils.

As is the case with so many other aquatic plants of Greenland our *Potamogeton* is thus merely retaining a "status quo". In favourable seasons it can just maintain its place, or, perhaps, gain a little more ground within the pond or lake, but it cannot produce any diaspores suitable for wider dispersal by action of winds, currents or animals. Its very presence in Greenland is thus a puzzle. Is every station a *carte de visite* of an occasional water-fowl, bringing viable seeds from a milder south, or is it, like all these sterile water-plants to be considered relics from an epoch of more genial life-conditions than to-day?

The name of the plant *P. pusillus*, as proposed by its first collectors, was accepted by LANGE and ROSENVINGE in their "Conspectus Florae Groenlandicae", and by OSTENFELD in his "Flora Arctica", but in his "Critical Researches on the Potamogetons" the Swedish monographer J. O. HAGSTRÖM declared our plant to be specifically distinct from *P. pusillus* and all its varieties, and probably an endemic of West Greenland for which he proposed the name *P. groenlandicus*.

In his brilliant work "De danske Blomsterplanters Naturhistorie" RAUNKIÆR greatly enriched our knowledge of the life-history, and of the external and internal morphology of the Danish potamogetons. He also gives keys based upon anatomical characters for identification of sterile specimens, especially thought to be useful as criteria for investigations of the numerous alleged hybrids. This latter part of his work, supplemented by investigations of a number of exotic species, was later

published in English as "Anatomical Contributions to a Monograph of the Genus Potamogeton".

It was clearly the aim of HAGSTRÖM not only to test RAUNKIÆR's results, but to extend his work to a monographic treatment of the potamogetons of the whole world. A vast number of species and supposed hybrids have been studied anatomically, and a large number of species and hybrid combinations have been proposed as new. But HAGSTRÖM had to content himself with the often rather scanty herbarium specimens available in Scandinavian herbaria. Often he described a new species from a single specimen. His arrangement of the genus in sections seems to be generally accepted by later writers, but the justification of some of his new species, the correctness of his interpretation of many hybrids, and the total lack of keys in his work have been duly criticized.

About **P. groenlandicus** n. sp. HAGSTRÖM says:

"Caulis compressus (1.8:1), simplex vel subramosus, internodiis 3—4 cm longis vel ultra. Folia uniformia, ca. 60 × 1 mm, angustissime linearia, 5—9 nervia, apice triangularia v. subcuspidata v. rotundata cum mucrone verrucæformi (vide fig. 55, *A*, *a*, *b*, *c*!), basi ad nervum medium ± lacunosa, nervis minutissimis. Ligulæ fissæ, apice rotundatæ, in spatio intercarinali 7—8 nerviæ, ca. 12 mm longæ, biglandulosæ. Spica ignota.

Anatomy coincides nearly with that of *P. pusillus* except that the leaves, in their upper half and sometimes also farther down, are lacking the lacunar rows along the midrib, and on either side of it always are furnished with very thin, mechanical strands scarcely perceivable to the naked eye. The topography of the central axis of the stem is of the circular type, and for the rest of pusillus-structure.

This species constitutes an interesting combining link between the *Oxyphylli* (*P. subsibiricus*) and *Pusilli* (*P. pusillus*) and would be ranked together with the former almost with the same right as with the latter. Ligules and leaf-apexes, however, unite it with the *Pusilli*.

Distribution: Greenland, probably endemic. It is gathered at Ivigtut (83, BERLIN), Christianshaab (90, HARTZ), Jakobshavn (92, SØRENSEN), Kingua Orpiksuit, 68°30′ N. L. (90, HARTZ), Ritenbenk, 69°44′ (88, HANSEN) and at Sarkak, 70° N. L. (90, HARTZ). The materials are preserved in Hb. Univ. Copenhagen."

HAGSTRÖM's new name was accepted by several later writers on the flora of Greenland among them OSTENFELD in "The Flora of Greenland and its Origin".

The next important work on *Potamogeton* is M. L. FERNALD's "The Linear-leaved North American Species of Potamogeton, Section Axillares", in quarto, 40 photogr. plates, 31 maps of distribution. In this work more than twelve thousand herbarium specimens from the principal American herbaria have been critically examined and revised. FERNALD's treatment is conservative. He admits for the N. American continent north of Mexico 22 linear-leaved species of the section *Axillares*, in addition to a number of varieties. The occasional occurrence of hybrids between richly flowering species is not denied, but most of the alleged

hybrids between plants, especially of those mainly propagated by buds, are, as it seems, rightly doubted. As usual in FERNALD's works the descriptions, keys, geographical distributions, and, above all, his clearing up of intricate nomenclature, are unexcelled. All illustrations of habits, and of details as well, are photographic, in good reproduction; the complete list of alle numbered exsiccata cited will greatly increase the usefulness of these sets where found. Anatomical studies are not included in the treatment.

FERNALD p. 87 places *P. groenlandicus* HAGSTRÖM as synonym to *P. pusillus* L. var. *mucronatus* (FIEB.) GRAEBN., a variety from the same geographical area as the typical plant, but differing from it by its more obtuse leaf-tip. As a vindication FERNALD, p. 95, gives his reasons for doing so saying:

"A word should be said regarding *Potamogeton groenlandicus*. HAGSTRÖM made this an endemic Greenland species, known only from foliage, differing from *P. pusillus* in having "Folia . . .[1]) 5—9-nervia, . . .[1]) basi ad nervum ± lacunosa, nervis minutissimis. Ligulae fissae"; but with anatomy which "coincides nearly with that of *P. pusillus*. . . .[1]) Ligules and leaf-apexes, however, unite it with the *Pusilli*." I have studied, repeatedly, such Greenland material as I have been able to see and am not yet able to convince myself that the leaves are truly 5—9-nerved. In some the lower half of the leaf is 3-nerved, the upper half appearing to be several-nerved, as if some modification of the tissue had taken place, but I have not been able to trace the extra nerve-like structures to the bases of the leaves. Except for this unconvincing and perhaps not quite normal tendency the Greenland material which I have seen is quite similar to the most translucent and sterile state of *P. pusillus* var. *mucronatus*. It will be most interesting to secure fruit of the Greenland plant, when HAGSTRÖM's interpretation may, perhaps, prove justified. Flowering material, recently secured, shows no difference from *P. pusillus* var. *mucronatus*."

In all descriptive works *P. pusillus* is said to be 3-nerved[2]), whereby is generally understood that, by "nerves", the midrib and the lateral vascular bundle on either side is meant, and that the marginal fiber-strands, present in most linear-leaved potamogetons, are not counted. On the other hand, leaves, of for example *P. zosterifolius* are called "many-nerved", even when only 5 of the "nerves" are vascular bundles and the remaining fiber-strands. Unfortunately HAGSTRÖM gave no illustrations of *P. groenlandicus*. As to the form of its leaf-tips he refers to his figures of some forms of *P. pusillus*, but his description quoted above -(in part, omitted by FERNALD) "on either side of the midrib always furnished with very thin mechanical strands, scarcely perceivable

[1]) The omissions are FERNALD's.

[2]) In RAUNKIÆR's Bl. pl. p. 57 (and redrawn by GRAEBNER in "Lebensgeschichte der Blütenpfl. Mittel-Europas" Vol. I, p. 414) a section of a 5-nerved leaf is erroneously labelled *P. pusillus*. In fact this section is from *P. mucronatus* SCHRAD., as said by RAUNKIÆR himself in Bot. Tidsskr. 25, 268.

to the naked eye" should leave no doubt about the "modification of tissue" which has taken place. Admittedly these delicate fiber strands

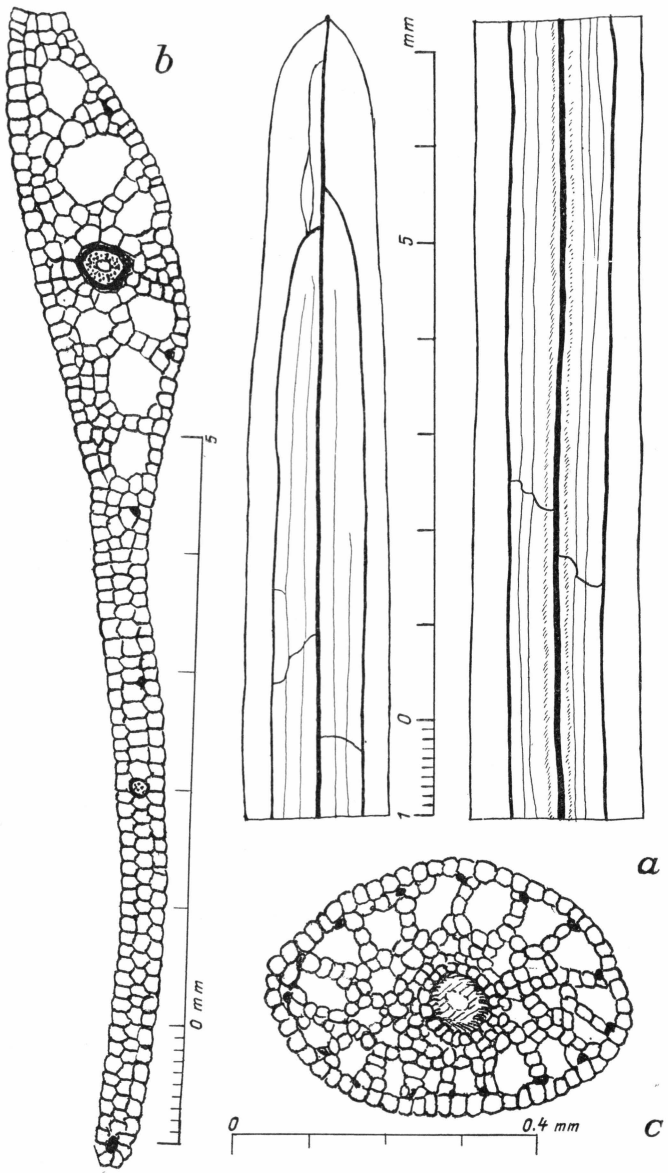

Fig. 3. *Potamogeton groenlandicus* HAGSTRÖM. *a.* End and middle part of leaf. *b.* Cross section of same. *c.* Cross section of stem. (Drawn with camera lucida).

are difficult to see, even under a strong lens, especially in well prepared and mounted herbarium specimens. As we know from RAUNKIÆR the anatomy by the submersed, linear leaves in *Potamogeton* consist of only

three layers of cells, except around the mid-rib where the vascular bundle is surrounded by a number of air-ducts. The chlorophyll is crammed into the cells of the epiderm, and as the mechanical strands are placed between the epiderm and the single subepidermal layer, mostly on the lower side of the leaf, the strands, consisting as they do of still smaller elements than the epiderm, are hardly visible. A cross-section of course would at once settle the question, but the making of appropriately thin cross-sections from these delicate and flaccid leaves, however, is at best a slow process. As a rule these strands are easily

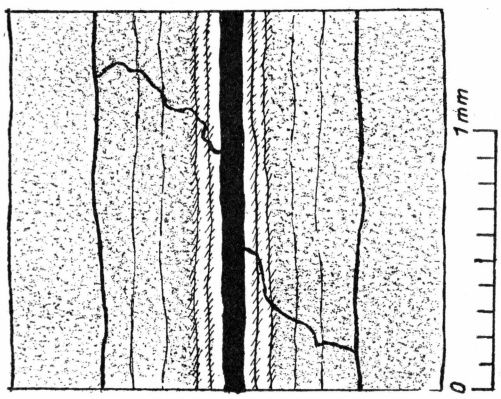

Fig. 4. Surface of the leaf after bleaching.

discernible in older leaves with incipient decay of the cell-contents, while in young and bright green leaves they can speedily be made visible by bleaching the leaves with *Eau de Javelle* (a solution of hypochlorite of potassium). Leaves preserved in alcohol may be placed directly in the fluid, while herbarium specimens should be boiled first for a couple of minutes in alcohol or water[1]).

After bleaching the delicate strands become distinct. In the upper part of the leaf there are mostly two between the midrib and the lateral nerve, farther down there may be three; only once have I seen one outside the lateral nerve. In some cases, in the leaf-tip, they pass the point of confluence of the lateral nerves with the midrib. Sometimes they are discontinuous, as if torn asunder by the growth of the leaf. At the crossings of the transversal "bridges" the latter are often slightly bent, as if stretched by the mechanical strands.

Of *P. pusillus* var. *mucronatus* (FIEB.) GRAEBN. the writer has seen specimens from the north shore of the Gulf of St. Lawrence, collected

[1]) Attention should be called to the fact that cell-walls in stems and leaves of potamogetons, for some unknown reason, generally fail to respond to the ordinary tests for wood and cellulose. (See RAUNKIÆR p. 39—40).

by H. ST. JOHN No. 90090, (identified by FERNALD). In habit this variety, as stated by FERNALD, is very similar to *P. groenlandicus*, but it lacks the fiber strands, even after bleaching. The same is the case with Icelandic *P. pusillus* leg. A. FEDDERSEN 1884. In the latter the leaves are narrower and their tips more acute.

To some degree the development of the mechanical strands in the leaves of aquatic plants is said to depend upon the environment. They become stout when the leaves are exposed to wave action or currents, slender in quiet or stagnant waters. If *P.* "*pusillus*", normally devoid of such strands (except in the leaf-margins), were able to develop such strands, there certainly would be no reason for doing so in Greenland where it grows in stagnant ponds, mostly without outlet. But if *P. groenlandicus* had inherited its fiber strands from ancestors, possibly like *P. subsibiricus*, a degeneration on its Greenland stations might, following the doctrine, be explainable.

Some observations. *P. groenlandicus* apparently has no persisting rhizome, but sprouts only from the winter buds that are anchored to mosses on the bottom of the pond. The stems are capillary, slightly flattened, 2—4 dm long, with the upper internodes of the sterile shoot about 1 cm long, the lower longer and those of the flowering shoot 7—8 cm long. The leaves are flat, linear, 5—9 cm long, 1.3—1.7—2.0 mm wide, and bright green, with obtuse tip yet with a sharp apex; in the lower part the leaf has two translucent air-ducts on either side, which vanish towards the tip. (About nerves and fiber strands see above). Ligules are 12—20 mm long, entire or longitudinally split. On the flowering plant (from Sinigfik) the peduncles are 5—25 mm long, barely stouter than the stem, upwards not dilated. In the score of individuals examined there were but two whorls of flowers, the upper with open stigmas and closed perianth leaves, the lower with some of the perianth leaves spreading, but with anthers still closed. The perianth leaves are flabelliform with a very slender claw.

RAUNKIÆR states that the cells of the axis of the winter bud of Danish linear-leaved potamogetons are densely crammed with starch. In cross-sections of those of *P. groenlandicus* (alcohol material) I found a little starch, but more fat, soluble in ether and stained by osmic acid. This, however, is hardly a specific character as many plants in the Arctic are storing fat instead of starch, at least by low temperatures.

On two undoubtedly erroneous records of Greenland Potamogetons.

In 1897 CHR. KRUUSE collected a sterile *Potamogeton* at Ikamiut, 68°38′ N., which by RAUNKIÆR was identified as *P. obtusifolius* M. & K., and published as a novelty for the flora by KRUUSE p. 361. And in 1898 M. P. PORSILD found in a small lake at Disko Fjord, 69°32′ N. another sterile plant which also by RAUNKIÆR was identified as *P. mucronatus* SCHRAD., and published as a novelty by PORSILD: I p. 206. The first was entered in OSTENFELD: Fl. Arct. p. 20, and both in PORSILD: Fl. of Disko p. 30. After the issue of HAGSTRÖM's work OSTENFELD told the present writer that he gravely doubted the correctness of both these records, supposing that both plants more likely should be referred to *P. groenlandicus*. And this view OSTENFELD maintained in his "Flora of Greenland and its Origin" p. 69.

Unfortunately this standpoint of his was overlooked by SAMUELSSON when he published his splendid work on the distribution of the aquatic vascular plants of the Scandinavian countries, and their climatic and edaphic requirements. On the authority of RAUNKIÆR, SAMUELSSON mentions on p. 159 the alleged occurrence of these two species in Greenland as an "almost incredible" anomaly. For instance, he states, that the northern limit of *P. mucronatus* in Sweden and Finland is at the isotherm of July of 15° C., in Norway at 12.5° C., whereas the mean temperature of July at Disko Fjord at most would be 7.5° C.

Seemingly this might be interpreted as a shortcoming of RAUNKIÆR's keys for identifying potamogetons by anatomy. But it should be kept in mind that when these identifications were made no *P. groenlandicus* had yet been proposed. And at least RAUNKIÆR did not name any of the specimens in question as *P. pusillus* which then figured in the literature as a Greenland plant.

The synonymy of *P. groenlandicus* will thus be (for fuller titles see bibliography):

P. groenlandicus n. sp. HAGSTRÖM 1916, p. 281 and ff. — M. P. PORSILD: II, 1920, 31. — A. E. PORSILD: 1926, 169. — OSTENFELD: II, 1926, 69. — M. P. PORSILD: III, 1935, 33, 59, 81. — BÖCHER: 1938, 200.

P. pusillus BERGGREN 1871, 873. — BERLIN: 1883, 65. — LANGE: I, 1880, 117. II, 1887, 282. — ROSENVINGE: 1892, 710, non L.

P. pusillus var *mucronatus* (FIEB.) GRAEBN. FERNALD: 1932, 87.

P. obtusifolius KRUUSE: 1898, 361. — OSTENFELD: I, 1902, 20. — PORSILD: II, 1920, 30, non MERT. & KOCH.

P. mucronatus PORSILD: I, 1902, 206. II, 1920, 30, non SCHRAD.

Dec. 1940.

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XVI. ON CAREX RUFINA DREJER

Carex rufina was described by SALOMON DREJER in his "Revisio Critica Caricum Borealium" of 1841. His diagnosis and description was based upon four sets of specimens, collected by JENS VAHL, in South and Southeast Greenland. Shortly afterwards the plant was found by the well-known caricologist N. J. ANDERSSON in Lule-Lappmark, N. Sweden and by N. G. MOE in Valders, S. Norway. During the almost hundred years that have elapsed since a good many new stations, both in Greenland and in Scandinavia, have been added, as well as in Iceland, but *C. rufina* is still a rare plant. Recently A. E. PORSILD has

recorded it as found by him in N. America, east of Hudson Bay ("Sargentia" IV, 19, 1943).

If we compare the descriptions given in the leading floristic handbooks we find some conflicting statements, showing that the plant is still imperfectly known. The descriptions consulted are the following (for full title see bibliography):

Drejer 1841, 446.
N. J. Andersson 1849, 56, fig. 14.
Flora Danica fasc. 43, t. 2481, 1849[1]).
M. N. Blytt 1861, 205.
Hartman II. ed. 1875, 470.
Neuman & Ahlfvengren 1901, 704.
Ostenfeld 1902. 79.
O. Dahl & A. Blytt 1906, 144.
G. Kükenthal 1909[1]).
K. M. Mackenzie 1935, 231.

Of these descriptions Mackenzie is by far the most exhaustive.

Of the authors mentioned above probably Andersson and Dahl only have seen the plant in its natural habitat, although M. N. Blytt had it under cultivation in the Botanical Garden of Christiania, by his head-gardener Moe, who found the plant. And we may fairly state, that as far as Scandinavian writers are concerned the descriptions of Andersson, Dahl and M. N. Blytt are the best. The remaining authors have drawn their descriptions from herbarium-specimens which, as will be shown below, in many cases must have been incomplete.

Authors writing in Latin or English are quoted verbatim, quotations from those writing in Norwegian or Swedish are translated.

Habitat. Jens Vahl's written labels are quite stereotypically worded in such terms as "in arenosis", "in paludosis", "in apricis", and so on, and about our plant he said "in locis irrigatis glareosis"; Andersson wrote "on muddy shores"; Hartman: "on moist banks of lakes and streams"; Dahl: "in moist places, especially on gravel near glaciers", and such recent investigators of the flora of SE. Greenland as Devold & Scholander (1933): "in places inundated in rainy weather, and sometimes at the shore of small lakes". On Disko Island the plant grows along the borders of shallow ponds, in moist summers partly inundated at first, later becoming dry. In exceptionally wet summers it does not flower, and in dry summers it does flower, but often the fructification is poor. Usually the inflorescences are hidden between the tips of green

[1]) Not accessible to the present writer.

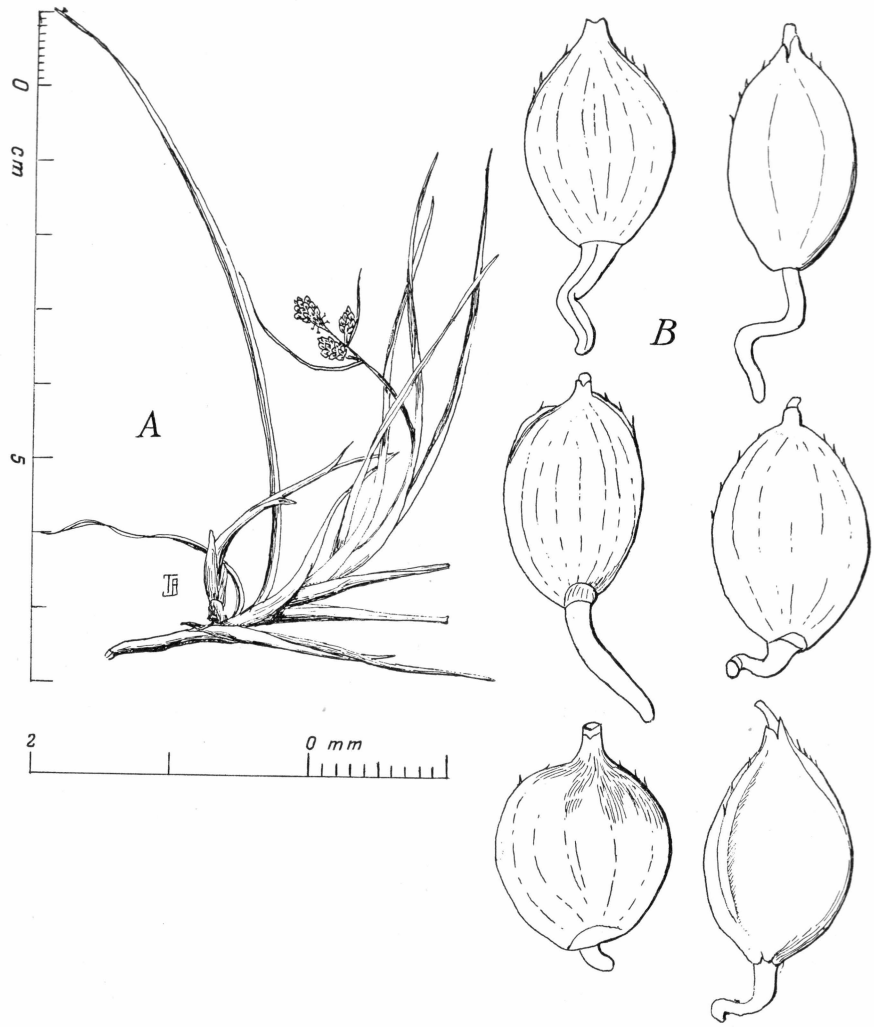

Fig. 5. (Drawn by TR. BRANDT). *A. Carex rufina* DREJ. Flowering shoot with an innovation below. *B.* Mature utricles with their long pedicels.

and withered leaves, and the plant is thus very inconspicuous as it simulates sterile growth of almost any grass-like plant. Its habitats, near the Arctic Station, are almost exclusively on Archæan rocks, but it is not necessarily an oxylophyte, because the low Archæan rocks here are closely surrounded by higher hills of basalt or volcanic tufa, and the loose soil of the valleys thus may be, in part, of origin basaltic.

Growth-form: "cespitose" (most authors); "loosely cespitose" (MACKENZIE); "densissime cæspitosa" (DREJER); "culms and sterile leafy shoots form small diffuse and decumbent tufts" (DAHL). Probably the

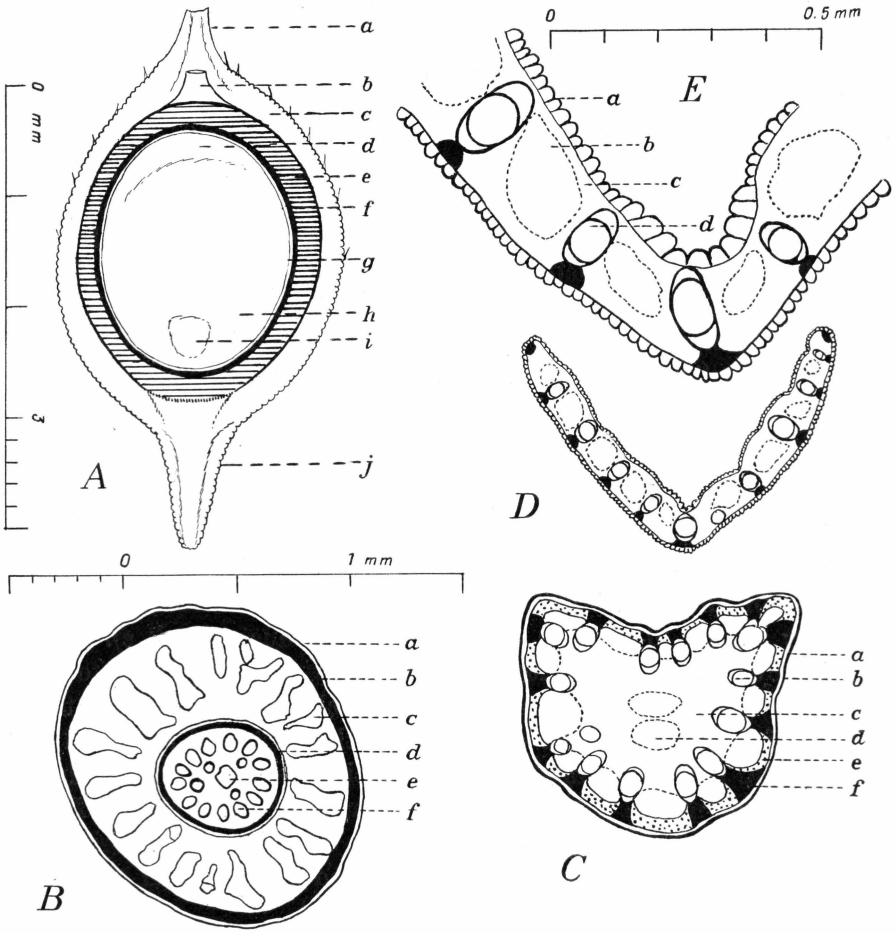

Fig. 6. *Carex rufina* DREJ. *A*. Longitudinal, almost median section of a mature utricle; *a* beak; *b* style; *c* utricle wall; *d* upper part of endosperm containing fat; *e* pericarp, lignified; *f* innermost layer of pericarp, consisting of stereids; *g* seed-coat; *h* main part of endosperm, containing carbohydrates; *i* embryo; *j* stipe. *B*. Section of rhizome; *a* epiderm; *b* stereome; *c* bark of thin-walled cells with large air-ducts; *d* endoderm; *e* central air-duct; *f* mestome-bundles. *C*. Section of culm; *a* epiderm; *b* mestome-bundle; *c* parenchyma of large, thin-walled cells; *d* air-duct; *e* chlorenchyma; *f* fibres. *D*. Section of leaf. Obs. Fig. *B*, *C*, *D* drawn to the same scale. *E*. Part of section of leaf; *a* epiderm with papillary cells (so on both sides of the leaf); *b* air-duct; *c* chlorenchyma; *d* mestome-bundle.

growth-form observed by DAHL well describes the plant as it behaves near the melting water from the glaciers, where it is pioneering on new soil. Such is also the normal form of its nearest relative *C. bicolor*. But on the pond-shores, in the lowland, it forms a closely bordering growth of dense tufts. While as a general rule OSTENFELD's figures of the habit of arctic Carices are excellent, his figure of *C. rufina* p. 79 is somewhat

misleading as no innovations are shown. These are short, with blade-less scales below (see fig. 5*A*), but within the dense tufts their tips are soon forced upwards, as in so many stoloniferous Carices, and the tuft thus gradually becomes denser.

Culms and leaves. The flowering culms below are surrounded by withered striate stramineous leaves and sheaths of the previous year, 5—10 cm long, soft and smooth. The fresh leaves, 2—5 to each culm, are soft, subflaccid, the blades flat, or slightly involute in drying, faintly scabrous above, exceeding the inflorescence. The leaves are fresh green, although OSTENFELD states that they are "glaucous", and MACKENZIE that they are "yellowish green", DAHL that they are "bright green".

The internal structure of the plant is in good accord with its semiaquatic habitat. The rhizome (fig. 6*B*) has under the epiderm a tube, the wall of which is several layers thick, of small sclerified cells with brown walls. The bark consists of large thin-walled cells and is split into a number of large longitudinal air-ducts. The inner and radial cell-walls of the endoderm are thickened, the mestome-bundles are relatively weak and there is also a central air-duct (fig. *B*, *e*).

The culm is well provided with air-ducts (fig. 6*C*) which occupy the whole circumference within the chlorenchyma. The central tissue consists of large thin-walled cells, and at the center of the culm two air-ducts are generally found, in some sections more or less confluent.

The epiderm-cells on both sides of the leaf (fig. 6*D* and *E*) are papillose, as already stated by RAUNKIÆR p. 513. There are longitudinal air-ducts in the blade between the nerves and the marginal strands of fibers are weakly developed.

The inflorescence is contracted, and usually consists of three, rarely five spikelets of which the terminal one as a rule is subclavate and staminate at the base, the lateral spikelets are pistillate, sessile to short peduncled, short-oblong to elliptic in outline, about 8 mm long and 4 mm wide, densely flowered. DREJER already observed that the arrangement of the sexes in the terminal spikelet varied. As his description is very exact, and as most subsequent authors have left out some details, it is quoted here in full below. Also MACKENZIE gives an exact and very detailed description. DREJER on p. 446 (separate issue p. 28) says:

(Diagnosis) "Spicis subquinis approximatis oblongis ellipticisve terminali androgyna".

(Descriptio) "Spicæ aggregatæ subsessiles v. subremotæ breve pedicellatæ, infima interdum *C. bicoloris* more a basi culmi in pedunculo longissimo erumpens; terminalis aut basi floribus paucissimis masculis instructa, aut basi apiceque, aut tota mascula; infima fulcitur bractea

foliacea culmum multo superante, colorato-auriculata basi sæpe undulata; bract. superiores longitudine subito descrescunt".

In 80 inflorescences examined the writer found the following arrangements in the terminal spikelet:

male at the base	female throughout	male throughout	male at the top	male at both ends, female between
58	12	8	1	1

Variations were found within the same individual. A pistillate spikelet on a long slender peduncle from one of the basilar axils of the culm, as seen by DREJER, has not been observed by the writer. But similar cases quite commonly occur in other species, such as *C. bicolor*, *C. holostoma*, *C. deflexa* etc.

The staminate scales are, mentioned by no one, they are obovate to spatulate, reddish-brown with lighter mid-vein, hyaline below, about 2.6 mm long; the anthers are pointed above, 2.0×0.3 mm.

About the pistillate scales authors disagree. DREJER said: "ovali-obtuse, rufo-fulvae (literally: "fox-red to lion-yellow"), interdum nervo dorsali, viridi pictae"; BLYTT: "obovate-elliptical, obtuse, reddish brown, with a green mid-vein that vanishes below the apex"; OSTENFELD: "obtuse, red-brown, sometimes with paler mid-vein, as long as, and broader than the utricles"; DAHL: blackish-red"; MACKENZIE: "closely appressed, obovate, obtuse, as wide as and slightly shorter than perigynia, shining, purplish-brown, with lighter midvein or center, not extending to apex"; LANGE: Consp. p.138: "colore cupreo nitido".

The writer finds, the pistillate scales obovate, obtuse, with the mid-vein not extending to the apex, clasping the utricles below, otherwise narrower, and always shorter, at maturity only covering the lower half, or at most $^2/_3$ of the utricles. At a certain stage of immaturity they are somewhat lustrous, beautifully dark-purple and some of them provided with a light-green mid-vein. At full maturity, however, they are perfectly dull, dark leather-brown, mostly throughout, but sometimes with a yellowish mid-vein.

Utricles. Similar or worse inconsistencies are found in descriptions of the utricles. DREJER: "perigyniis stipitatis ellipticis tenuissime ciliolato-serrulatis breve rostellatis squamas . . . superantibus"; ANDERSSON: "elliptical obovate, with short protruding orifice, biconvex, very minutely serrulate, indistinctly 3-nerved, exceeding the scales"; BLYTT: "equaling the scales or slightly longer, obovate-elliptical, substipitate, biconvex, indistinctly 3-nerved, slightly scabrous on the margins, ending in a very short truncate and entire beak"; HARTMAN: "acute, broadly oval, with a short beak, greenish"; NEUMAN: "strongly convex, broadly oval, in-

distinctly nerved, beak scabrous on the margins, distinctly but very slenderly stipitate, ab. 2 mm long"; OSTENFELD: "plano-convex or biconvex, ovate, with scabrous margins above, nerveless, pale or red-brown above, beak very short, entire"; DAHL: "equaling or slightly exceeding the scales, greenish, broadly elliptic, beak short, sides convex distinctly 3-nerved"; MACKENZIE: "perigynia obovoid, 2—2.5 mm long, 1.5 mm wide, very strongly flattened, unequally biconvex, the marginal perigynia 2-ribbed, all obsoletely very slenderly nerved, light-green or yellowish-green or somewhat glaucous-green, puncticulate, glabrous, the upper margin sparingly serrulate, round-truncate at base, stipitate, abruptly apiculate, the beak 0.1—0.2 mm long, slightly emarginate, purple-tinged".

At an early stage the utricles may well be termed "flattened", "plano-convex" or "unequally biconvex", but they are never "acute", nor constricted below the middle, as drawn by LINDMAN (Sv. Fan. Fl. 2. ed. fig. 101, 1). When immature they are light-green, strongly contrasting to the deep purplish scales of the same stage of development. But at maturity they are whitish, except on the outer side above where an irregular "sun-burnt" blotch may occur, strongly biconvex, almost circular in section, with faint nerves on the sides, visible on immature dry utricles, but hardly visible on perfectly mature ones. There are a few minute unicellular teeth on the upper margins, best seen when fresh. The average dimensions, from numerous samples measured, are 1.8—2.0 × 1.1—1.2 mm, beak included, but stipe excluded.

The wall of the utricle is very thin, consisting of a few layers of thin-walled colourless cells. When properly moistened the cells swell and the utricle becomes quite transparent and the yellowish-brown nutlet visible. Under a strong lens the utricle is dull, but not as distinctly granular as that of *C. bicolor*. Under the microscope the epiderm-cells are finely papillose.

The utricles are termed "stipitate" by DREJER, "substipitate" by BLYTT, "distinctly slenderly stipitate" by NEUMAN. In fact, in some of the utricles the stipe is short, about 0.2 mm, as in many species of *Carex*, but in most of them the stipe is elongated, almost half as long as the body, straight or curled in pig-tail fashion (see fig. 5*B*). To the writer's knowledge similar long stipes have not been mentioned before in the genus.

In several species of *Carex* the utricles by various authors are unreservedly described as "green" and the scales as "purple", although it would seem obvious that green and purple cannot be the final colours in these organs. In the higher plants "green" is chlorophyll and "purple" is mostly anthocyanin, both substances having important functions only in the living and growing cells. Both are common in bulblets and are

here able to keep throughout the winter without losing their viability. In bulblets they may well be needed, as these, so to speak, are detached fragments of the mother-plant and must continue their growth as soon as conditions permit, or perish. But in a fruit, with a firmly enclosed seed, which is destined to rest, often for a long period, before germination can start, chlorophyll and anthocyanin are not needed. At maturity pericarp and utricle have finished their growth, their tissues are transformed to suit their final functions which is the protection and dispersal of the seed.

The nutlets. DREJER: "caryopsis ovalis subbiconvexa laevis viridiflava"; MACKENZIE: "achenes lenticular, closely enveloped, filling lower $^3/_4$ of perigynium, ovoid-orbicular, 1.25—1.5 mm long, nearly as wide, yellowish-brown, puncticulate, sessile, apiculate, jointed with a short, slender, included style" (not mentioned by the other authors).

Fig. 6*A* shows a mature utricle in longitudinal section, in cross-section it is almost circular, the wall of the utricle is swollen from the softening treatment for cutting: boiling in alcohol and subsequent boiling in water with added hydrate of chloral. The nutlet completely fills the closely fitting utricle. When dry the wall of the utricle is very thin and white, because of the air-content of the empty cells. The whole surface is finely papillose and cutinized, so that a dry utricle floats on water for a long time, it even floats on alcohol for some time, though there is no air-chamber or "floating tissue". Contrasting to the weak utricle the pericarp is very strong, lignified, the inner layer, as usually, consisting of small, but thick-walled sclereids. For the rest see explanation of the figure.

Distribution.

Greenland, W.: about 15 scattered localities between 60° and 69°21′ N. L., one of them at 500 m altitude.

E.: about 20 localities between 60° and 71°25′ N. L. (map of Greenland distribution in BÖCHER: Studies etc., Medd. om Grl. 106, 2, p. 234, 1938)

Iceland: map in JOHS. GRÖNTVED: Botany of Iceland IV. I, p 173, 1942.

Norway: a southern area in the mountains from about 59° northward to about 62°, and a northern area from 66°—68°57′ N. L.

Sweden: the inner and highest parts of Härjedalen, about 62° N., Jämtland, Pite-, Lule- and Torne-Lappmark, about 68° N. L.

N. America: Keewatin, 60°58′ N., 97° W. A. E. PORSILD l. c.

Affinities. DREJER recognized the near affinity of his new species to *C. bicolor*, in which view ANDERSSON agrees. Nevertheless, some specimens from Scandinavia, labelled *C. rufina*, have puzzled recognized authorities. As late as 1879 C. HARTMAN remarks that he is unable to separate "tall-grown specimens with more remote spikelets and the terminal one staminate throughout" from *C. Goodenowii*, and NEUMAN categorically asserts: "leaves as in *C. Goodenowii*", although he describes these as glaucous. Also specimens of a sterile *Carex*-hybrid are at hand, which by their collector had been interpreted as *C. Goodenowii* × *rufina*. To the present writer it is impossible to find traces of *C. rufina* in them. Possibly influenced by such statements we find in KÜKENTHAL's monograph (1909) *C. bicolor* and *C. rufina* placed in a subsection *Bicolores* TUCK. at the head of the large section *Acutae* FR., and followed by the subsections *Rigidae* FR. and *Vulgaris* ASCH.

OSTENFELD (1902) placed the *Bicolores* TUCK. with the same two species, as a subsection under *Datylostachyae* DREJ. coordinated to *Paniceae* TUCK., and in MACKENZIE's work (1935) we find the same groups coordinated, but as separate sections.

MACKENZIE in this section, in addition to the former, includes three American species. In a recent revision of *C. Hassei* BAIL., FERNALD has recently segregated one new species: *C. Garberi*, with a geographical variety *bifaria* (Rh. 1935, p. 253). The section at present thus consists of:

1. *Carex rufina* DREJ. S. Greenland, Iceland and alpine Scandinavia, Keewatin.

2. *C. bicolor* ALL., the widest ranging and, therefore, probably also the oldest species of the group.

Asia: W. Siberia to Lena and Kolyma rivers.

Europe: Pyrenees, Alps, Karpathian Mts., alpine N. Europe and Iceland.

N. America: S. Greenland, Baffin Land, Newfoundland and SE. Alaska.

3. *C. Hassei* BAIL. Western U.S.

4. *C. Garberi* FERN. in the States and Provinces bordering the Great Lakes, north to the mountains of Alberta and Yukon.

var. *bifaria* FERN. Canadian Rockies and in the east around the Gulf of St. Lawrence.

5. *C. salinaeformis* MACK. Only from Mendocino, N. California.

6. *C. aurea* NUTT. across the continent, north to Newfoundland and B.C., south to S. California and N. Mexico.

The American species are all erect, stoloniferous, forming small to medium-sized clumps; *C. Hassei* may be 5 dm high, *C. salinaeformis* even 7 dm, the others are mostly 2—3 dm. To judge from the "fruits": utricles and nutlets, the affinity of *C. Hassei* and *C. Garberi* and its variety to *C. rufina* is evident. All have thin-walled utricles, in the young state light-green, at full maturity whitish, translucent when moist, in outline ± obovate, beak-less or nearly so, in section ± elliptic, and having the peculiar appearance of the surface of the utricles which MACKENZIE describes as "pulverulent". However, though perhaps it may produce such an illusion, there is actually nothing "powdery" about the utricle. The surface is densely and finely papillose, seemingly not by a simple bulging of the outer wall of the epiderm-cells, but due to the curious conical protuberances on their back-wall, which DUVAL-JOUVE found in the vegetative parts of numerous *Cyperaceæ*, and WILCZEK in the utricle-walls of other species (l. c. p. 135, 193). At maturity, when the utricle becomes white, the tissues are compressed, and the thin outer wall on each epiderm-cell is pressed against the conical nodule on its back-wall. I have been able to examine only utricles of *C. Garberi* var. *bifaria* and of an unauthenticated specimen of *C. Hassei*, but the structure of their utricles is identical with that of *C. bicolor* and *C. rufina* whereas their dimensions are different. In the dry state the wall is equally thin, throughout recalling tissue paper or elder-pith. There are no separate "floating tissues" or "water-storing" parts. But, nevertheless, they all float, even on alcohol, for some time.

Common to these species are also the two stigmas, a ± contracted inflorescence, the terminal gynaecandrous, or entirely staminate spikelet. *C. rufina* differs from all in having a minute beak, some few small teeth on the upper margins, utricles and nutlets more roundish than lenticular, and, as we have seen, by its long stipes.

C. salinaeformis MACK. (which I have not seen) is described as a littoral plant, up to 7 dm high, the utricles yellowish-green to straw-coloured, subcoriaceous, with a spongy base. By W. BOOTT it was considered a variety of *C. salina.*

C. aurea NUTT. has a "fruit" which is probably unique in the whole genus. At maturity the utricles are fleshy, translucent golden-yellow or orange. MACKENZIE describes them as being "flattened, oval in cross-section" "coarsely ribbed, broadly short-stipitate" and the achenes "lenticular", but by softening mature herbarium-material the writer found them almost globose, about 3 × 2 mm, or even slightly depressed at both ends like an apple, with ribs never visible. The utricle-wall is rather tough, but not leathery. In their colour, transparency and in the dark nutlets within they almost remind of spawn of sculpins. The

nutlet is dark-brown and shiny, in cross-section elliptic to subglobose, about 1.5 mm long and almost as wide. Because of its almost drupe-like fruit *Carex aurea* may be a zoochore, dispersed by birds, fish, or ants. If no other similar cases are known it should perhaps better form a section of its own.

Febr. 1941.

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XVII. THE GREENLAND ACHILLEA

In southernmost Greenland an *Achillea* occurs which has passed as *A. Millefolium* L., thus identified by HORNEMANN, J. VAHL, LANGE etc. Following RYDBERG: N. Am. Fl. 34, p. 221 the present writer, in 1932 (Alien Pl. p. 74), referred it to *A. Millefolium* var. *nigrescens* E. MEY. because of its dark involucral bracts, however, keeping apart from it specimens of typical *A. Millefolium*, with light coloured bracts, which in some places in South Greenland occurs as a recently introduced garden weed. According to information received from Mr. K. N. CHRISTENSEN, in charge of the Agricultural Station at Julianehaab, both forms are readily distinguished by this character. The dark-bracted

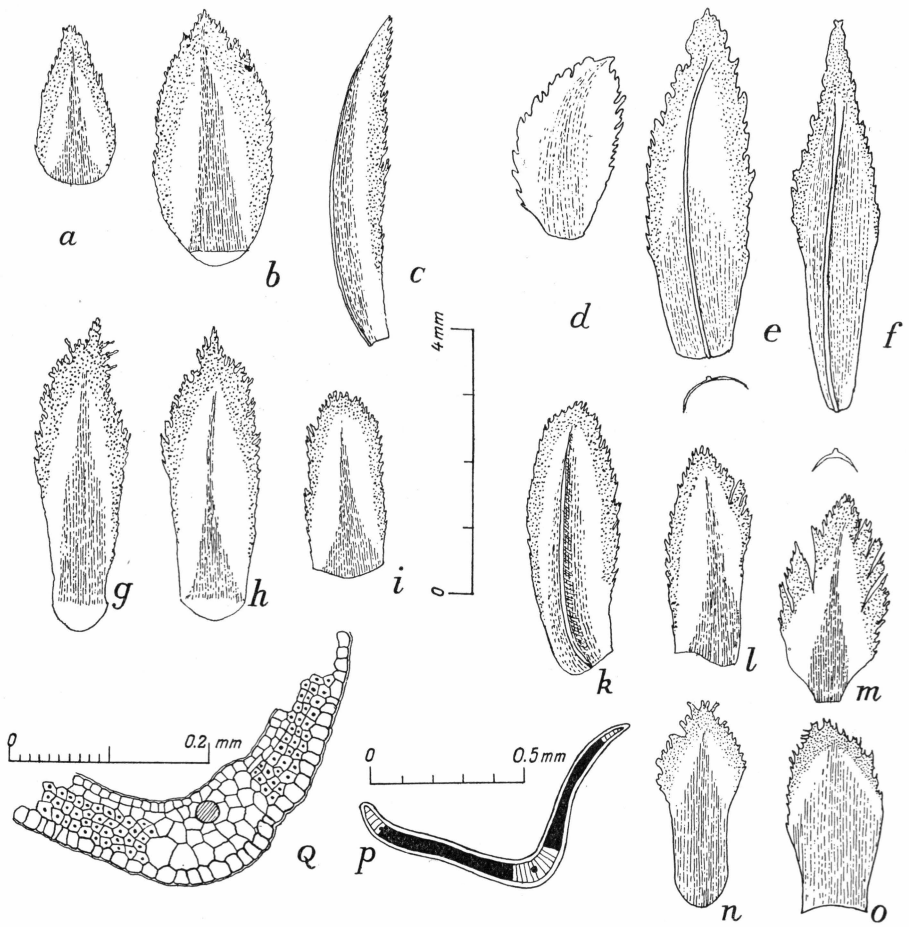

Fig. 7. Involucral bracts; *a*—*c* of *Achillea borealis*, from Bella Bella, Alaska; *d*—*f* of the same, from Kodiak, Alaska; *g*—*i* of *A. nigrescens*, from Nain, Labrador; *k*—*m* of the same from Gaspé, Québec; *n*—*o* af *A. Millefolium* from Jakutsk, Asia; *p* section of bract from Alaska, stereome shown in black; *q* part of the former magnified.

plant, in the Julianehaab district, is found chiefly near inhabited places and near Norse ruins, and was by Rosenvinge and Ostenfeld thought to have been introduced by the Norse from Iceland or Norway. This theory to the present writer seemed untenable, assuming that the plant in question really was identical with the Labrador plant.

A renewed study of the Greenland plant and of somewhat ampler material of American specimens for comparison shows that the colour of the involucral bracts in itself seems of minor importance, since in otherwise typical specimens of European or Asiatic *A. Millefolium* dark-bracted forms occur as well. The uppermost and innermost involucral

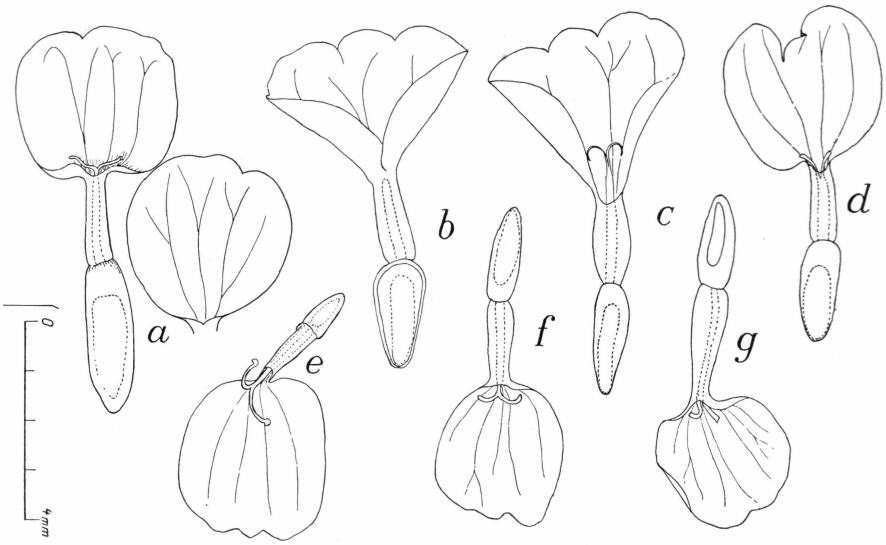

Fig. 8. RAY FLOWERS of *a Achillea borealis*, Kodiak, Alaska; *b*—*c* of *A. nigrescens*, Nain, Labrador; *d* of the same, Gaspé, Québec; *e* of *A. Millefolium*, Switzerland; *f* of the same, Qordlortoq, Greenland; *g* Igaliko, Greenland.

bracts pass gradually in shape, size and texture into the bracts of the chaff on the receptacle. In *A. Millefolium* the outer and inferior in-

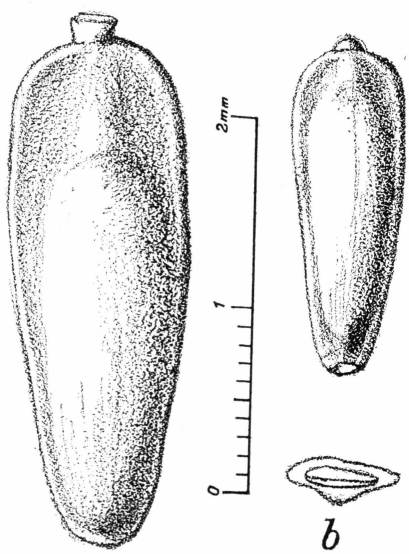

Fig. 9. ACHENES of *Achillea borealis*, Kodiak, Alaska and of *A. Millefolium*, Prussia. (Figs. 7—9 drawn by TR. BRANDT.)

volucral bracts are but slightly convex, rather soft and pliable, so much as to be easily flattened by the weight of a cover glass, whereas in

A. nigrescens (E. MEY.), or, especially in the West American *A. borealis* BONG., with which this has sometimes been united, the involucral bracts are spoon shaped (the lower) to distinctly cymbiform (the median and upper), and much stiffer. If squeezed flat between a pair of slides they invariably split along the edges.

Also their internal structure is different and quite peculiar for a leaf-like organ. Transverse sections show the median vascular bundle surrounded by a tissue of large thin-walled cells, but in the halves of the bracts we find in *A. borealis* the mesophyll consisting of 3—4 layers of small, thick-walled cells only. — The Labrador plant shows almost the same structure, whereas generally in the European *A. Millefolium* only one single layer of stereides is found.

E. MEYER already noticed that the ligules are larger in *A. nigrescens* than in *A. Millefolium*, and in the GRAY Manual, 7. ed. p. 845 this is rightly used as a key-character. In *A. borealis* the heads are still larger and the ray-flowers notably longer, as will be seen from the figures, which are drawn to the same scale.

The achenes also are different. Those of *A. Millefolium* are flattened, 1.8—2 mm long, about 0.6 mm wide above, somewhat tapering downwards. The seed is ellipsoid in outline, at maturity well filling the pericarp in length, but leaving at each side of the achene a wing-like empty space. These wings are whitish, the parts of the remaining pericarp silvery gray and translucent. In *A. borealis* and *nigrescens* the achenes are larger, 2.6—3.2 mm long, 0.9—1.2 mm wide above the middle, tapering downwards or conoid. In the best developed specimens, possibly not quite mature, yet with brown seed coats, the seeds are decidedly shorter than the pericarp. If this difference in length is constant in fully mature achenes, it should prove a valuable distinguishing character.

Since the external and internal structure of its involucral bracts of the Greenland *Achillea* as well as the size of its ligules and achenes are identical with those of *A. Millefolium* of Europe and Asia, both must belong to the same species. Its occurrence in the district of Julianehaab may thus very well suggest an introduction by the Norse settlers.

Aug. 1941.

Færdig fra Trykkeriet den 27. August 1946.