MEDDELELSER OM GRØNLAND
UDGIVNE AF
KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND
BD. 128 · NR. 5

DANSK PEARYLAND EKSPEDITION 1947–50
LEADER: EIGIL KNUTH

CYTOLOGICAL STUDIES IN THE FLORA OF PEARY LAND, NORTH GREENLAND

BY

KJELD HOLMEN

WITH 62 FIGURES IN THE TEXT

KØBENHAVN
C. A. REITZELS FORLAG
BIANCO LUNOS BOGTRYKKERI
1952

INTRODUCTION

Danish botany has during a long period been developing great traditions in Greenland, the result being that Greenland today is one of the countries outside Europe whose flora and conditions of vegetation are among those best known. Ever since the beginning of the 19th century Danish botanists have investigated the flora of Greenland, though, indeed, these 25 years, because of improved travelling and working possibilities created by the technical development, have provided the greatest results.

The accomplishment of the Danish Pearyland Expedition 1947—50 was also to the highest degree conditioned by the improved technics; for under the leadership of Count Eigil Knuth it provided the very best possibilities of scientific investigations in one of the hitherto least accessible and therefore least known areas of Greenland.

The flora of Peary Land was not, however, completely unknown before the Danish Pearyland Expedition. The country had previously been visited on sledge-journeys and a small number of plants had been brought home from there. The knowledge of the flora of the country and of all the problems connected with it, however, was still very poor. So it was a great joy and an invaluable experience for me to be allowed to take part in this expedition, thus trying to solve some of the problems connected with this peculiar high-arctic vegetation.

With the station in Jørgen Brønlunds Fjord as my base I had during four summers and one winter, to the extent allowed by the unfavourable physical conditions of the country, the best possibilities of accomplishing my studies up there. For these facilities I am greatly indebted to Count Eigil Knuth and Professor Knud Jessen. I am also much obliged to my companions on the expedition for their great helpfulness and good collaboration.

Even though the botanist's work on an expedition like this must first of all concentrate on investigating what species and what types of vegetation are characteristic of the area, I also, when time and opportunity offered themselves, embarked on investigations of a more special kind. The results of one of these are reported in the present work.

The purpose of the present investigations was mainly that of ascertaining the chromosome number in the higher plants in Peary Land and to compare these numbers with the chromosome numbers of the corresponding species from other regions of the earth in so far as they are known. The value of such investigations has in recent years become more and more evident, as through them we often get a possibility of a better evaluation of the taxonomic rank of the various types. Within plant geography as well investigations of chromosome numbers have proved to be of great importance as, e. g. in the case of species within which polyploidy occurs, it appears that such types with different chromosome numbers often have a different geographical distribution and therefore in many cases may be considered good systematic units.

At the investigations on which this work is based it was endeavoured to provide so complete a survey as possible of the chromosome numbers of the higher plants in the northernmost part of Greenland. Out of the about 85 species which were found to grow in Peary Land, 63 have been examined, i. e. 74 per cent. The majority of the species which I did not succeed in examining are such as grew very far from the station area and whose presence was ascertained only on the sledge journeys, at times when there were still frost and snow everywhere. From the rest of the species not examined, fixed material was, indeed, brought home, but proved to be insufficient. This particularly applied to the material of the genera *Dryas*, *Potentilla*, *Cassiope*, and *Draba*.

Nearly the whole material of the species discussed here was fixed on plants "in situ". Without danger of interference on the part of other plants this was possible also in the case of the material of root-tips, as in the poor vegetation of Peary Land it was very easy to find the various species growing isolated from other plants. Fixation in nature, however, in the case of a number of species was supplemented by fixation of material from cultures either in Peary Land or in the Botanical Garden of Copenhagen, to which living plants or seeds were brought home.

In order to obtain a material which, as regards the morphology of the chromosomes, was comparable, all the RT-material was fixed *ad modum* Levitsky in formalin chromic acid, and all the flower-bud material according to Navashin-Karpechenko with prefixation *ad modum* Carnoy. After being embedded in paraffin the material was sliced by the microtome with a section thickness of about 13 μ. Staining was made with fuchsine according to Feulgen's method after hydrolysis in HCl. The best results were obtained with a period of hydrolysis of half an hour and a period of staining for one hour. This staining method proved to be particularly satisfactory for material of grasses, and in most cases for the great majority of dicotyledons. It was less good for RT-material of *Cyperaceae* and *Juncaceae*, for which staining with crystal violet was more suitable.

The laboratory work was performed at Botanisk Laboratorium, Copenhagen, to the chief of which, Professor KNUD JESSEN, I want to offer my best thanks for facilities.

I am greatly indebted to T. W. BÖCHER, Ph. D., O. HAGERUP, Ph. D., Professor C. A. JØRGENSEN, TH. SØRENSEN, PH. D., and Professor M. WESTERGÅRD for the interest they have taken in my work and for their valuable assistance.

Finally I offer my respectful thanks to the trustees of the Carlsberg Foundation, without whose economic support this work could not have been published.

SPECIES STUDIED

This section includes all the examined species, treated apart. Since, as stated above, the greater part of the material by far was fixed at the natural stations of the plants, the date of fixation is stated in the remarks on each species in the list. The statement of this date is of the greatest interest in the cases where the material examined was flower-buds, as in this way we learn at which stage the meiosis in PMC or EMC takes place in nature. However, I am under the impression that in the case of most species the meiosis takes place a very short time before the flowering. In some of the species it seems to take place some time before (i. e. about a fortnight before the flowering). This, e. g., applies to the *Draba*-species, *Kobresia*, *Carex nardina*, and *Dryas*. A few deviations are mentioned under the species in question.

Furthermore the place of fixation is stated. In the case of most species this was in the environs of the station in Jørgen Brønlunds Fjord, situated in 82°10′ lat. N., 31° long.W. The collection of the material took place in the summer of 1949, with supplementing in the summer of 1950.

A short remark on the nature of the station of the species is added in the case of each species. For the more critical species reference is made to Herbarium No., corresponding to the collection number under which the fixed plant is kept in the Botanical Museum of Copenhagen.

As stated above, the present work does not lay claim to being anything but a list of chromosome numbers, and comments are made on few of the species. The taxonomic and plant-geographic consequences of the results will only appear after detailed investigations of the whole material of phanerogams collected in Peary Land.

Salix arctica PALLAS

2n = 76. Fig. 1.

The mitosis was studied in RT from a male plant growing in moist sandy soil near the station in Jørgen Brønlunds Fjord Aug. 7, 1950.

The number of this species has not been known previously, but it is in accordance with numbers known from other arctic *Salices* in having a basic number of 19. Cfr. MARKLUND in HOLMBERG (1931).

Oxyria digyna (L.) HILL.

n = 7. Fig. 2.

The number was found in meiosis in PMC. Material was fixed on plants from a snow-patch meadow south of the station in Jørgen Brønlunds Fjord June 11, 1949.

Several authors have studied this species, and they have all found the same chromosome number, 2n = 14. Thus JARETZKY (1928), EDMAN (1929) in material from Sweden, LÖVE and LÖVE (1942), KNABEN (1950) in material from Norway, SÖRENSEN and WESTERGÅRD (acc. to LÖVE and LÖVE 1948) in plants from East Greenland, FLOVIK (1940) in Svalbard, and BÖCHER and LARSEN (1950) in material from Kola Peninsula, West Greenland, and Canada.

Koenigia islandia L.

3n = 42. Fig. 3.

Mitosis was studied in the endosperm-cells of plants fixed in a snow-patch meadow near the station in Jørgen Brønlunds Fjord Aug. 2, 1949.

This number agrees with that found by HAGERUP (1926), who has examined material collected in West Greenland (ab. 65° lat. N.) and on the Faroes. According to LÖVE and LÖVE (1948) SÖRENSEN and WESTERGÅRD have found the same chromosome number in material from East Greenland.

Polygonum viviparum L.

2n = ab. 100.

RT material of this species from Jørgen Brønlunds Fjord in Peary Land has been examined, but it was not possible to determine the number exactly, as the chromosomes were very long and numerous. Many authors have tried to count the chromosome number of this species from other parts of the world, but it in vain. The numbers given vary from 2n = ab. 88 to 110.

Cerastium Regelii OSTENF.

n = 36. Fig. 4.

Flower buds were fixed from plants in a swamp rich in mosses not far from the station in Jørgen Brønlunds Fjord June 22, 1949. Meiosis in the PMCs was studied, and the same number as found by FLOVIK (1940) in plants from Svalbard was found here.

Cerastium alpinum L.

n = 54. Fig. 5.

This number was found in a plant fixed in a river-delta near the station in Jørgen Brønlunds Fjord June 23, 1949. Meiosis in EMC was examined. Two SAT-chromosomes were observed.

The species has first been studied by BÖCHER (1938 c) on material from Angmagssalik in East Greenland; the number given there is 2n = c. 72. From a locality farther north in East Greenland, however, SÖRENSEN and WESTERGÅRD (acc. to LÖVE and LÖVE 1948) have found the same number as that of mine from Peary Land, viz. 2n = 108. BÖCHER and LARSEN (1950) have examined the species from three different places on the west coast of Greenland. In the northernmost locality, at Niaqornat, they found 2n = 54. In the two localities farther south a number of 2n = 72 was found.

It has long been known that *Cerastium alpinum* occurs in different morphological types in Greenland. So it might be interesting to find out whether any relationship between the three chromosome types and the morphologically different types can be demonstrated and whether these are well separated geographically and ecologically.

LÖVE (1944) has found a number of 2n = 72 in material from Svalbard.

Melandrium apetalum (L.) FENZL.

n = 12. Fig. 6.

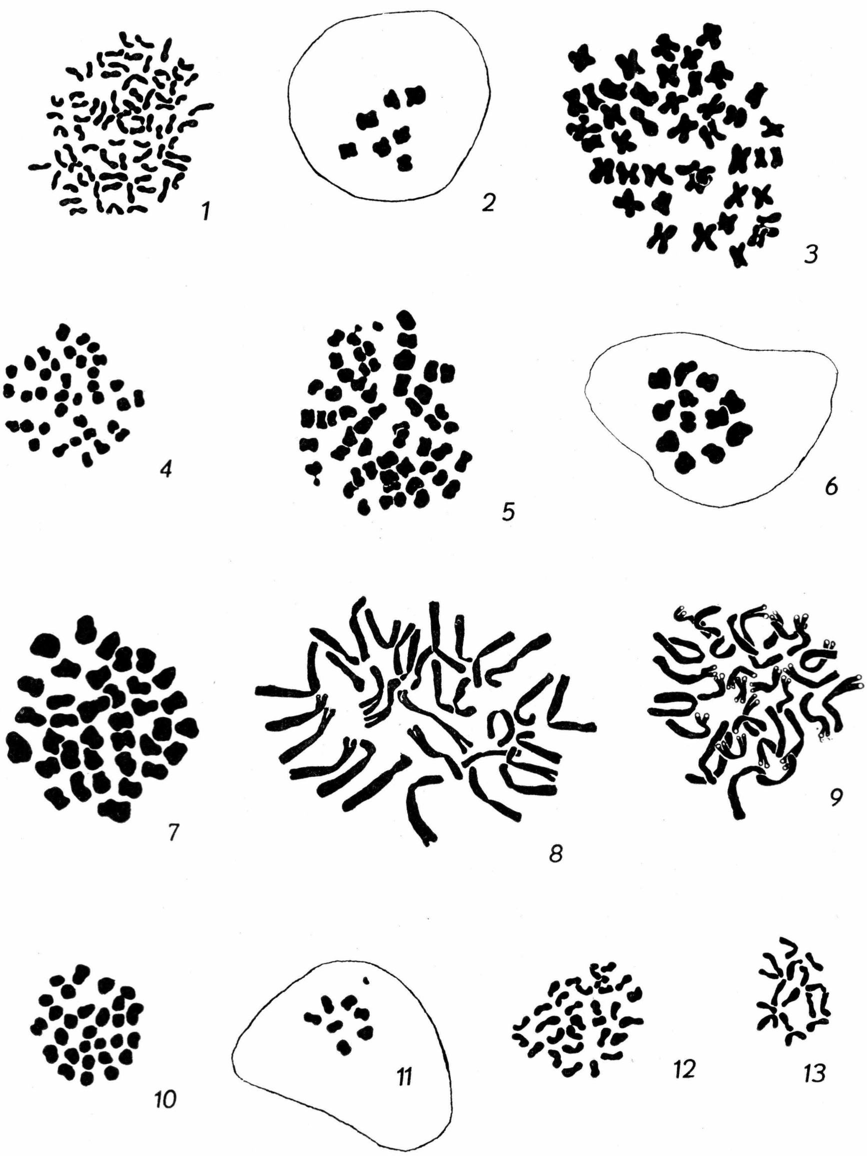
The species in Peary Land belongs to subsp. *arcticum* (FR.) HULTÉN. Meiosis was studied on plants growing in a river delta at the station in Jørgen Brønlunds Fjord, June 22, 1949.

The number agrees with that found by BLACKBURN (1930), LÖVE and LÖVE (1942), and NYGREN (1949). The last-mentioned author has found this number in material from Abisko, Sweden, as well as from Dovre, Norway.

Melandrium triflorum (R. BR.) J. VAHL.

n = 36. Fig. 7.

The number in the Peary Land plants was found in material fixed on a dry gravel slope near Klaresø, south of Jørgen Brønlunds Fjord, June 13, 1949. Meiosis in PMC was examined, and in several of the anthers was very irregular; in others it seems to be quite normal. The plants in Peary Land always produce good and ripe seeds, and I have



Figs.: 1 *Salix arctica*, mitosis in RT. 2 *Oxyria digyna*, meiosis in PMC I. metaphase. 3 *Koenigia islandica*, mitosis in endosperm. 4 *Cerastium Regelii*, meiosis in PMC I. metaphase. 5 *Cerastium alpinum*, meiosis in EMC I. metaphase. 6 *Melandrium apetalum*, meiosis in EMC I. metaphase. 7 *Melandrium triflorum*, meiosis in PMC I. metaphase. 8 *Ranunculus hyperboreus*, mitosis in RT. 9 *Ranunculus affinis*, mitosis in RT. 10 *Papaver radicatum*, meiosis in PMC I. metaphase. 11 *Cochlearia officinalis*, meiosis in PMC I. metaphase. 12 *Lesquerella arctica*, mitosis in pollen 13 *Draba subcapitata*, mitosis in young flower-bud. Magnification: 2500 ×.

often seen the flowers being visited by insects. On plants in nature I made some emasculation experiments, the result of which was that no seed development took place. It seems that the species needs a pollination in order to carry through the seed development.

NYGREN (1951) regards this species as an amphidiploid hybrid between *M. apetalum* and *M. furcatum* (RAF.) HULT., which seems to be more probable than *M. furcatum* being a hybrid of *M. apetalum* and *M. triflorum*, as supposed by GELTING (1934) and BÖCHER (1938 a), since the species in Peary Land always shows good seed setting. I had hoped to find *M. furcatum* in Peary Land, but did not succeed.

The number 2n = 72 in *M. triflorum* has previously been found by BLACKBURN (1930) and by BÖCHER and LARSEN (1950) in material from Søndre Strømfjord in West Greenland.

Ranunculus sulphureus SOL.

n = 48 ±

Mitosis in RT as well as meiosis in PMC was studied. The root-tip material was fixed in a moist *Carex stans* meadow south of the station in Jørgen Brønlunds Fjord on June 28, 1949, and the flower buds were fixed in the same place 10 days before. In spite of studying all of my very large material, it has not been possible to determine the number exactly, but the number may possibly be 2n = 96, if so it is in accordance with the numbers found by LANGLET (1936) in material from Abisko, Sweden, by NYGREN (acc. to LÖVE and LÖVE 1948) and by FLOVIK (1938) in material from Svalbard.

BÖCHER (1938 b) has given 2n = 56 in plants from Kap Dalton on the East coast of Greenland, but BÖCHER mentions that his material possibly has got confused with material of *R. nivalis*.

Ranunculus hyperboreus ROTTB.

2n = 32. Fig. 8.

This number was found in mitosis in RT material from plants growing in a rivulet near the station in Jørgen Brønlunds Fjord. Date of fixing: July 22, 1949.

The species has previously been examined several times. First by LANGLET (1936) on material from Abisko, Sweden. Next by BÖCHER (1938 c) on material from Disko in WestGreenland and from Kap Daussy in East Greenland. The chromosome number from all these localities is found to be 2n = 32, like that of mine from Peary Land. The same number has furthermore been found by FLOVIK (1940), by SØRENSEN and WESTERGÅRD (acc. to LÖVE and LÖVE 1948) in Northeast Greenland, and by Böcher and Larsen (1950) in West Greenland (74°41′ lat. N.).

Ranunculus affinis R. Br.

2n = 32. Fig. 9.

Living plants from Jørgen Brønlunds Fjord in Peary Land were brought home and cultivated in the Botanical Garden of Copenhagen. RT material of has been studied. Herb. no. 6695.

It has often been discussed whether this North American arctic plant really belongs to *R. affinis* or whether it is a race or a variety of the Asiatic *R. pedatifidus* E. Sm. The problem has recently been discussed by Polunin (1940) and by Hulten (1944).

Material of this species from West Greenland has been examined by Böcher and Larsen (1950), the chromosome number found by them being 2n = 48. I have had an opportunity to study these cultured plants from West Greenland and to compare them with cultures of the Peary Land plants, but in spite of the fact that the plants were different in respect of chromosome number, few morphological differences seemed to be present. It should, however, be mentioned that the Peary Land plant was somewhat smaller, and its stem and receptacle were more pilose. The West Greenland plant has almost quite smooth seeds and should perhaps be referred to the var. *leiocarpus* (Trautv.) Fern. of *R. pedatifidus*. This problem, however, requires further investigation.

Papaver radicatum Rottb.

n = 28. Fig. 10.

The chromosome number of this species is here given only from a single collection. Material was fixed on a dry slope at the station in Jørgen Brønlunds Fjord on July 21, 1949. Herb. no. 6678. Meiosis in PMC was examined. However, a larger material was collected during my stay in Peary Land, but this has been handed over to Professor C. A. Jørgensen, Copenhagen, who is working up a comprehensive study on this arctic species. I must refer to coming papers by Professor Jørgensen and Gunvor Knaben, M.Sc.

In Svalbard material Flovik (1940) has found 2n = 70.

Cochlearia officinalis L.

n = 7 + f. Fig. 11.

The material from Peary Land belongs to the var. *groenlandica* (L.) Gelert. Flower buds were fixed from plants brougt to growth in the house in Jørgen Brønlund Fjord on april 6, 1948. In spite of the plants brought in still were in winter conditions (outside temperature ab.

—35° C) the developement was very fast and vigorous. Five days later the fixation could be done. Meiosis was studied in PMC.

The number agrees with that found by FLOVIK (1940) and with that of BÖCHER and LARSEN (1950) in plants from Svalbard and West Greenland, respectively.

Lesquerella arctica (WORMSKJ.) S. WATS.

n = 30. Fig. 12.

Material of flower buds was fixed from plants groving on a dry gravelly hill south of the station in Jørgen Brønlunds Fjord, June 30, 1949. The number n = 30 was found in pollen-mitoses.

In West Greenland plants BÖCHER and LARSEN (1950) have found the same number. Other *Lesquerella*-species have been studied by MANTON (1932) and ROLLINS (1939), the numbers given there shows that the basic number in the genus may be 5, although some exceptions are found.

Draba subcapitata SIMM.

2n = 16. Fig. 13.

Of the *Drabas* of Greenland this species is one of those most easily recognizable. Material of flower buds was fixed on a moist bank of a river near the station in Jørgen Brønlunds Fjord, June 22, 1949. Herb. no. 6547. In this case as well as in my other fixations of *Drabas* in Peary Land, all the flower buds had ripe pollen in the anthers, thus it was not possible to study the meiosis in PMC. Meiosis seems to take place at a very early developmental stage of the buds, when these are very small. The number in this species was counted in somatic cells in a young flower-bud.

Draba arctogena E. EKM.

n = 24. Fig. 14.

This species has often been referred to *D. cinerea* as a variety. The problems of the arctic *Drabas* belonging to the *cinerea* group is, however, far from being solved, and the question whether Mrs. EKMAN's *Draba* species hold good or not is still open.

According to EKMAN's key (1941) the plants here treated must belong to *D. arctogena*. Herb. no. 6551. The material was fixed in a dired-up river-bed near Jørgen Brønlunds Fjord on June 23, 1949, and meiosis in EMC was examined.

The number found agrees with that found by HEILBORN (1941) in material from Greenland.

Draba groenlandica E. Ekm.

2n = 64. Fig. 15.

Like the preceding species this one is also often referred to *Draba cinerea* as a variety. My material was fixed from plants cultivated in the Botanical Garden of Copenhagen from seeds brought home from Jørgen Brønlunds Fjord in Peary Land. Mitosis was examined in RT. Herb. no. 6712.

The same number has been found by Heilborn (1941) on Greenland plants.

Draba macrocarpa Adams

2n = about 120.

Various types of yellow-flowered *Drabas* occur in Peary Land, which all seem to be closely related to *Draba Bellii* Holm. Seeds from one of these types were brought home and plants cultivated in the Botanical Garden of Copenhagen. The type listed here must according to Ekman's (1941) delimitation of the species be referred to *D. macrocarpa*, especially the size of the petals and the pods and the pubescence of the leaves being characteristic. Herb. no. 6594.

RT were fixed and mitosis examined from the cultivated plants. Because of the many small chromosomes it has not been possible to determine the number more exactly than with an uncertainty of ± 10. As might be expected, the number was 2n = 128, since within *Draba* multiples of 16 are commonly met with.

Cardamine bellidifolia L.

2n = 16. Fig. 16.

Mitosis was studied in young flower-buds fixed in a dry stone field 500 m above sea-level south of the station in Jørgen Brønlunds Fjord, July 8, 1949.

The species has previously been studied by Jaretzky (1928), who found the same number. According to Löve and Löve (1948) Sørensen and Westergård also found this number in material from East Greenland.

Erysimum Pallasii (Pursh) Fernald

2n = c. 28.

The geologist of the expedition, Dr. J. C. Troelsen, in March 1949 on a sledge-journey collected a few specimens of this plant in Wandels Dal at Aftenstjernesø. The plants were in winter condition, but had some capsules with ripe seeds. The seeds were germinated in petri dishes, and RT were fixed. In the same way I collected myself some seeds on a sledge-journey at Cape Ejnar Mikkelsen near the head of Independence Fjord, in the beginning of June 1949.

From both localities mitosis was studied, but it was impossible to find a metaphase plate in which I could determine exactly the number of this interesting high-arctic species.

Eutrema Edwardsii R. BR.

n = 14. Fig. 17.

The material in which the meiosis in PMC was studied, was fixed on plants in a wet *Carex stans* meadow at the station in Jørgen Brønlunds Fjord on Aug. 4, 1949. The number found has been published in BÖCHER and LARSEN (1950), to which publication reference is made.

Braya Thorild-Wulffii OSTENF.

n = 14. Fig. 18.

Meiosis in PMC was studied on plants fixed on a dry gravelly hill south of the station in Jørgen Brønlunds Fjord, June 20, 1949. Two of the chromosomes in the meiosis were distinctly larger than the others.

This small high-arctic Cruciferous plant has often been under discussion,—whether it is a good species or not. In ABBÉ (1948), e. g., it is regarded as a depauperate form of *B. purpurascens*, although ABBÉ has never seen the species. POLUNIN (1940), however, has studied the type specimen of *B. Thorild-Wulffii*, and states that it is clearly distinct from *B. purpurascens*. I agree. Through four summers I have studied the two species growing together, and I have never had any difficulties in keeping them apart. Furthermore *B. Thorild-Wulffii* is more specialized regarding ecological requirements. And lastly, as first stated here, the two species have different chromosome numbers. I must conclude that *Braya Thorild-Wulffii* OSTENF. is really a good species.

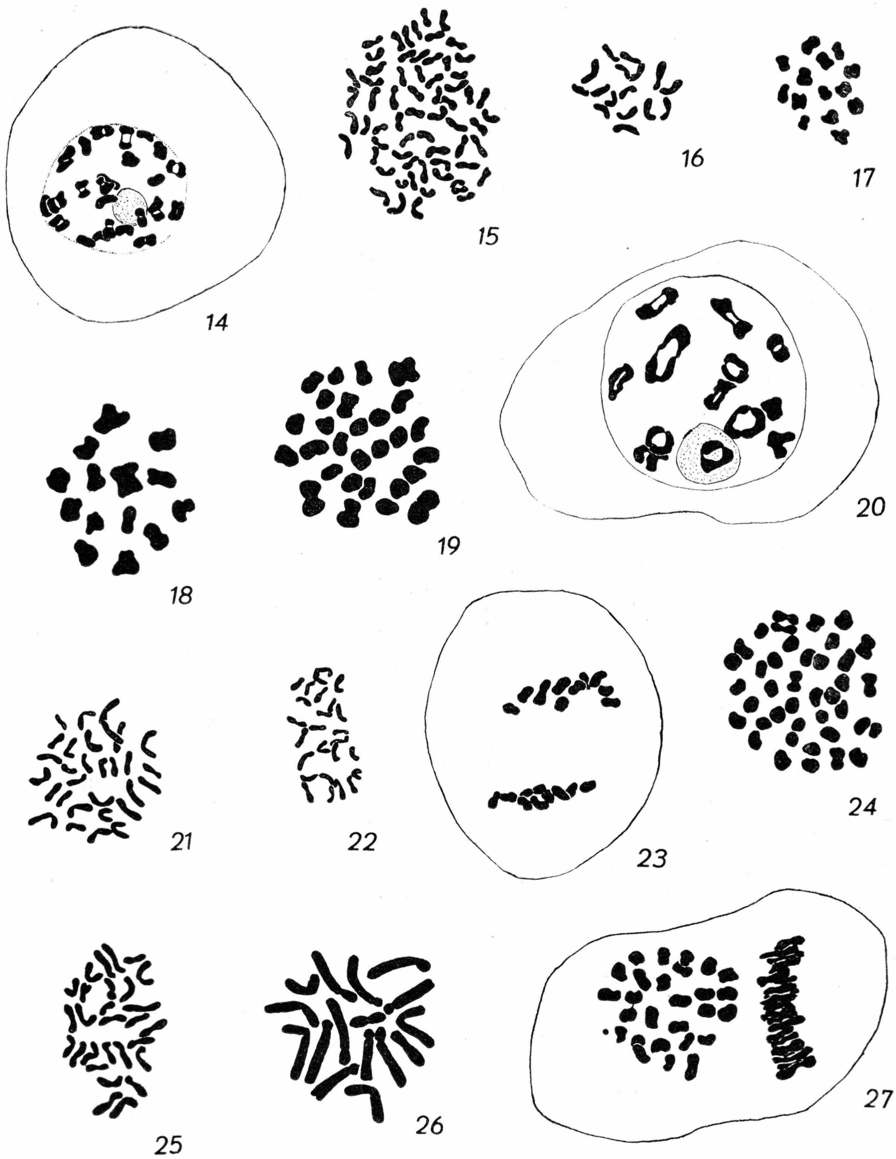
Braya purpurascens (R. BR.) BUNGE

n = 28. Fig. 19.

Flower buds of this species, which in Peary Land seems to be a good and distinct species, were fixed from plants in a river delta near the station in Jørgen Brønlunds Fjord, June 11, 1949.

Meiosis in PMC was studied, and in the 1st metaphase it was observed that four chromosomes were much larger than the others.

In material, presumably from Iceland, LÖVE and LÖVE (1948) give the number 2n = 64 in the species. A comparison of these two chromosome types would really be interesting.



Figs.: 14 *Draba arctogena*, diakinesis in PMC. 15 *Draba groenlandica*, mitosis in RT. 16 *Cardamine bellidifolia*, mitosis in young flower-bud. 17 *Eutrema Edwardsii*, meiosis in PMC I. metaphase. 18 *Braya Thorild-Wulffii*, meiosis in PMC I. metaphase. 19 *Braya purpurascens*, meiosis in PMC I. metaphase. 20 *Saxifraga oppositifolia*, diakinesis in PMC. 21 *Saxifraga nivalis*, mitosis in pollen-grain. 22 *Saxifraga rivularis*, mitosis in RT. 23 *Saxifraga tenuis*, meiosis in EMC I. anaphase. 24 *Saxifraga groenlandica*, meiosis in PMC I. metaphase. 25 *Potentilla pulchella*, mitosis in RT. 26 *Pedicularis hirsuta*, mitosis in young flower-bud. 27 *Erigeron compositus*, meiosis in PMC II. metaphase. — Magnification: 2500 ×.

Saxifraga oppositifolia L.

n = 13. Fig. 20.

Meiosis in PMC was examined in flower buds fixed in a dried up river bed at the station in Jørgen Brønlunds Fjord, June 1st, 1949.

This beautiful plant, which is the commonest species everywhere in Peary Land, is usually in flower there about a fortnight before all other plants. So the meiosis must take place just after the frost has left the surface of the soil, but in some flower buds, often in the same plant, the meiosis takes place already in the autumn, a fact, which has earlier been found by SØRENSEN (1941) in Northeast Greenland.

The chromosome number 2n = 26 has been found by several authors, thus SKOVSTED (1934) in material from Norway, BÖCHER (1941) in material from Traill Ø and Clavering Ø in East Greenland. According to LÖVE and LÖVE (1948) by SØRENSEN and WESTERGÅRD also in material from East Greenland. In Iceland LÖVE and LÖVE (1951) report 2n = 26. Of special interest is, finally, the finding of 2n = 52, a tetraploid type, in Svalbard (FLOVIK, 1940).

Saxifraga flagellaris WILL.

n = 16.

The material of flower buds was fixed in a snow-patch near the station in Jørgen Brønlunds Fjord, June 20, 1949.

The interpretation of the meiotic chromosomes in PMC was very difficult; but I feel fairly certain that n = 16 is the correct number in my plants.

2n = 32 has previously been found by FLOVIK (1940) in material from Svalbard.

Saxifraga nivalis L.

n = 30. Fig. 21.

The number was found in mitosis in pollen-grains. The material was fixed from plants in a moist stone field 500 m above sea-level, Heilprin Land south of Jørgen Brønlunds Fjord, July 8, 1949.

The number has previously been found in material from other places in Greenland. In Northeast Greenland by SØRENSEN and WESTERGÅRD (acc. to LÖVE and LÖVE 1948) and in West Greenland at Søndre Strømfjord by BÖCHER and LARSEN (1950). In Svalbard material FLOVIK (1940) has found the same number, which has also been found in Iceland by LÖVE and LÖVE (1951).

SKOVSTED (1934) gives the number 2n = 28 for this species, but, as mentioned by BÖCHER and LARSEN (l. c.) this counting is probably erroneous.

Saxifraga tenuis (Wg.) H. Sm.

n = 10. Fig. 23.

Material of this small plant closely related to *S. nivalis* was fixed in wet solifluction soil at the station in Jørgen Brønlunds Fjord on Aug. 4, 1950. The chromosome number was found in EMC.

The number 2n = 20 has also been found by previous authors, thus Flovik (1940) in Svalbard material, Löve and Löve (1944) in Swedish, Sørensen and Westergård (acc. to Löve and Löve 1948) in material from East Greenland, and Löve and Löve (1951) from Iceland.

Saxifraga rivularis L.

2n = 26. Fig. 22.

As is well known, this species is very polymorphic and occurs in Greenland in different types. Of these only one was found in Peary Land, *S. hyperborea* R. Br., a species which usually is regarded as a form or variety of *S. rivularis* (var. *hyperborea* (R. Br.) Engl.).

My material was fixed at a spring rich in mosses, 500 m above sea-level, south of Jørgen Brønlunds Fjord, Aug. 7, 1949. Herb. no. 6732. Mitosis was studied in RT.

S. rivularis s. lat. has previously been examined by Böcher (1938 c), who found 2n = 56 in material from East Greenland. From a place farther north in East Greenland, however, 2n = 52 was found by Sørensen and Westergård (acc. to Löve and Löve, 1948). In plants from Svalbard Flovik (1940) has found 2n = 26, the same number as that of Peary Land. In Iceland Löve and Löve (1951) have found 2n = 52.

Saxifraga caespitosa L.

n = 40. Fig. 24.

Flower-bud material was fixed in a scree on Heilprin Land, south of Jørgen Brønlunds Fjord, July 8, 1949. Meiosis was studied in PMC.

Taxonomic studies carried out on the *S. caespitosa* group, to which the species belongs, will not be given here, but my plant from Peary Land is the same as the one commenly found in East Greenland, and which in Seidenfaden and Sørensen (1937) is named *S. caespitosa* L. subsp. *eucaespitosa* Engl. and Irmsch. f. *uniflora.*

The species has previously been studied in Greenland. Harmsen (acc. to Löve and Löve, 1948) gives 2n = 80. Böcher and Larsen (1950) report the same number from West Greenland. In Böcher (1938 c) 2n = ab 84 is given, but as mentioned by Böcher and Larsen (*l. c.*) the correct number may be 2n = 80. Material from East Greenland. In plants from Svalbard Flovik (1940) also found this number, as well as Löve and Löve (1951) from Iceland.

From other parts of the world different numbers in the *caespitosa* group have been found, but since the problem of the taxonomy in this group is still open, a discussion of the chromosome numbers is on minor interest.

Potentilla pulchella R. BR.

2n = 28. Fig. 25.

Mitoses were studied in RT from plants fixed on gravelly slopes near Jørgen Brønlunds Fjord on Aug. 10, 1950.

The number agrees with that found by ERLANDSSON (acc. to LÖVE and LÖVE, 1942) and with that found by FLOVIK (1940) in Svalbard.

Pedicularis hirsuta L.

2n = 16. Fig. 26.

The number was found in somatic cells from anthers in young flower buds. Material from frozen plants brought to growth in the house in Jørgen Brønlunds Fjord, fixed on March 29, 1949.

The same number has previously been found by HARMSEN and by SØRENSEN and WESTERGÅRD (acc. to LÖVE and LÖVE, 1948) in Greenland material.

Erigeron compositus PURSH.

n = 27 + f. Fig. 27.

Meiosis was studied in material of flower buds, fixed on a dry slope at Klaresø, Heilprin Land, July 18, 1949. In several of the PMC's meiosis was very irregular.

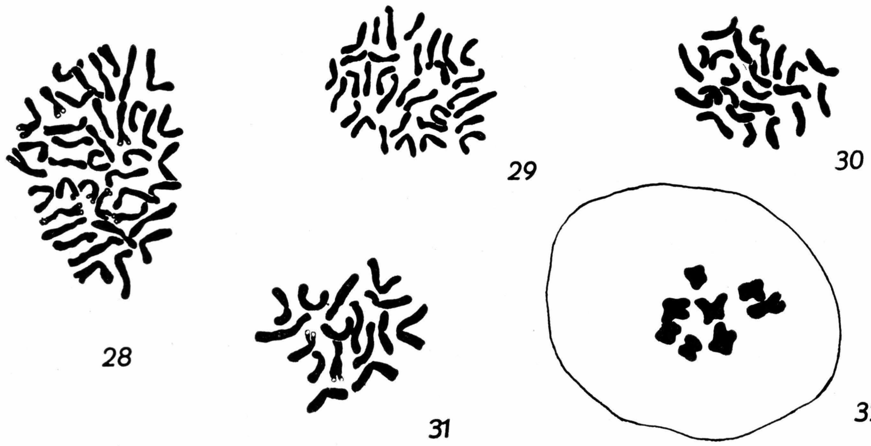
BÖCHER and LARSEN (1950) have examined this species and found the same number (2n = 54) in material of the var. *discoidea* GRAY from Canada. On the other hand they found 2n = 63 in material of the main species from Søndre Strømfjord in West Greenland, and they suppose that these plants are apomictic. The diploids from Peary Land may as well be apomictic, as the pollen development in these plants was irregular.

Taraxacum arcticum (TRAUTV.) DAHLST.

2n = 40. Fig. 28.

Mitosis was studied in RT material fixed from plants in a meadow 500 m above sea-level south of the station in Jørgen Brønlunds Fjord, Aug. 5, 1950. Herbarium no. 8178.

The plants in question belong to f. *albiflora* (KJELLM.) DAHLST. The same number has been found by FLOVIK (1940) in Svalbard material.



Figs.: 28 *Taraxacum arcticum*, mitosis in RT. 29. *Taraxacum arctogenum*, mitosis in RT. 30 *Taraxacum phymatocarpum*, mitosis in young flower-bud. 31 *Taraxacum pumilum*, mitosis in RT. 32 *Taraxacum pumilum*, meiosis in PMC, I. metaphase. — Magnification: 2500 ×.

Taraxacum arctogenum Dahlst.

2n = 32. Fig. 29.

Material fixed on plants in a river delta near Jørgen Brønlunds Fjord, July 18, 1949. Herbarium no. 6640. Mitoses were studied in RT.

Taraxacum phymatocarpum J. Vahl.

2n = 24. Fig. 30.

Mitosis was studied in someatic cells of young flower buds fixed on plants in a dried-up river-bed near Jørgen Brønlunds Fjord, June 25, 1949.

Taraxacum pumilum Dahlst.

n = 8. Fig. 31. 2n = 16. Fig. 32.

Material of this very small and characteristic, high-arctic species was fixed on a dry clayey slope near the station in Jørgen Brønlunds Fjord on July 11, 1949. Herb. 6633. Other material was collected on plants cultivated from seeds brought home from Peary Land.

Meiosis in PMC as well as mitosis in RT was examined. Meiosis was here regular and the pollen development seemed to be quite normal.

Taraxacum pumilum is one of the few *T.*-species which are diploid. These species are often supposed to have a normal sexual seed development, while the polyploid species generally are apomictic. Some pollen investigations of three of the Peary Land *Taraxaca* seem to confirme this.

Fig. 33 shows three curves: a. *T. phymatocarpum*, b. *arctogenum*, and c. *pumilum*, where the different size classes of pollen grains of each species are given in per cent. Most irregular is *T. arctogenum*, in which pollen sizes from 22 to 56 μ occur. The majority of the pollen grains are 25—32 μ, and another but less pronounced maximum is found at about 45 μ. Shown by a staining, only this category of pollen grains

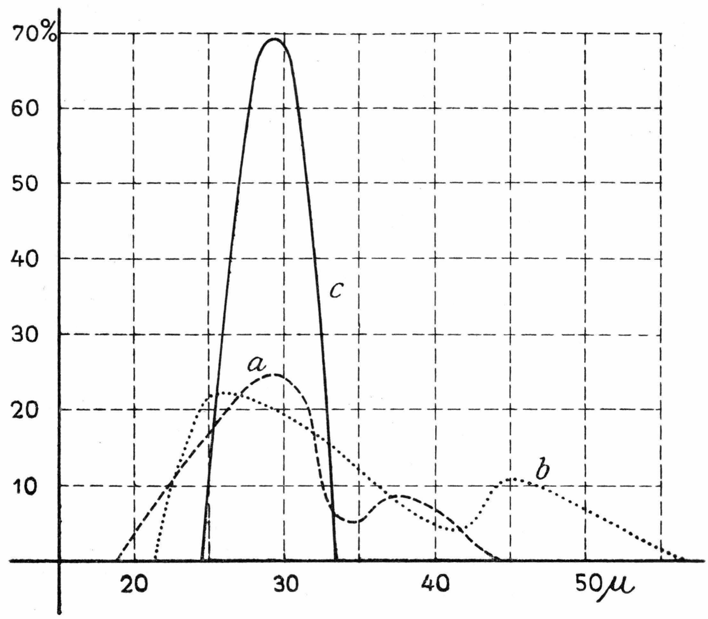


Fig. 33: Curves showing the variation of the pollen-size within 3 *Taraxacum*-species from Peary Land. *a. T. phymatocarpum. b. T. arctogenum. c. T. pumilum.*

can be supposed to be capable of germinating. The curve of *phymatocarpum* shows approximately the same characteristics as that of *arctogenum*. The curve of *pumilum* is strikingly different from these. Its pollen grains are of a very uniform size, all about 30 μ and with a normal and regular appearance.

Alopecurus alpinus SM.

n = 56 ±.

Meiosis was studied in PMC in flower-buds on plants in the river delta at Jørgen Brønlunds Fjord on June 18, 1949.

On examination the metaphases were very difficult to analyse, and as the material was insufficient an exact determination of the chromosome number was not possible.

FLOVIK (1938) and JOHNSSON (1941) have studied the species, resp. from Svalbard and from Greenland. Somatic numbers of 112—130 are given from there.

Arctagrostis latifolia (R. Br.) Griseb.

2n = 56. Fig. 34.

Of this very polymorphous arctic species a large material of different types from Jørgen Brønlunds Fjord was brought home, in the hope that different chromosome numbers should occur to account for the often very different morphological types. But in all my material of root-tips the same number was found. On the other hand, I did not succeed in examining material of the spikes in attempt to study the meiosis in PMC. Often the spikes were quite or partly sterile, and I never found any development of ripe seeds. However, the problem needs further investigations, and still larger material should be collected.

The species has previously been studied by Flovik (1938) on Svalbard material, and the number 2n = 62 was found, a number which indicates that the origin of this species is far from simple.

The metaphase figured here refers to herbarium no. 8076. Other plants with the same chromosome number are found under the herbarium numbers: 8100, 8101, 8168 and 8217.

Deschampsia brevifolia R. Br.

n = 13. 2n = 26. Figs. 35 and 36.

Material of flower buds was fixed in a river delta near Jørgen Brønlunds Fjord, July 2, 1949, and RT material was fixed at the same place on July 27, 1949. Meiosis in PMC as well as mitosis in RT was studied.

The species has previously been examined by Hagerup (1939) (sub nom. *D. arctica*), who reported the number of n = 14. As mentioned by Böcher and Larsen (1950) this number needs confirmation and may be erroneous; hence new investigations on the *D. caespitosa*-group, to which *D. brevifolia* belongs, will possibly reveal its basic number to be 13. Accordingly the species is diploid, not tetraploid, as supposed by Hagerup (*l. c.*).

Trisetum spicatum (L.) Richt.

2n = 28. Fig. 37.

This number was found in mitosis in RT-material fixed from plants in a river delta at the station in Jørgen Brønlunds Fjord on July 25, 1949. In other material fixed at the same place on June 25, 1949, meiosis was studied and the haploid number n = 14 found.

The species has previously been examined by several authors, thus Flovik (1938) in material from Svalbard, Löve and Löve (1944) in material from northern Sweden and Sørensen and Westergård (acc. to Löve and Löve 1948) in East Greenland material. From these places was found 2n = 28. Of special interest are the investigations by Böcher and LARSEN (1950) of the species in West Greenland. They found two forms with different chromosome numbers. In Søndre Strømfjord 2n = 28, and at Ivigtut 2n = 42.

Poa abbreviata R. BR.

2n = 42. Fig. 38.

Material of this very distinct species of the genus *Poa* was fixed on plants in a crevice of rock, south of the station in Jørgen Brønlunds Fjord on July 13, 1949. The metaphases in the RT, which were studied, had clearly 42 chromosomes.

The number found by FLOVIK (1938) 2n = 76 ± from Svalbard, can not directly be related to the number found in Peary Land. Although many peculiar chromosome numbers have been found within the genus *Poa*, I wonder two numbers so different could be found in this species, which does not seem to vary much.

Poa Hartzii GAND.

2n = 63—70.

Material of this grass, the largest of Peary Land, was fixed on a dry gravel slope near the station in Jørgen Brønlunds Fjord on July 28, 1950.

Mitosis in RT was examined, but it was not possible to determine the chromosome number with certaincy because of the numerous and long chromosomes. In a scarce material of spikes the meiosis was studied in PMC, but so many irregularities occurred, that a counting was completely impossible.

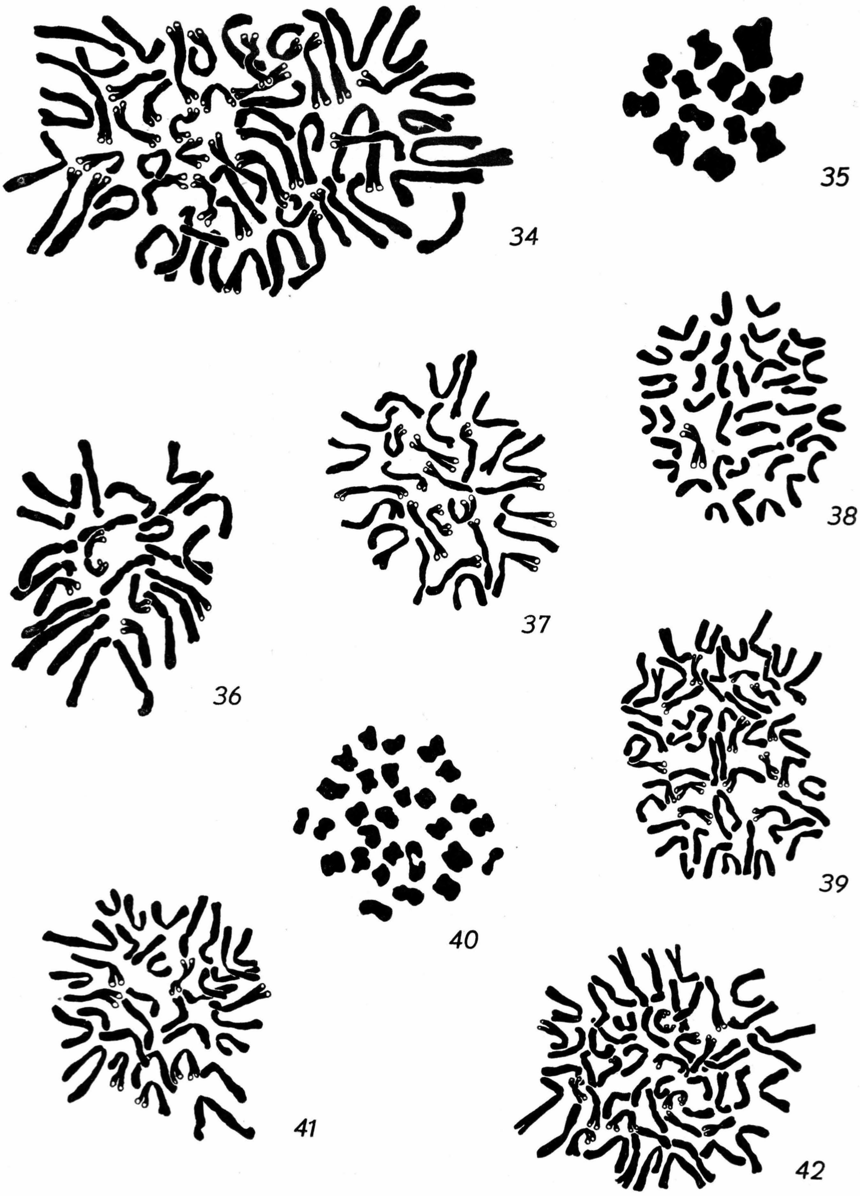
Poa glauca VAHL.

2n = 56. Fig. 39.

Of this very polymorphous species a couple of types occur in Peary Land. Fixed material of these was brought home, but only one sample was successful. RT of this was fixed in a dry stone field 500 m above sea level on a plateau south of the station in Jørgen Brønlunds Fjord, Aug. 5, 1950. Herb. no. 8163. Mitosis was studied, and the number 2n = 56 was found.

Several authors have examined this species, and many different numbers have been found. ÅKERBERG (1942) gives 2n = 65, presumably in material from Sweden. KIELLANDER (acc. to LÖVE and LÖVE 1942 has found such diploid numbers as 42, 47, 50, 56, 60, and 70.

In material from Svalbard FLOVIK (1938) gives 2n = 70—72, and according to FLOVIK (l. c.), AVDULOV has found the number 2n = 70. LÖVE and LÖVE (1948) give the number 2n = 63, and according to the same authors the number 2n = 70 was found by SØRENSEN and WESTER-



Figs.: 34 *Arctagrostis latifolia*, mitosis in RT. 35 *Deschampsia brevifolia*, meiosis im PMC I. metaphase. 36 *D. brevifolia*, mitosis in RT. 37 *Trisetum spicatum*, mitosis in RT. 38 *Poa abbreviata*, mitosis in RT. 39 *Poa glauca*, mitosis in RT. 40 *Poa arctica*, meiosis in PMC I. metaphase. 41 *Poa alpigena colpodea*, mitosis in RT. 42 *Puccinellia Andersonii*, mitosis in RT. — Magnification: 2500 ×.

GÅRD in East Greenland. BÖCHER and LARSEN (1950), finally, have found 2n = 63 in their material from West Greenland.

Poa arctica R. BR.

n = 28. Fig. 40.

The *Poa arctica* complex has been studied very intensively by NANNFELDT (1940), and a very large part of Greenland material seen by him is referred to the subsp. *caespitans* (SIMM.) NANNF. After a close study of the morphology of my material from Peary Land, I have reached the conclusion, that this also belongs to that subsp. or at least comes close to it.

Fixations in Peary Land were made in a dry stone field 500 m above sea-level south of the station in Jørgen Brønlunds Fjord on Aug. 8, 1949. Meiosis was here studied. Herb. no. 6737.

Many chromosome numbers have been reported in the *Poa arctica* complex specially by NANNFELDT (l. c.) and NYGREN (acc. to LÖVE and LÖVE 1948). The number in the subsp. caespitans has by both authors been found to be 2n = 56 in material presumably from Scandinavia. And the same number was found by FLOVIK (1938) in Svalbard plants. It is of special interest to note that the number 2n = 56 within the *Poa arctica* complex has been found only in the subsp. *caespitans* and in the Peary Land material, which in all probability belongs to this subsp.

Poa alpigena (E. FRIES) LINDM.

2n = 35. Fig. 41.

This species was in Peary Land represented only by the viviparous var. *colpodea* (TH. FR.) SCHOL. Material was fixed in a river delta at the station in Jørgen Brønlunds Fjord on Aug. 2, 1949. Mitosis was studied in RT. Herb. no. 6681.

Many different chromosome numbers have been found within *P. alpigena*, but in var. *colpodea* only two are known so far, one from Svalbard, counted by FLOVIK (1938), the other from East Greenland found by SØRENSEN and WESTERGÅRD (acc. to LÖVE and LÖVE 1948). The number from Svalbard was 2n = 51 + 5 ff, and in East Greenland 2n = 35 + 3 ff. As far I could discern, no fragments were at hand in the Peary Land material.

Puccinellia Andersonii SWALL.

2n = 56. Fig. 42.

Material of this species was fixed from plants growing at the beach near the station in Jørgen Brønlunds Fjord on July 27, 1950. Herb. no. 8065.

The somatic number 2n = 56 was found in RT. The chromosome number of the species has not previously been known.

Puccinellia angustata (R. Br.) Rand & Redf.

2n = 42. Fig. 43.

Material of RT was fixed from cultures. Plants in winter condition (frozen) were brought indoors and cultivated in the house in Jørgen Brønlunds Fjord. In spite of the time (Nov. 4), i. e. in the beginning of the winter and the dark time, the growth was very vigorous and fast. In five days the plants developed fresh green leaves and numerous roots. The RT were fixed on November 9, 1948. The chromosome number was found in mitosis.

The species has previously been studied by Flovik (1938), who found the same number in Svalbard plants.

Colpodium Vahlianum (Liebm.) Nevski

2n = 14. Fig. 44.

Mitosis was studied in RT from two different fixations, the first from a river delta at the station on Aug. 4, 1949, the second from a moist crevice of rock 200 m above sea-level south of the station in Jørgen Brønlunds Fjord on Aug. 11, 1950. In both collections 2n = 14 was found.

The number found agrees with that of Flovik (1938) from Svalbard.

Phippsia algida (Sol.) R. Br.

2n = 28. Fig. 45.

Phippsia algida in Peary Land occurs in two different types (at least according to ecology). Both types were examined in mitosis in RT. One type is confined to long lasting snow-patches and is very diminutive with adpressed culms. Material was fixed south of the station on Aug. 2, 1949 (figured). The other type, which is growing on the beach of the fiord near the water and without snow-cover during the winter, is erect and very vigorous. Material of this was fixed near the station in Jørgen Brønlunds Fjord on July 29, 1950. In both types 2n = 28 were found.

The species has previously been studied by several authors, who all report the same number as found in Peary Land: Nannfeldt (1937) from northern Sweden, Flovik (1938) from Svalbard, Knaben (1950) from Norway, and Sørensen and Westergård (acc. to Löve and Löve 1948) from East Greenland.

Pleuropogon Sabinei R. Br.

2n = 40. Fig. 46.

Material of this very characteristic grass was collected in a river near the station in Jørgen Brønlunds Fjord on July 22, 1949.

The number of this species, which not has been known before, was found in mitosis in RT.

Festuca brachyphylla SCHULTES coll.

The problem of the Greenland *Festucae* has through the years been discussed by several authors. They all conclude that *Festuca brachyphylla* (often incorrectly referred to *F. ovina* L.) consists of two or three types, which are very difficult to keep apart. After an inspection of the herbarium material of the Botanical Museum in Copenhagen I have found the same.

The most recent investigations on the Greenlandic material have been made by SCHOLANDER (1934), who refers the material to *F. brachyphylla* or to a variety named var. *groenlandica.* Since then large quantities of material have been brought home, and cytological investigations have been made.

Morphological characters together with different chromosome numbers, however, make it possible within the *F. brachyphylla* of Greenland to distinguish three types, which also show different geographical distribution. One of these, which I refer to *F. baffinensis* POLUNIN (1940), is a very distinct species. The rest of the herbarium material can easily, although a few transitional specimens occur, be divided into two groups corresponding to a hexaploid and a tetraploid form. The hexaploid form must, as far as I can see, be the true *F. brachyphylla* SCHULTES, which has a wide distribution in Greenland. The tetraploid form will here be regarded as sp. nov. *F. hyperborea*, which shows a special northern occurrence. This species includes the majority of the specimens which formerly have been named *Festuca ovina* L. var. *supina* (SCHUR.) HACKEL.

A cytological paper like this is not, however, the place for further taxonomic considerations. Together with a diagnosis these will later appear in a paper with an annotated list of the flora of Peary Land.

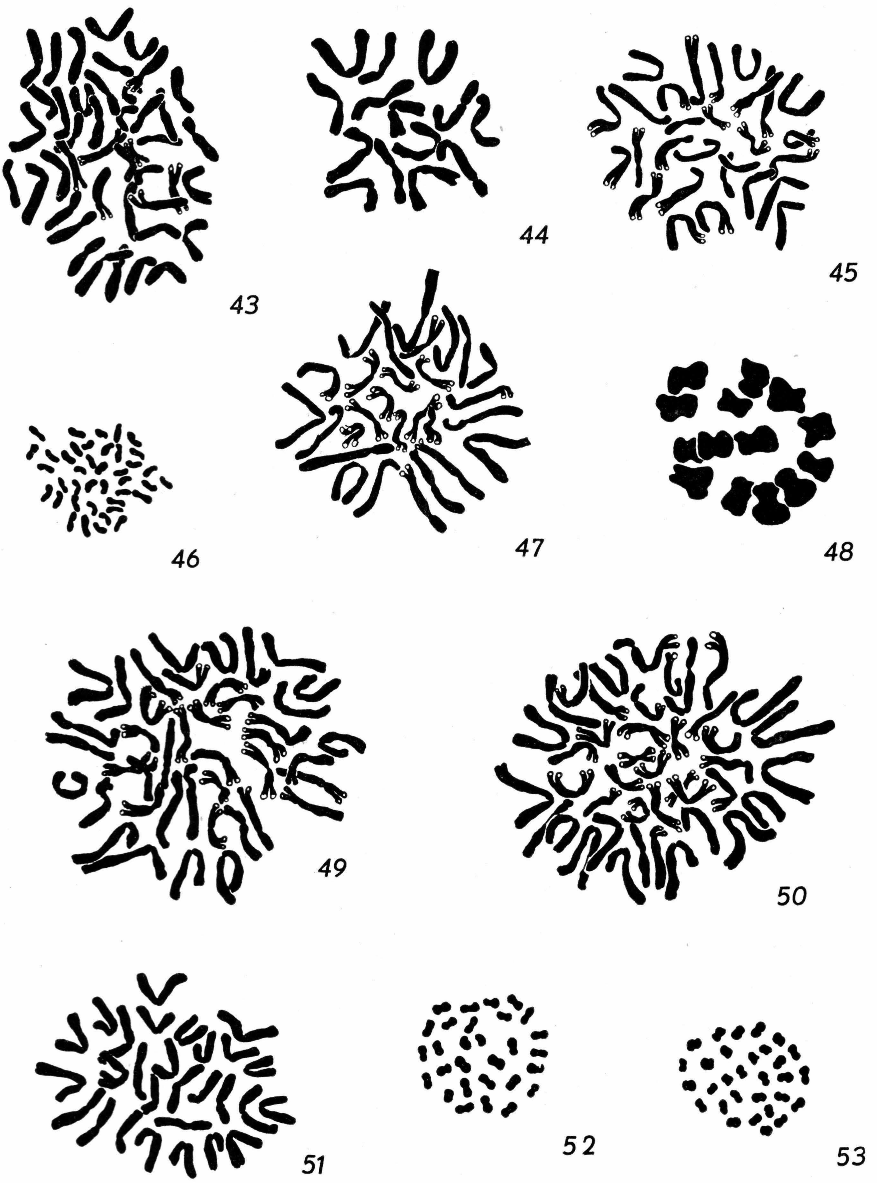
Festuca baffinensis N. POLUNIN.

2n = 28. Figs. 47 and 48.

It is with some hesitation I refer my material to this species, as I have not seen the type material of POLUNIN; but there is no doubt that my species is very distinct from all other Greenland *Festuca* material, and its characters are in good accordance with those given by POLUNIN (1940) of his *F. baffinensis*, especially in the character of the densely haired culms.

The cytological material of spikes and root-tips was fixed on resp. June 25, 1949, and July 27, 1950. Herbarium no. 8077. Both from plants in the river-delta at the station in Jørgen Brønlunds Fjord.

Meiosis in PMC and mitosis in RT were studied.



Figs.: 43 *Puccinellia angustata*, mitosis in RT. 44 *Colpodium Vahlianum*, mitosis in RT. 45 *Phippsia algida*, mitosis in RT. 46 *Pleuropogon Sabinei*, mitosis in RT. 47 *Festuca baffinensis*, mitosis in RT. 48 *Festuca baffinensis*, meiosis in PMC I. metaphase. 49 *Festuca brachyphylla*, mitosis in RT. 50 *Festuca brachyphylla*, mitosis in RT. 51 *Festuca hyperborea*, mitosis in RT. 52 *Eriophorum Scheuchzeri*, meiosis in PMC I. metaphase. 53 *Eriophorum triste*, meiosis in PMC I. metaphase. — Magnification: 2500 ×.

Festuca brachyphylla SCHULTES.

2n = 42. Figs. 49 and 50.

This species is not found in Peary Land, but at the southern base of the expedition at Zackenberg ($74^1/_2$° lat. N.) and later on Ella Ø (73° lat. N.). I had in the summer of 1950 an opportunity to study the species, which is much larger than the preceding and the following species.

The fixations were made at Zackenberg on July 26, 1950. Herb. no. 8056. On Ella Ø on Aug. 14, 1950. Herb. no. 8340.

The chromosome number 2n = 42 was found in both places in RT.

Festuca hyperborea n. sp.

2n = 28. Fig. 51.

The cytological material of this species was fixed on a clayey slope near the station in Jørgen Brønlunds Fjord, July 28, 1950. Herb. no. 8078. Mitosis in RT was studied.

Instead of a diagnosis a short description will here be given of the species. Closely related to *F. brachyphylla* s. str., from which it differs as follows: Plants small (10—15 cm tall), loosely tufted. The whole plant with a glaucous, pruinose, opaque tinge. Leaves usually strongly recurved. Panicles shorter, 1.5—2.5 cm. Glumes lanceolate-ovate, abruptly contracted into the rather short arista, not evenly tapering as in *F. brachyphylla*.

As will be seen, this description reminds much of the description given by SØRENSEN (1933) of *F. ovina* var. *supina*, which plant I think is identical with *F. hyperborea*.

Eriophorum Scheuchzeri HOPPE.

n = 29. Fig. 52.

Flower buds of this wide-spread arctic species was fixed from plants in a river delta near the station in Jørgen Brønlunds Fjord, June 15, 1949. Meiosis in PMC clearly shows 29 uniform chromosomes.

This number has previously been counted by FLOVIK (1943) in material from Svalbard, and according to LÖVE and LÖVE (1948) by SØRENSEN and WESTERGÅRD in plants from East Greenland.

Eriophorum triste (TH. FR.) HADAČ et LÖVE.

n = 30. Fig. 53.

This species which previously was regarded as a variety of *E. angustifolium* HONCK. has in a paper by LÖVE (1950) been evaluated as a separate species, according to differences in morphology and cytology. *Eriophorum angustifolium* has 2n = 58, in contradistinction to the number of 2n = 60 in *E. triste.*

The chromosome number of *E. triste* has previously been studied by FLOVIK (1943), who also found 2n = 60. And the same was found by SØRENSEN and WESTERGÅRD (acc. to LÖVE and LÖVE, 1948) in material from East Greenland.

The material examined by me was fixed in a meadow at Klaresø northwest of the station in Jørgen Brønlunds Fjord on June 13, 1949. Meiosis in PMC was studied.

I have searched in vain in places where the two species were growing together, for the hybrid between *E. triste* and *E. Scheuchzeri* which, according to SØRENSEN (1933) is found in several places in Northeast Greenland.

Kobresia myosuroides (VILL.) F. et PAOL.

2n = 60—66.

Mitosis was studied in root tips fixed on a dry gravelly hill near the station in Jørgen Brønlunds Fjord, July 28, 1950.

Although a large material was fixed, it was not possible to determine the exact number, because the chromosomes were very small, and the staining was very difficult and never very successful. My many countings make me believe that a number near 2n = 60 is the right one. A study of meioses in PMC's was also tried, but without success, as the anthers always had ripe pollen. I think that meiosis in PMC's takes place very early when the spikes are still hidden deep in the leaf-sheaths.

At Geysir in Iceland I had an opportunity to make some supplementary fixations of this species, but unfortunately this material did not provide satisfactory results, either. My unsuccessful countings, however, seem to indicate that the Iceland and the Peary Land plants do not differ cytologically.

The species has previously been studied by BÖCHER (1938 c), who gives the number 2n = 52. HEILBORN (1939) has studied material from Northern Sweden and gives 2n = ± 52—59.

Carex maritima GUNN.

2n = 60. Fig. 54.

Mitosis was studied in material of RT fixed on plants from a river delta at the station in Jørgen Brønlunds Fjord, July 13, 1949.

This species has formerly been examined by FLOVIK (1943), who found the same number in plants from Svalbard.

Carex nardina FR.

2n = c. 70.

Material was fixed on dry slope near the station in Jørgen Brønlunds Fjord on July 28, 1950, and mitosis was studied in RT.

Because of the high number and to the very small size of the chromosomes in this species, it was not possible to determine the exact chromosome number. My material has now been handed over to Professor M. WESTERGÅRD for closer investigations.

According to LÖVE and LÖVE (1948), SØRENSEN and WESTERGÅRD have found a number of 2n = 70 in material from East Greenland.

Carex rupestris ALL.

2n = c. 50. Fig. 55.

Mitosis was studied in RT fixed in a dry stone field 600 m above sea-level south of Jørgen Brønlunds Fjord, Aug. 5, 1950.

The species has previously been studied by HEILBORN (1924), who found the same number in material from northern Norway. This number is also known from Svalbard; FLOVIK (1943). From East Greenland the number 2n = 52 was counted by SÖRENSEN and WESTERGÅRD (acc. to LÖVE and LÖVE, 1948).

Carex misandra R. BR.

2n = 40. Fig. 56.

This number was found in mitosis in RT-material, fixed from plants at a rivulet near the station in Jørgen Brønlunds Fjord, Aug. 1, 1950.

The study of the metaphases showed that four of the chromosomes were somewhat larger than the others.

The same number has previously been found by FLOVIK (1943) in plants from Svalbard, and according to LÖVE and LÖVE (1948) also by SØRENSEN and WESTERGÅRD in material from East Greenland.

Carex stans DREJ.

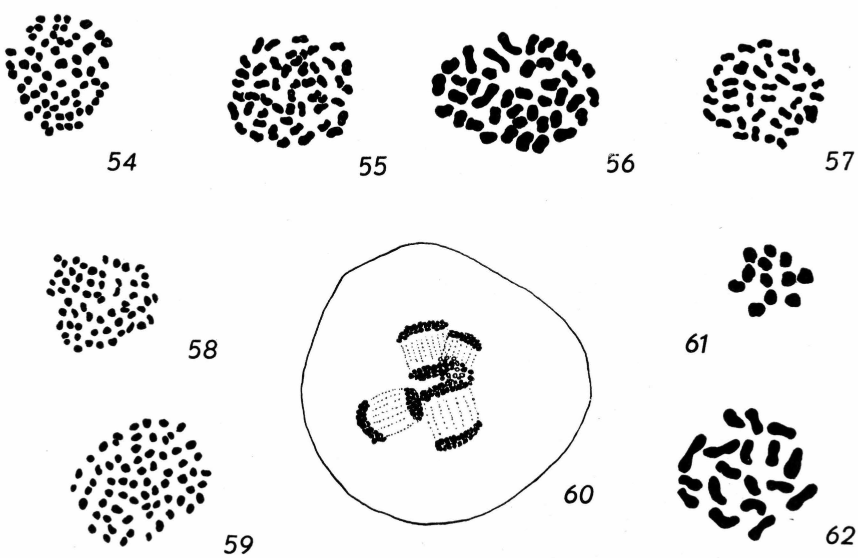
n = 38. Fig. 57.

This species has often been regarded as a variety of *Carex aquatilis* WG., so classed by BOOT. But according to SEIDENFADEN and SØRENSEN (1937) it seems that BOOT's variety is not identical with the species described by DREJER. The question of its specific rank is still open, and needs further investigation.

The chromosome number of the species in Peary Land was found in meiosis in PMC. Material of spikes was fixed in a meadow near Klaresø, southwest of the station in Jørgen Brønlunds Fjord on June 22, 1949.

Two of the chromosomes in the meiosis were particularly large-sized.

The chromosome number was not known before, but the closely related *C. aquatilis* Wg. has been studied by Levan (according to Löve and Löve, 1948) and by Stout (1913). The numbers found were resp.



Figs.: 54 *Carex maritima*, mitosis in RT. 44 *Carex rupestris*, mitosis in RT. 56 *Carex misandra*, mitosis in RT. 57 *Carex stans*, meiosis in PMC I. metaphase. 58 *Juncus biglumis*, meiosis in PMC I. metaphase. 59 *Juncus albescens*, meiosis in PMC II. metaphase. 60 *Juncus albescens*, meiosis "III. anaphase" in PMC. 61 *Luzula arctica*, meiosis in PMC I. metaphase. 62 *Luzula confusa*, meiosis in PMC II. anaphase. — Magnification: 2500 × (except fig. 60 — 1500 ×).

2n = 84 and n = c. 37. These different numbers indicate that *C. aquatilis* s. l. also affords a complicated problem.

Juncus biglumis L.

n = 60. Fig. 58.

Material of this species very common in Peary Land was fixed on October 18, 1948, from plants brought to growth in the house in Jørgen Brønlunds Fjord. The plants in question were frozen and in a wintering condition when they were brought in from a river delta on October 14, 1948. (Open-air temperature in those days was about —20° C.). The development of the plants was very fast and vigorous.

Meiosis in the PMC was studied. The chromosomes are very small, but in the metaphases distinctly separated from each other.

Juncus albescens (LANGE) FERN.

n = 67 ±. Figs. 59 and 60.

This species has often been referred as a variety of *J. triglumis* L., to which it seems closely related. After a study of FERNALD's paper (1927), I must refer the material from Peary Land to his *J. albescens*.

My material collected for cytological purposes was fixed in a moss-meadow south of the station in Jørgen Brønlunds Fjord on July 11, 1949. Meiosis in PMC was studied. It was not possible to determine the number exactly, but in several metaphase plates the number 67 occurs, a number which does not agree with what is known within the genus *Juncus*, where the basic number is 10. A plate with 67 chromosomes is given in Fig. 59.

Material of *Juncus triglumis* has also been examined. This material was collected by dr. T. W. BÖCHER in Switzerland and by myself in Iceland. In both collections mitosis in RT was studied, and a very high chromosome number was found, which makes me believe that *J. albescens* and *J. triglumis* have the same number. The number 2n = 50 in *J. triglumis* from Sweden given by LÖVE (1945) is interesting, but needs confirmation.

During the study of the PMC's of *J. albescens* and *J. biglumis* from Peary Land phenomena of special interest appeared. While meiosis in PMC in higher plants usually consists of two separate divisions, three divisions occur in these two species, and eight nuclei are present at the end of the meiosis. In fig. 60 the "III. anaphase" in PMC of *J. albescens* is given. In the pollen tetrads formed, each of the four cells contains two nuclei.

Similar conditions have been demonstrated by WULFF (1939) in other species within the genus *Juncus*, e. g. *J. filiformis*. In his paper he tries to account for it.

Luzula arctica BLYTT

n = 12. Fig. 61.

Meiosis was studied in PMC in flower buds fixed from plants in culture. The culture was started with plants in winter condition (frozen) from river delta, from which they were brought indoors in the house in Jørgen Brønlunds Fjord on March 21, 1949. In a fortnight the buds were fixed.

The number agrees with that found by NORDENSKIÖLD (1951) in material from northern Sweden, and with that of KNABEN (1950) from Norway.

Luzula confusa (HARTM.) LINDEB.

n = 18, Fig. 62.

This number has been found in studying the meiosis in PMC from flower buds, fixed in a stone field 500 m above sea-level in Heilprin Land, July 8, 1949.

BÖCHER and LARSEN (1950) have studied this species from Angmagssalik, East Greenland, and from Nûgssuaq, West Greenland. From both places the plants had 2n = 36. Outside Greenland the species has been studied several times. NORDENSKIÖLD (1951) has examined material from places in Sweden, from Baffin Island and Melville Peninsula in Canada. Her material belongs to *L. arcuta* coll. including *L. confusa* and *L. arcuata* (WG.) SW. *L. arcuata* s. str. has been studied by LÖVE and LÖVE (1945) in Sweden. From these countings the number 2n = 36 has been reported. Of special interest is the finding of 2n = 42 in *L. confusa* in Northeast Greenland made by WESTERGÅRD (acc. to NORDENSKIÖLD, l. c.), a number, which has also been found by NORDENSKIÖLD in northern Sweden. It may be assumed that this plant is of a hybrid nature. A specimen studied by myself from Zackenberg in Northeast Greenland had a chromosome number of 44—48, diploid.

SUMMARY

The first column of the table below briefly summarizes the result of countings of chromosome numbers in 63 species. In the following columns are listed hitherto known chromosome numbers in the species in question arranged according to geographical areas. It appears from the list that 16 of the species have not previously been investigated cytologically. Furthermore it appears that Svalbard is the area with which Peary Land shows the closest agreement in respect of chromosome numbers, a fact from which perhaps we cannot conclude too much, as long as the other areas have not been investigated more throughly than is actually the case.

	Peary Land	East Green-land	West Green-land	Sval-bard	Scan-dina-via	Other Countries
	2n	2n	2n	2n	2n	2n
Salix arctica	76	..	..	..	..	
Oxyria digyna	14	14	14	14	14	14 Canada
Koenigia islandica	28	28	28	..	..	28 Faroe Islands
Polygonum viviparum	c. 100	..	..	c. 100	..	
Cerastium Regelii	72	..	..	72	..	
Cerastium alpinum	108	72 & 108	54 & 72	72	..	
Melandrium apetalum	24	..	..	..	24	
Melandrium triflorum	72	..	72	..	..	
Ranunculus sulphureus	c. 96	..	..	96	96	
Ranunculus hyperboreus	32	32	32	32	32	
Ranunculus affinis	32	..	48	..	..	
Papaver radicatum	56	..	..	70	..	
Cochlearia officinalis v. groenlandica	14	..	14	14	..	
Draba subcapitata	16	..	..	..	..	
Draba arctogena	48	..	48[1])	..	..	
Draba groenlandica	64	..	64[1])	..	..	
Draba macrocarpa	c. 120	..	..	..	..	
Cardamine bellidifolia	16	16	..	..	..	

[1]) Presumably from West Greenland.

(continued)

	Peary Land	East Green-land	West Green-land	Sval-bard	Scan-dina-via	Other Countries
	2 n	2 n	2 n	2 n	2 n	2 n
Erysimum Pallasii	c. 28	..	..	..	..	
Eutrema Edwardsii	28	..	..	..	..	42 U.S.S.R.
Braya Thorild-Wulffii ...	28	..	..	..	..	
Braya purpurascens.....	56	..	..	..	..	64 Iceland
Saxifraga oppositifolia...	26	26	..	52	26	26 Iceland
Saxifraga flagellaris	32	..	..	32	..	
Saxifraga nivalis........	60	60	60	60	..	60 Iceland
Saxifraga rivularis	26	56 & 52	..	26	..	52 Iceland
Saxifraga tenuis	20	20	..	20	20	20 Iceland
Saxifraga groenlandica ..	80	80	80	80	..	
Potentilla pulchella	28	..	..	28	..	
Pedicularis hirsuta......	16	16	..	..	..	
Erigeron compositus	54	..	63	..	..	54 Canada
Taraxacum arcticum....	40	..	..	40	..	
Taraxacum artogenum ..	32	..	..	..	..	
Taraxacum phymatocar-pum................	24	..	..	..	..	
Taraxacum pumilum....	16	..	..	..	..	
Alopecurus alpinus......	c. 112	..	112–130	..	..	
Arctagrostis latifolia	56	..	..	62	..	
Deschampsia brevifolia ..	26	28?	..	..	..	
Trisetum spicatum......	28	28	28 & 42	28	..	
Poa abbreviata.........	42	..	..	76?	..	
Poa Hartzii...........	63–70	..	..	..	..	
Poa glauca............	56	70	63	c. 70	42–70	
Poa arctica caespitans ..	56	..	..	56	..	
Poa alpigena v. colpodea	35	35	..	51	..	
Puccinellia Andersonii...	56	..	..	..	..	
Puccinellia angustata....	42	..	..	42	..	
Colpodium Vahlianum...	14	..	..	14	..	
Phippsia algida.........	28	28	..	28	28	
Pleuropogon Sabinei	40	..	..	..	..	
Festuca baffinensis......	28	..	..	..	..	
Festuca hyperborea	28	..	..	..	..	
Eriophorum Scheuchzeri..	58	58	..	58	..	
Eriophorum triste	60	60	..	60	..	60 Iceland
Kobresia myosuroides ...	60–66	52	..	..	52–59	60–66 Iceland
Carex maritima.........	60	..	..	60	..	
Carex nardina..........	c. 70	70	..	..	..	
Carex rupestris	c. 50	52	..	50	..	
Carex misandra.........	40	40	..	40	..	
Carex stans	76	..	..	..	..	
Juncus biglumis	120	..	..	..	..	
Juncus albescens	c. 134	..	..	..	..	
Luzula arctica..........	24	..	..	..	24	
Luzula arcuata coll.	36	36 & c.42	36	..	36 & 42	36 Canada

In recent years great importance has often been attached to investigations of conditions of polyploidy in the various species within demarcated floral areas and comparisons with conditions of polyploidy in the species within other floral areas. It has been assumed that it would be possible through such comparisons to show that the degree of polyploidy would increase in the case of an aggravation of the conditions under which the species were growing, this to be understood in the way that in floral areas in which the climatic and ecological conditions were bad for the plants, the degree of polyploidy in the flora should on the whole be higher than that found in regions where conditions of growth were better. In this connexion it is maintained that polyploidy must be one of the most active factors in species formation in the areas where the conditions of the species are poor, as e. g. in arctic regions. Such a hypothesis has been advanced by HAGERUP (1931) and TISCHLER (1934) and is supported by others, e. g. FLOVIK (1940) and LÖVE and LÖVE (1949).

Without this theory being called in question, it appears from the list above, with the Peary Land flora as basis, that a comparison between the Peary Land chromosome numbers and the numbers in the corresponding species (in so far as these are known) from other floral areas, does not confirm the hypothesis convincingly.

Among the floral areas with which Peary Land has species in common it is evident that there are none with conditions of vegetation as bad as those of Peary Land. This country, the northernmost on earth, as no one else within the arctic regions is characterized by barrenness. During the year the plants are exposed to nine months' severe frost, very little precipitation, and strong, very dry gales. The growth of the plants is poor, few of them reaching a height of more than 10 cm.

In spite of these poor conditions the Peary Land flora on the whole shows no higher degrees of polyploidy within the species than is the case in other regions.

It appears that 47 out of the 63 species contained in the list have previously been studied cytologically, either in other parts of Greenland, in Europe, or in Canada. Within 29 out of the 47 species hitherto only one and the same number has been ascertained for each species, i. e. such species which as a rule must be considered good and well-defined, and which genetically must be considered as stabilized, e. g. *Oxyria*, *Koenigia*, and *Ranunculus hyperboreus*.

Only 12 species were found in Peary Land out of species within which different chromosome numbers have been ascertained. In this connexion it is interesting to note that only one of these has its highest chromosome number represented in Peary Land, viz. *Cerastium alpinum* with $2n = 108$. The other 11 species have their highest known numbers in individuals from floral areas farther south, thus from regions where the conditions of life of the plants are more favourable.

In this calculation 6 species have not been included the chromosome numbers of which have not yet been definitely established.

If the species of the list are considered genus by genus, the trend becomes more distinct. It appears that only 4 out of the 34 genera treated here have the highest known chromosome number of the genus represented in Peary Land. In 25 genera the highest number is known only from regions situated farther south. Finally there are 5 genera within which only one and the same number is known, i. e. this point of view does not support the hypothesis either.

Löve & Löve (1949) in their paper give an account of the material of facts available at present which may serve to support Hagerup and Tischler's hypothesis that "the frequency of polyploids increases with higher latitude," based on a calculation of the percentage of polyploid species constituted by the total number of species within the floral areas dealt with. The method of calculation used here, does not, however, seem to me to be quite uniform. Thus on p. 280 it is stated that 90.4 per cent. out of the 1306 species of Denmark should be cytologically known. This is only correct on the assumption that each species occurs only with one and the same chromosome number within its area of distribution. It does not seem to me allowable to assume that if a species has one number e. g. in Sweden, then it should have the same number in Denmark. There are several cases where this is not so. Hardly half of the Danish species have been studied cytologically on the basis of Danish material.

As already pointed out by Tischler (1934) it may be difficult enough to calculate the percentage of polyploid species within a floral area, as often it is not possible to decide whether a species is polyploid or not, and in many cases it is not possible to know how high a degree of polyploidy is represented by a given chromosome number. These difficulties also crop up at a study of conditions of polyploidy in the Peary Land flora. This flora includes a comparatively small number of diploid species. On the other hand it must be laid down that as a whole its species do not show particularly high degrees of polyploidy, and not so high at all as might be expected according to the hypothesis advanced.

LITERATURE

Åkerberg, E. 1942. Cytogenetic Studies in Poa pratensis and its Hybrid with Poa alpina', Hereditas Bd. 28. Lund.

Abbe, E. C. 1948. Braya in boreal Eastern America, Rhodora, Vol. 50.

Blackburn, K. 1930. In Tischler, G. Tabulae Biologicae, Bd. VII.

Böcher, T. W. 1938 a. Biological Distributional Types in the Flora of Greenland. Medd. om Grønland, Bd. 106, Nr. 2.

— 1938 b. Cytological Studies in the Genus Ranunculus. Dansk Botanisk Arkiv Bd. 9, Nr. 4. Copenhagen.

— 1938 c. Zur Zytologie einiger arktischen und borealen Blütenpflanzen. Svensk Bot. Tidskr. Bd. 32, H. 3.

— 1941. On the Origin of Saxifraga Nathorsti (Dusén) v. Hayek, Medd. om Grønland, Bd. 131, nr. 2. Copenhagen.

Böcher, T. W. and K. Larsen. 1950. Chromosome Numbers of some Arctic or Boreal Flowering Plants. Medd. om Grønland, Bd. 147, nr. 6. Copenhagen.

Edman, G. 1929. Zur Entwicklungsgeschichte der Gattung Oxyria Hill, etc. Acta Horti Bergian. Tom. IX, nr. 7. Uppsala.

Ekman, Elis. 1941. (posth.) Notes on the Genus Draba. Svensk Bot. Tidskr. Bd. 35. H. 2. Stockholm.

Fernald, M. L. 1924. Juncus triglumis and its American Representive. Rhodora, vol. 26.

Flovik, K. 1938. Cytological Studies of Arctic Grasses. Hereditas Bd. 24. Lund.

— 1940. Chromosome Numbers and Polyploidy within the Flora of Spitzbergen. Hereditas Bd. 26. Lund.

— 1943. The Chromosome Number of some Species of Carex and Eriophorum. Nytt Magasin f. Naturv. Vol. 83.

Gelting, P. 1934. Studies on the Vascular Plants of East Greenland between Franz Joseph Fjord and Dove Bay. Medd. om Grønland. Bd. 101, nr. 2.

Hagerup, O. 1926. Kønsdelenes Bygning og Udvikling hos Koenigia Islandica L. Medd. om Grønland, Bd. 58, nr. 3. Copenhagen.

— 1931. Über Polyploidie in Beziehung zu Klima, Ökologie und Phylogenie. Hereditas Bd. 16. Lund.

— 1939. Studies on the Significance of Polyploidy. III. Deschampsia and Aira. Hereditas Bd. 25. Lund.

Heilborn, O. 1924. Chromosome Numbers and Dimensions, Species-Formations and Phylogenie in the Genus Carex. Hereditas Bd. 5. Lund.

— 1939. Chromosomes Studies in Cyperaceae III—IV. Hereditas Bd. 25. Lund.

— 1941. Some Chromosome Numbers in Draba. Svensk Bot. Tidskr. Bd. 35. Stockholm.

Holmberg, O. 1931. Skandinaviens Flora, Bd. 1b, Hf. 1. Stockholm.
Hultén, E. 1944. Flora of Alaska and Yukon. IV. Lunds Univ. Årsskr. N. F. Avd. 2, Bd. 40, Nr. 1. Lund.
Jaretzky, R. 1928. Untersuchungen über Chromosomen und Phylogenie bei einigen Cruciferen. Jahrbücher f. wiss. Botanik. Bd. 68. Leipzig.
— 1928b. Histologische und karyologische Studien an Polygonaceen. Ibid. Bd. 69.
Johnsson, H. 1941. Cytological Studies in the Genus Alopecurus. Lunds Univ. Årskrift, N.F. avd. 2. Bd. 37, nr. 3. Lund.
Knaben, G. 1950. Chromosome Numbers of Scandinavian Arctic-Alpine Plant Species. I. Blyttia Bd. 8, hf. 4. Oslo.
Langlet, O. 1936. Några bidrag til kännedomen om kromosomtalen inom Nymphaeacea. Svensk Bot. Tidskr. Bd. 30, hf. 3. Uppsala.
Löve, A. 1950. Some Innovations and Nomenclatural Suggestions in the Icelandic Flora. Botan. Not. 1950. Lund.
Löve, A. & Löve, D. 1942. Chromosome Numbers of Scandinavian Plant Species. Botan. Not. 1942. Lund.
— 1944. Cyto-Taxonomical Studies on Boreal Plants. III. Arkiv f. Botanik. Bd. 31 A, nr. 12. Stockholm.
— 1945. Cyto-Taxonomical Studies on Boreal Plants. II. Ibid. Bd. 31 B, nr. 1. Stockholm.
— 1948. Chromosome Numbers of Northern Plant Species. Univ. Inst. of Appl. Sciences, Dept. of Agriculture Report. Series B. No. 3. Reykjavik.
— 1949. The Geobotanical Significance of Polyploidy. I. Polyploidy and Latitude. Portugal. Act. Biol. Ser. A, Vol.. R. B. Goldschmidt.
— 1951. Studies on the Origin of the Icelandic Flora. II. Saxifragaceae. Svensk Bot. Tidskrift. Bd. 45, H. 2. Stockholm.
Manton, I. 1932. Introduction to the General Cytology of the Cruciferae. Annals of Botany vol. 46. London.
Nannfeldt, J. A. 1937. On the Chromosome Number of Phippsia algida (Sol. ap. Phipps) R. Br. Bot. Not. 1937. Lund.
— 1940. On the Polymorphy of Poa arctica R. Br. Symb. Bot. Upsalienses, IV: 4. Uppsala.
Nordenskiöld, H. 1951. Cyto-Taxonomical Studies in the Genus Luzula. I. Somatic Chromosomes and Chromosomenumbers. Hereditas Bd. 37. Lund.
Nygren, A. 1949. Experimental Studies in Scandinavian Alpine Plants. I. Hereditas Bd. 35. Lund.
— 1951. Experimental Studies in Scandinavian Alpine Plants. II. Hereditas Bd. 37. Lund.
Polunin, N. 1940. Botany of the Canadian Eastern Arctic. Part I. Nat. Mus. of Canada, Bull. No. 92. Biol. Ser. No. 24.
Rollins, R. C. 1939. Studies in the Genus Lesquerella. Amer. Journ. of Bot. 26, No. 6.
Scholander, P. F. 1934. Vascular Plants from Northern Svalbard. Skr. om Svalbard og Ishavet. Nr. 62. Oslo.
Seidenfaden, G. & Th. Sørensen. 1937. The Vascular Plants of Northeast Greenland from 74°30′ to 79°00′ N. lat. Medd. om Grønland. Bd. 101, No. 4. Copenhagen.
Skovsted, A. 1934. Cytological Studies in the Tribe Saxifrageae. Dansk Bot. Arkiv Bd. 8. Nr. 5. Copenhagen.
Stout, A. B. 1913. The Individuality of the Chromosomes and their Serial Arrangement in Carex aqualitis. Archiv f. Zellforschung. 9.

SØRENSEN, TH. 1933. The Vascular Plants of East Greenland from 71°00′ to 73°30′ N. Lat. Medd. om Grønland, Bd. 101, Nr. 3. Copenhagen.

— 1941. Temperature Relations and Phenology of the Northeast Greenland Flowering Plants. Medd. om Grønland, Bd. 125, Nr. 9. Copenhagen.

TISCHLER, G. 1934. Die Bedeutung der Polyploidie für Verbreitung der Angiospermen. Botanische Jahrbücher Bd. 67. Leipzig.

— 1950. Die Chromosomenzahlen der Gefässpflanzen Mitteleuropas. Haag.

WULFF, H. D. 1939. Die Pollenentwicklung der Juncaceen . . . Jahrbücher für wissensch. Botanik. Bd. 87. Berlin.

Færdig fra trykkeriet den 30. august 1952.