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STUDIES ON THE ORIBATIDS AND COLLEMBOLES OF GREENLAND

BY

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WITH 38 FIGURES IN THE TEXT

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PREFACE

These investigations have been made on the basis of all the Berlese samples collected, at my request, on the coasts of Greenland in the years 1931—39. As a member of Dr. Knud Rasmussen's 7th Thule Expedition 1933 I myself examined the microfauna of the soil at Angmagssalik and in Mikis Fjord. The results of these investigations constitute a very important part of this paper. I owe great thanks to the late Dr. Knud Rasmussen, because he permitted me, a woman, to take part in an expedition of such importance to me, and because all the time he took great interest in my work. My thanks are also due to the captain of the ship, Commander (now Vice-Admiral) A. H. Vedel, R. D. N.; despite the limited space on board the ship he did everything in his power to make it possible for me to complete my work.

I also take the opportunity of bringing Dr. G. Thorson, Lector J. Brændegaard, cand. mag. Fr. Søgaard Andersen, mag. sc. E. Berthelsen, cand. mag. P. M. Hansen and Dr. Finn Salomonsen my best thanks for their kindness in collecting materials for me.

For several years I received the J. L. Smith scholarship and was thus made able to give my undivided attention to these investigations; I hereby wish to express my gratitude for this support. Likewise I wish to give thanks to Dr. Th. Sørensen and mag. sc. S. L. Tuxen for their advice and counsel during the execution of my work. I also wish to thank Mrs. Johanne Kastor Hansen who translated the paper into English in consultation with Mr. W. E. Calvert.

Holte, February 10, 1944. Marie Hammer.

INTRODUCTION

The *Oribatidae* and *Collembola* belong to the most widely distributed of all animal groups. As they live on lower plants and decaying plant remains, want of nutrition will hardly be able to stop their dispersion. Apparently drought is the only thing that might frustrate them. Presumably they are absent in the driest deserts. Towards the north and south they will certainly exist as far as vegetation obtains. Despite their wide distribution and their enormous numbers with which they crowd the soil, they were more or less unnoticed up to some decades ago. This is due partly to their diminutive size, partly to their unobserved existence. Some of them have done great harm to cultivated plants and have therefore been drawn forward from their well-hidden existence for closer investigation, and this investigation has been extended gradually to all the species. As MACNAMARA (1924) writes: "And just as the Japanese, for all their exquisite art and literature, won no standing among the nations until they killed a large number of Russians, so the *Collembola* are gaining respect among entomologists, not from the blameless and retiring life led by the great majority of the order, but because *Sminthurus hortensis* now and then eats up whole fields of onions." Thanks to the attention which undesirable components have drawn to the entire order, interest in the way of living of these animals has been roused. Sometimes one might wish that the *Oribatidae* had been less innocent than they are, so that some light may have been thrown upon the obscure life of these animals too.

It was not until special collecting apparatuses had been taken into use for the investigation of animal life of the soil, that this branch of science gained impetus. It had been practically impossible to collect diminutive animals such as oribatids and collemboles without special implements, and therefore our knowledge of these animals was very restricted up to recent years. In Greenland only 12 species of oribatids and a corresponding number of collemboles were known as late as 1934. That year my first two papers on the microfauna of Greenland were published, and thus the number was doubled. In HENRIKSEN and LUND-

BECK (1917) we read about the various species of *Oribatidae* "unknown in West Greenland", "one specimen from Scoresby Sound", "unknown in East Greenland", and so on about species which have now been found in large numbers, dispersed all over the parts of Greenland investigated.

And who would believe that the "barren" fell-fields harbour an animal life which, as to density of individuals, far surpasses what BORNEBUSCH (1930) found in forest soil in Denmark, and what FRENZEL (1936) found in German meadows. On a lichen heath at Angmagssalik about 7,800 individuals were found on $^1/_{100}$ m^2, that is 780,000 per m^2, while the highest numbers given by FRENZEL per m^2 are 73,900, 44,000, 88,900, 94,000, 36,500, and 58,700 in various meadow localities. However, it must be remarked that while the number of animals in Greenland consists almost solely of oribatids and collemboles, FRENZEL's numbers from Germany comprise many other animal species which, as to nutrition, require far larger quantities, for instance snails, earthworms, beetles. BORNEBUSCH has demonstrated that the better the soil, the fewer and larger the species, whereas poor soil has many small-sized species, so that the great quantities found in Greenland could not be a sign of any "rich" animal life, but of poor soil. On the other hand SCHIMITSCHEK (1937) arrived at the result that the number of small-sized animals in the soil, such as mites and collemboles, is the larger, the better is the soil and its condition.

By taking nourishment from decaying plant remains the *Oribatidae* and *Collembola* play a very conspicuous rôle in the bio-chemical changes in the soil and thus become the condition for the existence of a higher flora and fauna. This has increased the interest taken in these animals during recent years, when the cry from everywhere is: greater yield.

The investigation of the *Oribatidae* and *Collembola* of Greenland is only part of a work, originally planned much more comprehensively, to include an investigation of the soil fauna of North Scandinavia, Iceland, East and West Greenland, and possibly easterly Arctic North America as well. The purpose of that investigation was to endeavour to contribute to the solution of the question of the origin of the Greenland fauna. Did it originate in America or in Europe? Or is it a blending of both?

It soon became evident that such an investigation would prove unachievable for one single human being during a life-time, if a fairly truthful representation of the fauna were to be given. Therefore I had to confine myself for the time being to an investigation of Greenland and there take area by area and investigate. In my first work (JØRGENSEN 1934 a) I attempted to subdivide Greenland's mites and collemboles (The Franz Joseph Fjord region) into animal communities according to the humidity of the soil. No connection between the flora communities and the fauna communities was discovered. In the course of a later investigation of animal life in Mikis Fjord and on the southeast coast (HAMMER 1937) I extended what was known about the microfauna of Greenland and demonstrated that in wet biotopes there was a fauna widely different from that found in dry biotopes. The moisture is the direct cause. I also showed that the reproduction season sets in earlier in the dry than in the wet biotopes. In the first work the investigation comprised, besides *Oribatidae* and *Collembola*, also *Gamasidae*, *Trombidiidae*, *Chironomidae*, *Coccidiidae* and *Araneida*, but in the course of time I became aware that this investigation had been planned on far too big a scale; I could not tackle the determination of the various animal groups; therefore I confined the investigation to *Oribatidae* and *Collembola*; they live together in the soil, apparently independently of one another and mostly living on the same food, and presumably the same external factors prevail as to both.

In later years these two animal groups have been thoroughly investigated, sometimes one at a time, sometimes together, taxonomically as well as ecologically, biologically and zoo-geographically. Among the first of those who worked with Arctic collemboles was WAHLGREN, whose publications (1900), besides the collemboles of Greenland, also comprise the collemboles on Jan Mayen, Bear Island and King Karl's Land. In 1896 MEINERT published a rather short list of the collemboles of Greenland, and among these was a new species, *Sminthurus concolor*. TRÄGÅRDH's work on Arctic mites (1904) collects the widely spread information existing about the oribatids in Greenland. GRAVERSEN (1931) examined some subfossil and some recent Greenland *Oribatidae*, of which some few had not been found before. When the Berlese apparatus was taken into use (JØRGENSEN 1934 a and HAMMER 1937 and 1938), the knowledge of this part of the Greenland fauna was considerably increased. HAARLØV's investigation (1942) of the microfauna of northeast Greenland increased this knowledge still more.

Ecological investigations of these animal groups had been made a long time beforehand in other countries. In 1907—1912 appeared LINNANIEMI's great work on the *Apterygota* of Finland, where the collemboles for the first time were exhaustively treated ecologically, biotope by biotope. About the same time TRÄGÅRDH (1910) described the mite fauna of Lapland (the Sarek mountains); this fauna was also made the object of ecological examinations. Later on some investigations of a similar nature, mostly taxonomical, of the mites were made by SELLNICK in Iceland (1940) and by WILLMANN (1943) in Lapland. Investigations of the biology of some collembole species were made by STREBEL (1932) on *Hypogastrura purpurascens*, by RIPPER (1930) on *Hypogastrura manubrialis* and by MACLAGAN (1932) on *Sminthurus viridis*.

In recent decades, collective investigations of the fauna of a definite area have become more and more common, and at the same time the preponderance has been shifted from the taxonomical to the ecological, biological and zoo-geographical point of view. (HANDSCHIN 1924, SIG THOR 1930, LINDROTH 1931, THAMDRUP 1932, BERTRAM and LACK 1938). In all these investigations, however, the ecological ones have been confined to the verifying of the existence of the various species in certain biotopes. No attempt has been made to differentiate the factors that determine the thriving of the species in the biotopes. THOMPSON, FRENZEL and FORD, among others, took one step further; they investigated the ecological factors which are the cause of the annual fluctuations in the populations of these animal groups. Investigations into the occurrence of the animals during the whole year were made by THOMPSON (1924); at intervals of fourteen days the animal life was examined upon grassland and cultivated soil. Hereby it was made evident that there were annual fluctuations in the population with maxima during the winter months, minima during summer. FRENZEL (1936) likewise showed that oribatids and collemboles had annual fluctuations in the density of population in various meadows, conditioned by changing humidity. Maxima were found in spring and autumn, minima during summer and winter. FORD (1937—1938) found maxima during the six winter months. AGRELL's thorough investigation of collemboles in Lapland (1941) treats this animal group from an ecological point of view. He points out the existence of each species in various biotopes in relation to humidity, temperature, hydrogen-ion concentration, etc. and makes also preferenda-experiments in order to determine, in the laboratory, the limits of humidity, temperature, etc., within which the various species mostly occur. He finds, moreover, that some species have one annual generation, whereas others have two. Another investigation, though less exhaustive, of the occurrence of oribatids in various biotopes in Iceland was made by TUXEN (1943), who points out the difference between the fauna of the biotopes in relation to the different degrees of humidity.

By an investigation of all the factors influencing the density of population of mites and collemboles in the soil, SCHIMITSCHEK (1937) showed that the numbers increase—if there are sufficient nutrition and humidity—with increasing aërial capacity. Interest now is concentrated on the influence of these animals upon the quality of the soil. By means of finding the composition of the microfauna it is hoped that it will be possible to express the state of fertility of the soil, whereby different microfauna would express different fertilities. As yet, nobody has succeeded in working out the necessary formula. BORNEBUSCH (1930), KSENEMANN (1938), and FORSSLUND (1943) have tried to show an agreement between the fauna and the various types of forest soil. BORNE-

BUSCH (1930) found that the difference between the types of forest soil is essentially quantitative. For each type of forest soil FORSSLUND (1943) sets up a special community named after the species that are most numerous. In the two forest soil types investigated by FORSSLUND, the same oribatid and collembole species occur most numerously. The forest soil type is further characterised by still another species and by the mutually quantitative sequence of the species; thus the microfauna of the *Vaccinium* type is called a *Nanhermannia nana-Isotoma minor-Oppia neerlandica*-association, while the fauna of the *Dryopteris* type is called an *Isotoma minor-Oppia neerlandica-Ceratozetes hesselmani*-association.

HAARLØV's investigations (1942) of the mites, collemboles, etc. of East Greenland are specially interesting, as they treat the microfauna of East Greenland (Mørke Fjord) as seen from a taxonomic-ecologic-zoogeographic point of view. Besides determining some various species of *Oribatidae* not hitherto found in Greenland, he examines the stages at which these animal groups winter and he philosophizes over their annual rhythm (number of generations), relying upon his own observations. About the origin of the fauna he surmises that more highly specialised forms of the mites immigrated along some land bridge during the last inter-glacial period. The idea that the fauna, or part of it, originated from this land connection with Iceland during the last inter-glacial period, was first voiced by DEGERBØL in his investigations of the fauna of the Blosseville Coast (1937). The question of the origin of the fauna was treated most thoroughly by AD. S. JENSEN (1928), who inclines to the view that the greater part of the fauna originates in America, from where it immigrated during the post-glacial period, while some of the lower and more hardy animal species may be of pre-glacial origin. As far as Iceland is concerned, LINDROTH (1931), on the basis of the composition and distribution of the insect fauna, showed that Iceland's insect fauna is typically European and high-boreal and that presumably it immigrated from Europe during the inter-glacial period. He also goes into the origin of the Greenland fauna.

Chapter I.

Climate.

In order to understand the dependence the microfauna displays, in its annual rhythm, on climate and microclimate, it is necessary to know something of the climate in Greenland.

The Berlese investigations have been made on both East and West Greenland, from about Latitude 72.5 North (Ella Island off the East Coast and Upernavik on the West Coast) to the most southerly part of Greenland (see fig. 2), and also in inner fjord regions (Ella Island) as well, and at the coast (Scoresby Sound, Angmagssalik and Upernavik). In the various regions there are rather different climatic conditions which highly influence the temperature. The mean temperature, according to the meteorological registrations (HELGE PETERSEN 1938) from Scoresby Sound (lat. 70°30′ N., long. 22°00′ W.), Angmagssalik (lat. 65°37′ N., long. 37°34′ W.), and Upernavik (lat. 72°47′ N., long. 56°07′ W.) is shown in table 1.

Table 1. Mean temperatures.

Months	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	Year	Diff.
Scoresby Sound	-17.4	-18.7	-16.8	-12.4	-4.4	1.8	4.5	3.3	-0.2	-7.0	-12.7	-15.5	-8.0	23.2
Angmagssalik	-8.0	-9.1	-7.3	-4.0	1.0	4.9	7.1	5.9	3.1	-1.2	-5.0	-6.9	-1.6	16.2
Upernavik ..	-22.8	-23.2	-21.3	-14.3	-3.8	1.8	4.9	4.9	0.8	-4.0	-9.9	-17.0	-8.6	28.1

The temperature records show a great difference between the three stations. Scoresby Sound and Upernavik have much lower winter temperatures than Angmagssalik, which is situated somewhat more southerly. Of the first two, Upernavik has the colder winters. Despite this, the mean temperature of Scoresby Sound and Upernavik is about the same —8.0 and —8.6 respectively. This is due to the higher summer temperature at Upernavik, where four months of the year have a positive mean temperature. At all the stations July is the warmest month, although at Upern avik July and August have the same mean temperatures.

From Ella Island we have only the records made by the Three Year Expedition (TH. SØRENSEN 1941), from which table 2 gives the mean temperatures.

Table 2. The mean temperatures for Ella Island.

Months	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	Year
1931..	..	..	..	..	..	..	..	..	0.6	-9.8	-11.1	-22.4	..
1932..	-19.2	-12.6	-14.2	-17.9	-0.8	6.2	9.6	8.4	4.0[1])	-7.7	-18.3	-17.2	-6.7
1933..	-15.9	-18.6	-17.5	-19.2	-10.5	3.7	10.2	9.0	3.5	-7.0	-11.1	-12.9	-7.2
1934..	-23.7	-25.0	-17.2	-11.4	-4.2	5.8	..	..	..	..	..	..	..

[1]) was not recorded for the whole month.

From these temperatures it is seen that Ella Island has far colder winters and warmer summers than the three coastal stations. In the two years for which the records are complete, the mean temperature of the year was — 6.7 and — 7.2. It has been stated that 1932 was an abnormally warm or mild year. At Ella Island too July is the warmest month.

The records of the precipitation in table 3 reveal that Angmagssalik has a very considerable annual precipitation of 872 mm, while for Scoresby Sound and Upernavik it is much lower, 317 and 230 mm respectively.

On Ella Island the precipitation was recorded during the Three Year Expedition to East Greenland. The records showed a very small precipitation of about 110—120 mm (verbally communicated by TH. SØRENSEN).

Table 3. Mean precipitation.

Months	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	Year
Ella Island	..	..	..	..	..	..	..	..	..	..	..	..	c. 110
Scoresby Sound ..	45	43	14	38	7	25	14	11	27	28	26	39	317
Angmagssalik	83	51	62	61	61	53	49	60	94	144	84	70	872
Upernavik	11	11	16	14	15	15	25	28	26	29	27	13	230

According to HELGE PETERSEN the precipitation decreases greatly towards the north. In East Greenland there is most precipitation during winter, in West Greenland during summer or autumn. The number of days with precipitation decreases towards the north just as does the amount of precipitation.

The numbers of light and cloudy days do not differ greatly at the stations examined. The annual number of light days is for Scoresby Sound 78, for Angmagssalik 71 and for Upernavik 69, while the dark days number 123, 128 and 132 respectively. According to TH. SØRENSEN (1941) 53 per cent. of the days at Ella Island are bright.

Fogs are very frequent everywhere along the coast. The annual number of foggy days, 50 to 60, is about the same everywhere in places bordering upon the Polar Sea (Jan Mayen, Iceland, Bear Island). There is no great difference between the south and the north, but fogs are far less frequent in the inner fjords. Of the stations investigated Scoresby Sound has 98, Angmagssalik 48 and Upernavik 47 days with fog (HELGE PETERSEN 1938). TH. SØRENSEN (1941) states about Ella Island that fogs were recorded at 7 per cent. of all observations (three times daily) during January, 2 per cent. during March and April, 1 per cent. during May and 4 per cent. during August. No fog was recorded during the rest of the months.

From the above observations of temperature, precipitation and fogs, it will be seen that the climate is rather different at the various stations investigated.

Ella Island, situated far inside a system of fjords, has a continental climate with warm summers and cold winters, slight precipitation and only a few foggy days in the year. Scoresby Sound, Angmagssalik and Upernavik are all stations on the fringe of the coastline where the climate is strongly characterized by the ocean. They have oceanic climate with proportionally cold summers, relatively ample precipitation and many foggy days.

The Wind. Taken by and large, the wind at the various stations blows from opposite directions in summer and in winter. The situations of the stations influence the relative frequency of the various directions. According to HELGE PETERSEN, Scoresby Sound in summer has mostly southerly and westerly winds, less frequently southwesterly and southeasterly winds. In winter northeasterly and northwesterly winds prevail but there is also wind from the north. Winds from the south are by far the most frequent at Angmagssalik in summer, whereas in winter they come from north and northwest, but also from the west sometimes. At Upernavik the direction of the wind is mostly from the north during summer, also, but less frequently, from the southwest; in winter the wind blows mostly from the east, north and northeast.

Calm weather is common everywhere, the percentage of the observations being 20 to 30 on an average, lower at open places, higher at sheltered places (here up to 40 or 50 per cent.) Angmagssalik for example has very often calm weather; more than 50 per cent. of all observations show this.

Microclimate.

By the word microclimate is understood the climate in which the animals (here mites and collemboles) live, i. e. in the present connection the climate in and upon the surface of the soil. It is first and foremost dependent upon insolation. The amount of energy yielded by vertical sunrays gives 2 gramme-calories per minute per square centimetre at the limit of the earth's atmosphere. Only a part of this energy benefits the soil, because it is weakened by passing through the atmosphere.

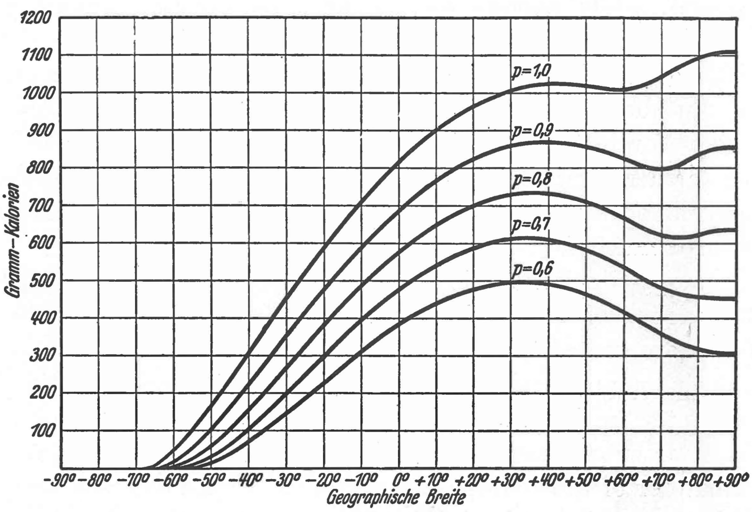


Fig. 1. Insolation on the 22nd of June at various transmission coefficients (according to MILANKOVITSCH).

The loss of energy depends partly on the distance passed through the atmosphere, partly on the permeability of the atmosphere, and also on the receiving plane's inclination in relation to the rays of light.

The transmission coefficient p is equal to 1 in the theoretical case that the insolation does not lose any energy by passing through the atmosphere. In practice p must always be less than 1; over mountains and in dry, clear air the value of the transmission coefficient increases.

Fig. 1 shows how the influence of the atmosphere makes itself felt in various geographical latitudes. Because of the existence of the atmosphere the insolation decreases at the Pole, partly because of the long distance the rays have to pass through the atmosphere, partly because of their oblique direction. The loss of energy is dependent on the value of the transmission coefficient, the loss being greatest when the transmission coefficient is lowest. With a decreasing p the geographical latitude plays a rôle, so that the higher latitudes come into an unfavourable position. For instance, while the Pole on the 22nd of June in case of the non-existence or complete permeability of the atmosphere ($p = 1$) would be the point in the hemisphere receiving most insolation, this will not be the case with a transmission coefficient of 0.9. With a transmission coefficient of 0.7 the Pole, even on the 22nd of June, receives less direct insolation than any other latitude in the northern hemisphere (according to MILANKOVITSCH 1930).

Coastal regions with much fog have low transmission coefficients, and consequently scanty insolation which again causes the low summer temperatures, while regions with a dry, continental climate receive strong rays and, because of this fact, are warmer in summer. Thus it is not the geographical latitude of the place alone that decides the climate, but just as much the transmission coefficient. Consequently Ella Island, for instance, with its continental climate, in spite of her situation farther north, has warmer summers than Angmagssalik which is situated much more southerly but on the other hand has an oceanic climate with much fog.

The energy which the soil receives from the sun at any place depends upon the incline of the earth in relation to the direction of the rays. Planes that are turned towards the sun receive more rays than all other planes. As no plane angles are given for the biotopes investigated, I shall not enter further into the matter.

The solar energy received by the biotopes is no indication of the microclimate or of the temperature of the microclimate, as a very large part of the energy is lost by irradiation and conduction. In Arctic areas there are two further factors which cause a levelling out of the solar energy received, namely the ice in the soil and the covering of snow (according to TH. SØRENSEN 1941). As both ice and snow must be thawed anew each spring, the increase in temperature is retarded during spring and summer, especially so in wet areas. The uneven thickness of the snow becomes a very important microclimatic factor, as it decides the duration of the annual season when the soil is not frozen.

In order to elucidate the microclimate TH. SØRENSEN (1941) made a series of temperature records, partly of the temperature of the air, partly of that of the surface of the soil, and of the temperature in the soil in a depth of 20 and 50 cm. As the Berlese samples are only some few centimetres thick, I have only taken the temperature of the soil surface into consideration. The records were made on early snow-free areas with a slight southern exposure.

From table 4 will be seen that the earth's surface during the six winter months has a lower mean temperature than the air until snow falls. At the same time the mean value of the daily oscillations in temperature at the surface is rather marked (7.1 degrees during October).

Table 4. Mean monthly temperature in the air and at the surface of the earth together with the monthly mean value of 24 hours' amplitude in the air and at the surface of the earth at Ella Island.

Ella Island 1931—32 °C.	Mean temperature of air	Mean temperature of the surface of soil[1]	Mean amplitude of air-temp.	Mean amplitude at surface
September	..	..	7.2	..
October	—9.8	—12.8	4.7	7.1
November	—11.1	—11.1	6.6	2.2
December	—22.4	—14.0	8.6	1.2
January	—19.2	..	8.5	..
February	—12.6	—12.6	12.1	4.2
March	—13.0[2]	—13.7[2]	8.0	3.8
April	—17.9	—12.0	10.4	14.4
May	—0.8	5.3	9.3	19.3
June	6.2	13.0	8.9	27.8
July	9.6	16.3	6.3	32.3
August	8.4[3]	13.4[3]	6.9	33.2

[1] The plane observed was "level ground" in the months October—March, during April—August it was southerly exposed at an angle of about 20°.

[2] Records 1st to 24th March.

[3] Records 1st to 26th August. According to TH. SØRENSEN (1941).

When snow has fallen at the beginning of November, conditions are somewhat different. The low heat-conveying power of the snow has the effect that the low temperature of the air is not very much felt upon the surface beneath the snow (during December —22.4° and —14.0° respectively). At the same time the daily oscillations are small (1.2° at the surface during December). Later on, during winter, when the cold has had time to penetrate and when the covering of snow has become more compact, the isolating power of the snow is less, so that the temperatures of the air and of the surface of the earth are about equal (during February—March), but the daily oscillations are much smaller for the surface of the earth.

In spring and summer the mean temperature of the earth's surface (no snow, about 20° inclination towards the south) is about 5 to 7° above the mean temperature of the air, being greatest in July. This difference in temperature is due to the daily maxima, which are highest at the earth's surface where the energy of insolation is absorbed. The nightly minima do not differ much from each other. The daily mean temperature of the surface upon southerly exposed slopes reaches zero in spring about three weeks before the temperature of the air (see table 5), while in autumn they attain zero almost simultaneously. While the daily

Table 5. Ella Island May 1932. The temperature of the surface of the soil was measured on a plane with 20° southern exposure. After TH. SØRENSEN 1941.

May	Temperature of air				Of surface of soil			
	Mean	Min.	Max.	Ampl.	Mean	Min.	Max.	Ampl.
1	—10.6	—15.6	—5.6	10.0	—6.3	—11.9	0.0	11.9
2	—1.9	—13.8	10.1	23.9	—1.1	—10.1	12.6	22.7
3	—2.6	—10.0	4.9	14.9	5.0	—3.9	17.0	22.9
4	—1.9	—7.5	3.8	11.3	5.7	—3.9	17.6	21.5
5	—1.5	—6.0	3.1	9.1	5.0	—2.0	18.5	20.5
6	0.2	—2.7	3.1	5.8	6.0	—2.2	18.8	21.0
7	—1.9	—6.5	2.8	9.3	6.0	—3.0	19.5	22.5
8	—3.0	—7.5	1.6	9.1	6.0	—2.9	21.0	23.9
9	—1.9	—4.8	1.1	5.9	4.3	—1.4	19.0	20.4
10	—1.9	—3.0	—0.7	2.3	2.7	—0.6	8.1	8.7
11	—2.0	—3.5	—0.4	3.1	1.8	—1.1	12.6	13.7
12	—3.8	—4.6	—2.9	1.7	3.0	—3.5	12.0	15.5
13	—7.8	—12.0	—3.5	8.5	4.8	—4.7	18.6	23.3
14	—6.8	—12.3	—1.3	11.0	5.3	—4.0	19.5	23.5
15	—3.8	—9.8	2.2	12.0	6.5	—3.0	20.0	23.0
16	0.7	—5.0	6.3	11.3	7.0	—1.2	21.9	23.0
17	—0.2	—4.7	4.4	9.1	7.3	—1.0	22.0	23.0
18	0.4	—4.0	4.8	8.8	7.5	—1.5	22.0	23.5
19	2.9	—3.8	9.6	13.4	8.3	—1.0	24.5	25.5
20	1.3	—3.2	5.8	9.0	5.1	—0.8	18.0	18.8
21	—1.0	—2.4	0.4	2.8	5.5	—1.5	17.1	18.6
22	—2.7	—7.0	1.6	8.6	6.5	—1.3	16.0	17.3
23	1.1	—4.7	7.0	11.7	5.7	0.0	13.5	13.5
24	0.3	—2.5	3.1	5.6	5.9	0.5	12.1	12.6
25	2.5	—4.6	9.6	14.2	6.3	0.0	15.0	15.0
26	3.7	—3.2	11.8	15.0	6.4	0.0	12.0	12.0
27	7.0	3.8	10.2	14.0	7.4	0.0	16.0	16.0
28	3.2	—0.9	7.2	8.1	6.8	0.0	16.0	16.0
29	2.5	—0.7	5.7	6.4	9.2	0.0	24.9	24.9
30	2.4	—2.0	6.8	8.8	7.3	0.0	20.8	20.8
31	0.9	—1.7	3.5	5.2	10.7	0.0	24.0	24.0
Monthly mean	—0.8			9.3	5.3			19.3

oscillations in the temperature of the air are greatest during February and April, the daily amplitude of the surface temperature is greatest later in summer. This is due to the influence of the meltwater during spring, whereby some heat is bound. Later in summer, however, the dry surface of the soil is exposed to great oscillations of temperature (see table 4).

The temperature curve for the surface of the earth upon a horizontal plane lies between the temperature curve of the air and the above mentioned temperature curve of the earth's surface upon a plane with a southern exposure of about 20° (Th. Sørensen 1941).

As mentioned above, snow has isolating power. Beneath 50 cm snow the oscillations of the air temperature can still be observed, but under 100 cm the temperature is almost constant and, as a rule, some few degrees higher than beneath 50 cm snow. During the melting of the snow the surface temperature does not rise above zero until all the snow is gone. The snow does not begin to melt in earnest until the mean air temperature rises above zero. In spring when the mean air temperature rises to zero, the earth in places without snow is already thawed as far down as to about 50 cm depth (Th. Sørensen 1941).

The dependence of the flora upon the microclimate.

In spring, plants seem to start growing about the time when the mean surface temperature of the 24 hours rises to about zero (Th. Sørensen 1941). In 1932 this took place at the beginning of May (compare table 5). Insolation makes the day temperature rise considerably, whereas the night temperature sinks below zero. Seemingly, these low temperatures do not injure the plants, even if the time when assimilation is possible will of course be reduced. Thanks to the power of the plants to avail themselves of the warm hours during the twenty-four, when the night temperature sinks below zero, they have a longer growth period. The period of growth, however, depends also upon the fall of snow. Thus Ella Island has not quite three months during the year with a positive mean air temperature. In the same regions, however, snow-free places have a mean earth surface temperature above zero in four months at least, while the snow-covered areas have it for about two months only. Despite this great difference in the duration of the favourable temperature period upon snow-free and snow-covered ground, the active period of the plants often seems to be no longer upon snow-free ground than upon snow-covered ground. This has to do with the drought that starts early in snow-free places, where the development of the vegetation is quickly completed. But where there is sufficient moisture, the plants may go on growing as long as the temperature permits. As a consequence, the vegetation will have the longest growing period at places which quickly become snow-free and at the same time are suitably moist.

By means of observations in nature, Th. Sørensen (1941) has determined the flowering seasons of the various plants. It turns out that the flowering season depends largely on the time when the snow melts. This again is dependent on the insolation and, taken by and large, it is constant within each vegetation type. The interval between snow melting and florescence is likewise almost constant for each type of vegetation. The later the snow melts, the quicker the plants will flower after the melting, as a rise of temperature in such case will take place so much the earlier.

TH. SØRENSEN drew up the following sequence by classifying the time and intensity of the florescence of the various types of vegetation:

Prevernal aspect (early spring) from the beginning until the end of May; thawing begins, no species in bloom.

Vernal aspect (spring), the end of May until the end of June. Spring plants, especially *Saxifraga oppositifolia* in bloom and the leaf-buds of the dwarf shrubs are opening.

Aestival aspect (summer), the end of June until the middle (and a little over the middle) of July. *Cassiope tetragona* in bloom.

Serotinal aspect (late summer), last half of July and the first half of August. *Chamaenerium latifolium* in bloom.

Autumnal aspect (autumn), last half of August and the beginning of September. The dwarf shrubs assume yellow and red autumnal colours.

Hiemal aspect (winter), from about the middle of September, that is the time when the upper layers of the soil freeze for the winter.

Each type of vegetation has only one season of florescence. As to the species contained, the vegetation types overlap; a great many species are represented in the various types of vegetation, despite the different time of florescence for the various types.

The classification into aspects holds good of the region at Franz Joseph Fjord (lat. 73—74° N.). Farther towards the north, summer and late summer will be more retarded than will spring. The same is the case towards the outer coast, because of the changed climatic conditions. Towards the north the thawing of the snow is retarded because of the lower position of the sun, at the outer coast because of the denser cloud cover and the greater humidity of the air, by which the insolation in both cases is hampered.

Chapter II.

Material and technique.

The material for the present investigation was collected during the years 1931—1939, partly by various scientific expeditions (LAUGE KOCH's Three Year Expedition to East Greenland 1931—34, KNUD RASMUSSEN's 7th Thule Expedition to Southeast Greenland 1933, ALF TROLLE's Expedition to Lindenow Fjord 1934 and FINN SALOMONSEN's Expedition to West Greenland 1936), and partly in the course of journeys to Greenland for other purposes (P. M. HANSEN). The investigation is

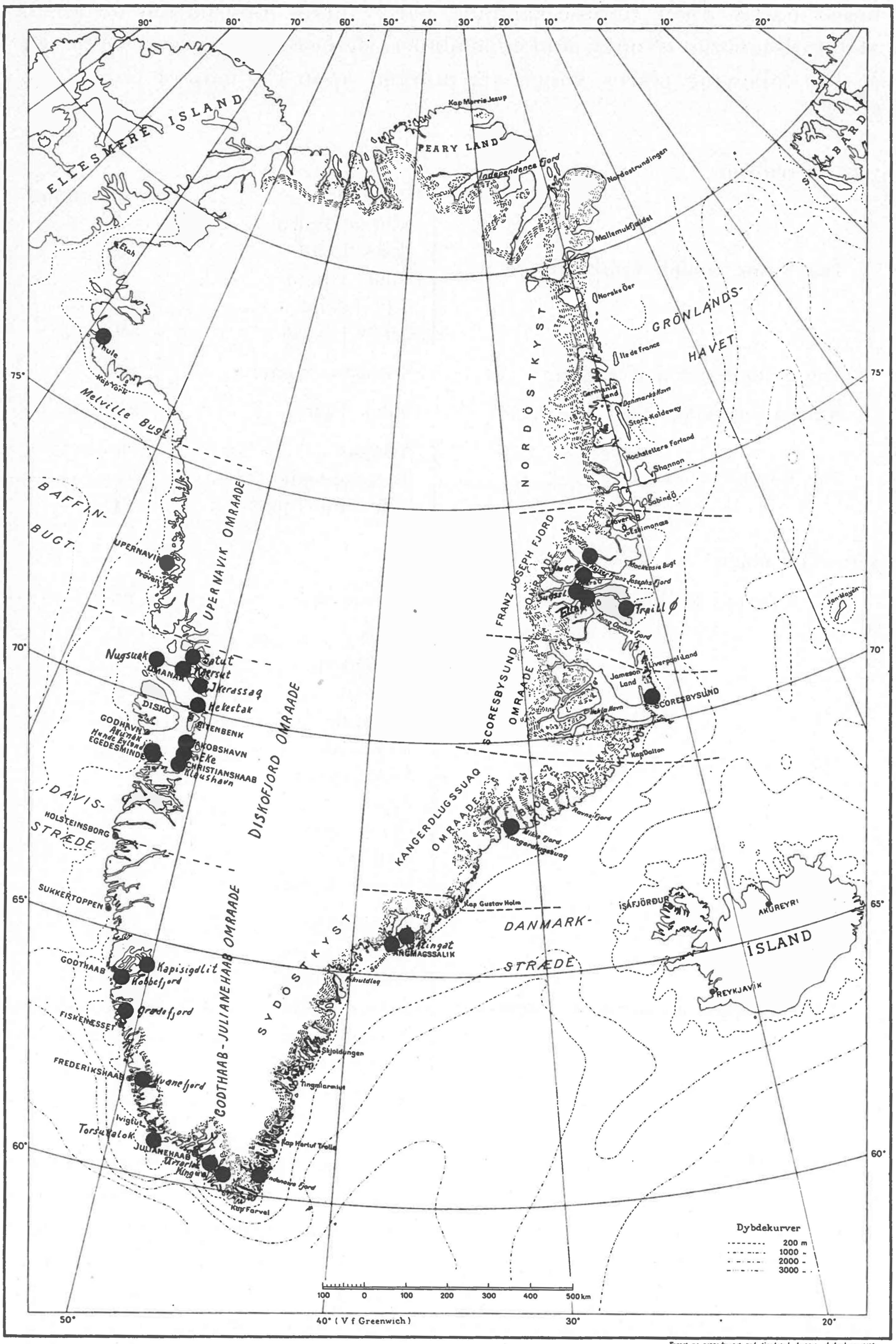


Fig. 2. Localities where Berlese samples were taken, marked upon a map of Greenland.

based partly upon Berlese samples, partly upon information obtained about discoveries of mites and collemboles. Berlese samples were collected at the following places, which are marked upon the map of Greenland fig. 2.

East Greenland:		
The Franz Joseph Fjord Region	North Fjord	7 samples
	Kempe Fjord	3 —
	Suess Land	19 —
	Ymer Island	6 —
	Ella Island	337 —
	Traill Island	9 —
The Scoresby Sound Region	Scoresby Sound	84 —
Kangerdlugssuaq Region	Mikis Fjord	19 —
The Southeast Coast	Atingat	6 —
	Angmagssalik	91 —
	Lindenow Fjord	9 —
West Greenland:		
The Upernavik Region	Upernavik	30 —
The Disco Fjord Region	Satut	1 —
	Nûgssuaq	1 —
	Qaersut	1 —
	Ikerasak	1 —
	Hekestak	1 —
	Jakobshavn	1 —
	Eqe	1 —
	Claushavn	1 —
	Akúnâq	1 —
	Hunde Eyland	1 —
The Godthaab-Julianehaab Region	Kapisigdlit	2 —
	Kobbe Fjord	1 —
	Græde Fjord	1 —
	Kvane Fjord	1 —
	Torssukátak	1 —
	Ûnartoq	1 —
	Qingua	2 —

As will be seen from this list, East Greenland with 590 samples is much better investigated than West Greenland with 49 samples. In actual fact the idea has been to investigate more thoroughly the microfauna of the West Coast and to collect material at Etah, Thule and several places in the southern part of West Greenland, but as the war interrupted navigation, this was rendered impossible. Samples from the Thule area and from Ellesmere Land had been taken before the war, but did not reach Denmark. All in all, the 639 samples which are treated in the present work comprise about 158,000 individuals, of which number about 76,000 are mites and about 82,000 are collemboles.

I had already treated a good many samples, for instance those from North Fjord, Suess Land, Ella Island (59 samples), and from Traill Island, in "A quantitative investigation of the microfauna communities of the soil in East Greenland" (Jørgensen 1934 a), and the samples from Mikis Fjord, Atingat and Angmagssalik in "A quantitative and qualitative investigation of the microfauna communities of the soil at Angmagssalik and in Mikis Fjord" (Hammer 1937). As the present investigation makes comparisons with the microfauna of various localities in Greenland, I shall again and again refer to the papers previously published. The material treated in these previous papers has been somewhat revised in the present work, so that it will be feasible to compare the results from previously investigated areas and the results arrived at by the investigation of hitherto untreated material from other areas.

Besides the Berlese samples that are the basis for the investigation of the microfauna in Greenland, I have included, as far as has been practicable, all information about the occurrence of oribatids and collemboles in Greenland, so that the present work contains the most important part of what has hitherto been found out about the occurrence and way of living of these animal groups in Greenland.

The samples, as will be seen from the above, were taken by several persons, and therefore the material, in spite of the persons in question having done their utmost to work on it according to a common plan, is far from being homogeneous as regards the number of individuals. How significant it is that the same person should take all the samples whose results are to be compared later on, can be judged merely by comparing the number of specimens derived from various people's treatment of the samples from the identical biotope. For it is undoubtedly the case that, by the use of various apparatuses for expelling the animals, and by applying different techniques and such like in the various countries where work is being done within this branch of science, such widely different results are obtained as regards the number of individuals that a comparison between the forthcoming numbers will have no very great significance. When this collecting by means of special apparatus for forcing the animals out has been done in exactly the same way, then, and not till then, can there be any talk of comparing the various countries. Even the collector may find difficulty in obtaining even approximately uniform samples owing to the sporadic occurrence of the animals. As an example mention may be made of two samples from bog, Elvdalen, Ella Island, with 44 and 1445 individuals respectively. Although the samples are equal in size and were taken simultaneously by the same person from the same type of vegetation and growing side by side where the vegetation as far as possible was uniform, one gave a count about 30 times higher than the other. The former was dried for 10 days in the Berlese apparatus, the latter for 15 days. That this difference in the time of treatment is not the sole cause of the different number of individuals may be seen from other samples taken in the same way as described above, with 438 and 168 individuals respectively, of which the former was dried for 5 days and the latter for 10 days. The different times may, however, have had some influence upon the unequally large numbers of individuals found when treatment in the funnels is so brief that wet or moist samples cannot become sufficiently dry and therefore all the individuals do not leave the sample.

Various techniques may be applied for expelling the animals. The material, that is the lump of soil, may either be plucked to pieces and put pell-mell into the wire netting in the upper part of the funnel, or the sample may be placed in the netting so that the original surface of the lump of soil is turned downwards. Some samples from Iceland show that the number of expelled specimens practically speaking is the same by the different methods of treatment. However, my samples from Iceland that were put bottom-up during the expulsion process are the only Berlese samples from Iceland where *Protura* have been found; this looks like a proof of the effectiveness of the treatment. In my experience the animals will leave the soil most quickly by the latter method; this is probably due to the fact that the animals in question, *Oribatidae* and *Collembola*, in Greenland and Iceland mostly keep to the surface of the soil, or at least not far below it. When the earth is merely turned upside down, the animals let themselves fall or they wander actively downwards, influenced by the warmth or the dessication process. Thus they need not work their way through the fractioned earth, where possibly a good many perish, before they manage to get away from the dessicating heat (hot water funnels), or the dried-up earth closes in upon them (cold funnels). When working with animals that live predilectively in the lump of soil investigated (for instance worms), the method of splitting up the sample before drying may be preferable.

As far as possible the samples are of equal size and thickness. They are $^1/_{100}$ m^2 in area measure and 5—7 cm thick, which is as far as the roots go in depth. However, in moss (Sphagnum) the samples may be up to 30 cm thick, depending on the thickness of the moss layer. The sample, 10×10 cm, was cut out of the soil surface with a sharp knife, then put upon a big piece of paper and after that placed into a tight-lidded tin box together with what animals and particles may have been lying on the paper. The sample was then transported in the tin box to the appointed place, where it was put into a Berlese funnel. The samples taken during winter had to be hewn out of the soil with an axe. On very wet biotopes, bogs or lake banks, the greater part of the samples at this time consists of ice; thus it was necessary first to thaw it upon a piece of filter paper and later on put the whole thing into a funnel.

For forcing the animals out, both hot water funnels (samples from Atingat and some from Mikis Fjord) and funnels without heat (HAMMER 1937) were used. Most samples were treated in funnels without heat. It seems as if there were no difference between the results arrived at by the use of either warm or cold funnels. A good many samples were transported to Copenhagen in tight-lidded tin boxes and were not treated in funnels until several months afterwards. This seems to have no very modifying influence upon the sample in question, either qualitatively or quantitatively (HAMMER 1937). As far as feasible—that is if the sample did not take up too much room—the measured earth sample, as mentioned above, was placed upon the wire netting stretched across the upper part of the funnel. When the animals leave the lump of earth they fall through the wire netting, down through the spout of the funnel into a tube containing alcohol (70 $^0/_0$) placed beneath the spout. This tube must be changed at intervals of some days until no more animals come into it. Then the sample is finished. The duration of this process depends upon the temperature of the place where the funnels containing the samples are, for cold funnels 5 to 20 days, perhaps more, in case of specially wet and cold weather; in hot water funnels (the temperature in the water jacket near boiling point) the tubes may be changed twice during 24 hours if the sample is loose and aërated; if it is somewhat pasty one must proceed more circumspectly (more slowly) so that no crusts are shaped immediately. The crust will check further dessication and also bar the animals in or make their egress difficult. Only the samples from Angmagssalik, Atingat and Mikis Fjord (collected by the author) were put whole in the funnel, bottom up, for expulsion; these samples contained far more individuals than the rest. As the expulsion in most cases took place during the expedition and was done by some member of the expedition not always proficient in the special technique, all the rest of the samples were plucked to pieces before dessication. The fact that the number of individuals at Angmagssalik, Atingat and Mikis Fjord is far greater than in the other regions, may partly be ascribed to the different forcing-out techniques, but it may be due to a really greater abundance of animals in these areas with rather a milder climate. Unfortunately, the samples taken at Ella Island (1933) and some at Upernavik did not stand the proper time, that is for as long as there were still animals in them; the number of animals found is thus presumably too small. As regards the samples from Upernavik this was due to the departure of the expedition. As to

Ella Island it was due to the somewhat mechanical way in which the collecting was done. By way of control there, two samples were always taken side by side at each biotope, and one of these samples was left in the funnel for 5 or 10 days, the other for 10 or 15 days. Then they were removed without regard to the consistence of the samples or to the possibility of there still being animals in them. Tubes were not changed during dessication. Thus there is a chance of a rather considerable source of inaccuracy, as very wet samples cannot become sufficiently dry in the course of so short a time (5 days), even with a fairly high indoor temperature. The samples from West Greenland, with the exception of Upernavik, were taken regardless of size. Here any available tin box was filled up with a sample of the type of vegetation in question. Thus these samples cannot be compared with the rest when the question is, say, to find out what species occur upon a certain surface unit or the like, but they are a splendid help in determining which *Oribatidae* and *Collembola* occur in West Greenland.

In the further treatment of the Berlese samples the contents of the tube with the animals collected were poured into a glass vessel of the kind called a "salt cellar" and then, species by species was picked up, very carefully, under a binocular microscope, by means of a minute needle with its point cut off so as not to transfix the animals. They were counted and identified as they were taken out, a small portion of each species being placed on a slide in glycerine with a cover glass and examined further under a monocular microscope. Naturally, with such great numbers as these (about 158,000), not all the individuals could be determined in the manner described; but as one became acquainted with their habitus, an exact determination was necessary only now and then. With species of, for instance, the genus *Onychiurus* (*Coll.*) or *Oppia* (*Orib.*), which cannot be distinguished without strong magnification, it was always necessary to take out a sample for determination. If there were only some few specimens of the genus in question in the sample, they were all identified as far as possible; if there were several hundred specimens, a lesser part was taken, 20—30, for identification. If more species of the same genus were found by this means, one more sample was taken and the mutual proportions of the different species were counted, whereafter the numerical proportion was determined. This method must of course involve considerable inaccuracy in identification; but if the identification of each individual were to be perfectly correct, the task would be insurmountable, and on the other hand it would have no great significance as regards the totality. Simultaneously with the identification it was noted how many of the species in question were adults and how many were in the nymph state (*Orib.*), and as to the collemboles, how many were large, medium and small in size. This

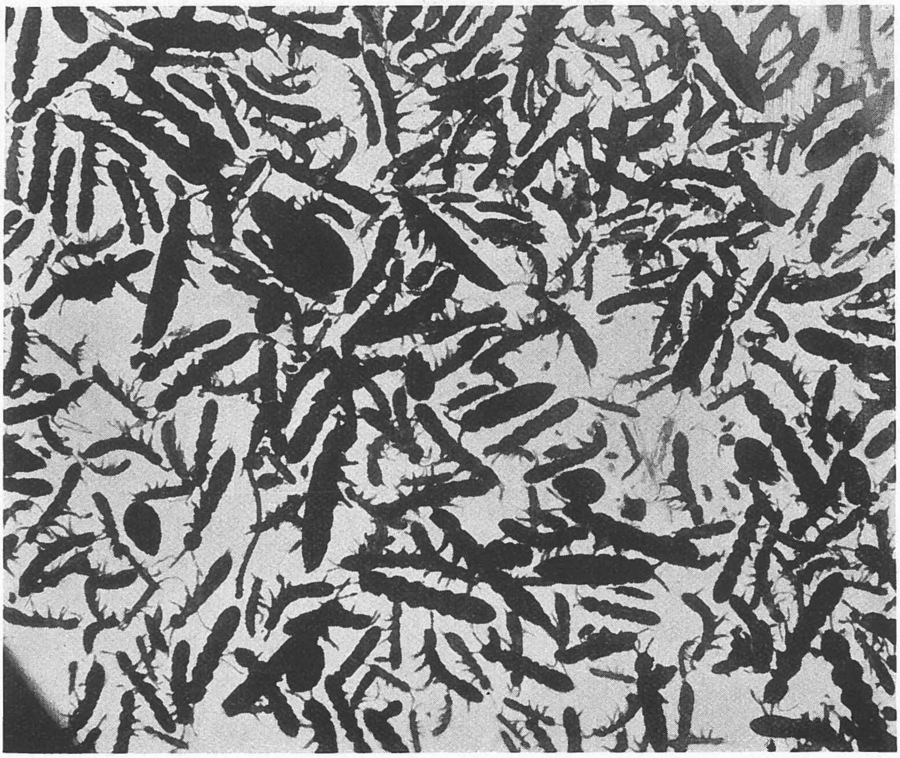


Fig. 3 shows part of the fauna on lichen heath at Angmagssalik. Here are seen, among others, *Tetracanthella wahlgreni*, *Folsomia quadrioculata*, *Isotoma* sp. and *Calyptozetes sarekensis*.

division according to size was employed only in the case of the samples treated last (Ella Island 1933, about 300 samples), as it was late before I learned to know nymphs of the various *Oribatidae* species. As to the collemboles I had to know them exceedingly well before they could be divided into the above-mentioned groups. When all the species had been counted in this way, there were sometimes large numbers of very small mite nymphs which were quite impossible to classify. Of these very tiny young I counted 100 or 200 for instance, all according to the total number, and from this an estimate was made of the entire number. In this way it is possible for an error to occur in the determination of the density of individuals; but as it could not even be decided whether it was *Oribatidae* young (perhaps *Trombidiidae*), the fact that they were present had to be utilised with great circumspection in any case, for instance in order to decide the approximate time of egg-laying and the like, otherwise not.

Unfortunately I have been obliged to limit myself to treating the *Oribatidae* and *Collembola*, as *Gamasidae* and *Trombididae*—which cer-

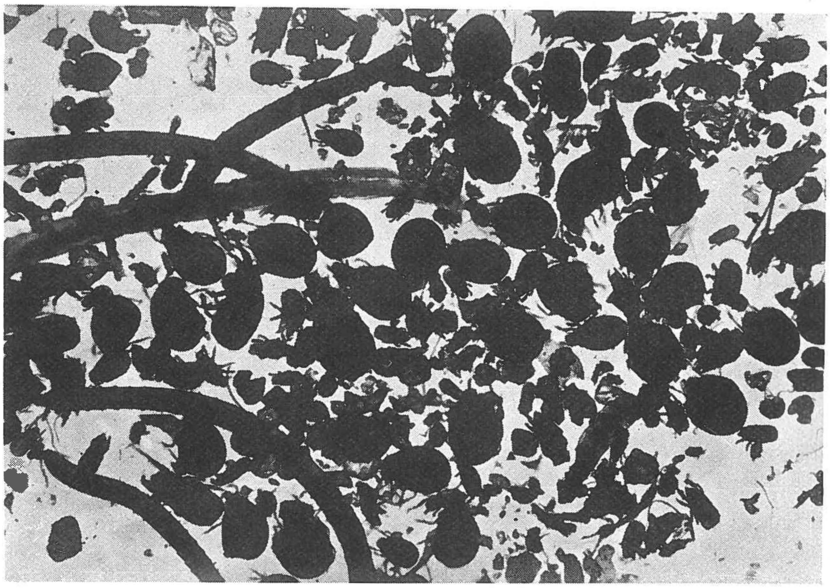


Fig. 4. Part of the fauna in moss at Angmagssalik. The *Oribatidae* are predominant. Here are seen, among others, *Platynothrus peltifer*, *Trichoribates trimaculatus*, *Edwardzetes edwardsii*, some few *Collembola*, *Chironomidae* and *Oligochaeta*.

tainly play a certain rôle in the community—were far too difficult for me to classify. In the two previously published papers on the microfauna in Greenland (JØRGENSEN 1934 a and HAMMER 1937) these two groups of mites were included; but so doing would have been impracticable with the enormous material since collected, as the determination of these difficult animals would delay the work for several years or render it totally impossible. *Gamasidae* and *Trombidiidae* constitute a very small part of the number of mites in the soil; in moist places, however, *Trombidiidae* are sometimes numerous. Besides mites and collemboles the samples contain a small number of *Hemiptera*, *Psysopoda*, *Coleoptera*, *Lepidoptera*, *Diptera*, *Arachnida*, *Oligochaeta* and *Nematoda*. These animals all occur so sporadically that they are of no significance in the micro-community.

The number of individuals found in a sample ($^1/_{100}$ m^2) varies very greatly, which fact may be due partly, as mentioned above, to the wrong expulsion technique, partly to the place (the biotope) where the sample was taken. In purely shingle and sandy regions, where moss or lichen vegetation is hardly ever found, there are next to no animals at all. As an example may be mentioned 10 samples from the Thule colony which, I regret to state, were all collected upon soil innocent of vegetation (because the person collecting was ignorant of the haunts of the microfauna); here was found one oribatid, all in all. The opposite of this is

Fig. 5. Part of the fauna in bog at Angmagssalik. Here are seen, among others, *Platynothrus peltifer*, *Trimalaconothrus novus*, *Isotoma viridis*, *Onychiurus armatus*, *Folsomia quadrioculata* and some few *larvae* of *Chironomidae*.

represented by some samples from lichen heath at Angmagssalik (fig. 3), where about 8000 individuals were found in one single sample (the very small, undeterminable mite nymphs are not included in the number). On an average, about 50—300 individuals were found per sample in most places.

When collecting the samples endeavours were made to take them from all fairly important plant communities within the locality in question, not only in the higher plant communities but also in moss and lichen carpets and, where it was possible, in places with alga vegetation, on wet rock slopes, and beach mounds, in sea weed washed in by the sea, and so on. This was done in order to examine whether the animals are associated with the various plant communities or whether other factors determine their distribution and conditions of living. As it was pointed out previously (Jørgensen 1934 a and Hammer 1937) how great a part moisture plays for these animal groups in Greenland, the samples were sometimes taken exclusively with regard to moisture, upon dry or moist (wet) ground and without paying any great attention to vegetation or the like. This way of procedure is most reprehensible, as many factors which might have had some importance as to the distribution of the microfauna were thereby disregarded beforehand. I regret to say that very little information, except that of the very highest significance regarding vegetation and moisture, is available about the plant communities from where the samples were taken. This is due to the fact that the collecting of Berlese samples almost always was a work of secondary moment during the expedition and was therefore done in leisure hours in between the work of the expedition proper. There was thus no time for recording temperature, humidity and the like. As a sort of excuse I may concede that a really well planned investigation of the microfauna and the factors that determine dispersion and conditions of living would take many years. As to most of the samples from Ella Island (about 300 taken in 1933), it is a happy circumstance that they were taken in plant communities which at the same time were investigated by a botanist who very precisely determined vegetation, temperature, amount of snow, exposure and the like, so that these plant communities have been well examined and yield splendid information to help us understand the precise time of breeding seasons of the fauna and the like. No determination of the degree of humidity was made anywhere; it was merely estimated.

Apart from some of the samples from Ella Island (about 300 in 1933), which were collected in the course of one year, all the rest were taken during the summer months June to September.

Chapter III.

Description of the biotopes.

To render a thorough description of all the biotopes investigated would be fairly futile, not to say impossible, as many samples were merely taken in a "moist" or "dry" place or from a cushion of one single species of plants, the result being the appearance of a great number of various biotopes which, furthermore, are different from region to region. This is due partly to the fact that the various collectors did not choose similar biotopes where it would have been feasible to do so, partly also to the fact that the biotopes very often may differ from region to region because of the influence of the climate upon the plant communities. The strong heat in summer upon Ella Island and the dessication are, for instance, the cause of some very dry plant communities (dry *Elyna* vegetation, *Carex rupestris* herbaceous vegetation and so on). In Scoresby Sound, on the contrary, there is a good deal of fog and consequently less clear sunshine. The effect of this is that the plant communities become of a different composition. The really dry communities are missing.

In order to arrive at some idea of the many and various biotopes it has been necessary to group together into one collection many of the biotopes in which only one or some few samples were taken and which as to moisture, vegetation and fauna are fairly alike. Biotopes that become dry during summer are styled dry biotopes, while those that do not do so are called wet biotopes (see p. 71 and Jørgensen 1934 a, p. 35). A collection of samples from various dry or wet biotopes that have been grouped together is styled dry or wet biotope, as the case may be, and in the tables they are co-ordinated with the biotopes.

The descriptions of the biotopes previously investigated in Jørgensen 1934 a and Hammer 1937, are taken from these works. In tables 18—67 of the fauna in the biotopes, the dates of the samples taken and the height above the sea level is stated where known.

Franz Joseph Fjord region.

North Fjord.

Wet Biotope. 2 samples taken in moist moss, *Eriophorum polystachyum*, *Salix arctica* and in moist moss, *Carex*, *Eriophorum polystachyum* and *Salix* sp.

Dry Biotope. Samples taken in luxuriant grass, *Dryas* vegetation, dry grass vegetation and in moist *Vaccinium uliginosum-Cassiope tetragona* vegetation.

Kempe Fjord.

Dry Biotope. 3 samples taken in vegetation of respectively *Salix*, *Cassiope* and moss at the Langdal glacier 300 m above sea level.

Suess Land.

Wet Biotope. *Calamagrostis neglecta-Chamaenerium latifolium* vegetation.

Fell-Field, like Ella Island.

Dry Biotope. The samples were taken in *Carex rupestris* herbaceous vegetation, birch scrub and mixed dwarf scrub vegetation (a description of these biotopes may be found in Jørgensen 1934 a).

Moraine at Narhval Sound. The samples were taken partly on dry moraine with luxuriant *Dryas* vegetation, partly on moist moraine with *Dryas*, *Sedum*, *Salix* and *Carex*.

Ymer Island.

Lake Bank like Ella Island.

Bog — — —

Fell-Field like Ella Island.

Mixed *Chamaephyt* vegetation like Ella Island: Mix. *Chamaephyt* veg. I.

Ella Island.

Lake Bank I. Flat, saturated stretches on banks of Langsø. Mostly a thick, swampy moss carpet at the bottom. The flats are visibly manured by the excrement of geese and other aquatic birds. Characteristic plant species mostly *Equisetum variegatum*, in patches also the following species, usually of high frequency: *Eriophorum scheuchzeri*, *Carex subspathacea*, *C. atrofusca.* Of high frequency, but less dominant physiognomically: *Salix arctica*, *Juncus biglumis* and *Polygonum viviparum.*

Lake Bank II consists of samples taken partly on the shore of Langø at the same place as lake bank I, partly on the shores of other lakes (Ulvesø, Bjørnesø, Rundsø and Hvalpesø).

Bog I. Big tufts, chiefly built up of fibrous raw humus. The tufts are separated by passages of mineral soil, which are flooded with water in the spring and sometimes most of the summer. (The Berlese samples were taken from the tufts). A bottom vegetation of moss, where the higher plant-cover is not very dense. As a rule there is no distinct characteristic species, since dwarf scrubs and gramineous plants exhibit almost the same luxuriance and density. Species of plants of high frequency: *Dryas octopetala*, *Betula nana*, *Vaccinium uliginosum*, *Salix arctica*, *Cassiope tetragona*, *Eriophorum polystachyum*, *Carex parallela*, *Equisetum variegatum.*

Bog II consists of samples taken in bogs in various places on the island (at Langesø, Ulvesø, Bjørnesø, in Ulvedal, Bjørnedal, etc.).

Moist Rock. Tufts of moss upon south-exposed rocks with gently running water (Cap Oswald).

Fell-Field I. The soil not covered with a closed vegetation. The plants are scattered and generally form dense cushions (The Berlese samples were taken from the cushions). No bottom vegetation of moss. Usually free of snow in winter. Very dry in summer. The soil mostly made up of sharp-edged gravel. The principal plant species are: *Carex nardina*, *Dryas octopetala*, *Saxifraga oppositifolia*, *Carex rupestris.* Of less importance are: *Silene acaulis*, *Lesquerella arctica.*

Fell-Field II. A collection of samples taken on fell-field in various places on the island (at Vejrhøj, at Ulvesø, in the Elvdalen, Ulvedalen, Bjørnedalen, etc.).

Mixed *Chamaephyt* veg. usually occurs on more or less level ground, often on flats outside the *Cassiope* snow-patch proper, and is thus generally more sparsely snow-covered and becomes free of snow earlier than the latter. It dries up relatively late in summer, or retains a certain dampness throughout the summer. There is often some bottom vegetation of moss. Further, there is usually a thin layer of raw humus above the mineral soil. The characteristic species of plants are dwarf shrubs, viz.: *Betula nana*, *Dryas octopetala*, *Vaccinium uliginosum*, *Rhododendron lapponicum*, *Cassiope tetragona*. Of high frequency are: *Carex rupestris*, *Silene acaulis*, *Polygonum viviparum*, *Tofieldia palustris*, *Carex scirpoidea*, *Equisetum variegatum*.

Mixed *Chamaephyt* veg. I. A collection of samples taken in mixed *Chamaephyt* vegetation at various places (at Vejrhøj, at Ulvesø, in Elvdalen, a. s. o.).

Mixed *Chamaephyt* veg. II. Some few samples from various biotopes: thawed *Saxifraga*, thawed *Dryas*, *Carex* and moss, thawed *Cassiope*, thawed *Betula*.

Mixed *Chamaephyt* veg. III. Some few samples from various biotopes that differ from mixed *Chamaephyt* veg. II by containing a large percentage of damp moss: *Cassiope* and moss; *Betula* and moss; *Salix*, *Dryas* and puff-ball; *Betula* and luxuriant moss.

Dry Biotope. A collection of samples from various biotopes: *Carex rupestris* herbaceous vegetation; dry and moist *Elyna* veg.; birch scrubs; lines of birch upon flow-earth; birch grass vegetation; *Dryas* heath; mixed dwarf scrub vegetation and *Cassiope* snow-bed. A description of the different biotopes may be found in Jørgensen 1934 a.

Dry Biotope at Fimbul 400 m above sea level, very like fell-field and mixed *Chamaephyt* vegetation; fell-field without fauna.

Lagoon at the mouth of the Storelven is dry at low water, but at high tide becomes full of brackish water.

The Beach Mound consists of stones and decaying *Fucus inflatus*.

Dry River Bed with algae. In this biotope no fauna was found and therefore it is not included in the tables. 2 samples.

Traill Island.

Dry Biotope. Samples taken in the following biotopes: with *Ranunculus pygmaeus* (snow bed); luxuriant *Salix* (in bog); *Cassiope* heath with moss; *Cassiope* heath with lichens; *Salix* upon flow-earth; bog with *Cassiope*; *Salix* and *Dryas* upon flow-earth.

H. MADSEN phot.

Fig. 6. Mixed *Chamaephyt* vegetation II at Scoresby Sound.

Scoresby Sound Region.

Mixed *Chamaephyt* veg. I. More luxuriant than mixed *Chamaephyt* vegetation II, which is presumably due to its having protection against wind and also to more humidity (evidently snow bed). The vegetation consists mostly of *Salix arctica* and grass (*Heterochloe alpina*, *Poa glauca*, *Poa arctica* and *Festuca ovina*) (communicated by TH. SØRENSEN after photo of the biotope).

Mixed *Chamaephyt* veg. II. Fig. 6. This biotope may be called a mixture of *Cassiope* heath, mixed *Chamaephyt* veg. and fell-field, as they occur at Ella Island. The vegetation consists of an abundance of *Cassiope tetragona* together with *Salix arctica*, *Luzula confuca*, *Carex rigida* and *Poa arctica* (communicated by TH. SØRENSEN after photo of the biotope).

Kangerdlugssuaq Region.

Mikis Fjord.

Moss, very wet *Sphagnum* moss from the bank of a small rivulet.

Salix herbacea vegetation; rather dry. A more thorough description of *Salix herbacea* vegetation will be found under the heading Angmagssalik.

T. BÖCHER phot.

Fig. 7. Lake near Angmagssalik. The samples were taken at a place on the shore, where there was a narrow strip of sand.

Empetrum vegetation. Pure *Empetrum nigrum* vegetation with lichens at the bottom; rather dry.

Lichen heath. Lichen heath with sparsely scattered *Salix herbacea* vegetation. Dry. All the samples from Mikis Fjord were taken from a southern exposure. (Like Angmagssalik.)

The South East Coast.

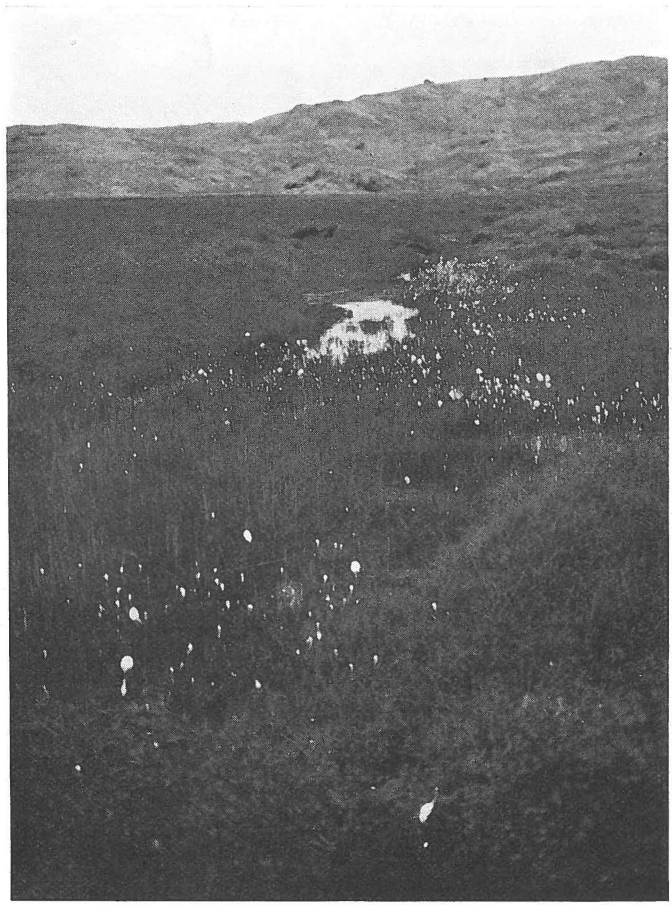
Atingat.

Bog. Like Angmagssalik.
Moss. - — —
Salix herbacea vegetation, like Angmagssalik.
Lichen heath, like Angmagssalik.

Angmagssalik.

Lake Bank. Fig. 7. The lake bank is a flat, sandy or gravelly surface laying at one end of a fairly large and deep lake which is almost devoid of vegetation, and on all other sides is surrounded by stones or fairly steep rock faces. The vegetation at this lake is extremely sparse and consists of a little low, scattered moss and a few *Carex* plants. Soil wet, washed by the larger waves.

Bog. Fig. 8. The supply of water is plentiful. The water is stagnant. The snow covers everything and lies till well into the summer. The



T. BÖCHER phot.

Fig. 8. Bog near Angmagssalik.

bog generally dries up in the latter half of August. At the beginning of September, when the last samples were taken, the bog had not yet dried up. The vegetation consists of *Eriophorum scheuchzeri*, *Carex*, grasses, and, between the scattered plants, lichens and a thick carpet of various mosses. There is often open water between the plants. The samples were taken from moss cushions.

Moss. This vegetation, which occurred both near the shore of an open mountain lake and near rushing streams, consists of a thick, luxuriant layer of various mosses, mostly *Sphagnum*. The layer is about 20 cm thick, very wet. Water supply abundant the whole summer.

Fell-Fields. Fig. 9. The very sparse, scattered vegetation of the fell-field, having no quantity of bottom vegetation of moss or lichens, to some extent is the result of the low supply of water,

Fig. 9. Fell-field near Angmagssalik (Drum-dancing). M. HAMMER phot.

which decreases early in summer. As the soil consists of loose sand and gravel overlying rock, from which water rapidly runs away, any richer vegetation is impossible. The covering of snow is usually thin and is often removed by the strong gales; this again tends to destroy the vegetation. No mull; only extremely small quantities of organic remains. The principal plants are *Empetrum nigrum*, *Silene acaulis*, *Cerastium alpinum*, *Ranunculus glacialis*, *Vaccinium uliginosum*, *Salix glauca*, *Polygonum viviparum*, *Carex* and grasses.

Lichen heath. Lichen heath is often found on fairly steep sandy surfaces with no constant supply of running water, but with deep ground water. The snow covering is thin, but not torn away by the wind. Lichen heath, however, often occurs on patches that are not snow-covered in winter. It is a type of vegetation that is mostly found in the form of small islands on grassy slopes (see later). The rather sporadic vegetation consists of i. a. *Betula nana*, *Juniperus communis*, *Cerastium alpinum*, *Carex* and grasses. Various shrub-formed lichens and fungi grow everywhere, like a dense carpet between the scattered plants. It is the lichens which most of all characterize this type of vegetation. The samples were taken from pure lichen vegetation.

Grassy Slopes. Fig. 10. Grassy slopes occur in localities similar to lichen heaths, which must be regarded as small islands in the grass. Accordingly, what was said as to soil and water-supply under lichen heath applies to the grassy slope. The vegetation consists preponderantly of grasslike plants, such as *Luzula spicata*, *Carex rigida*, *Poa pratensis*, etc. (according to KRUUSE 1912). A number of other species also occur, but in smaller quantities. The bottom vegetation consists mainly of lichens, less so of mosses.

Salix herbacea vegetation. According to KRUUSE (1912) *Salix herbacea* vegetation may be taken to be a special form of herbaceous bank, which arises when the bank reaches down to a valley bottom having a slight dip and with running water. He characterized the herbaceous bank as a complete carpet, mostly composed of perennial herbs on a sloping bottom. It is the richest plant formation, in both species and individuals, in the whole region. This is due almost exclusively to the water supply. Water runs or seeps down almost continuously from the hills above, from which there is an abundance of meltwater. The thickness of snow is considerable. *Salix herbacea* vegetation is a special form of herbaceous bank, comprising this one species alone with a slight bottom vegetation of lichens. Some mull is formed. At the time of taking the samples the soil was already dry.

Grass-*Salix* Snow Bed. This type of vegetation must also be classed with the herbaceous bank. It is found on rather steep slopes some distance below the mountain or hill top, where the snow lies till into the summer. In spring and early summer the water supply is plentiful on account of the thawing of the snow. Later in summer, when the snow has gone, this type of vegetation is very like *Salix herbaceous* vegetation, except that it is mingled with some grasses. The samples were taken at one to three metres from the snow margin. When the samples were taken, the vegetation was mostly still withered, though with fresh shoots on the surface of the ground.

Lindenow Fjord.

Moss. Various samples taken in: *Sphagnum* at stagnant water; wet moss from rivulet; shore meadow with a little sporadic moss

T. Böcher phot.

Fig. 10. Grassy slope near Angmagssalik.

(perhaps lake bank, *author.*); *Betula nana* vegetation with wet moss.

Wet rock. Wet, short, dense, black moss on rock.

Dry Biotope. Various samples taken in the following biotopes: dry foliferous and *Betula*-growth on rock ledge; dry *Empetrum nigrum* on hill slope; dry rivulet bed in hill slope with moss, grass and *Lycopodium: Louiseleurea procumbens* vegetation on hill slope.

Upernavik Region.

Bog or boggy biotope. A collection of samples taken in bog with *Eriophorum polystachyum*, *Salix herbacea*, *Polygonum viviparum* and dense moss; bog at lake bank with moss and *Carex*; on the bank of rushing springs with moss and *Carex* sp.; on moist ground with moss and *Luzula confusa* and others.

Fell-Field vegetation consists of *Salix arctica*, *Silene acaulis*, *Saxifraga tricuspidata*, *Empetrum nigrum*, *Dryas octopetala*, *Luzula* *confusa* and lichens. The samples were taken in tussocks or under bushes.

Mixed *Chamaephyt* vegetation. Various samples taken in *Cassiope* vegetation; heath (mixture of *Betula nana*, which is the characteristic plant, *Vaccinium uliginosum*, *Empetrum nigrum* and a little *Salix arctica*); *Cassiope* heath, *Dryas* patch; *Empetrum* heath with *Pyrola* and others.

Information as to the rest of samples from West Greenland is included in tables 15—16.

Chapter IV.

Taxanomical list of the Oribatidae and Collembola of Greenland.

As regards the nomenclature of the oribatids I have mostly followed C. WILLMANN: Moosmilben oder *Oribatiden*, Die Tierwelt Deutschlands, 22. Teil, 1931, and as regards the collemboles E. HANDSCHIN: Urinsekten oder *Apterygota*, Die Tierwelt Deutschlands, 16. Teil, 1929. These two works have likewise mostly been used in the determination of the species. In this list I have only included the varieties already known, as the identification of the enormous material did not leave me any time for going further into possible new varieties.

Some *Oribatidae* have for the first time been described by Dr. MAX SELLNICK, to whom I hereby tender my very best thanks. These new genera, species and varieties are inserted in their proper places in the list with Dr. SELLNICK's original text and pictures. The species marked * have not been found in this investigation.

Acarina:

**Brachychthonius berlesei* Willm.
**Brachychtonius zelawaiensis* Sell.
Brachychthonius brevis Mich.
Brachychthonius sellnicki Sig Thor
Brachychthonius laetepictus Berl.

Brachychthonius grandis Sell. n. sp. Fig. 11. Länge 314 μ, Breite 182 μ. Farblos. Grösser als alle bisher gefundenen Arten. Sie ähnelt in der Form und Beborstung sehr *B. latior* Berl. 1910 aus Florida. Sie zeigt aber nicht die Flecke am Hinterrand des Propodosoma. Auch sind die pseudostigmatischen Organe bei *B. grandis* kürzer als bei *B. latior*. *B. grandis* hat auf jeder Schulter innenseits der vordersten Randborste des ersten Hysterosomaschildes eine kleine elliptische Grube.

As the *Brachychthonius* species are very difficult to discern from one another, I have below sometimes merely called them *Brachychthonius* sp.

Trhypochthonius tectorum Berl. A nymph of this species was mistakenly styled *T. nigricans* Willm. in Jørgensen 1934 b.

Trimalaconothrus novus Sell.

Trimalaconothrus foveolatus Willm.

Camisia horrida Herm.

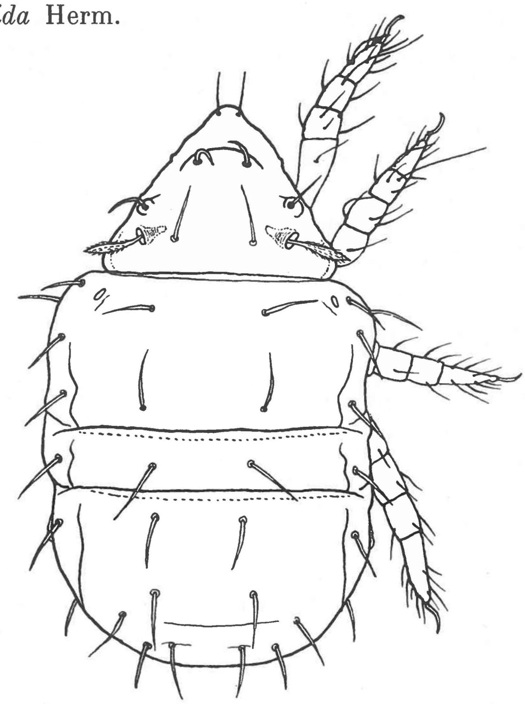


Fig. 11. *Brachychtonius grandis* Sell. n. sp.

Nothrus borussicus Sell. This species I have hitherto (Jørgensen 34 a, b, and Hammer 1937) called *N. silvestris* Nic. However, *N. borussicus* differs from *N. silvestris* by having three claws (*N. silv.* one claw) and by the sculpture on *Hysterosoma*, which on *N. silv.* everywhere consists of equally large reticulations, whereas *N. borussicus* has a very plainly delimited area along the lateral and posterior margins with smaller meshes (Willmann 1935). Specimens belonging to this species have been determined by Trägårdh (1904) as *N. biciliatus* C. L. Koch. On comparing these individuals with *N. borussicus* it was found that Trägårdh's specimens were *N. borussicus*. *Nothrus silvestris* in Iceland (Tuxen 1943) is *N. borussicus*, which is revealed by the fact that it has three claws.

Platynothrus peltifer C. L. Koch

Platynothrus lapponicus Trägårdh

Platynothrus capillatus Berl. var. *septentrionalis* Sell. n. var. Etwas kleiner als die Art und ihr sehr ähnlich in Form und Beborstung. Während aber bei der Art die Rückenskulptur in kleinen Vertiefungen besteht, hat die Varietät deutliche vertiefte Verbindungen durch Linien, sodass — was besonders nach dem Rande zu gut zu erkennen ist — da eine Skulptur zu sehen ist, die wie ein regelmässiges Steinpflaster erscheint. Some specimens of this species were previously (JØRGENSEN 1934 b) determined erroneously to be *Nothrus punctatus*? L. KOCH.

Heminothrus thori Berl.

Heminothrus paolianus Berl.

Hermannia reticulata Thor.

Hermannia scabra L. Koch

Belba gracilipes Kulcz. In JØRGENSEN 34 b erroneously determined as *B. clavipes* Herm.

Belba tenuipes Mich.

Belba tatrica Kulcz.

**Belba trägardhi* Graversen. A subfossil species, seemingly closely related to *Belba bituberculata* Kulcz.

Suctobelba subtrigona Oudms.

Oppia quadricarinata Mich.

Oppia neerlandica Oudms.

Oppia translamellata Willm. Greenland specimens of the species have no distinct translamella and thus resemble the Icelandic species (TUXEN 1943).

Oppia ornata Oudms.

**Oppia maritima* Willm.

Oppia splendens C. L. Koch

Eremaeus oblongus C. L. Koch

Hydrozetes confervae Schrank

Ceratoppia bipilis Herm. var. *sphaerica* L. KOCH. As with the species *C. hoeli* described by SIG THOR, the distal part of the lamellae on the variety *sphaerica* is only half the length of the proximal part. When I (JØRGENSEN 1934 a and b) previously mentioned *C. hoeli* from Greenland, it was due to the finding of nymphs which on their legs had some leaf-shaped hairs as described by SIG THOR on *C. hoeli*. The nymphs of *C. bipilis* have, according to this author, not these broad hairs but ordinary, bristle-shaped hairs and also a very long, tactile hair upon the penultimate joint of their first pair of legs. The nymphs found in Greenland have, besides the leaf-shaped hairs, also the long tactile hair on their first pair of legs (HAARLØV 1942 pl. 3, figs. 1—2) and thus they seem to be something between *C. bipilis* and *C. hoeli*.

As these nymphs are always found together with *C. bipilis* var. *sphaerica* they must presumably belong to this variety, which thus comes close to *C. hoeli.* According to TRÄGÅRDH (1931), *C. hoeli* tallies in most essentials with the variety *sphaerica* and thus it cannot be presumed to be a separate species.

Tectocepheus velatus Mich.

Ameronothrus lineatus Thor. Of this species the variety *nigrofemorata* L. KOCH, which differs from the main form by having only one claw, whereas the main form has 3 claws, is also found in Greenland.

**Ameronothrus maculatus* Mich.

Carabodes labyrinthicus Mich.

Liacarus globifer Kramer

Liebstadia similis Mich.

Oribatula exilis Nic. var. *crassipes* L. KOCH. The variety *crassipes* differs from the main form by lacking translamellae. Some specimens from West Greenland I previously called *Oribatula tibialis*? Nic. (JØRGENSEN 1934 b). On the whole, the variety *crassipes* seems to bear an extraordinary likeness to *O. tibialis.* The specimens of *O. tibialis* Nic. (TUXEN 1943) found in Iceland conform with the Greenland specimens which I refer to the variety *crassipes.* Thus there is no doubt that the Icelandic specimens belong to the same species, here listed as *O. exilis* var. *crassipes.* About *O. tibialis* from Lapland WILLMANN (1943) writes: "Dies ist wahrscheinlich dieselbe Art, die TRÄGÅRDH als *O. exilis* var. *crassipes* bezeichnet."

Scheloribates pallidulus C. L. Koch

Edwardzetes edwardsii Nic.

Chamobates cuspidatus Mich.

Iugoribates gracilis Sell. n. gen. n. sp.

Iugoribates n. gen. Nach der Form der Lamellen in der Nähe von *Chamobates*, doch hat *Chamobates* sehr viel schmälere und am Ende zugespitzte Tectp. I, die bei *Iugoribates* breit und löffelartig, ähnlich wie Tectp. II am Vorderende gerundet, aber mit einer kleinen Einbuchtung versehen sind. Während bei *Chamobates* keine oder nur winzige Haare auf dem Rücken des Hyst. zu finden sind, hat *Iugoribates* recht grosse. Drei Krallen an allen Tarsen, die mittelste am dichsten. *Iugoribates gracilis* Sell. n. sp. Fig. 12—14. Länge des Körpers 594—638 μ, Breite 374—375 μ. Kastanienbraun. Körperoberfläche anscheinend glat. Rostrum gerundet. Ein heller Nasenfleck ist in einiger Entfernung hinter den Vorderrande zu finden. Rostralhaare einwärts gebogen, auf der Aussenseite gut geborstet. Lamellen niedrige Kiele, die nicht halb so lang wie das Propodosoma sind. Am niedrigen Vorderende der Lam. befindet sich ein flache Kerbe, in der das recht lange Lamellarhaar sitzt, welches über das Rostrum hinausreicht. Es ist mit unregelmässigen Eckchen rauch besetzt. Die Interlamellarhaare entspringen unter dem Vorderrand des Hysterosoma auf einer flachen Einbuchtung eines Chitinquerbalkens, der unter dem Vorderrand des Hyst. von Lamelle zu Lamelle verläuft. Die Inth. sind schräg vorwärts und aufwärts gerichtet, zu einander geneigt und sind wie die Lamh. mit Eckchen rauh besetzt. Das pseudostigmatische Organ ist eine meist einwärts gerichtete

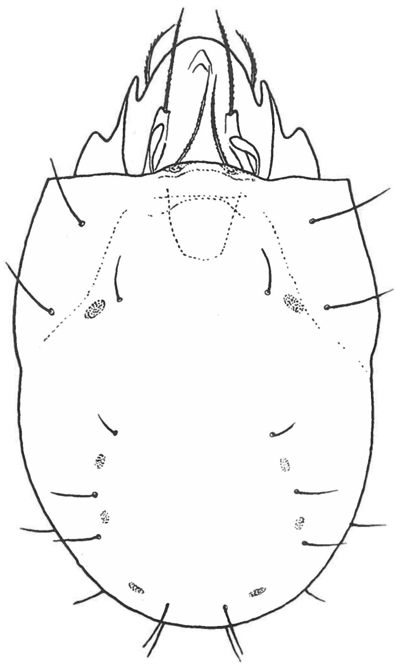


Fig. 12. *Iugoribates gracilis* Sell. n. sp. From above.

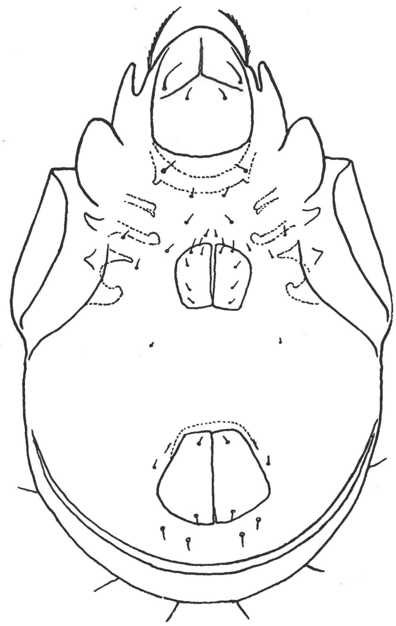


Fig. 13. *Iugoribates gracilis* Sell. n. sp. From below, without legs.

Keule, gelegentlich am Ende etwas abgestutzt, sodass sie etwas spatelförmig erscheint. Tectop. I eine weit über den Vorderrand der Lam. hinausreichende grosse Schuppe. Ihre Oberseite und die Vorderkante sind gerundet, aber diese zeigt am Vorderende eine kleine Einbuchtung. Die Tectp. II hat die normale Löffelform. Der Vorderrand des Hyst. springt in der Mitte nur wenig vor und geht mit sehr flacher Bucht in den fast geraden Vorderrand der Pteromorphen über. Der Aussenrand der Ptm. bildet mit deren Vorder- und Hinterrand gerundete Ecken. Der Winkel zwischen dem Hinterrand der Ptm. und dem Rand des Rückenpanzers ist wenig grösser als ein rechter. Das hintere Dreiviertel der Ptm. ist mit dem Rückenpanzer durch bedeutend dünneres Chitin verbunden, als der vordere Teil, was eine gewisse Beweglichkeit der Ptm. gestatten wird. Neben der Innenkante der Ptm. zwei recht lange

Borsten hintereinander. Ein Stück innenseits der hinteren dieser beiden Borsten ein etwas kürzere und zwischen ihnen eine Area porosa adalaris. Vier weitere Borsten in einer gerundeten Längsreihe haben drei weitere Area porosae zwischen sich, die aber viel kleiner sind als die Ar. por. adal. Am hinteren Rande des Rückenpanzers jederseits noch eine Querreihe von drei Borsten. Alle diese Borsten sind etwas kleiner als die an den Ptm. sitzenden. Die Unterseite des Körpers (ohne die Beine)

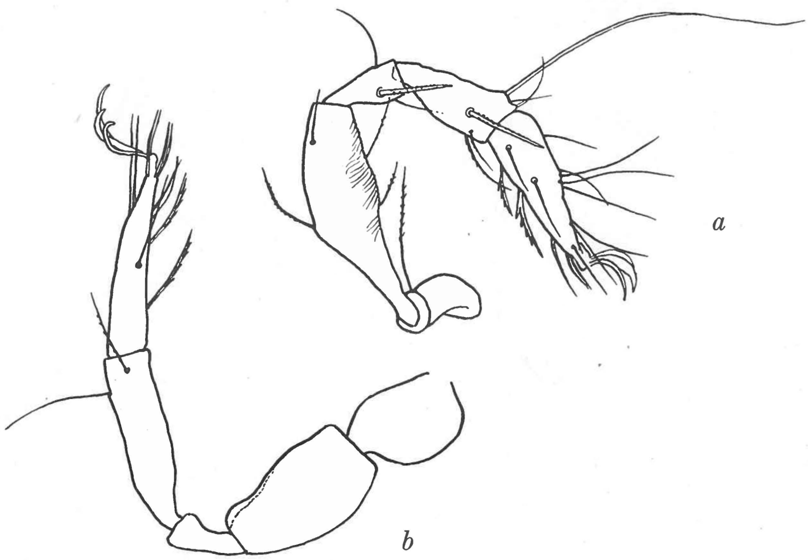


Fig. 14. *Iugoribates gracilis* Sell. n. sp. Leg I (a) and leg IV (b).

wird durch Abbild. 13 widergegeben. Von den Beinen ist als bemerkenswert zu berichten, dass Genu und Tibia I und II auf der Aussenseite je eine stärkere Borste tragen. Die Tarsen I und II haben auf der Unterseite zwei hintereinander stehende Borsten, die etwas kammartig aussehen.

Ceratozetes thienemanni Willm. As to some specimens from Nanuseq in Lindenow Fjord, Sellnick remarks: Stimmt mit der Form, wie Willmann sie darstellt, im allgemeinen überein; doch kommen neben Lamellenenden mit Kerben auch solche ohne diese vor. This species was previously (Jørgensen 1934 b) mistakenly identified as *C. gracilis* Mich.

Melanozetes ?mollicomus C. L. Koch. The Greenland specimens differ from the form described by Willmann (1931) by the place of the lamellae in the middle of *Propodosoma* and by the flat, club-shaped spread lamellae, both traits being characteristic of *M. meridianus* Sell., but conforming with *M. mollicomus* by having a plainly free point upon Tect. I, which is said to be characteristic of *M. mollicomus.*

Melanozetes sp. I have been unable to refer *Melanozetes* sp. to any definite species. Some individuals, which, I regret to say, were smashed in the slide, were by SELLNICK identified as *M. meridionalis* Sell.? However, it may hardly be this species, as my specimens have a plainly free

Fig. 15. *Hammeria groenlandica* Sell. n. sp. Oblique, downward view.

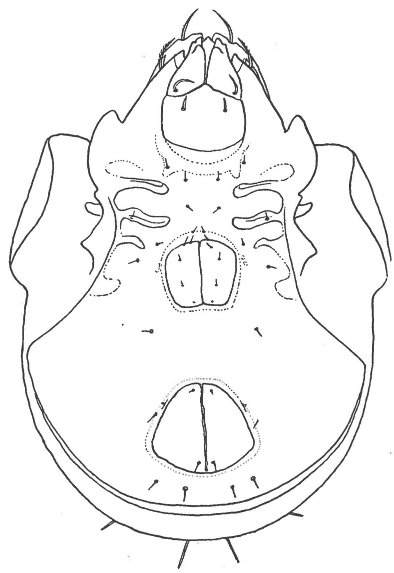


Fig. 16. *Hammeria groenlandica* Sell. n. sp. Under-side, without legs.

point on Tect. I (which could hardly have been seen on the individuals that SELLNICK got for identification) and as the pseudostigmal organs are built as *M. mollicomus*'. On the other hand the lamellae and translamella are like those of *M. meridionalis.* Moreover, *M.* sp. is very much smaller than *M. mollicomus* and *M. meridionalis.*

Hammeria groenlandica Sell. n. gen. n. sp.

Hammeria Sell. n. gen. steht in der Nähe der *Trichoribates*-Gruppe. Die Innenkanten der Cuspides der Lamellen sind hinten vereinigt, bilden also eine kurze Translamelle. Das Lamellarhaar steht in einer ganz flachen Senke der Lamellenkrantze, ziemlich weit nach aussen gerückt. Tarsen dreikrallig, mittlere Kralle stärker als die seitlichen. Typische art: *Hammeria groenlandica* Sell. n. sp. Abb. 15—17. Länge 462 μ, Breite 308 μ. Farbe dunkelbraun. Propodosoma kegelförmig. Rostrum mit gerundeter Spitze, jederseits mit kleiner Ecke daneben. Die Lamellen reichen bis zur Spitze des Rostrums. Es sind flach liegende Blättchen. Die Cuspides stossen mit ihrer Innenkante fastaneinander und sind hinten verschmolzen, sodass eine Translamelle entsteht. Unterhalb dieser ist ein quer liegender Chitinbalken zu sehen, dessen aüssere Enden noch unter den Lamellen etwas nach aussen und hinten umbiegen. Die Aussenkante des Vorderendes der Lamellen zeigt zwei unbedeutende

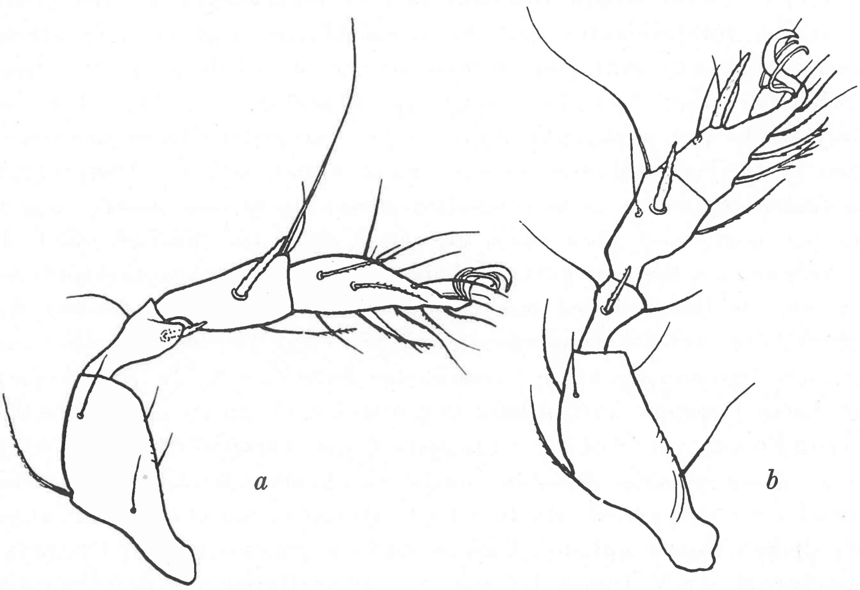


Fig. 17. *Hammeria groenlandica* Sell. n. sp. Leg I (a) and leg II (b).

Einbuchtungen. In der äusseren von ihnen steht das Lamellarhaar. Es ist kurz, leicht nach innen gebogen und auf der Aussenkante fein beborstet. Die Innenkanten der Lamellen divergieren etwas. Der Raum zwischen den Lamellen hat den Umriss einer Kirchenglocke. Da, wo der Vorderrand des Hysterosoma und die Innenkante der Lamelle zusammenstossen, sitzt das Interlamellarhaar. Es ist eine kurz, fast aufrechte Borste. Auf dem becherförmigen Pseudostigmatum am Hinterende der Lamelle entspringt das pseudostigmatische Organ. Es hat bei den meisten Exemplaren einen anscheinend spatelförmigen Kopf auf dünnerem Stiel, der etwas einwärts gebogen ist. Der Kopf des Organs erscheint am Ende abgestutzt; von der Seite gesehen (linkes Organ in der Abbildung 15) ist er aber zugespitzt. Eine kielförmige Tectop. I endet in eine scharfe Spitze in Höhe des Vorderendes der Lamelle. Unter der Spitze der Tectp. und an ihrem Beginn sitzt die einwärts gebogene und sehr deutlich auf der Aussenseite beborstete Rostralborste. Tectop. II ist eine grosse Schuppe, die aussenseits etwas eingedrückt ist. Der Vorderrand des Hysterosoma springt in der Mitte nur wenig vor, stösst beinahe an das Interlamellarhaar und überdeckt ein schmales Stück des hinteren Teils des Propodosoma. Ohne eine Einbuchtung geht der mittlere Teil des Hysterosomarandes in den geraden Vorderrande der Pteromorphen über. Die Pteromorphen gehen ohne Grenze in den Rückenpanzer über, sind recht kurz, fast so breit als lang. Der Aussenrand ist gerundet und der Hinterrand läuft ziemlich rechtwinklig auf den Seitenrand des Rückenpanzers zu. Die Rückenfläche zeigt bei sehr starker Vergrössung eine ganz feine Körnelung. Es ist auf ihr 10 Borstenpaare vorhanden. Ihre Verteilung zeigt die Abbildung 15. Auffaldend ist, dass die Ar. por. adalis ganz nahe bei der vordersten Borste der mittelsten Reihe liegt, während sie sonst meist weiter nach der Pteromorpha zu finden ist. Sie ist nicht sonderlich gross; die Ar. por. meson. und die Ar. por. post. sind aber noch kleiner. Ueber die Beschaffenheit der Unterseite des Körpers gibt die Abbildung 16 am besten Auskunft. Die Tarsen der Beine haben eine Starke Mittelkralle und jederseits eine schwächere. Auf der Aussenseite der Tibia I und II findet man die auch bei den *Trichoribates*-Arten vorhandenen dicke Borste, die rauh bezackt ist. Genu I springt nach aussen und etwas nach unten in eine kleinere Verbreiterung vor. Auf der Unterseite dieser Verbreiterung und schräg nach aussen gerichtet sitzt eine Borste, die ebenfalls etwas dick erscheint, aber kürzer und dünner als die vorher genannten ist. Bein II hat ausser der dicken Borste auf der Aussenseite eine gleiche auf der Oberkante des Tarsus. Auch Tarsus III hat eine dicke Borste auf der Oberseite, während Bein IV eine dicke Borste auf der Aussenseite von Genu und Tibia trägt.

Trichoribates trimaculatus C. L. Koch. The *T. trimaculatus* covers the *Sphaerozetes strandi* identified by Berlese, which seems to be identical with *T. trim.* Trägårdh (1912) writes: Remarkably enough Berlese does not compare it with *O. notata* [= *T. trimaculatus*, *author*]; from the comparison with *O. setosa* which the diagnosis contains, it is, however, evident that *S. strandi* differs from that species in exactly the same respects as does *O. notata*, viz. through the shorter cusps of the lamellae and the presence of a stout bristle on genu and tibia of the first and second pair of legs.

Trichoribates sp. Max Sellnick identified some specimens as *T. oblonga* L. Koch; this differs e. g. from *T. trimaculatus* (length about 0.62 mm, br. about 0.43 mm) and *Oromurcia lucens* (length about 0.60 mm, br. about 0.42 mm) by its very considerable size (length 0.90 mm, br. about 0.63 mm). My specimens, however, were much smaller than these two species. The cephalothoracal lamellae of *T. oblonga* have as on *T. trimaculatus*, a sharp, well-developed cusp at the point. This cusp is absent on *Trichoribates sp.* The pseudostigmal organ of *T. oblonga* is slightly club-shaped, almost cylindrical, whereas on the Greenland individuals it is short, flat and round. The colour is light brown, while that of *T. oblonga* is chestnut brown. All these discrepancies make me doubt very much whether the Greenland individuals can belong to *T. oblonga.*

Oromurcia bicuspidata Sig Thor

Oromurcia lucens L. Koch. M. Sellnick has identified some Greenland specimens as *O. lucens* L. Koch and writes: "Nach Thor müssten die beiden vorhandenen Ex. = *O. bicuspidatus* Thor sein. Ich halte diese Art aber für identisch mit *O. lucens.* Meine Ex. von Island und der Färöer haben dieselbe Form. Trägårdh zeichnet zwar in der Fauna arctica eine längliche Area por. adalaris, aber ich glaube, er hat sich da durch benachbarte Formen täuschen lassen." As Tuxen (1943) does not record the occurrence of *O. lucens* in Iceland, but only *O. bicuspidata,* the conclusion may be drawn with great probability that Sellnick's individuals from Iceland may also have been *O. bicuspidata.* When one has both species together, there is no doubting their representing two independent species, very easy to distinguish from each other, for instance by the appearance of the lamellae, as *O. bicuspidata* has broad lamellae like *Trichoribates trimaculatus* C. L. Koch, though without translamella and distinct, well-developed cusps with lateral teeth, whereas *O. lucens* has lamellae that are much narrower and a very inconspicuous cusp or none at all, on cuspis (compare Trägårdh 1904). The two lateral cusps on rostrum, which have given *O. bicuspidata* its name, are, moreover absent in *O. lucens.*

Calyptozetes sarekensis Trägårdh

Mycobates sp. I have been unable to determine the species of some specimens of this genus.

Notaspis punctatus Nic.

**Notaspis coleoptratus* L.

Pelops ?bilobus Sell.

Pelops ureaceus C. L. Koch. Sellnick det.

Pelops ?septentrionalis Trägårdh. As I am unable definitely to distinguish these various species, I have in the following merely called them *Pelops sp.*

Hoploderma stricutum C. L. Koch

Phthiracarus piger Scopoli

Collembola:

Hypogastrura armata Nicolet

Hypogastrura sp. (*?longispina* Tullberg)

Hypogastrura tullbergi Schäffer
Hypogastrura viatica Tullberg
Hypogastrura purpurascens Lubbock
Hypogastrura manubrialis Tullberg
Xenylla humicola O. Fabricius
Willemia anophthalma Börner
Friesea quinquespinosa Wahlgren
Anurida granaria Nicolet
Achorutes muscorum Templeton
Onychiurus groenlandicus Tullberg
Onychiurus sibiricus Tullberg
Onychiurus armatus Tullberg
Onychiurus pseudarmatus Folsom
Tullbergia krausbaueri Börner
Tetracanthella wahlgreni Axelson
Folsomia sexoculata Tullberg
Folsomia quadrioculata Tullberg
Folsomia diplophthalma Axelson
Folsomia fimetaria Linne
Archisotoma besselsi Packard
Proisotoma tenella Reuter
Isotoma (Pseudisotoma) sensibilis Tullberg
**Isotoma (Vertagopus) cinerea* Nicolet
**Isotoma (Vertagopus) arborea* Linne
**Isotoma finitima* Stscherbakow
Isotoma minor Schäffer
Isotoma coeruleo-griseus Hammer

Isotoma bipunctata Axelson. Greenland specimens of this species have been compared by W. M. LINNANIEMI with the type specimens which confirmed the correctness of the identification. Later on I. AGRELL had an opportunity to examine specimens from Greenland, and, according to him, they ought to be placed to *Isotoma notabilis* SCHÄFFER var. *pallida* Agrell. I have here listed it as *Isotoma bipunctata*, because the greater part of the material had been fully treated before AGRELL's publication in 1939.

Isotoma viridis Bourlet

Isotoma violacea Tullberg. According to AGRELL (1936) *I. violacea* Tullberg is a variety of *I. olivacea* Tullberg and ought to be called *I. olivacea* var. *violacea*. In my previously published papers I have treated them as two independent species with different distributions and different ecological requirements, and therefore for practical reasons they must here be kept as two species.

Isotoma olivacea Tullberg

Ågrenia bidenticulata Tullberg
Lepidocyrtus cyaneus Tullberg
Lepidocyrtus lanuginosus Gmelin
Sminthurides malmgreni Tullberg
Arrhopalites pygmaeus Wankel
**Sminthurinus niger* Lubbock
Sminthurinus concolor Meinert
**Sminthurus viridis* Linne

Chapter V.

Geographical distribution.

The distribution in Greenland.

As a starting point for an account of the distribution of the species in Greenland I have, in the schematic diagram of the dispersion of the *Oribatidae* in Greenland (fig. 18), chosen the species which the Franz Joseph Fjord region has in common with the Scoresby Sound region, as almost all these seem to occur everywhere in Greenland. In the column for the Franz Joseph Fjord region and Scoresby Sound region the numeral 14 signifies that 14 species are common to these two regions. Which species the numeral 14 and the following numerals represent,

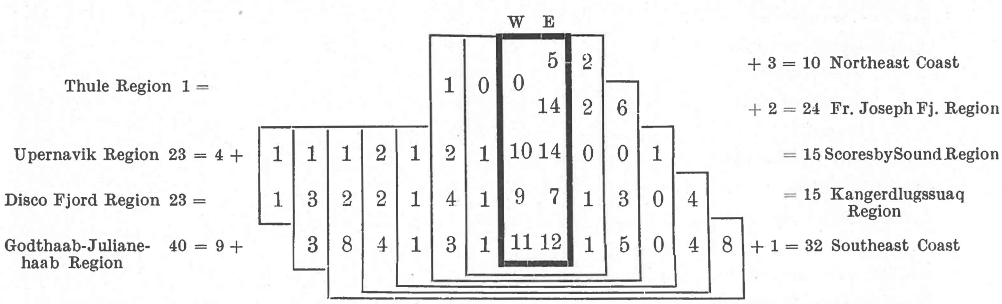


Fig. 18. Schematic diagram of the distribution of the oribatids in Greenland. The vertical fields marked W. and E. represent West and East Greenland which are divided into 4 and 5 fields respectively, corresponding to the investigated areas in Table 6. See text.

will become clear from table 6. Of the 14 species 5 are found on the northeast coast. In the Kangerdlugssuaq region only 7 have been found, while the southeast coast has 12. On the west coast 11 were found in the Godthaab-Julianehaab region, in the Disco Fjord region 9 and in the Upernavik region 10 species. As none of the 14 species are specially northern forms, most of them will presumably be found everywhere when a more thorough investigation is made, also upon the west coast. However, it looks as if the Kangerdlugssuaq region were rather poor

Table 6. The distribution of the *Oribatidae* in Greenland.

Species	Thule Region	Upernavik Region	Disco Fjord Region	Godthaab-Julianehaab Region	Southeast Coast	Kangerdlugssuaq Region	Scoresby Sound Region	Franz Joseph Fjord Region	Northeast Coast
Brachychthonius berlesei	..	..	..	..	..	..	..	..	×
— *sellnicki*	..	..	..	..	..	..	..	×	×
— *zelawaiensis*	..	..	..	..	..	..	..	..	×
Oppia maritima	..	..	..	..	..	..	..	..	×
Heminothrus thori	..	..	..	..	..	..	..	×	..
Scheloribates pallidulus	..	..	..	..	..	..	..	×	..
Iugoribates gracilis	×	×	..	..	..	..	..	×	..
Ceratoppia bipilis v. sph.	..	..	..	×	..	..	×	×	×
Hermannia reticulata	..	×	×	×	×	..	×	×	×
Camisia horrida	..	×	×	..	×	×	×	×	×
Platynothrus peltifer	..	×	×	×	×	×	..	×	×
Tectocepheus velatus	..	×	×	×	×	×	×	×	×
Trichoribates trimaculatus	..	×	×	×	×	×	×	×	×
Brachychthonius brevis	..	×	..	..	×	×	×	×	..
Trhypochthonius tectorum	..	..	×	×	×	×	..	×	..
Nothrus borussicus	..	×	×	×	×	×	×	×	..
Oppia quadricarinata	..	×	×	×	×	×	..	×	..
— *neerlandica*	..	×	×	×	×	..	× [1]	×	..
— *translamellata*	..	×	×	×	×	..	×	×	..
— *ornata*	..	..	×	×	×	..	× [1]	× ?	..
Ameronothrus lineatus	..	..	..	×	×	..	×	×	..
Oribatula exilis	..	×	×	×	×	×	×	×	..
Trichoribates sp.	..	..	×	..	×	×	..	×	..
Belba sp.	..	..	..	..	..	..	×	×	..
Calyptozetes sarekensis	..	×	..	×	×	×	×	×	..
Heminothrus paolianus	..	..	×	×	×	..	..	×	..
Trimalaconothrus novus	..	..	..	..	×	..	..	×	..
Oromurcia lucens	..	×	×	×	..	..	×	..	..
Plathynothrus lapponicus	..	×	×	×	×	×	..	..	..
Suctobelba subtrigona	..	..	..	×	×	×	..	..	..
Chamobates cuspidatus	..	..	..	×	×	×	..	..	..
Melanozetes ? mollicomus	..	×	×	×	×	×	..	..	..
Oppia splendens	..	..	..	..	×	..	..	..	..
Oromurcia bicuspidata	..	..	..	..	×	..	..	..	..
Trimalaconothrus foveolatus	..	..	..	×	×	..	..	..	..
Carabodes labyrinthicus	..	..	..	×	×	..	..	..	..
Liebstadia similis	..	..	..	×	×	..	..	..	..
Edwardzetes edwardsii	..	..	..	×	×	..	..	..	..
Pelops sp.	..	..	×	×	×	..	..	..	..

[1] From 4 previously collected samples which were not counted and are therefore not included in the table of the ecological distribution of the *Oribatidae*.

Table 6 (continued).

Species	Thule Region	Upernavik Region	Disco Fjord Region	Godthaab-Julianehaab Region	Southeast Coast	Kangerdlugssuaq Region	Scoresby Sound Region	Franz Joseph Fjord Region	Northeast Coast
Phthiracarus piger	..	..	..	×	×	..	..	..	..
Ceratozetes thienemanni	..	..	..	×	×	..	..	..	..
Mycobates sp.	..	×	×	×	×	..	..	..	..
Platynothrus capillatus	..	..	×	×	..	..	..	..	..
Hermannia scabra	..	..	..	×	..	..	..	..	..
Belba gracilipes	..	..	..	×	..	..	..	..	..
— *tatrica*	..	..	..	×	..	..	..	..	..
— *tenuipes*	..	..	..	×	..	..	..	..	..
— *trägardhi*	..	..	..	×	..	..	..	..	..
Ameronothrus maculatus	..	..	..	×	..	..	..	..	..
Notaspis punctatus	..	..	..	×	..	..	..	..	..
— *coleoptratus*	..	..	..	×	..	..	..	..	..
Hoploderma striculum	..	..	..	×	..	..	..	..	..
Hydrozetes confervae	..	..	×	×	..	..	..	..	..
Brachychthonius laetepictus	..	×	×	×	..	..	..	..	..
Liacarus globifer	..	×	×	..	..	..	..	..	..
Brachychthonius grandis	..	×	..	..	..	..	..	..	..
Eremaeus oblongus	..	×	..	..	..	..	..	..	..
Melanozetes sp.	..	×	..	..	..	..	..	..	..
Hammeria groenlandica	..	×	..	..	..	..	..	..	..

in species. That may be due to a less comprehensive investigation of this area, but also to other circumstances, such as the narrow ice-free shore area. The procedure is the same when establishing the distribution of the other species. Besides the 5 it has in common with the Franz Joseph Fjord and the Scoresby Sound regions, the northeast coast has 2 species, both to be found in the Franz Joseph Fjord region but lacking in the Scoresby Sound region; the one is found in all the other regions investigated upon the east and west coast except in the Thule region, wherefrom only one oribatid, *Iugoribates gracilis*, is known. Besides these 2 species there are other 3 species on the northeast coast which are not known in any other areas. For the northeast coast we have thus 5 plus 2 plus 3 = 10 species, and so on. On the west coast are a good many species that have not been found in East Greenland at all; the Godthaab-Julianehaab region is especially rich in such species. In contradistinction, East Greenland has only a few species that are not known in West Greenland. This is all the more remarkable, as East

Greenland has been much better investigated than has West Greenland. Seeing that the few and casually taken samples from West Greenland have shown such abundance in species, it may be expected that West Greenland, when subjected to a Berlese-investigation just as thorough as East Greenland, will turn out to have a good many more species that are new in Greenland.

With the collemboles matters are quite different. From table 7 and the schematic diagram fig. 19 it is seen that one species only, the *Lepidocyrtus cyaneus*, is unknown in East Greenland. On the other hand East Greenland boasts a good many species, mostly forms which

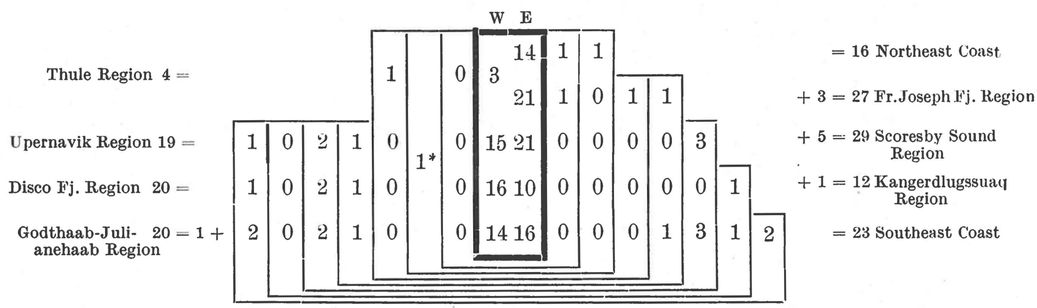


Fig. 19. Schematic diagram of the distribution of the *Collembola* in Greenland. Explanation see fig. 18. * West Greenland, no locality.

occur in the north and which have not been found on the west coast; but as the investigation in this part of Greenland has not been so thorough as on the east coast—Northwest Greenland especially having been much neglected—careful collecting will presumably reveal the existence of these species in the northwest of Greenland too. If so, that will mean that the collembole fauna of Greenland practically speaking is the same on the east and the west coasts. In contradistinction to what was the case with the oribatids, the few Berlese samples from West Greenland have not helped to increase the number of collemboles; from this it may reasonably be presumed that a further investigation of West Greenland will reveal no more *Collembola* species, or at any rate only a few, than those already known.

While the number of *Collembola* species practically speaking is the same in the north and in the south, the number of *Oribatidae* species is considerably larger towards the south. The question now is: what can be the reason of the very different distribution of the oribatids and the collemboles in Greenland? Why is it that the collembole fauna is the same on the east and the west coast, whereas the oribatid fauna comprises a very large number of species among those in Southwest Greenland which are not found on the east coast? As will be seen from table 9,

Table 7. The Distribution of the *Collembola* in Greenland.

Species	Thule Region	Upernavik Region	Disco Fjord Region	Godthaab-Julianehaab Region	Southeast Coast	Kangerdlugssuaq Region	Scoresbysound Region	Franz Joseph Fjord Region	Northeast Coast
Ågrenia bidenticulata	West Greenland				..	..	..	..	×
Hypogastrura manubrialis	..	..	..	..	..	..	..	×	×
— *tullbergi*	×	..	..	..	..	..	..	×	..
Onychiurus sibiricus	..	..	..	..	..	..	..	×	..
Isotoma finitima	..	..	..	..	..	..	..	×	..
Lepidocyrtus lanuginosus	..	..	..	..	..	..	..	×	..
Hypogastrura purpurascens	..	×	×	×	..	..	×	×	×
Tullbergia krausbaueri	..	..	×	..	..	..	×	×	×
Archisotoma besselsi	×	..	×	×	..	..	×	×	..
Hypogastrura sp. (? longispina)	..	..	..	..	..	..	×	..	..
Onychiurus pseudarmatus	..	..	..	..	..	..	×	..	..
Isotoma cinerea	..	..	..	..	..	..	×	..	..
Sminthurinus niger	..	..	..	..	..	..	×	..	..
Sminthurus viridis	..	..	..	..	..	..	×	..	..
Folsomia diplophthalma	×	×	..	..	..	×	×	×	×
— *fimetaria*	..	×	×	..	..	×	×	×	×
Isotoma arborea	..	..	..	..	..	×	..	..	..
Hypogastrura armata	..	×	×	×	×	×	×	×	×
Willemia anophthalma	..	×	×	×	×	×	×	×	×
Onychiurus groenlandicus	×	×	×	×	×	×	×	×	×
Folsomia sexoculata	..	..	×	×	×	×	×	×	×
— *quadrioculata*	..	×	×	×	×	×	×	×	×
Isotoma bipunctata	..	×	×	..	×	×	×	×	×
Sminthurinus concolor	..	×	×	×	×	×	×	×	×
Anurida granaria	..	×	..	..	×	..	×	×	×
Isotoma olivacea	..	×	×	×	×	..	×	×	×
Sminthurides malmgreni	..	×	×	..	×	..	×	×	×
Isotoma sensibilis	..	×	..	×	×	×	×	×	..
Hypogastrura viatica	..	×	×	×	×	..	×	×	..
Friesea quinquespinosa	..	..	..	×	×	..	×	×	..
Onychiurus armatus	..	..	×	×	×	..	×	×	..
Isotoma viridis	..	×	×	×	×	..	×	×	..
Arrhopalites pygmaeus	..	..	..	..	×	..	×	×	..
Isotoma violacea	..	×	×	×	×	..	..	×	..
Xenylla humicola	..	×	×	×	×	..	×	..	..
Tetracanthella wahlgreni	..	×	×	×	×	..	×	..	..
Proisotoma tenella	..	..	..	..	×	..	×	..	..
Isotoma minor	..	..	..	..	×	×	..	..	..
Achorutes muscorum	..	..	..	×	×	..	..	..	..
Isotoma coeruleo-griseus	..	×	×	×	×	..	..	..	..
Lepidocyrtus cyaneus	..	..	..	×	..	..	..	..	..

and as will be discussed on page 148, the collembole fauna consists for the greater part of species that are widely distributed over the northern hemisphere, while the distribution of the oribatids is mostly limited to the old world. While presumably most of the Greenland collemboles can thrive everywhere along the coast of Greenland, the oribatids seem to be more sensitive to cold. The great number of oribatids found in Southwest Greenland but in no other region is probably due to the specially favourable climatic conditions in these regions and is undoubtedly not connected with possibly different ways or routes of immigration.

One single species of collemboles has such a distribution in Greenland that it is unquestionably connected with climatic conditions. Thus the *Isotoma bipunctata* is found at Atingat in the inner part of Angmagssalik Fjord, but not at the coast at Angmagssalik nor farther south in Lindenow Fjord. In East Greenland it occurs from Mørke Fjord to Mikis Fjord, in West Greenland from Upernavik to Nûgssuaq in the Disco Fjord region. Thus it is, apparently, a northern species which in southern areas (Atingat) keeps to the inner part of the fjords. The *Hypogastrura* species have not been found in the many samples taken at Angmagssalik, Atingat and in Lindenow Fjord, that is to say all the southeast coast. Still they are known in this area, as *Hypogastrura viatica* has been found at Kap Dan outside of Angmagssalik and *Hypogastrura armata* on Storø north of Angmagssalik. I am unable to explain this remarkable occurrence on the lesser island or headlands, right out at the coast, but not at Angmagssalik, which is situated near the sea. The species of *Hypogastrura* have been found in all the rest of the regions investigated. It also seems inexplicable that *Folsomia diplophthalma* and *F. fimetaria*, which most often occur in large numbers, are absolutely non-existent on the southeast coast (table 7) but otherwise occur everywhere in East Greenland and in several places in West Greenland. Again, the occurrence of *Onychiurus sibiricus* in Greenland is singular, as it is known only in the region of Franz Joseph Fjord. This may probably be due to the climatic conditions. In Europe it is emphatically a relic form from the glacial period. From table 9 it will be clear that it ranges over Novaja Semlja, Siberia, Europe and North America. In Europe it grows in mountain tracts (The Vosges, Tatra, Urals, Alps) and in the lowlands, but here it occurs only in caves (FRENZEL 1937). *Tetracanthella wahlgreni* too must in Europe be considered as a relic from the glacial period; it occurs on Bear Island, Spitzbergen, in Lapland, Scandinavia, on mountains in Germany and Poland, in England and in Canada; the same is true of *Ågrenia bidenticulata*, known from Bear Island, Spitzbergen, Franz Joseph Land, Lapland, Novaja Selmja, Siberia, North Russia, Scandinavian mountains, Germany (the Vosges, Riesen Gebirge, on glaciers and near cold springs), Poland (Tatra), Switzerland (the Alps) and U. S. A. (Rocky Mountains).

As to the oribatids, nearly all the species found in the Franz Joseph Fjord region are also known in the more southerly regions. *Heminothrus thori*, *Ceratoppia bipilis*, *Scheloribates pallidulus* and *Iugoribates gracilis* will also undoubtedly be found in more southerly areas if closer investigations be made of their presumed habitat. In Southeast Greenland, and especially in Southwest Greenland, on the contrary, a number of species occur which will hardly be found in more northerly regions; this is true of *Pelops* species, *Hoploderma striculum*, *Phthiracarus piger*, several *Belba* species and maybe others, which probably owe their existence in these regions to a somewhat milder climate (p. 142).

Some species have so far been found only at Upernavik; these are *Brachychthonius grandis*, *Eremaeus oblongus*, *Melanozetes sp.* and *Hammeria groenlandica*, while *Liacarus globifer* has also been found in the Disco Fjord area. Of these, *Brachychthonius grandis* is a new species, which may very easily have been overlooked in the other regions on account of the difficulty of distinguishing the *Brachychthonius* species from each other. Haarløv (1942) demonstrated the presence of *Br. berlesei* and *Br. zelawaiensis* in Mørke Fjord, and that is presumably why I have missed *Br. berlesei* and *Br. zelawaiensis* when I determined the *Brachychthonius* species, e. g. upon Ella Island. Of the other species found at Upernavik, *Hammeria groenlandica* is likewise a new species; the same is undoubtedly the case with *Melanozetes* sp. Both these species are very characteristic, but not very numerous. Nor are *Eremaeus oblongus* and *Liacarus globifer* found in any great number. Of the latter I have found only one specimen. Previously it has been found by Vanhöffen, at the Karajak Nunatak in the Disco Fjord region. I am unable to explain the occurrence of these species solely in these regions. *Eremaeus oblongus* is known both in North America and in Europe; outside Greenland *Liacarus globifer* has up till now been found only in Finland on the shore. Whether the new species are endemic or not is difficult to say, but it is not very probable. Of the *Oribatidae* hitherto known in Greenland none are endemic. *Oribata* (*Belba*) *trägardhi*, which is subfossil and known only in Greenland, seems according to Graversen to be most closely related to the European *Belba bituberculata*; as perfect individuals apparently are not known, its identify cannot be ascertained with certainty, so that it cannot be considered as being a decidedly endemic species. Among the collemboles only *Friesea quinquespinosa* is endemic. Despite the very characteristic appearance of this species, with five spinules arranged fanwise upon the last abdominal segment, it may easily be overlooked because of its small size and its great likeness to young, very faintly pigmented individuals of the *Hypogastrura* species, especially of *Hypogastrura armata*. *Friesea quinquespinosa* may possibly have been overlooked in other Arctic countries. Also the *Isotoma coeruleo-griseus*, described some few years ago, has hitherto been found only in Greenland; as it is very small indeed, it is very likely that it has been overlooked in other countries where it may be expected to exist as well. Thus endemic species are rare among the *Oribatidae* and *Collembola*.

The distribution outside Greenland.

The distribution of the oribatids and collemboles outside Greenland will be seen from the tables 8 and 9. In order to emphasize further the similarity between the oribatid fauna of Greenland and the other North Atlantic Arctic islands[1]), which may be seen plainly from table 8, it must be mentioned that Jan Mayen has 6 species in all, of which 5 also are found in Greenland. Bear Island has 10 species in all, and every one of them is also found in Greenland. Spitzbergen has 24 species, of which 18 are recorded from Greenland. On the other hand, Iceland has 69 species, but only 24—25 of these are found in Greenland. Accordingly this island differs considerably from the other North Atlantic islands, not only by its much richer oribatid fauna, but also by a different composition of the species. The similarity between Iceland and the above mentioned North Atlantic Arctic islands is not nearly so great as that between Greenland and these islands, as will be seen from table 8.

Outside the North Atlantic islands the *Oribatidae* of Greenland (60 species) are for the most part widely distributed over Europe, while only a small part, 10 species, are known in North America. This discrepancy looks very improbable and, at first glance, it might signify that the Americans work without considering species already known in other countries. For the small number of Greenland *Oribatidae* known in North America does not mean that the oribatid fauna in North America has been badly investigated. In 1909 111 species of *Oribatidae* were known alone in Illinois in North America (EWING), of which only a few are known in Europe. EWING draws attention to the fact that the American oribatid fauna is very rich in *Pterogasterea* (abdominal-winged forms). On account of their bright integument they were speedily discovered, and this may be the reason why they constitute a much greater percentage of the fauna than they do in Europe (EWING). This statement seems to convey that EWING knows the European oribatid fauna. An examination of the *Oribatidae* illustrated might likewise convey the idea that the American species are unlike the European ones, but it must be pointed out that this cannot be decided from drawings alone. That EWING knows the European oribatid fauna is seen moreover by the

[1]) Jan Mayen, Bear Island and Spitzbergen.

Table 8. The distribution of the Greenland *Oribatidae.*

Species	North America[1]	West Greenland	East Greenland	Iceland	Jan Mayen	Bear Island	Spitzbergen	Franz Joseph Land	Lapland	Novaja Semlja	Arctic Siberia	Switzerland	The rest of Europe
Brachychthonius berlesei	×	..	×	..	..	..	..	..	..	..	..	..	×
— *zelawaiensis*	..	..	×	..	..	..	..	..	..	..	..	..	×
— *brevis*	..	×	×	..	..	..	×	..	×	..	..	×	×
— *sellnicki*	..	..	×	..	..	..	×	..	..	..	..	..	..
— *laetepictus*	..	×	..	..	..	..	×	..	..	..	..	..	×
— *grandis*	..	×	..	..	..	..	..	..	..	..	..	..	..
Trhypochthonius tectorum	..	×	×	×	..	..	..	..	..	..	..	..	×
Trimalaconothrus novus	..	..	×	..	..	..	..	..	×	..	..	..	×
— *foveolatus*	..	×	×	..	..	..	..	..	..	..	..	..	×
Camisia horrida	..	×	×	×	..	×	×	..	×	..	×	×	×
Nothrus borussicus	..	×	×	×	..	..	..	..	×	..	..	..	×
Platynothrus peltifer	×	×	×	×	×	×	..	..	×	×	..	..	×
— *lapponicus*	..	×	×	..	..	..	..	..	×	..	..	..	×
— *capillatus*	..	×	..	..	..	..	..	..	..	..	..	..	×
Heminothrus thori	..	..	×	×	..	..	..	..	×	..	..	..	×
— *paolianus*	..	×	×	..	..	..	..	..	..	..	..	..	×
Hermannia reticulata	..	×	×	..	×	×	×	..	..	×	..	..	×
— *scabra*	..	×	..	×	..	×	..	..	..	×	×	..	×
Belba gracilipes	..	×	..	..	..	..	..	..	..	..	..	..	×
— *tenuipes*	..	×	..	..	..	..	..	..	..	..	..	..	×
— *tatrica*	..	×	..	..	..	..	..	..	..	..	..	..	×
— *trägardhi*	..	×	..	..	..	..	..	..	..	..	..	..	..
Suctobelba subtrigona	×	×	×	..	..	..	..	..	×	..	..	×	×
Oppia quadricarinata	×	×	×	×	..	..	..	..	..	..	..	×	×
— *neerlandica*	..	×	×	×	..	..	×	..	×	..	..	..	×
— *translamellata*	..	×	×	×	..	..	×	..	×	..	..	..	×
— *ornata*	..	×	×	×	..	×	×	..	..	..	..	..	×
— *maritima*	..	..	×	..	..	..	..	..	..	..	..	..	×
— *splendens*	×	..	×	×	..	..	..	..	..	..	..	×	×
Eremaeus oblongus	×	×	..	×	..	..	..	..	×	..	..	..	×
Hydrozetes confervae	..	×	..	..	..	..	..	..	×	..	..	×	×
Ceratoppia bipilis v. sph.	×	×	×	..	×	×	×	..	×	×	×	×	×
Tectocepheus velatus	×	×	×	×	..	..	×	..	×	..	..	×	×
Ameronothrus lineatus	×	×	×	..	×	×	×	..	..	×	×	..	×
— *maculatus*	..	×	..	..	..	..	..	..	..	..	..	..	×
Carabodes labyrinthicus	..	×	×	..	..	..	..	..	×	..	..	×	×
Liacarus globifer	..	×	..	..	..	..	..	..	..	..	..	..	×
Liebstadia similis	..	×	×	×	..	..	..	..	×	..	..	×	×
Oribatula exilis	..	×	×	×	..	×	×	..	×	×	×	×	×
Scheloribates pallidulus	..	..	×	..	..	..	..	..	..	..	..	..	×

[1]) U.S.A., Alaska, Canada, Northwest Territories, Baffins Land and Ellesmere Land.

Table 8 (continued).

Species	North America	West Greenland	East Greenland	Iceland	Jan Mayen	Bear Island	Spitzbergen	Franz Joseph Land	Lapland	Novaja Semlja	Arctic Siberia	Switzerland	The rest of Europe
Edwardzetes edwardsii	..	×	×	×	..	..	×	..	×	..	..	×	×
Chamobates cuspidatus	..	×	×	×	..	..	×	..	×	..	..	×	×
Iugoribates gracilis	..	×	×	..	..	..	..	..	..	..	..	..	..
Ceratozetes thienemanni	..	×	×	..	..	..	..	..	×	..	..	..	..
Melanozetes mollicomus	..	×?	×?	..	..	..	..	..	×	..	..	×	×
— *sp.*	..	×	..	..	..	..	..	..	..	..	..	..	..
Hammeria groenlandica	..	×	..	..	..	..	..	..	..	..	..	..	..
Trichoribates trimaculatus	..	×	×	×	×	×	×	×	×	×	×	×	×
— *sp.*	..	×	×	..	..	..	..	..	..	..	..	..	..
Oromurcia bicuspidata	..	..	×	×	..	..	×	..	..	..	..	..	×[1]
— *lucens*	..	×	×	?	..	..	×	..	×	×	×	..	..
Calyptozetes sarekensis	..	×	×	×	..	×	×	..	×	..	..	..	..
Mycobates sp.	..	×	×	..	..	..	..	..	..	..	..	..	..
Notaspis punctatus	..	×	..	×	..	..	..	..	..	..	..	..	×
— *coleoptratus*	×	×	..	×	..	..	..	..	..	..	..	..	×
Pelops bilobus	..	×?	..	..	..	..	..	..	..	..	..	..	×
— *ureaceus*	..	..	×	..	..	..	..	..	..	..	..	×	×
— *septentrionalis*	..	..	×?	×	..	..	..	..	×	..	..	..	..
Hoploderma striculum	..	×	..	..	..	..	..	..	..	..	..	×	×
Phthiracarus piger	..	×	×	×	..	..	..	..	..	..	..	..	×

[1]) According to WILLMANN (1939) *Oromurcia sudetica* Willm. may be a middle European race of *O. bicuspidata* Thor.

fact that he mentions his receiving a big collection of determined European species from A. D. MICHAEL. One may therefore infer that at least the *Oribatidae* identified by EWING are correctly determined. NATHAN BANKS, who described the bulk of American oribatids, also knows the oribatids of Europe, as may be seen from his list of literature of 1905, in which BERLESE, MICHAEL, KRAMER, OUDEMANS and others are mentioned. Thus the oribatid fauna of North America may probably be quite different from that of Europe with which Greenland's agrees.

As to the collembole fauna, great similarity is also seen between Greenland and the other North Atlantic Arctic islands. Thus Jan Mayen has 18 species in all; of these 15 also occur in Greenland; Bear Island has 14 species, and 12 of these are found in Greenland; Spitzbergen has 30 species, of which 26 are also found in Greenland. On the other hand, of the 33 species of collemboles that grow in Iceland, only 17 are known in Greenland. Here again the similarity between the collembole fauna

Table 9. The Distribution of the Greenland *Collembola*.

Species	North America[1]	West Greenland	East Greenland	Iceland	Jan Mayen	Bear Island	Spitzbergen	Franz Joseph Land	Lapland	Novaja Semlja	Arctic Siberia	Finland	Switzerland	The rest of Europe
Hypogastrura armata	×	×	×	×	×	..	×	..	×	×	×	×	×	×
— *longispina*	..	..	×?	..	..	..	×	×	×	×	×	×	×	×
— *tullbergi*	×	×	×	..	..	..	×	×	..	×	×	..	..	×
— *viatica*	×	×	×	×	..	×	×	..	×	×	×	×	..	×
— *purpurascens*	..	×	×	×	..	..	..	..	×	..	..	×	×	×
— *manubrialis*	..	..	×	×	..	..	..	..	..	..	×	×	..	×
Xenylla humicola	×	×	×	×	×	×	×	..	×	×	×	×	×	×
Willemia anophthalma	..	×	×	..	..	..	×	..	×	..	..	×	×	×
Friesea quinquespinosa	..	×	×	..	..	..	..	..	..	..	..	..	..	..
Anurida granaria	×	×	×	×	×	..	×	×	×	..	×	×	..	×
Achorutes muscorum	×	×	×	×	..	..	..	..	×	..	×	×	×	×
Onychiurus groenlandicus	..	×	×	..	×	..	×	×	..	..	..	×	×	×
— *sibiricus*	×	..	×	..	..	..	..	..	..	×	×	×	×	×
— *armatus*	×	×	×	×	×	×	×	..	×	×	×	×	×	×
— — *v. arctica*	×	×	×	×	×	×	×	..	×	×	×	×	..	..
— *pseudarmatus*	×	..	×	..	..	..	..	..	..	..	..	..	..	..
Tullbergia krausbaueri	..	×	×	..	×	..	..	..	×	..	..	×	×	×
Tetracanthella wahlgreni	×	×	×	..	..	×	×	..	×	..	..	×	..	×
Folsomia sexoculata	..	×	×	..	×	×	×	..	..	..	..	×	×	×
— *quadrioculata*	×	×	×	×	×	×	×	..	×	×	×	×	×	×
— *diplophthalma*	×	×	×	..	..	..	×	..	×	×	×	×	..	×
— *fimetaria*	×	×	×	..	×	..	×	×	×	..	×	×	×	×
Archisotoma besselsi	×	×	×	..	×	..	×	..	..	×	..	×	..	×
Proisotoma tenella	..	..	×	..	..	..	..	..	..	..	..	×	..	×
Isotoma sensibilis	×	×	×	×	×	..	×	..	×	×	×	×	×	×
— *cinerea*	×	..	×	..	..	..	..	×	×	..	×	×	×	×
— *arborea*	×	..	×	..	..	..	..	..	..	×	×	×	..	×
— *finitima*	..	..	×	..	..	..	..	..	..	..	..	..	..	×
— *minor*	×	..	×	..	..	..	..	..	×	..	..	×	×	×
— *coeruleo-griseus*	..	×	×	..	..	..	..	..	..	..	..	..	..	..
— *bipunctata*	..	×	×	..	..	..	..	..	×	..	..	×	×	×
— *viridis*	×	×	×	×	×	×	×	×	×	×	×	×	×	×
— *violacea*	×	×	×	×	..	×	×	..	×	..	×	×	×	×
— *olivacea*	×	×	×	×	×	..	×	..	×	..	..	×	×	×
Ågrenia bidenticulata	×	×	×	..	..	×	×	×	×	×	×	×	×	×
Lepidocyrtus cyaneus	×	×	..	×	..	..	..	..	×	..	×	×	×	×
— *lanuginosus*	×	..	×	×	..	..	×	..	×	..	×	×	×	×
Sminthurides malmgreni	×	×	×	..	..	×	×	..	×	×	..	×	..	×
Arrhopalites pygmaeus	×	..	×	..	..	..	×	..	×	..	..	×	×	×
Sminthurinus niger	×	..	×	..	×	×	×	..	×	..	×	×	..	×
— *concolor*	..	×	×	..	..	..	×	..	..	..	..	..	..	..
Sminthurus viridis	×	..	×	×	..	..	..	..	×	×	×	×	..	×

[1]) U.S.A., Alaska, Canada, Northwest Territories, Baffins Land and Ellesmere Land.

of Iceland and the North Atlantic Arctic islands is not so great as that between Greenland and these islands, as may be seen from table 9.

Apart from some few species, the Greenland *Collembola* (41 species) are all known in Europe, and a great many in Arctic Siberia and Novaja Semlja. In North America 29 of the Greenland *Collembola* are known. Thus they are far more widely distributed over the northern hemisphere than the *Oribatidae*. This may probably be due to their antiquity.

Chapter VI.

The animal communities.

In the following description of the animal communities the word biotope will be applied in the meaning stated by KROGERUS (1932): a well circumscribed part of the living space which, as regards the most important living conditions, differs from other parts; for instance, fell-field, bog, lake bank and the like are good biotopes. KROGERUS also uses the designations dominant, influent and recedent, terms that mean the density of the species according to the scale below:

dominant: species constituting more than 5 per cent. of the entire number of individuals.
influent: species constituting from 5 per cent. to 2 per cent. of the entire number of individuals.
recedent: species constituting less than 2 per cent. of the entire number of individuals.

In the present work the word dominance is employed in order to designate how great a part of the entire number of individuals (*Oribatidae* and *Collembola*) the species constitutes. This number is called the dominance number regardless of whether it is less than 5 per cent. Later on, when judging the significance of the various species within the biotope, great importance must therefore be ascribed to the magnitude of the dominance number.

In order to calculate the distribution of the species within the biotope, the word constance is used to signify in what percentage of the samples the species in question has been found. This number is called the constance number or the distribution number, without regard to size. KROGERUS also uses the following designations within the distribution to denominate the more or less regular occurrence of the species in the biotope:

constant: species occurring in more than 50 per cent. of the samples.
accessory: species occurring in 50—25 per cent. of the samples.
accidental: species occurring in less than 25 per cent. of the samples.

This further differentiation will in many cases be useful, for instance if instead of the numbers originally calculated one would indicate the distribution of the species by words alone. On the other hand, such a classification, if it is to be maintained, may very well have the effect that species which unequivocally belong to a certain biotope, may be excluded from it as character animals, because they must, according to their occurrence in the sample, be classed as accidental, whereby the literal meaning of the word may lead to their being considered as accidental guests. As an example I may mention lake bank II, Ella Island (table 10), where the character animal *Platynothrus peltifer* has a constance number of 22; for no other oribatid is the constance number higher than 10, while two collembole species attain as high as 27. These low numbers are due to the extreme scarcity of individuals in the biotope (see table 10, column 2).

For the purpose of finding out whether mites and collemboles may be divided into different animal communities, and, if so, what factors govern these communities, all the species from each plant community (biotope) at each locality are put into one table. In order not to have too many tables nearly alike, I have confined myself to showing some examples in the text, but otherwise I have put them all at the back of this book and then, in a comprehensive table, collected the most important information together.

For each table I have indicated the locality, the plant community, height above sea level if known, the date, as well as the number of samples. In vertical column 1 (see table 10) is shown the aggregate number of individuals of each species, in column 2 the average number of individuals per sample, in column 3 the highest number of individuals in one sample, in column 4 the number of samples in which the species in question has been found, in column 5 the percentage of the samples in which the species has been found, in column 6 the percentage represented by the species of the entire number of individuals. From these numbers an estimate may be made as to those species that are important within the plant community in question, as it can be seen which species are most numerous (percentage of the total of individuals: the dominance number), and also which species are most commonly distributed (percentage of the samples; this number designates the distribution of the species: the constance number or the distribution number). These two numbers need not tally, as some species may be evenly distributed over a biotope but never in great numbers, which is often the case, e. g. with *Camisia horrida* (for instance tables 39 and 49); this species will have a high distribution number, while other species may occur in teeming multitudes in some samples within the plant community (e. g. *Oppia translamellata*, see tables 36 and 67); these species may attain a high dominance number. Finally, one species may occur fairly numerously in all or in a large part of the samples from one biotope; it will thereby have a high distribution number as well as a high dominance number. These latter species are first and foremost characteristic of the biotope in question.

As the number of samples from the various biotopes differs very much—from 69 to 1—the dominance and constance numbers of the species cannot be compared, except where the number of samples is relatively high. Before one appraises the magnitude of these numbers the number of samples ought always to be observed first. At the lake bank of Ymer Island (table 25), for instance, 2 samples were taken, of which one had one single *Trichoribates trimaculatus*, the other one single *Onychiurus sibiricus*. In both cases the species get a dominance number and constance number of 50, which is absolutely misleading.

In table 10, showing the composition of the fauna upon lake bank II on Ella Island, is an example of the above mentioned representation. At the top of the table are the *Oribatidae*, at the bottom the *Collembola*. The *Brachychthonius brevis* and the *Platynothrus peltifer* are the most numerous of the oribatids and occur in almost similar numbers, but while *Platynothrus peltifer* occurs in 22 per cent. of the samples, *Brachythonius brevis* is only found in 10 per cent. *Heminothrus thori* and *Trichoribates trimaculatus* constitute only 1 per cent. of the total of individuals and moreover it has a low constance number (slight distribution). The other *Oribatidae* occur only singly; in all, the oribatids constitute 8 per cent. of the aggregate fauna. Of collemboles the *Onychiurus sibiricus* occurs in great numbers and constitutes 62 per cent. of the entire community but the constance number is not very high, only 27. Just as common is *Folsomia quadrioculata*, which, however, constitutes only a small part, 2 per cent., of the entire animal community. After *Onychiurus sibiricus*, the *Sminthurinus concolor* is most numerous with the dominance number 17 and the constance number 16. All the rest of the collemboles occur only in small quantities and they are unevenly distributed. In this biotope the collemboles constitute 92 per cent. of the fauna.

As an example of a biotope where the oribatids dominate the collemboles I may mention the *Salix herbacea* vegetation at Angmagssalik (table 11).

Table 10.

Ella Island lake bank II. 49 samples Annual samples	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	62	1	35	5	10	3
Camisia horrida	1	+	1	1	2	+
Platynothrus peltifer	69	1	28	11	22	3
Heminothrus thori	13	+	11	3	6	1
Tectocepheus velatus	3	+	1	3	6	+
Oribatula exilis	2	+	2	1	2	+
Scheloribates pallidulus	4	+	3	2	4	+
Trichoribates trimaculatus	14	+	8	3	6	1
						8 % oribatids
Hypogastrura armata	24	+	12	5	10	1
Friesea quinquespinosa	1	+	1	1	2	+
Onychiurus groenlandicus	10	+	4	6	12	1
— *sibiricus*	1222	25	748	13	27	62
Folsomia quadrioculata	35	1	6	13	27	2
— *fimetaria*	67	1	61	3	6	3
Isotoma sensibilis	10	+	6	5	10	1
— *bipunctata*	17	+	7	5	10	1
— *olivacea*	1	+	1	1	2	+
Smithurides malmgreni	46	1	25	9	18	2
Sminthurinus concolor	336	7	85	8	16	17
undetermined *Sminthuridae*	48	1	20	4	8	2
total...	1985					92 % collemboles
average per sample		41				

+ = less than 1.

The oribatids *Tectocepheus velatus*, *Oribatula exilis*, *Trichoribates trimaculatus* and *Trichoribates sp.* have all been found in every sample, which means that the constance number is 100; in addition they occur in great numbers constituting 20, 17, 4 and 19 per cent. respectively of the fauna. *Calyptozetes sarekensis* is also very common, with the dominance number 6 and the constance number 80. *Pelops sp.* occurs in very small numbers in the samples but is found to the number of 29 in one of the samples, whereby it constitutes 1 per cent. of the entire fauna. *Melanozetes ?mollicomus* also constitutes 1 per cent., but with a lower constance number. The other oribatids occur only in small numbers. Of the collemboles only *Tetracanthella wahlgreni* occurs fairly generally, the constance number being 60. *Folsomia quadrioculata*, found only in one

Table 11.

Angmagssalik *Salix herbacea* veg. 10 samples d. 18. 7. 33	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent of total individuals: dominance number
Camisia horrida	1	+	1	1	10	+
Platynothrus lapponicus	1	+	1	1	10	+
Tectocepheus velatus	556	56	125	10	100	20
Oribatula exilis	461	46	143	10	100	17
Chamobates cuspidatus	1	+	1	1	10	+
Melanozetes ?mollicomus	25	3	13	3	30	1
Trichoribates trimaculatus	109	11	22	10	100	4
— *sp.*	521	52	140	10	100	19
Calyptozetes sarekensis	157	16	35	8	80	6
Pelops sp.	34	3	29	5	50	1
undeterm. *oribatidae* nymphs	723	72	269	10	100	26
						94 % oribatids
Xenylla humicola	1	+	1	1	10	+
Friesea quinquespinosa	1	+	1	1	10	+
Tetracanthella wahlgreni	14	1	5	6	60	1
Folsomia quadrioculata	133	13	133	1	10	5
Isotoma coeruleo-griseus	3	+	3	1	10	+
— *viridis*	6	1	3	4	40	+
total...	2747					6 % collemboles
average per sample		275				

sample to a number of 133 individuals, constitutes 5 per cent. of the total fauna. Despite this relatively high dominance number it becomes evident from the distribution number that it cannot be considered as characteristic of the biotope in question, but must be reckoned as a casual guest. In this biotope the oribatids (mainly 5 species) constitute 94 per cent., the collemboles only 6 per cent. of the entire fauna.

In this way all the biotopes have been dealt with (see the tables 18—67).

In order to avoid all these tables I have, as mentioned above, put all the constance and dominance numbers (also where they are lower than 1 (indicated by a +)) for all the biotopes in the tables 13 and 14. As will be seen, certain species seem to occur almost everywhere. This is true as regards the oribatids *Tectocepheus velatus*, *Oribatula exilis* and *Trichoribates trimaculatus* and for the collemboles *Folsomia quadrioculata*. A further calculation shows that these species occur in 37, 45, 42 and 49 per cent. respectively of all the samples examined. If one would attempt to distinguish between various animal communities one must first exclude these commonly distributed species (ubiquists) and examine whether there are species which occur in some biotopes with high dominance and constance numbers and lack in others. One such species is the oribatid *Platynothrus peltifer*. If one tabularizes the dominance and constance numbers of this species for the biotopes in question (the dominance numbers first and according to value) it will be seen that this species occurs almost exclusively in quantities that constitute over 1 per cent. of the total fauna in the very wet biotopes:

Ella Isl. lake bank I	Angmagssalik lake bank	Angmagssalik bog	Atingat bog	Lindenow Fjord moss
88—88	45—92	42—100	35—100	22—75

Angmagssalik moss	Upernavik bog	Ella Isl. lake bank II	Ella Isl. fell-field I	Ella Isl. bog II
8—100	3—36	3—22	1—33[1]	1—26

Another oribatid, *Calyptozetes sarekensis*, occurs in like manner and is widely distributed in some biotopes.

Angmagssalik grassy slope	Mikis Fjord lichen heath	Angmagssalik fell-field	Angmagssalik *Salix* *herb.* veg.	Angmagssalik lichen heath	Mikis Fjord *Empetrum* veg.
				(8)[2]	
21—100	13—100	12—100	6—80	4—64	1—75

Angmagssalik grass *Salix* snow bed	Mikis Fjord *Salix* *herb.* veg.	Lindenow Fjord dry biot.	Scoresby Sound mix. *Cham.* veg. II	Upernavik mix. *Cham.* veg.
1—60	1—50	1—50	1—38	1—29

As is recorded in this table, *Calyptozetes sarekensis* with a dominance number of at least 1, is found exclusively in dry biotopes. The species hitherto mentioned have been found in all the Greenland regions investigated.

Another species, most frequent in wet biotopes, is *Melanozetes ?mollicomus*. With the dominance number 1 and above, it has been found exclusively on wet soil, except in the *Empetrum* vegetation in Mikis Fjord, in *Salix herbacea* vegetation at Angmagssalik and Atingat.

[1]) At fell-field I, Ella Island, only one specimen of *Pl. peltifer* has been found.

[2]) Explanation see p. 85.

Angmagssalik lake bank	Angmagssalik bog	Angmagssalik moss	Atingat bog	Lindenow Fjord moss
9—76	8—85	1—100	1—100	1—50

Atingat *Salix herb.* veg.	Mikis Fjord *Empetrum* veg.	Upernavik bog	Angmagssalik *Salix herb.* veg.
1—50	1—50	1—36	1—30

Camisia horrida, with the dominance number 1 and above occurs exclusively in dry biotopes but may also be found at wet places, although then the quantity is always small.

Mikis Fjord lichen heath	Kempe Fjord dry biot.	Suess Land dry biot.	Atingat *Salix herb.* veg.	Traill Isl. dry biot.
4—83	4—67	3—83	3—100	3—33

Ella Isl. dry biot.	Ella Isl. fell-field II	Upernavik fell-field	Angmagssalik lichen heath	Upernavik mix. *Cham.* veg.
2—46	2—13	1—80	(1) + —50	1—36

Ella Isl. fell-field I	Ella Isl. mix. *Cham.* veg. III	Ella Isl. mix. *Cham.* veg. I
1—33	1—25	1—22

Of collemboles there is not one that as markedly as the oribatids *Platynothrus peltifer* and *Calyptozetes sarekensis* occurs in great numbers and generally dispersed in certain biotopes while being absent in others. This is due to the high ecological valence of the Greenland collemboles. No collembole occurs that is characteristic of certain biotopes. That it must be so is clear when the special conditions in Greenland are taken into consideration; here the species cannot chose biotopes with widely different ecological condition; they must adapt themselves to existing conditions. KSENEMAN (1938 b) names the following collemboles with high ecological valence: *Tullbergia krausbaueri*, *Isotoma bipunctata* (= *notabiles*), *I. minor*, *I. olivacea* var. *grisescens*, *Hypogastrura armata*, *Onychiurus armatus*, *Folsomia quadrioculata* and *Lepidocyrtus cyaneus*, all occurring in Greenland except the variety *grisescens*. Nevertheless, *Xenylla humicola*, *Friesea quinquespinosa*, *Onychiurus groenlandicus*, *O. sibiricus*, *O. armatus*, *Proisotoma tenella*, *Isotoma bipunctata*, *I. viridis*, *Sminthurides malmgreni* and *Sminthurinus concolor* occur predilectively in wet biotopes, but rarely in great numbers or with any very wide distributions. However, several of these occur in nearly the same numbers in dry biotopes, e. g. the *Onychiurus* species. Bertram and Lack (1938) found *Sminthurides malmgreni* exclusively in wet biotopes (in partly immersed moss and upon the water surface) on Bear Island. *Tullbergia krausbaueri* occurs solely in dry biotopes; and *Willemia anophthalma* is far more frequent in dry ones, where it has been found in 34 per cent. of all samples, while in the wet ones it has been found in only 9 per cent.

If all the samples (those from Disco Fjord and the Godthaab-Julianehaab areas are not included) taken in wet places: lake bank, bog, wet moss (mostly *Sphagnum*) are placed in one group, and all those from dry places: fell-field, lichen heath, *Salix herbacea* vegetation and the like, in another, it becomes clear that the four generally distributed species already mentioned, namely the oribatids *Tectocepheus velatus*, *Oribatula exilis*, *Trichoribates trimaculatus* and the collembole *Folsomia quadrioculata*, have been found in respectively 36, 19, 43 and 60 per cent. of the samples from wet biotopes, and in respectively 40, 63, 47 and 50 per cent. of the samples from the dry biotopes, i. e. that *Tectocepheus velatus* and *Trichoribates trimaculatus* are equally frequent everywhere, while *Oribatula exilis* is most common in dry biotopes and *Folsomia quadrioculata* most common in wet ones. These figures merely show the distribution of the species, but say nothing of in which biotopes the species find optimal conditions of life. If then we take the number of individuals which of each species have been found in all dry biotopes and in all wet biotopes, each species taken apart, we get a table as follows (see p. 70).

In vertical column 1 is recorded the aggregate number of individuals from the dry biotopes, in column 2 the individuals from the wel biotopes. Based upon these numbers an estimate may be formed as to where each species has been found in the greater number, i. e. one can see whether it prefers dry or wet biotopes. From this it is also very clear that *Platynothrus peltifer* is far more frequent in wet biotopes (11 in dry, 16004 in wet biotopes); as for *Melanozetes ?mollicomus* the position is about the same (53 as against 1395) while *Calyptozetes sarekensis* (2564 against 23) and *Camisia horrida* (435 against 67) are examples of species preferring the dry biotopes. As to the collemboles it turns out that, besides *Tullbergia krausbaueri* and *Willemia anophthalma*, also *Tetracanthella wahlgreni*, *Folsomia diplophthalma*, *Isotoma minor* and *Isotoma coeruleo-griseus* decidedly belong to dry biotopes. It will also be seen that the collemboles which above (p. 68) have been described as mostly occurring in wet biotopes, really belong here.

Besides the humidity, it looks as if there are no other factors that have an immediate influence on the fauna.

Table 12.

Oribatids	Found in 377 samples from dry biot.	Found in 221 samples from wet biot.
Brachychthonius brevis	3664	1478
— *laetepictus*	175	223
— *sp.*	100	0
Trhypochthonius tectorum	469	164
Trimalaconothrus novus	1	1428
— *foveolatus*	0	6
Camisia horrida	435	67
Nothrus borussicus	1578	350
Platynothrus peltifer	11	16004
— *lapponicus*	14	466
Heminothrus thori	4	793
— *paolianus*	5	4
Hermannia reticulata	216	8
Belba sp.	2	0
Suctobelba subtrigona	53	0
Oppia quadricarinata	271	1
— *neerlandica*	290	707
— *translamellata*	3159	162
— *ornata*	190	8
— *splendens*	37	0
Eremaeus oblongus	129	0
Ceratoppia bipilis v. sph.	95	0
Tectocepheus velatus	3929	1848
Ameronothrus lineatus	0	1
Carabodes labyrinthicus	1	0
Liacarus globifer	1	0
Liebstadia similis	174	32
Oribatula exilis v. crassipes	4934	327
Scheloribates pallidulus	4	419
Edwardzetes edwardsii	2	106
Chamobates cuspidatus	125	6
Iugoribates gracilis	61	0
Ceratozetes thienemanni	218	1
Melanozetes ?mollicomus	53	1395
— *sp.*	2	5
Hammeria groenlandica	110	0
Trichoribates trimaculatus	1213	937
— *sp.*	587	7
Oromurcia lucens	0	14
Calyptozetes sarekensis	2564	23
Mycobates sp.	220	3
Pelops sp.	254	141
Phthiracarus piger	4	0

Collemboles	Found in 377 samples from dry biot.	Found in 221 samples from wet biot.
Hypogastrura armata	644	334
— *sp.*	2	2
— *viatica*	0	2
— *purpurascens*	147	39
Xenylla humicola	3	171
Willemia anophthalma	2885	292
Friesea quinquespinosa	28	295
Anurida granaria	144	17
Achorutes muscorum	0	6
Onychiurus groenlandicus	389	492
— *sibiricus*	3873	9250
— *armatus*	63	231
— *sp.*	3	4
Tullbergia krausbaueri	73	0
Tetracanthella wahlgreni	5565	263
Folsomia sexoculata	17	111
— *quadrioculata*	20756	5392
— *diplophthalma*	2120	148
— *fimetaria*	2352	1025
Archisotoma besselsi	1	0
Proisotoma tenella	0	1996
Isotoma sensibilis	866	767
— *minor*	1970	29
— *coeruleo-griseus*	3820	22
— *bipunctata*	201	662
— *viridis*	198	460
— *violacea*	678	185
— *olivacea*	10	51
Lepidocyrtus lanuginosus	0	1
Sminthurides malmgreni	14	203
Arrhopalites pygmæus	3	22
Sminthurinus concolor	535	1119

Mark the different number of samples from dry and wet biotopes.

Samples from the Disco Fjord and the Godthaab-Julianehaab regions not included on account of lacking knowledge of the character of the biotopes.

Table 13. The occurrence of *Oribatidae* on the biotopes, arranged according to the geographical and ecological distribution (see text). The figures are dominance-constance numbers.

Region	Franz Joseph Fjord Region																										Scoresby Sound Region		Kangerdlugssuaq Region				Southeast Coast															Upernavik Region		
Biotope	wet biotope North Fjord	dry biotope North Fjord	dry biotope Kempe Fjord	wet biotope Suess Land	fell-field Suess Land	dry biotope Suess Land	moraine Suess Land	lake bank Ymer Isl.	bog Ymer Isl.	fell-field Ymer Isl.	mx. *Chamaephyt* veg. Ymer Isl.	lake bank I Ella Isl.	lake bank II Ella Isl.	bog I Ella Isl.	bog II Ella Isl.	moist rock Ella Isl.	fell-field I Ella Isl.	fell-field II Ella Isl.	mx. *Chamaephyt* veg. I Ella Isl.	mx. *Chamaephyt* veg. II Ella Isl.	mx. *Chamaephyt* veg. III Ella Isl.	dry biotope Ella Isl.	dry biotope at Fimbul Ella Isl.	lagoon Ella Isl.	beach mound Ella Isl.	dry biotope Traill Island	mx. *Chamaephyt* veg. I Scoresby Sound	mx. *Chamaephyt* veg. II Scoresby Sound	moss Mikis Fjord	*Salix herbacea* veg. Mikis Fjord	*Empetrum* veg. Mikis Fjord	Lichen heath Mikis Fjord	bog Atingat	moss Atingat	*Salix herbacea* veg. Atingat	Lichen heath Atingat	lake bank Angmagssalik	bog Angmagssalik	moss Angmagssalik	fell-field Angmagssalik	Lichen heath Angmagssalik	grassy slope Angmagssalik	*Salix herbacea* veg. Angmagssalik	grass *Salix* snow-bed Angmagssalik	moss Lindenow Fjord	wet rock Lindenow Fjord	dry biotope Lindenow Fjord	bog Upernavik	fell-field Upernavik	mx. *Chamaephyt* veg. Upernavik
Table No.	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
Number of samples	2	5	3	2	3	6	8	2	1	1	2	8	49	9	69	3	3	67	63	6	4	39	4	2	9	9	36	48	5	4	4	6	2	1	2	1	25	20	7	5	14	5	10	5	4	1	4	11	5	14
≡ wet biotope, ⊗ dry biotope	≡	⊗	⊗	≡	⊗	⊗	⊗	≡	≡	⊗	⊗	≡	≡	≡	≡	≡	⊗	⊗	⊗	⊗	⊗	⊗	⊗			⊗	⊗	⊗	≡	⊗	⊗	⊗	≡	≡	⊗	⊗	≡	≡	≡	⊗	⊗	⊗	⊗	⊗	≡	≡	⊗	≡	⊗	⊗
Brachychthonius brevis	30–50	3–60	+–33	21–100	..	{sp. 26–67}	3–50	..	..	..	1–50	+–38	3–10	1–22	4–45	..	..	9–19	6–24	1–83	1–25	1–21	22–25	no oribatids	..	3–44	7–56	25–73	..	..	5–25	3–100	..	..	..	..	5–40	+–40	9–57	..	{(+)[6] +–7}	+–60	..	5–40	..	..	..	+–18	..	..
Trhypochthonius tectorum	2–50	39–20	..	..	..	..	11–50	..	..	..	..	..	..	..	1–16	..	..	..	1–8	..	..	3–15	..		..	..	..	..	..	..	+–50	1–67	..	..	..	..	+–4	..	..	..	{(+) +–14}	..	..	..	..	..	..	..	..	..
Trimalaconothrus novus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–1	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	15–90	..	..	{(+) +–7}	..	..	..	..	..	..	..	..	..
Camisia horrida	..	..	4–67	..	7–67	3–83	+–25	..	..	..	..	..	+–2	+–56	+–17	..	1–33	2–13	1–22	..	1–25	2–46	..		..	3–33	+–8	+–15	..	..	+–25	4–83	..	..	3–100	1–	..	+–5	+–57	..	{(1) +–50}	+–60	+–10	..	+–50	..	..	..	1–80	1–36
Nothrus borussicus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1–9	..	..	..	+–2	..	..	1–5	..		..	..	..	+–17	..	..	41–75	12–83	..	6–	..	7–	+–12	2–40	2–43	..	{(+) +–64}	1–80	..	..	+–25	..	1–50	..	..	+–7
Platynothrus peltifer	..	..	..	..	..	..	..	..	..	..	..	88–88	3–22	..	1–26	..	1–33	+–1	+–5	..	..	+–3	..		..	..	..	..	..	..	+–25	..	35–100	..	..	..	45–92	42–100	8–100	..	{(+) +–7}	..	..	..	22–75	..	..	3–36	..	..
Heminothrus thori	..	1–20	..	7–100	..	..	..	..	..	..	..	+–13	1–6	15–78	+–7	..	..	..	..	..	..	+–3	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
— *paolianus*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–3	..	..	+–1	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–50	..	..	..
Hermannia reticulata	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–1	..	..	..	..	..	..	..	..		..	..	2–28	1–21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1–25	..	+–25	+–18	1–40	1–36
Belba sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–1	..	..	..	..	..		+–11	..	..	+–2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Oppia quadricarinata	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–1	..	..	1–9	+–3	..	1–25	+–10	..		..	..	..	..	..	..	..	6–83	..	..	..	..	..	..	..	..	{(+) +–36}	..	..	..	..	..	..	..	+–40	7–21
— *neerlandica*	..	..	..	+–50	1–33	3–33	+–13	..	..	..	..	..	..	..	+–1	..	9–33	12–19	1–8	..	1–25	..	..		..	1–22	..	..	..	..	..	..	8–100	..	1–50	1–	+–36	6–30	+–57	+–20	..	+–20	..	..	5–50	..	1–25	..	+–20	+–21
— *translamellata*	..	..	..	..	..	+–17	..	..	..	..	..	{sp. +–13}	..	..	1–7	..	..	..	5–2	..	..	{sp. 1–13}	..		..	..	20–69	6–54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–50	+–	49–100	2–9	..	15–43
— *ornata*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	2–11	..	..	..	..	..	..	..	..	..	..	..	..	+–43	..	{(+) +–14}	2–80	..	2–40	..	..	4–25	..	..	..
Ceratoppia bipilis v. *sph.*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	2–22	1–58	+–19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tectocepheus velatus	2–50	7–20	+–33	19–100	2–33	..	20–50	..	..	..	..	..	+–6	9–89	2–30	..	1–33	21–22	+–8	..	4–25	6–38	..		..	9–44	2–36	5–48	24–100	29–75	7–75	20–100	17–100	20–	7–100	47–	4–72	+–35	3–100	16–100	{(6) 3–86}	1–100	20–100	3–80	5–75	+–	11–50	+–9	3–80	1–57
Ameronothrus lineatus[1]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	+–4	..	..	..	..	..	..	..	..	..	..	..	..	..
Oribatula exilis	..	2–20	1–33	1–50	45–100	33–100	15–63	..	..	..	..	+–13	+–2	+–11	2–28	..	13–100	15–39	6–60	+–33	2–50	6–72	..		..	..	5–61	7–60	+–20	35–75	1–75	8–100	+–100	..	7–100	21–	+–16	+–25	+–29	10–100	{(2) 1–93}	11–100	17–100	12–100	3–25	..	18–50	2–36	17–60	26–93
Scheloribates pallidulus	..	..	..	..	..	..	..	..	..	..	..	..	+–4	5–89	2–36	..	..	..	+–2	+–17	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Iugoribates gracilis	..	..	..	..	..	..	..	..	..	13–[5]	..	..	..	..	..	..	..	2–30	+–13	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–40	+–21
Trichoribates trimaculatus	..	2–40	22–67	8–100	17–33	6–67	3–63	50–50	2–[5]	13–[5]	5–100	+–38	1–6	3–100	3–49	..	1–33	2–12	2–48	3–100	..	6–41	..		..	9–78	3–75	1–42	+–20	5–75	1–50	..	3–100	..	15–100	..	1–28	1–60	3–71	2–60	..	1–100	4–100	1–40	+–25	..	+–25	5–82	1–80	3–71
— *sp.*	..	..	1–33	..	..	..	+–13	..	..	..	..	..	..	..	+–3	..	..	..	1–6	..	..	..	..		..	..	..	..	..	2–25	..	..	..	..	1–50	..	..	+–10	..	..	{(+) +–14}	+–60	19–100	..	..	..	+–25	..	..	..
Calyptozetes sarekensis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–4	+–6	..	..	..	..		..	..	+–17	1–38	..	1–50	1–75	13–100	..	..	..	9–	+–36	..	+–43	12–100	{(8) 4–64}	21–100	6–80	1–60	..	..	1–50	..	..	1–29
Oromurcia lucens[2]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1–18	..	..
Platynothrus lapponicus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	19–100	..	..	..	+–50	6–	..	..	1–36	+–5	+–43	..	{(+) +–14}	..	+–10	..	+–25	..	1–25	+–9	..	+–7
Suctobelba subtrigona	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	+–25	5–50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–25	..	..	..
Chamobates cuspidatus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	3–83	..	..	..	1–	+–4	+–5	+–29	..	{(1) +–36}	+–20	+–10	..	..	..	..	..	..	..
Melanozetes ?mollicomus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	+–20	..	1–50	..	1–100	11–	1–50	..	9–76	8–85	1–100	+–20	{(+) +–7}	+–40	1–30	..	1–50	..	..	1–33	..	..
Trimalaconothrus foveolatus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1–25	..	..	..	..	..
Oppia splendens	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14–40	{(+) +–7}	..	..	..	..	..	..	..	..	..
Carabodes labyrinthicus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–25	..	..	..
Liebstadia similis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–57	..	..	4–100	..	+–20	2–25	..	..	..	..	..
Edwardzetes edwardsii	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	+–50	9–	..	..	+–8	+–15	2–71	..	..	+–40	..	..	..	..	..	..	..	..
Ceratozetes thienemanni	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–14	..	{(1) 1–29}	..	..	3–80	..	..	1–25	..	..	..
Oromurcia bicuspidata[3]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	+	+	..	..	..	..	..	..	+	..	+	..	..	..
Mycobates sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	{(1) +–50}	..	..	..	..	..	..	+–9	..	+–21
Pelops sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	2–100	11–	47–100	..	+–12	1–45	+–29	1–20	{(+) +–29}	2–100	1–50	1–40	3–50	..	..	..	..	..
Phthiracarus piger	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–50	..	..	..
Brachychthonius laetepictus[4]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14–36	1–40	7–57
Eremaeus oblongus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2–60	5–50
Liacarus globifer	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–7
Melanozetes sp.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–27	..	+–7
Hammeria groenlandica	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2–40	3–50

[1]) Littoral form; found on Ella Island too (see beach-community). [2]) Known from the Scoresby Sound region (TRÄGÅRDH 1904). [3]) Some few individuals of *Oromurcia bicuspidata* was found on lake bank and bog at Angmagssalik together with *Trichoribates trimaculatus* into the number of which it was merged, and also in moss (1 individual) and on dry biotope (2 individuals) in Lindenow Fjord; all these places are marked by a cross in Table 13. [4]) Here some few individuals of *Brachychthonius grandis*.
[5]) At biotopes with only 1 sample there are no constance number e.g. bog and fell-field Ymer Isl. [6]) Explanation p. 85

Table 14. The occurrence of *Collembola* on the biotopes arranged according to the geographical and ecological distribution (see text). The figures are dominance-constance numbers.

	Franz Joseph Fjord Region															
	wet biotope North Fjord	dry biotope North Fjord	dry biotope Kempe Fjord	wet biotope Suess Land	fell-field Suess Land	dry biotope Suess Land	moraine Suess Land	lake bank Ymer Isl.	bog Ymer Isl.	fell-field Ymer Isl.	mx. *Chamaephyt* veg. Ymer Isl.	lake bank I Ella Isl.	lake bank II Ella Isl.	bog I Ella Isl.	bog II Ella Isl.	moist rock Ella Isl.
Table No.	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Number of samples	2	5	3	2	3	6	8	2	1	1	2	8	49	9	69	3
≡ wet biotope, ⊗ dry biotope	≡	⊗	⊗	≡	⊗	⊗	⊗	≡	≡	⊗	⊗	≡	≡	≡	≡	≡
Hypogastrura armata	9–50	14–40	..	13–100	..	..	1–50	..	..	..	1–50	+–13	1–10	1–67	1–54	..
— *viatica*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
— *purpurascens*	+–50	+–20	..	..	..	..	..	..	..	..	..	..	..	..	+–12	..
— *sp.*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Willemia anophthalma	..	..	22–67	..	..	..	..	..	..	50–	39–100	..	..	..	1–20	..
Friesea quinquespinosa	..	..	..	..	..	..	..	..	..	..	..	..	+–2	..	+–20	..
Anurida granaria[1]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Onychiurus groenlandicus	25–10	50–20	..	..	..	..	..	..	..	..	..	+–13	1–12	..	+–9	..
— *sibiricus*	..	2–40	47–100	27–100	4–33	21–50	31–100	50–50	95–[3]	13–	40–100	3–75	62–27	18–100	53–91	..
— *armatus*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
— *sp.*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tullbergia krausbaueri	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Folsomia sexoculata	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
— *quadrioculata*	13–100	6–60	..	..	..	1–17	3–63	..	4–	..	1–50	7–88	2–27	4–89	5–52	..
— *diplophthalma*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–6	..
— *fimetaria*	..	..	1–67	..	..	..	5–50	..	..	13–	12–100	..	3–6	..	8–57	..
Archisotoma besselsi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Isotoma sensibilis	..	1–20	1–67	..	..	..	1–50	..	..	..	..	+–75	1–10	1–78	2–54	100–67
— *bipunctata*	..	..	..	..	..	..	..	..	..	..	..	..	1–10	..	5–70	..
— *viridis*	..	..	..	..	..	+–17	2–25	..	..	..	..	+–25	..	+–33	+–4	..
— *violacea*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
— *olivacea*	14–50	..	..	..	..	..	+–13	..	..	..	..	+–25	+–2	..	+–20	..
— *sp.*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lepidocyrtus lanuginosus	..	..	..	..	..	..	..	..	..	..	..	..	..	+–11	..	..
Sminthurides malmgreni	..	..	..	..	..	..	..	..	..	..	..	+–13	2–18	..	1–12	..
Arrhopalites pygmaeus	..	..	..	..	..	..	+–13	..	..	..	..	..	..	..	+–3	..
Sminthurinus concolor	1–50	..	..	..	..	..	3–38	..	..	..	..	+–13	17–16	2–78	6–51	..
Xenylla humicola[2]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tetracanthella wahlgreni	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Isotoma minor	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Achorutes muscorum	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Proisotoma tenella	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Isotoma coeruleo-griseus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

	Franz Joseph Fjord Region										Scoresby Sound Region		Kangerdlugssuaq Region			
	fell-field I Ella Isl.	fell field II Ella Isl.	mx. *Chamaephyt* veg. I Ella Isl.	mx. *Chamaephyt* veg. II Ella Isl.	mx. *Chamaephyt* veg. III Ella Isl.	dry biotope Ella Isl.	dry biotope at Fimbul Ella Isl.	lagoon Ella Isl.	beach mound Ella Isl.	dry biotope Traill Isl.	mx. *Chamaephyt* veg. I Scoresby Sound	mx. *Chamaephyt* veg. II Scoresby Sound	moss Mikis Fjord	*Salix herbacea* veg. Mikis Fjord	*Empetrum* veg. Mikis Fjord	Lichen heath Mikis Fjord
Table No.	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
Number of samples	3	67	63	6	4	39	4	2	9	9	36	48	5	4	4	6
≡ wet biotope, ⊗ dry biotope	⊗	⊗	⊗	⊗	⊗	⊗	⊗			⊗	⊗	⊗	≡	⊗	⊗	⊗
Hypogastrura armata	1–33	1–7	1–27	3–33	21–50	1–28	..	..	..	1–11	2–50	2–42	+–20	+–25	2–75	2–67
— *viatica*	..	..	..	..	..	..	..	..	3–44	..	..	..	..	..	..	..
— *purpurascens*	..	..	..	..	..	..	..	..	..	..	2–31	+–2	..	..	..	..
— *sp.*	..	..	..	..	..	..	9–25	..	..	..	..	..	..	..	..	..
Willemia anophthalma	..	4–18	13–71	..	2–25	..	..	..	..	..	1–19	+–4	..	13–50	12–25	5–83
Friesea quinquespinosa	..	+–3	+–19	+–17	..	..	..	..	..	..	..	..	..	..	..	..
Anurida granaria[1]	..	..	..	..	..	..	..	..	..	..	2–31	..	..	..	..	..
Onychiurus groenlandicus	..	..	+–2	..	..	..	..	..	..	..	2–61	1–56	30–100	7–25	2–75	..
— *sibiricus*	14–67	19–49	31–84	9–100	8–75	26–74	..	..	7–11	35–100	..	..	..	..	..	..
— *armatus*	..	..	..	..	..	..	..	..	28–78	..	1–19	+–2	..	..	..	..
— *sp.*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tullbergia krausbaueri	..	..	..	..	1–25	..	..	..	..	..	1–6	+–19	..	..	..	..
Folsomia sexoculata	..	..	..	..	..	..	..	..	+–11	..	..	..	..	3–25	+–25	..
— *quadrioculata*	14–67	2–13	3–32	3–33	4–25	3–26	..	..	..	22–100	7–81	24–60	+–60	..	..	..
— *diplophthalma*	..	..	2–30	+–17	1–25	..	..	..	..	..	13–83	12–77	8–100	..	..	..
— *fimetaria*	..	5–25	22–78	36–100	32–75	..	..	..	12–22	..	..	+–6	..	..	19–50	5–83
Archisotoma besselsi	..	..	..	..	..	..	..	100–50	47–33	..	..	+–2	..	..	..	..
Isotoma sensibilis	..	1–7	1–24	5–100	4–25	1–18	35–50	..	..	1–33	6–81	1–48	18–100	4–100	+–75	4–100
— *bipunctata*	..	..	+–19	2–67	..	..	..	..	..	..	2–39	+–15	..	..	+–50	..
— *viridis*	..	4–27	+–17	2–17	..	+–3	..	..	+–11	..	+–6	..	..	..	..	..
— *violacea*	..	+–1	+–2	..	1–25	..	..	..	? 1–11	..	..	..	..	..	..	..
— *olivacea*	..	+–1	..	..	..	..	..	..	..	+–11	+–3	..	..	..	..	..
— *sp.*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lepidocyrtus lanuginosus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sminthurides malmgreni	..	..	+–2	..	..	+–3	..	..	..	..	+–14	..	..	..	..	..
Arrhopalites pygmaeus	..	..	..	..	..	..	..	..	..	..	+–3	..	..	..	..	..
Sminthurinus concolor	1–33	+–3	1–29	34–100	19–75	3–26	35–25	..	..	+–22	+–22	+–2	..	..	+–25	..
Xenylla humicola[2]	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tetracanthella wahlgreni	..	..	..	..	..	..	..	..	..	..	17–56	2–31	..	..	..	..
Isotoma minor	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6–75	..
Achorutes muscorum	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Proisotoma tenella	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Isotoma coeruleo-griseus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

	Southeast Coast															Upernavik Region		
	bog Atingat	moss Atingat	*Salix herbacea* veg. Atingat	Lichen heath Atingat	lake bank Angmagssalik	bog Angmagssalik	moss Angmagssalik	fell-field Angmagssalik	Lichen heath Angmagssalik	grassy slope Angmagssalik	*Salix herbacea* veg. Angmagssalik	grass *Salix* snow-bed Angmagssalik	moss Lindenow Fjord	wet rock Lindenow Fjord	dry biotope Lindenow Fjord	bog Upernavik	fell-field Upernavik	mx. *Chamaephyt* veg. Upernavik
Table No.	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
Number of samples	2	1	2	1	25	20	7	5	14	5	10	5	4	1	4	11	5	14
≡ wet biotope, ⊗ dry biotope	≡	≡	⊗	⊗	≡	≡	≡	⊗	⊗	⊗	⊗	⊗	≡	≡	⊗	≡	⊗	⊗
Hypogastrura armata	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4–27	..	1–36
— *viatica*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–9	..	..
— *purpurascens*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1–18	..	..
— *sp.*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–18	..	..
Willemia anophthalma	+–50	3–	1–50	..	..	..	..	5–100	{(6)[4] 3–79}	12–100	..	5–80	25–25	..	1–50	1–18	1–60	1–36
Friesea quinquespinosa	2–100	..	..	..	1–52	2–30	+–43	..	..	..	+–10	..	..	..	..	..	..	..
Anurida granaria[1]	..	..	..	..	..	..	..	..	..	..	..	..	2–25	..	..	+–9	..	..
Onychiurus groenlandicus	1–50	..	..	..	+–4	..	..	..	..	..	..	..	1–25	..	..	1–45	..	..
— *sibiricus*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
— *armatus*	..	..	..	..	2–88	1–35	1–86	..	..	..	..	..	+–25	..	+–25	..	..	..
— *sp.*	+–50	3–	1–50	1–	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tullbergia krausbaueri	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Folsomia sexoculata	+–50	..	..	..	2–44	..	..	..	..	..	..	..	..	..	..	..	..	..
— *quadrioculata*	18–100	3–	10–100	6–	12–100	16–70	10–100	31–100	{(÷) 51–100}	34–100	5–10	60–100	24–75	..	5–100	23–82	7–20	10–79
— *diplophthalma*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	+–9	+–20	..
— *fimetaria*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1–20	..
Archisotoma besselsi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Isotoma sensibilis	..	..	..	1–	..	..	..	..	{(+) +–7}	..	..	..	..	..	..	5–18	3–60	+–29
— *bipunctata*	4–50	20–	..	..	..	..	..	..	..	..	..	..	..	..	..	+–9	..	1–21
— *viridis*	+–100	..	..	..	5–68	1–65	1–86	..	{(+) +–14}	+–80	+–40	1–40	+–25	..	..	1–43	..	1–21
— *violacea*	..	..	1–50	..	2–48	+–15	1–86	..	{(2) 1–64}	9–100	..	..	..	..	1–75	..	..	+–21
— *olivacea*	..	..	..	..	..	..	..	..	..	..	..	..	+–25	..	..	..	..	{? +–7}
— *sp.*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1–9	..	..
Lepidocyrtus lanuginosus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sminthurides malmgreni	..	..	..	..	+–44	+–20	+–14	..	..	..	..	..	..	..	..	+–18	..	..
Arrhopalites pygmaeus	..	..	..	..	..	+–10	+–29	..	..	..	..	..	+–25	..	..	..	..	..
Sminthurinus concolor	..	..	..	..	..	..	+–14	..	{(+) +–7}	..	..	..	..	..	..	+–18	1–20	+–14
Xenylla humicola[2]	..	..	..	..	..	1–50	..	1–40	..	..	1–10	..	..	..	..	6–9	..	..
Tetracanthella wahlgreni	1–50	..	..	..	1–56	1–20	..	..	{(24) 12–100}	..	1–60	..	..	..	+–25	8–45	47–80	3–29
Isotoma minor	..	..	..	..	+–4	..	..	..	{(12) 6–43}	..	..	..	3–25	..	3–75	..	..	..
Achorutes muscorum	..	..	..	..	..	+–5	+–29	..	..	..	..	..	..	..	..	..	..	..
Proisotoma tenella	..	..	..	..	1–44	1–55	..	..	..	..	..	..	1–25	100–	..	..	..	..
Isotoma coeruleo-griseus	1–100	..	6–50	1–	+–4	..	..	..	{(26) 13–93}	..	+–10	5–100	..	..	..	..	..	2–14

[1]) *Anurida granaria* known from the Franz Joseph Fjord Region. [2]) *Xenylla humicola*, known from the Scoresby Sound Region. [3]) At biotopes with only 1 sample there are no constance numbers, e.g. bog, Ymer Isl. [4]) Explanation p. 85.

Anyhow, it does not seem as if there is any connection between the plant communities and the animal life.

From what has been stated above it is possible immediately to discern between wet and dry biotopes with their own special characteristic fauna elements. Whether a biotope may be wet or dry seems to be easy to decide while taking the samples; that which decides whether a biotope is to be considered as wet or not, however, is the humidity all the year round. It turns out (table 13—14) that only biotopes which do not dry up during summer (wet biotopes) have a fauna differing from the rest of the biotopes. Even apparently very wet biotopes, at least during snow-melting—e. g. snow beds that dry up late in summer—do not distinguish themselves more from the other "dry" biotopes as to their fauna than any of them do (table 13—14). This must be due to the humidity of the soil. Only in places where the water remains do such special conditions prevail: incomplete decay, perhaps a different degree of acidity, and a particular, lower vegetation consisting mainly of mosses and others, that one may expect to find singular species which have adapted themselves to these conditions. Such species constitute the animal community in wet biotopes, to which lake bank, bog and moss alone may be placed.

The *Platynothrus peltifer* and *Oribatula exilis* communities.

In the wet biotopes (lake bank, bog and moss), *Platynothrus peltifer* is the most characteristic oribatid and, on the whole, the most common animal, for which reason I have previously (Hammer 1937) called this community the *Platynothrus peltifer* community.

The *Platynothrus peltifer* community consists of the following elements in so far as the geographical distribution allows:

Character animal: *Platynothrus peltifer*[1]).

Frequently occurring: *Melanozetes ?mollicomus.*

Occurring now and then: *Trimalaconothrus novus.*
Heminothrus thori.
Oppia neerlandica.
Scheloribates pallidulus.
Edwardzetes edwardsii.
Xenylla humicola.
Friesea quinquespinosa.
Isotoma bipunctata.
— *viridis.*
Sminthurides malmgreni.
Sminthurinus concolor.

[1]) *Platynothrus peltifer* is sometimes replaced by its near relation *Platynothrus lapponicus* (moss in Mikis Fjord).

The animal community in the dry biotopes (fell-fields, lichen heath, *Salix herbacea* vegetation, grassy slope, grass *Salix* in snow bed, mixed *Chamaephyt* vegetation, *Empetrum* vegetation, and so on) I have previously (HAMMER 1937) called the *Oribatula exilis* community. As I remarked before, the *Oribatula exilis* is found in 63 per cent. of all samples taken in the dry biotopes, and in 19 per cent. of those taken in the wet ones, so that it does not appear directly that this mite is typical of the animal community in dry biotopes. However, if we examine in what numbers it occurs in wet and dry biotopes respectively, it will be seen that it is far more numerous in dry biotopes, which contain 94 per cent. of the entire number of individuals found. This great preponderance in number in certain of the biotopes signifies that the species finds optimum conditions of life. *An animal community is not characterised by the existence of certain species, but by the quantities in which the species occur.* HANDSCHIN (1924) says about this: "Es sind also nicht die qualitativen Unterschiede im Artbilde, welche die einzelnen ökologischen Kategorien characterisieren, sondern das konstante quantitative Auftreten bestimmter Species an analogen Örtlichkeiten."

The community consists of the following species, of which several are distributed everywhere.

Character animal: *Oribatula exilis.*

Frequent: *Calyptozetes sarekensis.*
Camisia horrida.

Occurring now and then: *Oppia quadricarinata.*
— *translamellata.*
— *ornata.*
Eremaeus oblongus.
Chamobates cuspidatus.
Iugoribates gracilis.
Ceratozetes thienemanni.
Hammeria groenlandica.
Trichoribates sp.
Mycobates sp.
Willemia anophthalma.
Tetracanthella wahlgreni.
Folsomia diplophthalma.
Isotoma minor.
— *coeruleo-griseus.*

The geographical distribution greatly restricts the number of the species occurring now and then in the various areas. *Hermannia reticulata* (216 in dry biotopes as against 8 in wet ones) apparently belongs to the dry biotopes; however, it has been found, especially in the Scoresby Sound and Upernavik areas and hardly ever in the dry biotopes in the other areas. The same is the case with *Ceratoppia bipilis* (95 as against 0). Undoubtedly special circumstances prevail as to these two species; perhaps they require a special nutrition, host plant or the like, for instance birch, on which *Ceratoppia bipilis* is often found.

Thus these two species cannot be included in the number of representatives of the dry animal communities.

The animal communities listed above are by no means sharply delimited but form smooth transitions, as very few species among oribatids as well as collemboles are strictly confined to definite biotopes; as a rule a species will always be found outside its own biotope but in steadily decreasing numbers, and the more sparsely distributed the farther it gets away from the place where it finds optimum conditions of life, and the greater the competition becomes with the species that belong to the biotope to which it has immigrated.

Within the *Platynothrus peltifer* and *Oribatula exilis* communities there are various gradations. Thus the fauna on lake banks must be considered as being the most typical *Platynothrus peltifer* community, as conditions here sometimes may be so extreme (poor), that only few species besides the characteristic animals can thrive and find optimum conditions of life. At some of the lake banks investigated on Ella Island no other *Oribatidae* were found than *Platynothus peltifer*. The fauna in bog and moss is much richer in species and constitutes a natural transition to the *Oribatula exilis* community, *via* the mixed *Chamaephyt* vegetation and so on to fell-field, which must be considered as the other extreme in the series of biotopes. Circumstances here too may be so extreme (dry and barren) that only some few species can occur numerously and with a wide distribution. The samples from fell-field are sometimes totally void of animal life (Oribatidae and Collembola).

If one attempts to distinguish between several animal communities within the *Platynothrus peltifer* and *Oribatula exilis* communities, the task proves to be very difficult. To be sure, some few species occur in one biotope and not in the others within one geographical region, but in another geographical region the species may be found in a biotope quite different from the first one (for instance *Folsomia sexoculata* on the shore of Ella Island, in dry biotopes in Mikis Fjord and upon lake banks at Angmagssalik). The reason for this discrepancy may be our very slight knowledge of the biology of these animals. Conditions of nutrition, together with humidity undoubtedly play the greatest rôle in the choice of biotopes; for this reason biotopes that seem widely different may nevertheless possess both the ingredients necessary to the existence of the species. On the other hand, the same type of vegetation (biotope) in various different geographical regions, may permanently harbour a certain species. One may, perhaps, be tempted to call the biotope in question an independent animal community, for instance the *Salix herbacea* vegetation in Mikis Fjord, at Atingat and at Angmagssalik, where the oribatid *Trichoribates sp.* has been found in great numbers and very widely distributed, while outside the *Salix herbacea* vegetation it has been found in small numbers only. Likewise for each biotope, though not quite so definitely, a species may be singled out as occurring there but only very sparsely or not at all in other biotopes. As an example I may mention the dry biotopes at Angmagssalik, of which fell-field contains *Oppia splendens*, grassy slope *Liebstadia similis*, grass *Salix* snow bed *Ceratozetes thienemanni*, and *Salix herbacea* vegetation *Trichoribates sp.* Lichen heath has no specific species. This species, which is peculiar to every biotope, is, however, no sufficient reason for saying that the biotope harbours an independent animal community. A comparison of the biotopes shows that all the wet and, respectively, all the dry biotopes within the same geographical region have most of the species in common and often in nearly the same numbers, so that, until we know more about the biology of these animals, it will be impossible to distinguish between more than the animal communities listed here. (See, however, the beach community p. 86.)

The *Platynothrus peltifer* community in various geographical regions.

A direct comparison of the two animal communities in various geographical regions is difficult, as the species characteristic of the communities are not all distributed over all the regions investigated. Of the characteristic animals and the frequently occurring species, *Platynothrus peltifer*, *Oribatula exilis*, *Camisia horrida* and *Calyptozetes sarekensis* are to be found everywhere, while *Melanozetes ?mollicomus* in East Greenland has not been found north of Mikis Fjord. All species occur in the investigated part of West Greenland. This means that the animal communities listed above are not composed of all the said representatives at the same time; they are really an agglomeration of all animal communities in wet or in dry biotopes in various geographical regions. In order to be able to compare them direct, all the biotopes in tables 13—14 have therefore been so arranged that the biotopes in the most northerly of the regions investigated have been put first, and within these the wet ones (marked with ≡) are placed before the dry ones (marked with ⊗). The species are likewise arranged geographically, so that the most northerly occurring species are put at the top of the list. However, the species within each area have been arranged in taxonomic sequence. The geographical regions are separated by vertical lines, whereas the horizontal lines delimit the species that are new in each of the geographical regions. The field at the top left thus contains all the species occurring in the region of Franz Joseph Fjord (Ella Island, etc.). In the other vertical field are the species which the region of Scoresby Sound has in common with the Franz Joseph Fjord region—likewise with the wet biotopes to the left. In the horizontal fields are seen the species contained in each region beyond the species it has in common with the previously named regions, and so on. The collemboles are arranged in the same manner. Now it is easier to compare the two animal communities in the various geographical regions.

In the Franz Joseph Fjord region the *Platynothrus peltifer* community has been found on Ella Island on the banks of several lakes (Langsø, Rundsø, Ulvesø, Bjørnesø and Hvalpesø) and in the bog at the same place. In its purest form it occurs at Langsø, Ella Island, lake bank I, where the characteristic animal *Platynothrus peltifer* is dominant to such a degree that it constitutes 88 per cent. of the entire microfauna, on an average 1013 individuals per sample (table 29); no other oribatid constitutes as much as 1 per cent. of the community, which means that the life conditions are so favourable for *Platynothrus peltifer* that the consequent reproduction out-rivals all the other species for which the ecological conditions are less favourable. Of collemboles only two species, *Onychiurus sibiricus* and *Folsomia quadrioculata*, thrive under these conditions. Both are found everywhere within this region.

In slightly different shape this community is known from lake bank II (table 30), which, as previously mentioned, comprises samples both from the banks of Langsø and from other lake banks on Ella Island (p. 32). Curiously enough, here *Platynothrus peltifer* occurs very sparsely, on an average 1 individual per sample; indeed, it is completely lacking at certain lake banks (Ulvesø, Rundsø), while at others (Langsø, Hvalpesø) it is the only mite existing. On the banks of Langsø (inside lake bank II) it nevertheless constitutes only 7 per cent. of the community; the low average number is not due to the fact that the average has been calculated on the basis of all samples from the whole year, whereas lake bank I is represented only by summer samples; the average number of the samples from the summer period is not higher. On the whole, the fauna on lake bank II is very scanty, especially as to *Oribatidae*. Whether or not this is due to the fauna having changed considerably in the eighteen months that have lapsed since lake bank I was investigated, it is impossible to say, but it is not very probable; it is more likely that the samples from lake bank II were taken from a practically barren spot on the bank. The samples from Langsø, lake bank I and lake bank II, were all taken at the same place on the bank.

As is the case with lake bank I, the collemboles *Onychiurus sibiricus* and *Folsomia quadrioculata* together with *Sminthurides malmgreni* and

Sminthurinus concolor are the only ones of any importance; *Sminthurides malmgreni* alone is decidedly characteristic of wet biotopes. Of other animals of the *Platynothrus peltifer* community mention must be made of the oribatids *Heminothrus thori* and *Scheloribates pallidulus*, of which the former, on bog I and Suess Land makes up for *Platynothrus peltifer*, with which, however, it may be found side by side as on lake bank I—II and bog II. *Heminothrus thori* and *Scheloribates pallidulus* are geographically limited to the area of Franz Joseph Fjord.

In the Scoresby Sound region the *Platynothrus peltifer* community is not known at all. Perhaps this is due to the fact that no investigations have ever been made in really wet biotopes, where experience shows that this community often occurs. All the same, the characteristic animal, *Platynothrus peltifer*, is not known in the Scoresby Sound region.

Nor has the *Platynothrus peltifer* community proper been found in the Kangerdlugssuaq region. As in the Scoresby Sound region the reason must be that no investigations have been made in suitable biotopes, for the characteristic animal *Platynothrus peltifer* as well as *Melanozetes ?mollicomus* have been found within this region. Here the wet biotope is represented by wet, luxuriant moss at a small rivulet. Here the *Platynothrus lapponicus*, which is closely related to *Platynothrus peltifer*, was found in such great numbers that it constituted 19 per cent. of the total fauna. This oribatid has never been found north of Mikis Fjord, but it lives in more southerly regions together with *Pl. peltifer*. None of the other oribatids that are characteristic of the *Platynothrus peltifer* community have been observed here in any quantity; *Melanozetes ?mollicomus* constitutes less than 1 per cent. of the fauna. On the whole it seems as if the fauna in Mikis Fjord in many respects is different from that of the rest of Greenland, perhaps especially as regards the collemboles. The ubiquitous *Folsomia quadrioculata* also lives in moss at Mikis Fjord, but it is very scanty and does not reach a dominance number of 1; its place is taken by *Folsomia diplophthalma*, which together with *Isotoma sensibilis* and *Onychiurus groenlandicus* constitutes 56 per cent. of the total fauna. Of these, *Onychiurus groenlandicus* is especially numerous.

On the Southeast Coast *Platynothrus peltifer* everywhere forms a very great part of the whole fauna in the wet biotopes (35, 45, 42, 8 and 22 per cent.) and is also very widely spread in the individual biotopes (constance numbers: 100, 92, 100, 100 and 75). These numbers say nothing about the individual density, which is best seen from the average number of *Platynothrus peltifer* per sample (211, 113[1]), 196[1]), 50 and 43). From

[1]) In HAMMER 1937 these numbers are 174 and 253 respectively, calculated as the average of 15 samples, while in this investigation they have been calculated from all the samples.

this it will be seen that *Platynothrus peltifer* is frequent everywhere on the southeast coast and in relatively large numbers in all wet biotopes. The other oribatid, *Melanozetes ?mollicomus*, which is frequent in the community, lives everywhere together with *Pl. peltifer*, but never in such large numbers; on lake bank and in bogs at Angmagssalik it constitutes 9 and 8 per cent. respectively of the total fauna; in the other wet biotopes it is very scarce (dominance numbers 1, 1 and 1) and also in moss, Atingat, 11, where the number of samples per biotope is so small that too much importance must not be ascribed to the numbers (table 51). As previously mentioned, this species, which has a special liking for wet moss, is also found in small numbers in other biotopes. On the southeast coast 3 species are found in the *Platynothrus peltifer* community: *Trimalaconothrus novus*, *T. foveolatus* and *Edwardzetes edwardsii*, of which the first two are decidedly hygrophil. According to Sellnick (1921) *Trimalaconothrus novus* will perish after a short time, if it be taken away from its habitat (*Sphagnum*) and from other mosses in the bog. On the east coast *Edwardzetes edwardsii* is limited to this area. *Trimalaconothrus novus* is profuse and common in bogs at Angmagssalik, while *Trimalaconothrus foveolatus* has been found in moss in Lindenow Fjord, but only in small numbers. Apparently *Trimalaconothrus foveolatus* has a southerly distribution in Greenland, as it has also been found in the southernmost part of West Greenland. *Edwardzetes edwardsii* is most numerous in wet moss (*Sphagnum*) at Angmagssalik. In moss at Atingat the dominance number is 9, but as there is only one sample from here, the figure is misleading (table 51). This species never occurs in any great quantity, and therefore it rarely attains a dominance number of 1 and thus it is not one of those species that make themselves conspicuous by their multitude. On the other hand, it is one of the species that are rather strictly associated with certain biotopes. From the table 13 it will be seen that besides in mosses, it has been found at Angmagssalik on lake bank, in bog and on grassy slope, and also in bog and moss at Atingat.

Among those of the collemboles that prefer much humidity are *Xenylla humicola*, *Friesea quinquespinosa*, *Onychiurus groenlandicus*, *O. armatus* and *Isotoma bipunctata*, all of which also occur in the more northernly regions; to these we must add *Proisotoma tenella*, which on the east coast is confined to this region. It is rarely found in great numbers or widely distributed. Still, of *Proisotoma tenella* 1796 individuals were found in Lindenow Fjord (dominance number 100) in a special biotope: wet rock with growth of short, dense, black, wet moss. With the most favourable ecological conditions of life it had ousted all the other species, so that all the rest of the fauna consisted merely of 1 *Oppia translamellata* and 1 *Tectocepheus velatus*. Here, as almost everywhere in Greenland, *Folsomia quadrioculata* is the most frequently occurring collembole.

In the Upernavik region on the west coast there is a *Platynothrus peltifer* community which, by the occurrence of the characteristic animal *Platynothrus peltifer* and of *Melanozetes ?mollicomus*, is very like the corresponding community on the southeast coast. These two species, however, occur only very scantily and with low constance numbers. Of the other *Oribatidae* that are characteristic of the *Platynothrus peltifer* community of the southeast coast, namely the *Platynothrus lapponicus*, *Trimalaconothrus novus* and *Edwardzetes edwardsii*, only the first occurs in the Upernavik region, where only one individual has been found. In the Upernavik region, however, another apparently hygrophil species is found, viz. *Oromurcia lucens*, which, like *Edwardzetes edwardsii*, never occurs in great numbers and is therefore not immediately observed. Of those collemboles that are specially fond of wet biotopes there are *Onychiurus groenlandicus* and *Xenylla humicola*, neither of them very numerous, and both only slightly distributed. On the whole, the collembole fauna is rather poor, always excepting *Folsomia quadrioculata*, which as elsewhere occurs in large numbers and almost everywhere.

The other part of the west coast has not been subjected to similarly thorough investigations, with several Berlese samples from each biotope for the purpose of elucidating the composition of the fauna. However, there is a series of Berlese samples of casual sizes, most of which have been taken in "moist" material; unfortunately they are not from decidedly characteristic lake bank or bog, but in moist moss, in *Sphagnum*, under birches and the like, thus comprising probably dry as well as wet biotopes, so that one cannot expect to find any typical or pure *Platynothrus peltifer* community here. These samples were all taken in the Disco Fjord region and in the region from Godthaab to the southern point of Greenland (the Godthaab-Julianehaab area), only 1 from each locality or 1 from each biotope in the same locality (fig. 2 and p. 22), so that there can be no question of constance numbers for the species in question within the biotope. Thus a comparison of these samples with the *Platynothrus peltifer* community in other parts of Greenland will merely establish the presence or the absence of the species that ar characteristic of the community, and which of these species are the more numerous.

In the Disco Fjord region and in the Godthaab-Julianehaab region there will presumably be a *Platynothrus peltifer* community which in many ways resembles that of the southeast coast. From the tables 15—16, in which all the samples from these regions are recorded, it will be seen that *Platynothrus peltifer* and *Melanozetes ?mollicomus* are the oribatid species most often occurring in the samples; the latter, moreover, is sometimes found in rather large numbers. Besides these two common species we find in the Godthaab-Julianehaab region the oribatids: *Platynothrus lapponicus*, *Trimalaconothrus foveolatus* and *Edwardzetes edwardsii*, which occur here and there in the *Platynothrus peltifer* community of the southeast coast, but only sporadically. Of these, *Platynothrus lapponicus* is also found in the Disco Fjord region; there we also know *Oromurcia lucens*, which otherwise has been found only in the Upernavik region and in the Scoresby Sound region. Besides the *Oribatidae* hitherto mentioned, both regions contain a large number of species which are completely unknown in East Greenland (see under the heading Geographical Distribution), and some species which are not characteristic of the biotopes that are the habitat of *Platynothrus peltifer*. Thus the samples taken from moist biotopes in the Disco Fjord region and in the Godthaab-Julianehaab region cannot be said to harbour a typical *Platynothrus peltifer* community. Nor can the collembole fauna (table 16) be said to be typical of the *Platynothrus peltifer* community or even to resemble the composition which within this community has been found in the other parts of Greenland. Several species which have never been met with in the *Platynothrus peltifer* community in other places, or only sparsely, occur here in great numbers; for instance in the Disco Fjord region we find *Hypogastrura viatica*, otherwise mostly found on beaches; in the Godthaab-Julianehaab region *Achorutes muscorum*, and in both regions *Folsomia sexoculata*. Of these, *Achorutes muscorum* and *Folsomia sexoculata* must be presumed to belong to this community; both are also known on the southeast coast, where they were found in bog and moss respectively (Angmagssalik), and in bog (Atingat) as well as on lake bank (Angmagssalik), but only some few individuals or at least only in small quantities. *Folsomia sexoculata* is also met with in dry biotopes, however, among other places in Mikis Fjord, and is often observed on the beach (p. 88).

All in all, the fauna in the moist biotopes in the Godthaab-Julianehaab region resembles mostly the *Platynothrus peltifer* community on the southeast coast, while in the Disco Fjord region it mostly resembles the fauna in the Upernavik region.

The *Oribatula exilis* community in various geographical regions.

This community, whose most characteristic members are the *Oribatidae: Oribatula exilis*, *Calyptozetes sarekensis* and *Camisia horrida*, is very widely dispersed all over Greenland and of almost the same composition, as these three species all occur throughout the whole of explored Greenland.

In the Franz Joseph Fjord region *Oribatula exilis*, as everywhere, is the most numerous and most widely distributed oribatid. Nevertheless it nowhere constitutes more than 45 per cent. of the total fauna. On the whole, no oribatid in this community dominates to the

Table 15. The occurrence of the *Oribatidae* on the biotopes

Species	Disco Fjord Region					
	Såtut 1935 moist	Nûgssuaq $^{5}/_{9}$ 1935 moist	Qaersut ?/$_{9}$ 1935 moist	Ikerasak 1935 very moist moss	Hekestak $^{6}/_{9}$ 1935 moist	Jakobshavn ?/$_{9}$ 1935 moist thick moss
Brachychthonius laetepictus	..	10	..	..	no oribatids	c.10
Trhypochthonius tectorum	..	..	..	..		1
Trimalaconothrus foveolatus	..	..	..	..		..
Camisia horrida	..	..	..	..		2
Nothrus borussicus	..	..	..	..		1
Platynothrus peltifer	6	..	..	..		..
— *capillatus*	..	..	..	..		16
— *lapponicus*	..	..	..	..		..
Heminothrus paolianus	..	12	..	..		..
Hermannia reticulata	..	..	..	..		1
— *scabra*	..	..	..	..		..
Belba tatrica	..	..	..	..		..
— *tenuipes*	..	..	..	..		..
— *gracilipes*	..	..	..	..		..
Suctobella subtrigona	..	..	..	..		..
Oppia quadricarinata	..	6	..	..		20
— *neerlandica*	..	..	..	..		25
— *translamellata*	..	..	..	..		10
— *ornata*	..	40	..	..		..
Hydrozetes confervae	..	..	..	..		..
Ceratoppia bipilis v. *sph.*	..	..	..	..		..
Tectocepheus velatus	..	18	..	..		58
Carabodes labyrinthicus	..	..	..	..		..
Liebstadia similis	..	..	..	..		..
Oribatula exilis	..	23	..	..		..
Edwardzetes edwardsii	..	..	..	..		..
Chamobates cuspidatus	..	..	..	..		..
Ceratozetes thienemanni	..	..	..	..		..
Melanozetes ?mollicomus	..	2	1	..		20
Trichoribates trimaculatus	..	11	2	..		..
— *sp.*	..	1	..	..		..
Oromurcia lucens	..	..	..	20		..
Calyptozetes sarekensis	..	..	..	..		..
Mycobates sp.	..	2	..	..		1
Notaspis punctatus	..	..	..	..		..
Pelops sp.	..	3	..	..		..
Hoploderma striculum	..	..	..	..		..
Phthiracarus piger	..	..	..	..		..

+ Not counted because of a technical mishap whereby the animals were made unrecognisable after the identification.

in the Disco Fjord and Godthaab-Julianehaab Regions.

				Godthaab-Julianehaab Region								
Eqe $^{18}/_{9}$ 1935 moist	Claushavn ?/$_{9}$ 1935 moist	Akúnâq $^{18}/_{9}$ 1935 moist	Hunde Eyland $^{9}/_{7}$ 1935 bog with moss and grass	Kapisigdlit $^{3}/_{6}$ 1933 moist moss, *Empetrum and Salix*	Kapisigdlit $^{3}/_{6}$ 1933 Grass and *Salix*	Kobbefjord $^{7}/_{7}$ 1934 moist	Grædefjord $^{10}/_{7}$ 1933 Sphagnum	Kvanefjord $^{29}/_{7}$ 1939 moist moss, lichens	Torssukátak $^{28}/_{7}$ 1934 wet moss, lichens	Ûnartoq 1934 hot spring with moss	Qíngua $^{5}/_{9}$ 1934 *Sphagnum*	Qíngua $^{26}/_{8}$ 1934 beneath 7 m high birch trees
4	25	..		+	7	..	10	..	..	..		..
..	..	..		1	..	..	..	..	..	..		..
..	..	..		..	..	..	..	..	..	+		..
..	..	..		..	..	..	..	..	..	..		..
..	..	..		+	1	..	..	45	2	..		1
..	7	34		+	75	21	28	22	..	..		..
..	..	..		..	15	1	..	..	..	..		..
5	..	..		..	..	7	..	..	..	..		..
..	..	..		+	..	..	..	..	..	..		..
..	..	..		+	..	..	..	10	6	..		..
..	..	..		..	..	..	..	2	..	..		..
..	..	..		+	..	..	..	10	..	..		..
..	..	..		..	..	..	..	5	..	..		..
..	..	..		..	..	..	..	..	..	..		1
..	..	..		+	..	c. 60	..	..	..	..		..
..	..	..	no oribatids	..	..	c. 10	..	..	..	..	no oribatids	..
..	..	..		+	130	c. 15	..	..	} c. 200	12		..
..	..	..		..	..	c. 15	c. 300	c. 500		..		..
..	..	..		+	..	..	..	..	c. 40	..		..
..	5	2		..	..	..	..	..	..	..		..
..	..	..		+	..	..	..	1	..	..		..
..	..	..		+	2	..	..	..	34	..		..
..	..	..		+	3	..	..	..	..	..		..
..	..	..		..	..	..	32	34	..	..		1
..	..	..		+	..	1	..	..	..	..		1
..	..	..		..	..	..	..	..	..	..		2
..	..	..		..	..	..	..	13	..	..		..
..	..	..		+	..	11	..	..	..	..		1
..	20	25		+	16	5	..	..	c. 200	..		1
..	..	..		..	4	..	..	..	..	..		..
..	..	..		..	..	..	..	..	..	..		..
..	3	..		..	..	..	..	..	..	..		..
..	..	..		+	1	3	..	..	..	..		..
..	..	..		+	..	..	..	8	14	..		..
..	..	..		..	..	..	..	..	..	5		..
..	..	..		..	..	..	3	1	..	..		..
..	..	..		..	..	..	..	..	..	4		..
..	..	..		..	..	..	..	..	..	..		1

Table 16. The occurrence of the *Collembola* in

Species	Disco Fjord Region					
	Såtut 1935 moist	Nûgssuaq 5/9 1935 moist	Qaersut ?/9 1935 moist	Ikerasak 1935 very wet moss	Hekestak 6/9 1935 moist	Jacobshavn ?/9 1935 moist thick moss
Hypogastrura armata	..	25	..	..	..	8
— *viatica*	198	..	140	c. 450	11	..
— *purpurascens*	..	..	..	..	..	8
Xenylla humicola	..	..	..	..	..	..
Willemia anophthalma	..	4	..	20	1	20
Friesea quinquespinosa	..	..	..	..	..	..
Achorutes muscorum	..	..	..	..	..	..
Onychiurus groenlandicus	..	..	1	c. 100	..	..
— *armatus*	..	6	..	..	..	4
Tullbergia krausbaueri	..	..	c. 110	..	..	..
Tetracanthella wahlgreni	..	2	..	..	..	120
Folsomia sexoculata	..	..	..	c. 1700	..	..
— *quadrioculata*	..	c. 50	c. 10	..	..	c. 75
— *fimetaria*	..	..	c. 10	..	..	..
Isotoma coeruleo-griseus	..	..	..	..	..	c. 200
— *bipunctata*	..	25	..	..	..	..
— *viridis*	..	..	..	..	..	..
— *violacea*	..	9	..	..	..	1
— *olivacea*	..	..	..	..	..	..
Lepidocyrtus cyaneus	..	..	..	..	..	..
Sminthurides malmgreni	1	5	..	..	..	..
Sminthurinus concolor	..	2	..	c. 20	..	..

same degree as does *Platynothrus peltifer* for instance upon lake bank I, Ella Island (table 29). This is due to the fact that the dry biotopes offer favourable life conditions to many more species and thus the number of species becomes far greater than, for instance, on lake bank, where the conditions exclude every other species than just the characteristic animals.

Tectocepheus velatus and *Trichoribates trimaculatus*, both very numerous, are, as previously mentioned, equally common in wet and dry biotopes and are therefore always omitted when the question arises as to what species are characteristic of one or another community. From table 12 will be seen, moreover, that these two species occur in about the same number in wet and in dry biotopes. *Camisia horrida* is the Disco Fjord and Godthaab-Julianehaab regions.

				Godthaab-Julianehaab Region								
Eqe 16/9 1935 moist	Qlaushavn ?/9 1935 moist	Akúnâq 18/9 1935 moist	Hunde Eyland 9/7 1935 bog with moss and grass	Kapisigdlit 3/6 1933 moss, moist *Empetrum* and *Salix*	Kapisigdlit 3/6 1933 grass, *Salix*, moss, moist	Kobbefjord 7/7 1934 moist	Grædefjord 10/7 1933 *Sphagnum*	Kvanefjord 29/7 1939 lichens, moss, moist	Torssukátaq 26/7 1934 lichens, moss, wet	Ûnartoq 1934 hot spring with moss	Qíngua 5/9 1934 *Sphagnum*	Qíngua 28/8 1934 beneath 7 m high birch trees
..	15	..	..	..	..	..	..		..	c. 50	..	
..	..	25	330	..	..	..	..		..	..	..	
..	..	..	..	6	..	..	66		4	50	..	
2	..	..	..	..	..	..	..		..	..	..	
1	..	..	..	25	..	..	..		..	..	..	
..	..	..	..	4	..	..	..		..	..	..	
..	..	..	..	10	..	..	..		c. 220	..	..	
..	8	..	..	5	..	..	..		..	..	..	
..	..	..	..	..	..	..	5		..	..	..	
..	..	..	..	..	..	..	..	no collemboles	..	..	..	no collemboles
..	..	..	..	28	1	..	..		24	..	..	
..	190	..	56	..	..	..	..		10	..	..	
142	..	..	..	c. 100	5	1	24		6	..	8	
..	..	..	..	..	..	..	..		..	..	..	
..	..	..	..	..	..	..	35		..	..	..	
..	..	..	..	..	..	..	..		..	..	..	
..	..	..	..	..	..	..	..		c. 300	..	..	
..	..	..	..	70	8	..	..		..	..	..	
..	..	..	..	..	..	..	18		c. 300	..	..	
..	..	..	..	6	..	..	..		..	..	..	
9	..	..	..	..	..	..	..		..	..	..	
..	5	..	..	..	..	..	..		..	..	..	

found in some of the biotopes, but always in small numbers and often with only slight distribution. Less common are *Trhypochthonius tectorum*, *Oppia quadricarinata*, *Oppia translamellata*, *Iugoribates gracilis* and *Trichoribates sp.*, all of which occur mostly in dry biotopes. Besides the above species there are some which, like *Tectocepheus velatus* and *Trichoribates trimaculatus*, occur nearly everywhere and apparently with the same liking for all biotopes. One of these species is *Brachychthonius brevis*, which may sometimes occur in fairly large numbers. Here *Oppia neerlandica* apparently prefers the dry biotopes, but in other regions it is found, with equally high dominance and constance numbers, in wet biotopes; for instance, it is common in wet biotopes on the southeast coast and, according to table 12, it is most numerous in wet biotopes.

In the *Oribatula exilis* community there is a whole series of *Collembola* of which really only *Willemia anophthalma* and *Folsomia diplophthalma* are most frequent in dry biotopes. All the other species are apparently equally common everywhere. On the whole, the collemboles in Greenland do not seem to prefer, like many oribatids, certain biotopes according to their water content and the factors dependent on that content (p. 68). To most of the collemboles the humidity seems everywhere to be sufficient, so that it looks as if this factor were no obstacle to their dispersion over all the biotopes.

All the samples from the Scoresby Sound region were taken in mixed *Chamaephyte* vegetation I—II, of which I apparently was taken in snow bed and shows a more moist character than II (p. 34). The moist character is most conspicuous when the time of the breeding season in the quite dry and the moist biotopes respectively is taken into consideration (figs. 31—34). In the composition of the species there is nothing that indicates a moist or wet ground. This tallies with what was said above, namely, that only biotopes with permanent water have a fauna different from that of the other biotopes.

All the *Oribatidae* characteristic of the community occur here, though all are most numerous in the driest biotope, mixed *Chamaephyte* vegetation II (table 45). *Oppia translamellata* is frequent everywhere. Of collemboles belonging to this community there are *Folsomia diplophthalma* and *Willemia anophthalma*, though the latter occurs only in small numbers and with little dispersion. *Tullbergia krausbaueri* has been found in both biotopes; outside the Scoresby Sound region this species has been found only some few times. *Tetracanthella wahlgreni* has also been found in both biotopes and in great numbers. The *Oribatula exilis* community must be said to be well represented in the Scoresby Sound region.

In the Kangerdlugssuaq region there is a typical *Oribatula exilis* community with all three characteristic oribatids, together with a number of species, *Oppia quadricarinata*, *Trichoribates sp.* and *Chamobates cuspidatus*, which prefer dry biotopes. Of these, *Chamobates cuspidatus* has not been found north of this region. Besides, there is reason to mention *Nothrus borussicus*, which constitutes a great part of the fauna, whereas it is rarely found in very large numbers in the other regions of Greenland. The collembole fauna in Mikis Fjord distinguishes itself from the collembole fauna in the rest of Greenland in that *Folsomia quadrioculata* is completely lacking in this community. In its stead, the *Folsomia fimetaria* occurs in the dry biotopes. *Willemia anophthalma* constitutes a great part of the fauna in all the dry biotopes.

On the Southeast Coast the *Oribatula exilis* community becomes still richer in species by being augmented by more southerly species such as *Ceratozetes thienemanni* and *Mycobates sp.* and by retaining nearly all the species that are typical of this community in more northerly regions. *Oribatula exilis* is found in nearly all biotopes in large numbers and widely distributed; *Calyptozetes sarekensis* is likewise numerous in many biotopes. *Camisia horrida*, as always, occurs in small numbers and only in some of the biotopes. The other species, *Oppia ornata*, *Trichoribates sp.*, *Chamobates cuspidatus*, *Ceratozetes thienemanni* and *Mycobates sp.* which are mostly found in dry biotopes, occur only in some of the biotopes, sometimes only in one which appears to be more advantageous to the species in question than the others. Thus *Trichoribates sp.* on *Salix herbacea* vegetation at Angmagssalik constitutes 19 per cent. of the fauna, and in the same vegetation type at Atingat 1 per cent. In Mikis Fjord (2 per cent.) it has likewise been found only upon this vegetation type, which probably has a set of definite plants (mosses, lichens or fungi) on which *Trichoribates sp.* preferably lives.

The collembole fauna in the *Oribatula exilis* community is much poorer in species with a dominance number of 1 and over than in the *Platynothrus peltifer* community. Of collemboles most often found in dry vegetation types, *Willemia anophthalma* is present nearly everywhere, but only upon grassy slope does it constitute a considerable part of the fauna. The distribution is often rather wide. The collembole most frequent in the *Oribatula exilis* community is *Folsomia quadriloculata*, which occurs here in great multitudes; of all the samples examined it was found in 50 per cent. of the dry and in 60 per cent of the wet, which means that the distribution is greatest in the wet, but it occurs more numerously in the dry biotopes (20756 as against 5392, table 12). On lichen heath at Angmagssalik it constitutes 51 per cent. of the total fauna, and its occurring in such multitudes (on an average 1052 per sample, the highest number in one sample being 4505 specimens) entails that all other species virtually disappear from the fauna list. Besides the usual calculation of the dominance numbers I have therefore here (tables 58 and 14) made still another calculation of the dominance number of the species, but this time by excluding *Folsomia quadrioculata* (marked by a ÷ in parentheses above the dominance number. The recalculated dominance numbers of the other species are likewise placed in parentheses above the original one). In this manner, several species which are found in comparatively large numbers acquire a dominance number of 1 and over, whereas otherwise they almost disappear from the fauna list, for instance the *Oribatidae Camisia horrida*, *Camobates cuspidatus* and *Mycobates sp.* This second calculation of the dominance number does not effect the collembole composition, as all the collembole species on lichen heath are either very numerous or occur only in a few individuals. Presumably this abundance of animals (19 species of

Oribatidae and 9 *Collembola* species as against for instance 8 species of *Oribatidae* and 3 species of *Collembola* on fell-field (see table 57)) is likewise due to the vegetation conditions.

The *Oribatula exilis* community in the Upernivik region does not differ very much from the fauna of the same community in other places in Greenland. All three characteristic *Oribatidae* occur, even if *Oribatula exilis* is the only one found in large numbers. The small number of animals in the samples may possibly be due to a less efficacious expulsion technique. *Camisia horrida* and *Calyptozetes sarekensis* have nowhere a dominance number higher than 1, and only *Camisia horrida* is fairly widely distributed. The Upernavik region has *Oppia quadricarinata* in common with the east coast. Besides, there are two species, viz. *Eremaeus oblongus* and *Hammeria groenlandica*, which have been found only in this region and only in the dry biotopes.

As to the collembole fauna it also does not differ very much from what is found in this community in the other regions investigated. *Willemia anophthalma* is found in both the biotopes investigated, fell-field and mixed *Chamaephyte* vegetation, but it constitutes only 1 per cent. of the total fauna and is not everywhere dispersed in the biotopes. *Tetracanthella wahlgreni* is the most numerous collembole and also the most widely distributed. *Isotoma coeruleo-griseus* is found here as on the southeast coast.

In the Disco Fjord and Godthaab-Julianehaab regions no investigations have been made of the really dry biotopes. Presumably some of the samples shown in tables 15—16 must be considered as dry biotopes, despite the designation "moist". To judge from what we know of the fauna in these areas there is an *Oribatula exilis* community with all three characteristic *Oribatidae* together with a multitude of other species, of which most are also found on the southeast coast. Thus this community resembles in some degree that of the southeast coast, which was also the case with the *Platynothrus peltifer* community.

The beach community:

The *Ameronothrus lineatus-Archisotoma besselsi* community.

Besides the two animal communities already described, brief mention must be made of the fauna occurring in the outermost part of the shore. MADSEN (1936) thoroughly investigated this special animal life in the Franz Joseph Fjord and Scoresby Sound regions and found that the oribatid *Ameronothrus lineatus* and the collembole *Archisotoma besselsi* are strictly confined to the coast. In some samples from Ella Island (JØRGENSEN 1934 a), which were taken beneath beached sea weed and in lagoons, these two littoral forms were found in rather large numbers (in 4 samples of $^1/_{200}$ m^2 there were respectively 23 *Archisotoma besselsi* plus 1 *Sminthurinus sp.* beneath beached sea weed, 8 *Archisotoma besselsi*, about 110 *Ameronothrus lineatus* and about 40 *Ameronothrus lineatus* in lagoons). Madsen also mentions *Hypogastrura viatica* and *Folsomia sexoculata*, of which the former most often was found on the beach, while *Folsomia sexoculata* also may be found in moist biotopes outside the coastal area proper.

Still another series of various species may be found on the beach. Madsen also mentions the *Oribatidae Tectocepheus velatus* and *Trichoribates trimaculatus*[1]) and the collemboles *Hypogastrura armata*, (mistakenly identified as *H. longispina*), *Xenylla humicola* (mistakenly identified as *X. mucronata*), *Onychiurus groenlandicus*, *Folsomia quadrioculata*, *Isotoma sensibilis* and *Sminthurides malmgreni*. None of these are exclusively associated with the coastal zone, even if they may be found here now and then, and several are often found here in rather large numbers. This is the case with *Hypogastrura armata* and *Xenylla humicola*. *Hypogastrura armata f. principalis* has in Finland been found on the beach beneath decaying *Fucus*, and *Xenylla humicola f. principalis* is distributed all over Finland but is only frequent at the beach, where it prefers to be under the seaweed (Linnaniemi 1912).

This tallies very well with the later investigations of lagoons and beach mounds at Ella Island (tables 41—42). *Oribatidae* are almost completely absent; only one *Belba* nymph was found, and presumably it does not belong to this special biotope. The most numerous collembole, *Archisotoma besselsi*, on the beach mound, has a dominance number of 47, while the constance number is only 33. This is probably due to the very unfavourable conditions under which these animals live. The beach mound consists of stones and decaying algae (*Fucus*), and only in patches with decaying vegetable matter can these animals find food. In lagoons the nutrition conditions are better, but presumably also more special. In the two lagoon samples examined (table 41) only the collembole *Archisotoma besselsi* was found; the lagoon, however, is also the habitat of the oribatid *Ameronothrus lineatus*.

Apparently it is only where the tidal water frequently floods the biotope that the fauna is as special as in the above mentioned samples from lagoons and beach mounds (beached seaweed). Under the special conditions thus arising, some few species may attain to a considerable abundance in individuals. In one of the biotopes investigated, namely the *Puccinellia phryganodes* shore meadow in the Scoresby Sound region

[1]) Halbert (1920) likewise mentions *Trichoribates trimaculatus* (*Oribata setosa*) from the beach. In Ireland he also found *Oribatula similis*, *Scutovertex* (= *Ameronothrus*) *maculatus*, *Hermannia scabra* and *H. reticulata* at places immersed at high tide.

(fig. 20), which is flooded at normal high tide, the oribatid *Ameronothrus lineatus* reached a very considerable number of individuals, about 2060 (MADSEN 1936) being found upon $^1/_{100}$ m^2. Presumably these teeming multitudes have to live on *Cyanophyceae*, which in this biotope forms extensive, folded coverings. According to THORELL (1872), larvae and nymphs winter in the dead bodies of the mother individuals (after SIG THOR 1931). The latter probably adhere to the substratum by means of their claws, or they are held fast by the vegetation. During all spring this biotope is washed by the meltwater, which, however, does not remove the layer of algae where the *Oribatidae* presumably live.

In the Northwest Territories of Arctic Canada colonies of *Ameronothrus lineatus* were found near the coast in recesses on the underside of flat stones (BANKS 1919). SIG THOR (1930) found *Ameronothrus lineatus* in moss and lichen upon Bear Island (how far from the beach was not stated). SUMMERHAYES and ELTON (1923) mention a bird cliff at Spitzbergen, on the rocky sides of which were great masses of *Enteromorpha sp.*, in which was a rich fauna of *Rotifera*, *Tardigrada*, *Nematoda*, *Protozoa* and of *Ameronothrus lineatus*. As the fauna mentioned was found in *Enteromorpha*, it must have been very near the sea, probably within the reach of the tidal water or the surge of the waves.

The elements of the beach community must be designated as highly specialized. *Ameronothrus lineatus* is almost the only inhabitant of lagoons, although the collembole *Archisotoma besselsi* is sometimes found as well, but in no large numbers. On the other hand, in France *Archisotoma besselsi* was found in thousands on the silt in patches where the mud, which was perforated by stems of *Nereis diversicolor,* was covered with a short, dense "greensward" of the green alga *Vaucheria*, on which the *Archisotoma besselsi* feeds (WILLEM 1925). From Spitzbergen CARPENTER and PHILLIPS (1922) write about the places where the *Archisotoma besselsi* is found: "in large numbers among the decaying seaweed on shingle shore, inner side of Richard Lagoon", "sixteen specimens on surface of tidal pools", "belonging essentially to the tide-mark fauna." SUMMERHAYES and ELTON (1928) found *Archisotoma besselsi* together with *Hypogastrura viatica*, *Ågrenia bidenticulata* and *Isotoma viridis* in large mounds of *Laminaria* and *Fucus* in the tidal water zone at Spitzbergen. Thus apparently it lives equally well in lagoons and on beach mounds.

On beach mounds the fauna is more mixed, as other species occur besides *Archisotoma besselsi* (*Ameronothrus lineatus* has not been found on beach mound), including *Hypogastrura viatica* and *Folsomia sexoculata*, which often live on the shore, as well as species that belong to the interior but, on account of their general distribution, may also be found at the coast. On Ella Island *Hypogastrura viatica* and *Folsomia sexoculata* have been found only at the beach. This seems to signify

H. Madsen phot.

Fig. 20. The beach at Hurry Inlet, Scoresby Sound. To the right, in the middle of the picture, is seen the lagoon where numerous *Ameronothrus lineatus* were found.

that they prefer the special biotopes at the coast, which tallies with the observations of Madsen (1936). In Finland both species are most commonly found at the coast under beached seaweed, wet stones and pieces of wood, sometimes in great numbers. (Linnaniemi 1912.)

Besides the more or less special littoral forms, mention must be made of *Onychiurus armatus*; on Ella Island it was likewise found only at the shore, whereas in other areas it was found in wet biotopes, isolated individuals also in dry biotopes. On the beach mounds it attains a rather considerable size; unfortunately the individuals were not measured, but each time some extraordinarily large *Onychiurus* individuals were found in a sample, I was able before determination to say with certainty that the samples were taken from beach mounds and that the individuals belonged to the species *Onychiurus armatus*. Its uncommon size is probably due to the special nutrition; *Onychiurus sibiricus*, which was found together with *Onychiurus armatus*, was of normal size, and individuals of *Onychiurus armatus* found in wet biotopes at Angmagssalik were not uncommonly large either. Probably it was the variety *arctica* Tullberg, which according to Linnaniemi (1912) is only distinguished from the main form (0.9—2.5 mm) by its very considerable size, up to 3.6—4 mm. From Finland we know the *arctica* variety from the Murman coast, where several specimens were found beneath stones on the shore. Consequently the variety *arctica* must be a shore form. SUMMERHAYES and ELTON, however, found it in fell-field on Bear Island (how far from the sea was not stated). It was also found in West Greenland (for its further distribution see table 9).

The beach community has only been found in the Franz Joseph Fjord region and in the Scoresby Sound region; for all other regions no Berlese samples have been made in the coastal zone. One single individual of *Ameronothrus lineatus* was found, however, on lake bank at Angmagssalik, and one specimen of *Archisotoma besselsi* was found in mixed *Chamaephyte* vegetation II at Scoresby Sound.

If one would make a rough outline of the animal communities of Greenland, the conclusion would be that everywhere, in wet biotopes, there is great probability of finding a *Platynothrus peltifer* community with the characteristic animal *Platynothrus peltifer*, and in more southerly areas also with *Melanozetes ?mollicomus* together with the more or less moisture-loving species occurring in each area. In all dry biotopes, that is by far the greater part of ice-free Greenland, we find the *Oribatula exilis* community with the characteristic oribatids *Oribatula exilis*, *Camisia horrida* and *Calyptozetes sarekensis* besides those oribatids with their habitat in each area that prefer the dry biotopes. The collemboles cannot, like the oribatids, be divided into two plainly distinguishable groups belonging to two animal communities. The great majority of species are found in all biotopes; though some few species prefer quite definitely the one or the other of the communities. Thus it is not at all by chance that nearly all the animal communities are named after the oribatids. One exception is the beach community that has been named after the oribatid *Ameronothrus lineatus* and the collembole *Archisotoma besselsi*, which have both adapted themselves to the special conditions prevailing at the coast, where the sea water as a rule floods the biotopes.

Chapter VII.

Reflections on the influence of external factors.

Humidity. In Chapter VI it was shown how immensely important humidity is to the distribution of animals over the various biotopes. A high degree of atmospheric humidity seems to be the most important factor in the thriving of the animals on the whole. AGRELL (1941) found that humidity is the factor which determines the occurrence of animals in nature. Even if it is not the only factor, it is still the deciding one.

He examined the humidity optimum of the various species in nature (the humidity expressed by the water content in percentage of the entire weight) and found that it lies between 10 and 100 per cent.; samples with a humidity of less than 30 weight per cent. in the biotopes examined are rare. By an investigation of the moisture on Danish heaths ("maar", raw humus) THAMDRUP (1939) has shown that the relative degree of atmospheric humidity in soil cavities "on the average is not essentially lower than 90 per cent., even during lengthy and pronounced periods of drought, when the percentage of water in the raw humus (maar) has been reduced, for instance, to 30." In soil with a lower content of organic matter than the raw humus (maar), e. g. sand, the relative atmospheric humidity is about 90—100 per cent. with a still lower weight percentage of water in the soil (KEEN 1931). On comparing this with AGRELL's investigations, where the water percentage likewise was rarely less than 30, the atmospheric humidity must always, or nearly always, be very great and almost at the point of saturation. However, AGRELL arrives at the conclusion that the various collembole species show very different quantitative distributions in the various biotopes with more than 20 per cent. water content. This seems, according to AGRELL, to disagree with THAMDRUP's investigations, at all events when it is presumed that the animals are influenced by the relative atmospheric humidity. By means of preferenda tests, AGRELL demonstrated the humidity optimum of each species, whereby he found conformity with the humidity values under which animals are found in nature. As in the matter of the collemboles in their relation to humidity, AGRELL found that there are conspicuous individual differences within the same species, all according to the humidity in the biotope where it is found; each species must adapt itself in each biotope to the humidity conditions prevailing. It is probable therefore that the atmospheric humidity is of importance only within certain limits to the distribution of the species in the biotopes. Here it is of interest to know what conditions of humidity the animals require in order to live.

STREBEL (1932) demonstrated by experiments with *Hypogastrura purpurascens* that it will die in the course of some few hours with a relative atmospheric humidity of 55—56 per cent. at 16—21° Celsius. By means of investigations with other species he found that *Entomobrya marginata* endured an atmospheric humidity of 52—55 per cent. at 21° Celsius for 16 hours, while 20 per cent. of the closely related *Entomobrya multifasciata* were dead after 7 hours in a 50 per cent. atmospheric humidity and 25° Celsius; after 15 hours all had died. At 90 per cent. atmospheric humidity the death rate after 50 hours was 10 per cent.; after 90 hours all had died. There is no question of their having died from hunger, STREBEL says. The high death rate at 90 per cent. relative atmospheric humidity and over, is due, according to STREBEL, partly to respiratory disturbances, partly to hindrances to their movement by their adhesion to moist surfaces (see p. 94). RIPPER (1930) writes about the humidity requirements of *Hypogastrura manubrialis*: "Zum Leben und zur Entwicklung brauchen die Hypogastruren aber eine weit feuchtere Atmosphäre, die nahezu oder ganz mit Wasser gesättigt sein muss." MACLAGAN (1932) found that 100 per cent. relative humidity is definitely the optimum for *Sminthurus viridis*; it causes both a higher rate of growth and maximum growth.

No similar investigations on the humidity optimum of the oribatids have ever been made, as far as I know.

No records of the water content of the soil have been made in Greenland, unfortunately; but according to TH. SØRENSEN (verbal communication) the humidity on Ella Island is rather high, at any rate until the middle of July; in certain areas, snow beds, the snow does not melt until still later. At Angmagssalik the humidity is likewise high most of the summer, and even towards the end of July snow beds are still to be found. As Ella Island, in consequence of its continental climate, has much warmer and drier summers than most other Greenland regions, it may be concluded that the relative atmospheric humidity in the microclimate everywhere in the areas investigated must be very high for the greater part of the summer, and sufficient for collemboles to thrive everywhere. Thus it does not look as if it were the relative air humidity in the microclimate—which, according to THAMDRUP's investigations, is always very high—that alone decides the distribution of the collemboles in various biotopes. Here, however, there is reason for dwelling a little on the results obtained by AGRELL by means of investigations in the field. At "Nadelstreu", a specially dry biotope, he finds an average humidity of 19 per cent. (weight percentage), with 9 per cent. in the upper layer; the relative air humidity here must be something less than in the other localities with 30 per cent. and more, where saturation is almost reached. This biotope is characterized by quite definite species which never, or hardly ever, occur in the other biotopes. These species are specially protected by means of hair or scales against desiccation. Of course it is not necessarily the low relative atmospheric humidity that determines the presence of these species in this biotope, even if the thought is reasonable; it may just as well be a certain nutritive substance which, upon this singular biotope, has produced a special fauna that is able to live there because of protecting scales or the like.

As the humidity of the soil plays such a decisive rôle for the habitat of the animals, it must also have influence on the way of living in some other way besides the rel. atmosph. humidity. THAMDRUP (1939) considers it proved by investigations of the heaths in Jutland "that the water content of the bottom of the heath, despite great variations which may tempt us to presume some correspondingly significant alterations in the microclimate to which the bottom fauna is subjected, has no direct significance in this connection and under no circumstances causes such changes in the atmospheric humidity of the typical heath bottom that a "desert-like state" will prevail as regards the living conditions of the bottom fauna. Having regard to the humidity it must rather be said that the opposite is the case. If the water content of the bottom plays a rôle in the animal life of the heath bottom, it must be by other means, through influence of vital factors of other kinds." There is one point where the moisture certainly is of great significance, and that is in its softening of the food. In order to investigate this question Strebel (1932) examined the nutrition of *Hypogastrura purpurascens*. After having ascertained that it devoured just anything, such as potatoes, raw and boiled, boiled grains, decayed vegetables, soaked rusks, the substance of various fruits, cheese, both the hard and the soft sorts, the whites of hard-boiled hens' eggs, the yolks of eggs, meat, raw and boiled, cocoanut butter, *Protococcaceae*, little dead diptera, even human fæces, he made some food tests where the food was proteins, carbohydrates, and fat. All groups of nutritive substance were gnawed, fat least and cheese most. In a later test cheese was also preferred. As Strebel thought that there was reason to assume that cheese was preferred on account of its softness (I wonder if the great proteïn content does not play some part?), he undertook some tests where he made the animals eat grated and whole pieces of potatoes and the ribs of lettuce leaves, both whole and mashed to pulp. In both cases there were far more individuals which ate of the grated potatoes and of the pulpy lettuce mash than of the food which had not been made soft. A series of similar tests gave the same result. Lettuce leaves and lettuce ribs were not gnawed until after several days they were softened by incipient decay. On the whole, Strebel's tests show that *Hypogastrura purpurascens* eats all sorts of animal and vegetable matter if only it is sufficiently soft. Handschin (1926) mentions that as a rule fungi are inhabited by collemboles only as long as they are moist and rotting. Ford (1937) found by food tests that the food must contain a great deal of water, as the collemboles apparently, despite their biting mouth organs (some have mouths adapted for sucking), mainly seek their nourishment by means of a sort of suction pipe formed of labrum and labium. The biting mouth organs first grate the surface to pieces, and then the food is sucked in. Because of this suctorial feeding he explains the wanderings of the collemboles in the biotope by the different water content. After rains he found that many collemboles made their way upwards in the vegetation where only small numbers of animals lived under normal conditions. This may also be explained, however, by the fact that also higher up in the vegetation the air humidity after rain is sufficient for the animals to live there. After this there may be reason to assume that the great importance of moisture to the microfauna (mites and collemboles), besides producing a sufficiently high atmospheric humidity, also lies in the fact that it helps by causing softening and thereby decay of organic matter which serves the animal as food. It will be seen from this that a high atmospheric humidity is not sufficient for the thriving of the animals: a certain amount of free water (not colloidally combined) is necessary in order to soften the food of the animals and procure an ample amount of water in the food, as these soft-skinned animals would otherwise shrink and die very quickly. AGRELL (1941) mentions the possibility that the distribution of the various collembole species in accordance with the different water contents of the soil is mostly dependent on the various capacity of the collemboles to satisfy their water requirement from the surrounding substratum, e. g. through their nutrition.

The water content of the soil likewise has a great bearing on the amount of oxygen present; but as the collemboles do not require any specially great amount of oxygen (STREBEL 1932), its importance is doubtless small as long as the water content is not so great as to cause the filling up of all pores and cavities, thereby causing a want of breathing air from which the animals die (FRENZEL 1936). The high water content causes the animals to avoid these places (STREBEL 1932), as there they become subject to the danger of sticking upon wet leaves, in the substratum or the like. By vain attemps to get loose they exhaust themselves and at last they die. That adhesion in nature should play such an important part as STREBEL claims to be the case, is improbable. Most sound animals will surely be able to free themselves from the effects of adhesion if they should happen to experience them.

Unfortunately, I know very little about how the oribatids behave towards the water content of the soil. SELLNICK (1908) mentions that most oribatids are easily killed in a drought. Only a few armoured species can stand drought for any length of time. SIG THOR (1930) revealed by experiments that for instance *Nothrus*, *Hermannia* and *Ceratoppia* after 3—5 months drought were nearly all dead. Several of these species lived for two years in a collecting bottle which was closed with a cork (further information unfortunately is wanting). That some species can live in water for rather a long time was shown by TRÄGÅRDH (1910). He found that all specimens of *Nothrus horridus vàr. borealis* were still alive after a week in a glass tube filled with water. The habitat of *Ameronothrus lineatus* in shore meadows that are flooded by high water is a further proof that they can tolerate being in water for rather a long time. However, there is the possibility that they keep mainly to the layers of algae, which are probably filled with air bubbles caused by the assimilation processes of the algae. But also in the very wet biotopes, bog and lake bank, which in spring are covered with meltwater, it may have some importance that the animals can survive for a time under water, even if they certainly keep mostly to higher, freely protruding tufts, mosses, and so on.

Frenzel (1936) established the fact by tests that mites stand drought better than do collemboles. On account of their armour the oribatids are fairly well protected against the danger of giving off too much water to their surroundings. And with their strong mouth organs they cannot be so dependent on softened nutritive media as are the collemboles. One might therefore expect that the collemboles in dry biotopes would breed earlier than the oribatids, or that they would partly be ousted by the oribatids (see p. 101), which apparently are better equipped to stand drought. Nothing of the kind appears from the curves of their occurrence during the breeding season (e. g. fig. 30) or from their occurrence in various biotopes.

However, if the humidity in a biotope changes temporarily it may happen that the composition of the species on the surface of the soil changes as well. Glasgow (1939) found that *Onychiurus ambulans* showed seasonal changes in vertical dispersion; during spring and autumn it was most numerous at the surface, during summer and winter deeper down. During summer it takes refuge from drought, during winter from cold. He also found that certain collemboles living in colonies expand these in rainy weather; this is the case, for instance, with *Onychiurus armatus*, the colonies of which normally have a diameter of 7—8 cm.

Temperature. It will appear later on that temperature plays a very great part in the life rhythm of the animals, as it has great influence upon the rate of development and thereby also upon the time of reproduction. That the temperature may also be of importance as a factor in the distribution of species was proved, e. g. by Krogerus (1937), by means of investigations of the insect fauna on mountain sides with a north and a south exposure in Finland. In Greenland Haarløv (1942), around a bird stone where the "geographical summer" was probably prolonged because of radiation from the stone, found a *Thysanoptera*, *Aptinothrips rufus*, which was absent at all other places, presumably as it is unable to conclude its development at any other place than here, where the summer is prolonged. The occurrence of this insect around the bird stone may perhaps also be explained by the changed manure conditions, the effect of which is that certain plants from which *Aptinothrips* derives its nutrition can grow in such a locality. Haarløv says that the manured soil to a certain degree, but not completely, may explain the occurrence of the rich flora and fauna around the stone. TRÄGÅRDH (1910) also found species under such conditions that it seemed as if the temperature had some part in it. *Camisia horrida var. borealis* and *Oribata monticola* occurred in great numbers in all stages of development at the side of some stones which lay in or at the edge of melting snow layers and which had only recently become free of snow. However, they were not found on the other side of the stones which had been ice free for a longer period. This remarkable fact may only be explained by assuming that these species have a special liking for cold. The greater moisture cannot, at any rate, be the only cause, as the species in question did not occur upon the side of the stone which lay upon moist soil at some distance from the melting snow (TRÄGÅRDH).

The unusually large number of *Proisotoma tenella* (1796 specimens per $^1/_{100}$ m^2) which was found at Nanuseq in Lindenow Fjord on a rock clad with short, dense, black moss may possibly be due to specially favourable exposure. In the other biotopes investigated no species with a preference for south-exposed slopes have been found. When collecting samples it has not always been considered essential to take samples in biotopes with different exposures. Only at Upernavik were samples taken with this in mind from various, sloping surfaces, but it does not appear from this whether the exposure had any influence either upon the composition of species or upon the density of individuals. On investigating the factors that have an influence upon or determine the density of oribatids and collemboles in the soil, SCHIMITSCHEK (1937) found that the warmest bottom does not harbour the greatest density of individuals, but that the density grows with a sufficient amount of organic matter with increasing air capacity in the soil. AGRELL (1941) has shown, by thermo-preferenda tests, that the collemboles are influenced only very little by the temperature, even within very wide limits. Thus the temperature apparently has no considerable significance to the composition of the oribatid and collembole species in the biotopes.

The capacity of resistance against cold, which the collemboles must possess in order to be able to stand the very low winter temperatures, is greater for large individuals than for small ones of the same species (AGRELL 1941). The resistance to cold only commences really when the collemboles have arrived at a certain size, and it increases with lowering temperature. As the collemboles winter in all stages of development, the result must presumably be that a very great many of the young individuals die when the cold sets in. This tallies very well with the facts, from which it is seen that samples taken in winter as a rule have only a very small percentage of quite young individuals, as figures 23—24 indicate. GLASGOW (1939) found that during winter *Onychiurus ambulans* makes its way down into the earth in order to avoid the low temperatures. Nothing of the sort happens in Greenland (HAARLØV 1942). Nor in Lapland is there a general movement towards deeper lying strata, according to AGRELL (1941). This would, indeed, have no significance except at low temperatures just above zero, by which the unfavourable climatic conditions might be avoided temporarily. Flight from the low winter temperature in Greenland is not feasible, as these very low degrees, even under a thick layer of snow, go far down into the soil, at any rate when midwinter is reached (TH. SØRENSEN 1941). The snow-layer does not afford much protection from the cold, only from too great fluctuations. However, AGRELL believes that the snow had such a heat-insulating effect that the animals beneath the snow are not exposed to the low temperatures of the air. By some records taken in the air and in the soil at 5 and 10 cm depth under a layer of snow which varied in thickness from some few cm up to 44 cm—he showed that the low air temperature does not penetrate into the ground. The results found do not prove anything in particular, as, in the period when records were taken each tenth day, there were apparently no constant air temperatures over a period long enough for the cold to penetrate downwards before the weather changed. The temperature at the surface of the soil may, according to TH. SØRENSEN's records, fall 12° (from—12 to—24) under a layer of snow of 30 cm thickness in the course of ten days. (TH. SØRENSEN, 1941, table 12, the end of December 1931).

Nutrition. As oribatids as well as collemboles feed upon decaying organic matter and lower plants, of which there is a sufficient supply everywhere if there is only a slight covering of vegetation, want of nutrition does not stop the dispersion of these animals. However, there is no doubt that different vegetations influence the composition of species in the biotope. Despite the general distribution of most of the oribatids and collemboles, in many biotopes will be found a certain species of oribatid which occurs only in that particular biotope or is rare outside it (p. 74). This is probably due to special conditions which in the biotopes in question favour the growth of a certain element in the flora (fungi, lichens or the like) on which the species in question lives. Unfortunately I know very little about the food requirements of the various species. Apparently the food of most collemboles is very varied. As previously mentioned, STREBEL (1932) has demonstrated by food tests that *Hypogastrura purpurascens* lives on a very varied diet, comprising both vegetable and animal nutritives; the most important thing is that the food must be soft. FORD (1937) also draws attention to the fact that the food must contain a quantity of water, because it is sucked in. GISIN (1942) says that most "edaphic" collemboles are soil eaters, by which expression is probably meant that they feed on decaying vegetable matter or humus. HANDSCHIN (1926) draws up the "menu" of each species as far as it is known. It seems to be generally presumed that many collemboles feed on fungus hyphæ and spores and on decaying vegetable matter. MACNAMARA (1924) found by stomach examinations that the stomach sometimes was full of spores that apparently had been swallowed whole, in spite of the splendid mouth organs of these animals. The spores cannot very well have arrived there by accident when they are found in such large numbers. It has been observed that some species seek for pollen in flowers.

HANDSCHIN (1919) constantly found *Bourletiella lutea* and *B. pruinosa* in great numbers in the flowers of *Ranunculus glacialis*. Later finds (HANDSCHIN 1924) have revealed that they also seek other flowers. In *Ranunculus alpestris* were found *Lepidocyrtus lanuginosus-albicans*, *Bourletiella lutea*, *B. pruinosa*, *Deuterosminthurus bicinctus-repanda* together with *D. bic.-pallipes*, in *Anthyllis vulneraria* were found *B. lutea* and *Entomobrya nivalis-immaculata*, and in *Campanula barbata* there was *B. pruinosa*. AGRELL (1941) mentions that *Deuterosminthurus bicinctus f. repanda* apparently always eats pollen grains of *Trollius europaeus*. According to HANDSCHIN (1919), snow and ice forms in the Alps also live on pollen grains that are transported by the wind up into the nival region when the conifer forests blossom. All other nutrition is very scarce in these regions. The pollen is dispersed so abundantly that it drives along like clouds and falls down as "sulphur rain".

In Greenland the nutrition probably consists essentially of decaying plant remains and fungus hyphæ. Fungus spores and pollen grains may not be obtainable all the summer, but may be an important supplement to the food. Species that live under special conditions such as *Archisotoma besselsi* on the beach, feed on algae and the like. WILLEM (1925) found *Archisotoma besselsi* beneath a carpet of the green alga *Vaucheria*, on which it lives; but in addition it collects microorganisms from the surface of the water and may also gnaw dead animals *(Planorbis, Limnæa)*.

The nutrition of the oribatids apparently consists mainly of the same elements as that of the collemboles. VITZTHUM (1923) considers that the German oribatids presumably without exception feed on fungi or very low plants. SIG THOR (1931) mentions that oribatids bite off plant stalks and leaves in suitable pieces and chew them, and that pollen, spores, green algae, diatomes and other algae, as well as fungi, bacteria and protozoa are often found in the intestinal tract. As is the case with the collemboles, he found that certain species of oribatids choose certain plants, where they live. Thus in Norway (Dovre) he found *Calyptozetes sarekensis* and some few *Carabodes* species firmly attached to lichens. On the other hand, at Spitzbergen most species (including *Calyptozetes*) seem to have adapted themselves to live in various plants. In MICHAEL's (1883) opinion the oribatids are strictly herbivorous. LUNDSTROEM (1887) observed how the larvae of oribatids scraped something together with their mouth organs and devoured it; it turned out to be fungus spores. Remains of fungus cells were found in the excrement. SELLNICK (1921) has also seen oribatids eating fungus spores. SCHIMITSCHEK (1937) mentions the great rôle played by the oribatids and the collemboles by speeding up the cycle of the organic components of the soil; he considers that in any case they contribute essentially in the decomposition of dead animals and plants; and also in the destruction of fungi in the soil. Independent investigations into the nutrition of oribatids have been made by FORSSLUND (1938). By examining the stomachs of some oribatid species he found that the food consists preponderantly of fungus hyphae, but that the oribatids also use fungus spores for food, although to a lesser degree. With the exception of the *Phthiracaridae*, the food of which mostly consists of small fragments of wood, bast or other fibrous matter, the oribatids, according to FORSSLUND, seem to play rather an insignificant rôle in the breaking down of vegetable and animal offal in nature. FRANZ (1943), however, believes that mites are one of the most important animal groups in the soil for producing valuable humus matter; many oribatids gnaw moss and from this food they produce humous excrement of a very high degree of reduction. In 1942 FRANZ writes that the degree of breaking-down among mites and earth worms is very far-reaching; and on the humus production of soil animals (mites included) he says: "Die Produktion humoser Excremente is demnach nicht, wie meist angenommen wird, von einer vorherigen humosen Zersetzung der tierischen Nahrung durch Bakterien und Pilze abhängig, sondern wird vom Tier selbständig besorgt. Bakterien haben an diesem Prozess nur in dem Masse Anteil, als sie an der Zersetzung der Nahrung im Verdauungstrakt der Bodentiere teilnehmen."

SELLNICK (1908) likewise ascribes great significance to fungi as a source of nutrition.

According to this information as regards nutrition it must be assumed that the oribatids in Greenland feed chiefly on decaying vegetable matter and on fungus hyphae, of which the latter seem to be the more important source of nutrition. As is the case with the collemboles, fungus spores and pollen grains constitute part of the food.

As the oribatids and collemboles feed on the same sort of material, and as the various species, as far as is known, have not to any considerable degree specialized on certain plants or the like, nutrition can only to a certain point explain the presence of the various species in the biotopes. When *Calyptozetes sarekensis* is found in such great numbers on lichen heath and other dry biotopes with a high lichen content, food must be the reason. In like manner it may be assumed that certain species prefer a certain sort of fungus, or they are found in certain biotopes on account of their containing certain plants, the pollen grains of which they devour. However, this can only in broad outlines explain the different fauna in the various biotopes. No doubt other factors still unknown play a not unimportant rôle in the life of the animals in their special habitats.

Soil acidity. An investigation made by RIPPER (1930) in order to determine whether the acidity of the soil has any influence upon the life and development of the collemboles (*Hypogastrura manubrialis*), showed that such is not the case. FRENZEL (1936) found that the hydrogen-ion concentrations for each of the meadow bottoms are very near each other, and that the organisms in the soil are indifferent as to the pH-value. SCHIMITSCHEK (1937) found that no connection could be found between the pH-value of the soil and the density of mites and collemboles in the soil. Nor could AGRELL (1941), whose measurements of the pH in the biotopes are between 3.2 and 8.8, find any connection between the frequency of the most commonly occurring species and the pH-values found. KSENEMAN (1938 a), whose aim was to investigate whether the *Apterygota* fauna could be utilized as an indicator of certain ecological properties at a certain place and also of the goodness and fertility of the soil, came to the conclusion that the influence of the soil reaction on the composition of the *Apterygota* fauna was only slight. On the other hand, GISIN (1943) holds the opinion that some collemboles are basophil, others acidophil; as it does not appear that he measured the pH-value, and as he made no physiological-ecological experiments, his theory of basophil and acidophil collemboles is not convincing. As the pH-value on Ella Island, Greenland, always is between 7 and 8 (communicated by TH. SØRENSEN) even in bog, on account of the chalk substratum, it cannot very well in this region be assumed to have any significance as a species-distributing factor. (In the other regions in Greenland the pH has not been measured). When such a degree of significance is sometimes ascribed to it, it may be due to its influence upon other factors, which again influence the fauna of the locality. It is possible that the degree of acidity of the soil may really cause the appearance of various fauna elements in various acid biotopes; but until further investigations have been made as to this, its significance in this respect is not convincing.

The factors that decide what biotope is preferred by each species are apparently—the geographical conditions being equal—first and foremost moisture and nutrition. However, it may be assumed that there is some form of interplay between all the ecological factors of the biotope and its vegetable and animal life.

Alternation between Oribatidae and Collembola.

A certain biotope may sometimes have a large preponderance either of *Oribatidae* or of *Collembola*, while conditions in other biotopes may be the reverse (p. 65, table 10, p. 66 table 11). It has proved to be very difficult to explain why one of these animal groups sometimes is very much more numerous than another. FRENZEL (1936) among other things investigated the occurrence of mites and collemboles throughout the year in various types of meadow. In a dry meadow the mites outnumbered the collemboles, while in a moist meadow the collemboles were more numerous. Comparisons between a dry, manured meadow and a meadow without manure showed that the mites in both cases outnumbered the collemboles. FRENZEL presumes that besides the effect of the moisture an alternating influence is exerted between these two groups of animals.

As the meadows are constantly renewing their content of rotting vegetable matter and always have a large reserve of vegetable matter on which these animal groups feed, FRENZEL thinks that there can be no question of any nutrition competition. Therefore FRENZEL is inclined to conclude that the competition is rather one of space; this may be possible when the animals, as here at the bottom of the meadow, are limited to the porous area. Which of the two animal groups exceeds the other as regards number of individuals seems, according to FRENZEL, to be subjected to no rule. The capacity for maximum reproduction must be contingent on conditions at the spot, conditions which are not very obvious. That greater bottom moisture furthers a strong development of the frail *Apterygota* is certain, but moisture alone cannot be the cause, as in certain wet meadows the mites are numerically preponderant. The temperature of the soil is not the cause either, as the soil animals have proved to be independent of this factor. The pH-values in each meadow are very near each other, and as the organisms of the soil are indifferent towards the hydrogen-ion concentration, this factor is not the explanation either. FRENZEL concludes from this that "biotic factors", which are difficult to determine on account of the obscure life of the bottom fauna, are the cause of the alternating numerical superiority of mites and collemboles in the biotopes.

With regard to FRENZEL's theory AGRELL (1941) considers that a competition for space is possible, but that it is more probable that the various degrees of humidity in one case may have limited the number of collemboles, in another the number of mites. In several cases he saw an enormous development of oribatids, apparently taking place at the cost of the collemboles; this was always at very dry places, and thus he concludes that above all moisture has a bearing on the distribution of these animals, and not competion. As AGRELL worked exclusively with collemboles, his opinion is based on casual observations.

In Greenland moisture alone cannot explain this alternating numerical superiority between *Oribatidae* and *Collembola.* To be sure, the oribatids on lake bank II on Ella Island constitute only 8 per cent. of the fauna, while the collemboles represent 92 per cent.; but on lake bank at Angmagssalik the oribatids constitute 71 per cent. and the collemboles only 29 per cent. On lichen heath at Angmagssalik, which is one of the driest biotopes, the collemboles are far superior to the oribatids—90 per cent. as against only 10 per cent. There is no doubt that there may be a competition for food when for instance one single species, *Platynothrus peltifer* on lake bank I on Ella Island, where it constitutes 88 per cent. of the fauna, has found such optimum conditions of life that it has more or less ousted most of the other species; here, however, other ecological circumstances may play some part, for instance moisture. In most cases where the animals are not limited to the pore volume in the soil, but are free to develop in the vegetation, a competition for space will in reality turn out to be a competition for food. If it were a question of competition for space it might be expected that one of these animal groups would be completely ousted if, from some cause or other the other multiplied greatly. Lichen heath at Angmagssalik (table 58) is an example of a biotope very rich in individuals. Despite the fact that the collemboles are very numerous (more so than in any other biotope), this has had no influence upon the number of oribatids. To be sure, they constitute only 10 per cent. of the fauna, but numerically it is one of the richest of biotopes, both as regards species and individuals. In lichen vegetations there must be splendid conditions for nutrition when both animal groups can increase in numbers as they do (see also tables 15—16). Possibly the maximum density of individuals has not been attained as yet; therefore it is impossible to say whether the result may be that one animal group may oust the other completely.

The alternation between the oribatids and collemboles is a problem that cannot be explained by considering oribatids and collemboles separately as an entirety. Each species' requirements as to humidity, food and the like, must be analysed; only then may it be possible to see why the collemboles are more numerous in certain biotopes, and oribatids in others.

Chapter VIII.

Breeding seasons.

In order to determine the time of the breeding season of the various species it is necessary to know their larvae and nymphs[1]).

As I have already stated, when the Berlese investigations were started with the analysis of the samples from Ella Island, North Fjord, Suess Land and Traill Island, I was familiar only with the nymphs of some few species, for instance *Nothrus borussicus* and *Platynothrus peltifer*. Not till later on, in the course of working up the rest of the material, did I succeed in extending my knowledge in this respect. If all the different species and their nymphs were to be counted one by one for the purpose of determining the time when each species mates, a re-arrangement of the entire material would be necessary; this, however, would demand such an amount of work that I have abandoned the idea. It was only with the treating of the second batch from Ella Island (the annual collection) that it was possible to identify the nymphs of most of the species. Based upon this material it was possible to survey the breeding seasons of some of the species. For each sample a record was made, when determining each species, of whether the specimens were fully grown or in the nymph stage (oribatid), fully grown, half grown or small (collembole). From the averages of samples of the same date or with an interval of a fortnight, a survey was obtained of the occurrence of each species during the whole year. However, the fact is that the number of individuals on Ella Island is very small, which may possibly be due to the dry climate, possibly to less effective expulsion (p. 26); many of the species which in other places in Greenland commonly occur everywhere and are found in nearly all samples, occur only now and then here. Thus great gaps arise in the curves of their occurrence during the whole year, or they are present in such small quantities that it is impossible to arrive at any conclusion as to their breeding season. Thus this area—the only one investigated all the year round—provides little opportunity for drawing any conclusions as to the occurrence of the species during the whole year, because it is difficult to find out at what time the breeding season begins. As was stated in Chapter III, several bogs, lake banks, fell-fields and mixed *Chamaephyte* localities were investigated on Ella Island. If these are examined one by one, or for instance all the samples from bogs in one lot and the average number is taken, the result is very nearly the same; there is no great difference, qualitatively or quantitatively. Calculating the averages facilitates the evening out of

[1]) For young individuals the term nymph is mostly employed, irrespective of the stage of development.

irregularities arising, for instance, because of the well-known occurrence of collemboles in colonies; but on the other hand, very big samples (rich in individuals) if they alone represent a certain interval of 14 days, may disturb the whole final result (fig. 23). Both methods were here employed, according to which gave the clearer result. Of species that occur fairly evenly all the year round, the oribatid *Oribatula exilis* and the collembole *Onychiurus sibiricus* may be mentioned; the latter is easily the most numerous on Ella Island.

The curve (fig. 21) shows the course of the occurrence of *Oribatula exilis* in bog at Langsø, Ella Island and fig. 22 the course in fell-field, Vejrhøj, Ella Island. The interruption in the curves (figs. 21—24) in the middle of summer is due to the fact that the samples were not taken in continuous sequence, but extended over twice six months. In bog (fig. 21) *Oribatula exilis* does not occur until the 28th of June. At this time there are both adult individuals and nymphs; (samples on the 24th of April did not contain this species); on the 22nd of July the number of both stages has risen greatly, whereafter a number of samples taken on the 30th of August do not contain this oribatid at all; a number of samples taken on the 10th of October show only a few adult individuals and also a few nymphs; in November the curve again shows a peak, but this time only of adult individuals. From the course of this curve nothing more may be deduced than that the maximum of the breeding season probably occurs late in July and early in August; on the other hand, the maximum in November, when the cold paralyses all animal life, is merely due to the fact that there is a greater number of individuals wintering in a few samples. In fell-field (fig. 22) both adult individuals and nymphs occur almost all through the winter. This can be explained only by assuming that the species winters while in both stages, which is what HAARLØV (1942) has drawn attention to as regards the oribatids as a whole. That there is a conspicuous peak in the curve already in February is due to the large quantity of animals in certain samples, for at this time, when the temperature is far below zero (table 4) and the animals are frozen stiff, there is certainly no reproduction. The curve for nymphs shows a maximum on the 27th of June, one that was passed already on the 22nd of July. Later in the summer there are only few nymphs. This might indicate a breeding season in June and July, perhaps beginning late in May, but in any case earlier than in bog. This may presumably be explained by the different water content of the biotopes and the consequently different temperatures. All winter and spring the bog is flooded and consists mostly of ice, from which the sparse vegetation juts out (cf. the taking of samples during winter p. 25). Not until later in the summer, when the snow-melting is over and the meltwater has disappeared, can animal life develop in the tufts rising

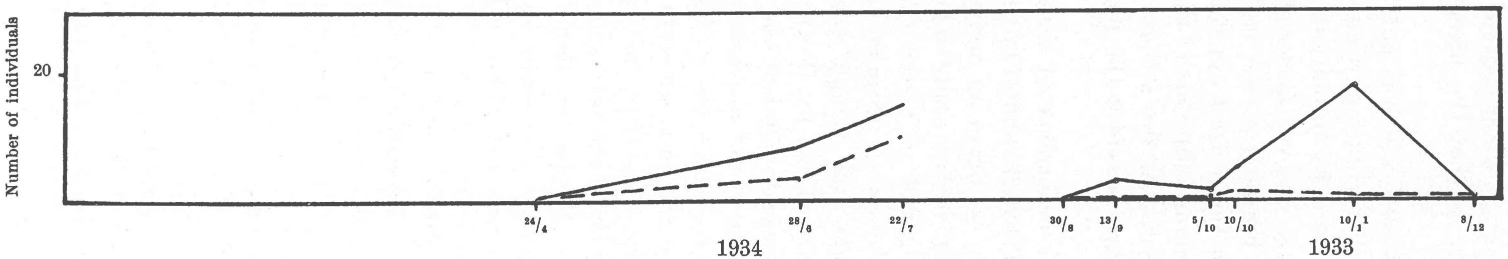


Fig. 21. Curve of the occurrence of *Oribatula exilis* on bog at Langsø, Ella Island.

——— adults
– – – nymphs

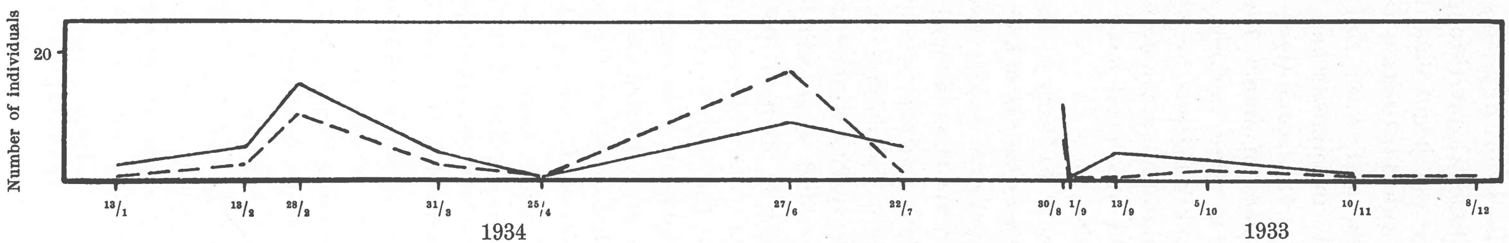


Fig. 22. Curve of the occurrence of *Oribatula exilis* on fell-field at Vejrhøj, Ella Island.

——— adults
– – – nymphs

out of the water. As a consequence of the great water content of the bog this biotope warms through very slowly, so that the breeding season here does not begin until late in July.

In contradistinction to the bog, fell-field, which is not flooded by meltwater and, most commonly, is snowfree during winter, becomes dry early in summer and is quickly warmed by insolation. The effect of this is that conditions here very early become favourable to the development of animal life, so that the breeding season may occur as early as in June, perhaps still earlier; on the other hand the humidity may quickly become too slight for the young individuals; they are unable to stand too much desiccation; the effect of all this is that the animals in this biotope must have an early breeding season if the population is to survive.

If next we turn to the curves of the occurrence of the collembole *Onychiurus sibiricus* in bog II, Ella Island (fig. 23) and of mixed *Chamaephyte* vegetation I, Ella Island (fig. 24) we see again an earlier breeding season in dry than in moist biotopes, though it is not quite so pronounced. *Onychiurus sibiricus* winters both in bog and in mixed *Chamaephyte* vegetation. Individuals of all sizes are found all through the winter. Thus the species winters in the egg?, larva and nymph stages as well as in the adult stage, which was also demonstrated by HAARLØV (1942). One might be tempted to assume that the newly hatched and the young individuals are from eggs that have wintered and are hatched out by means of the high temperature in the room where the Berlese samples were examined. This cannot very well be the case, however, as many of these samples had only been some few days (five) in the funnels; during that short time the eggs may be hatched if germination commenced early, before the winter; but in any case, the larvae cannot attain to the half-grown stage because the development of collemboles, from the hatching of the egg till the animal is full-grown, takes two or three weeks (HANDSCHIN 1926), all according to temperature and nutrition; STREBEL (1932) gives three to four weeks for *Hypogastrura purpurascens*, RIPPER (1930) five to seven weeks for *Hypogastrura manubrialis*. The curve from bog (fig. 23) reveals in winter and in spring two very high peaks, due to the abundance of individuals in some few of the samples. On the other hand, a great increase of all stages takes place in July. This might indicate a breeding season where the maximum is attained in the last part of July. The very large numbers at all stages in November cannot be due to the brood in nature, as the temperature at this time is too low for life. Like the two peaks in winter and in spring this peak is due to samples with a multitude of individuals in which the wintering population consisted of a large percentage of young individuals that as yet had not succumbed on account of their lower power of resistance to cold (p. 96).

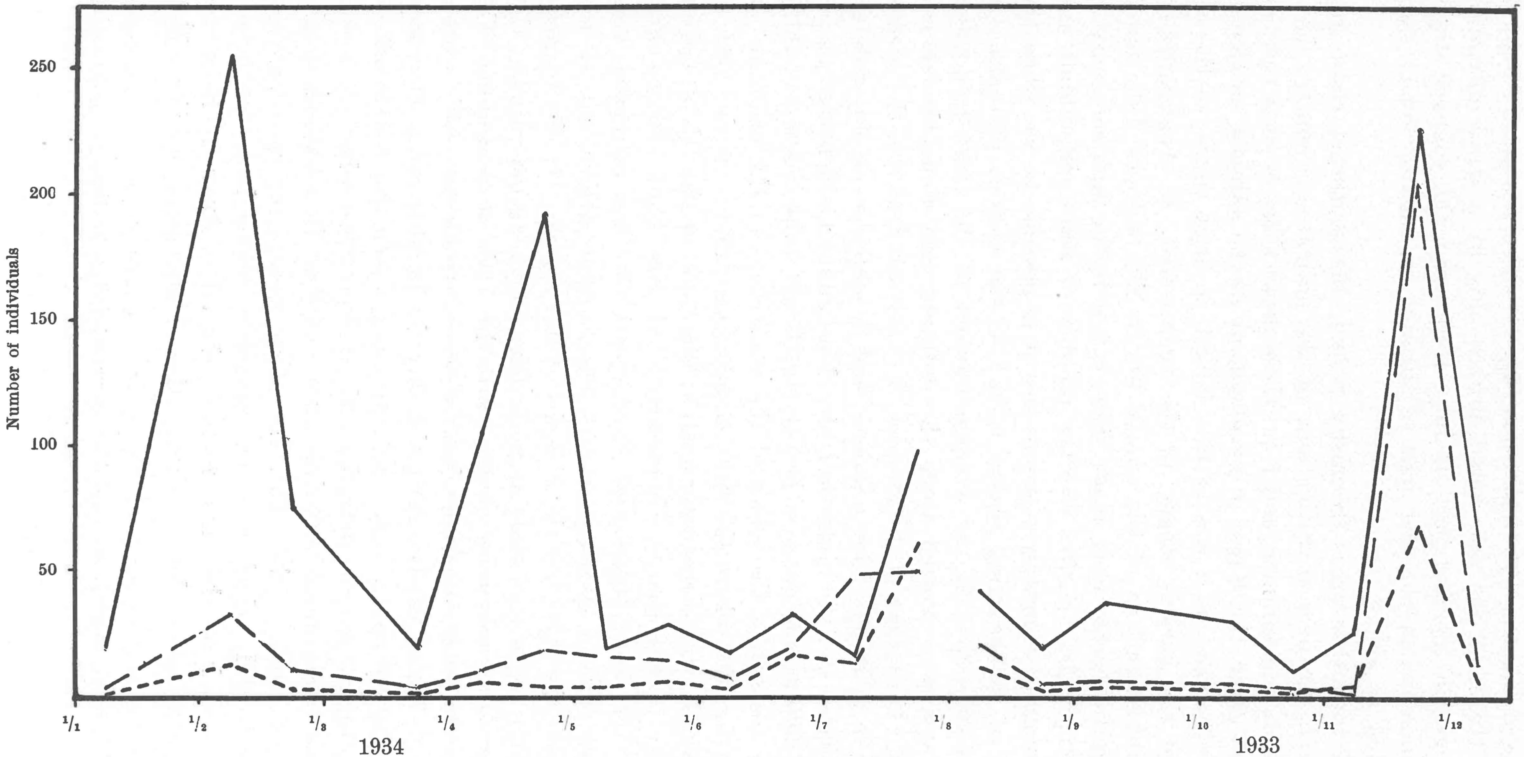


Fig. 23. Curve of the occurrence of *Onychiurus sibiricus* on bog II, Ella Island. The points in the curves are the mean values of all the samples for 14 days.

——— adults — — — half grown - - - - - - - small

In mixed *Chamaephyte* vegetation (fig. 24) there is a steady population of all stages all the year round, broken only by a small maximum for all stages in the first part of July. Here again the younger stages have an increase, in the last part of autumn, an increase which may be explained as above.

In all the other areas (Scoresby Sound, the southeast coast and Upernavik[1])) the only investigations of the animal communities have been made during summer, and from these areas there is, as a rule, no information about the stages of development of the animals, so that it is not possible here, as it was at Ella Island, to draw curves of the occurrence of the various stages all the year round. At Angmagssalik, however, investigations of the animal life in the biotopes (lake bank, bog and lichen heath) were made three times during summer; only as regards *Platynothrus peltifer* was the number of adult individuals and nymphs counted separately. Despite this it is possible to see when the maximum of the breeding season occurs in the various biotopes. On the curves (figs. 25—30) the average number of the most frequently occurring species is plotted along the ordinate, and along the abcissa the dates for the taking of the samples. A curve was drawn of the species that occur in relatively large numbers, and in addition one for undetermined nymphs, i. e. the larger nymphs that cannot be identified as belonging to definite species (not the very small and quite indeterminable). As will be seen from the curve of the occurrence of the oribatids on lake bank (fig. 25), where the first samples were taken on the 28th of July, the number of all species is small at this time; on the 7th of August the number of the species characteristic of lake bank, *Platynothrus peltifer* (I—II) and *Melanozetes ?mollicomus* (V) has increased very considerably. This is specially true of *Platynothrus peltifer* and, as will be clear from the curve for the nymphs of this species (II), the increase is due mostly to an enormous augmentation of young individuals; this rise in the curve continues gently until the 12th of September. The curve for undetermined nymphs has likewise a strong rise, with a maximum on the 7th of August. After this day the number again decreases. However, there is now a very long interval between this maximum on the 7th of August and the date the 12th of September, when the investigation was discontinued, and thus it may be that the maximum ought to be moved more to the right. The other species (except *Brachychthonius brevis* (III) which does not specially belong here but occurs everywhere), all have their maximum on the 7th of August. The curves from lake bank seem thus to signify that *Platynothrus peltifer* which

[1]) In the Kangerdlugssuaq area (Mikis Fjord) almost all samples were taken on the same date, so there is no possibility of ascertaining the time of the breeding season.

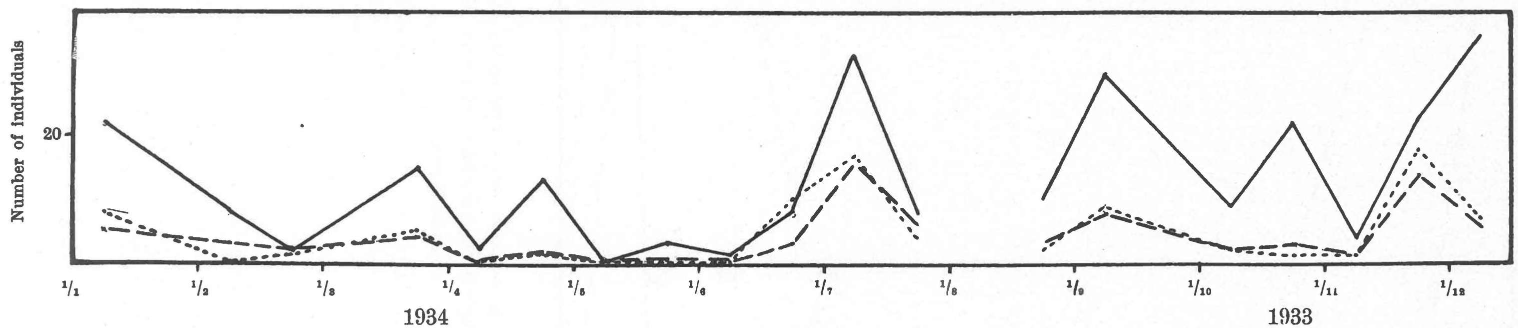


Fig. 24. Curve of the occurrence of *Onychiurus sibiricus* on mixed *Chamaephyte* vegetation I, Ella Island.

——— **adults** — — — **half grown** ········ **small**

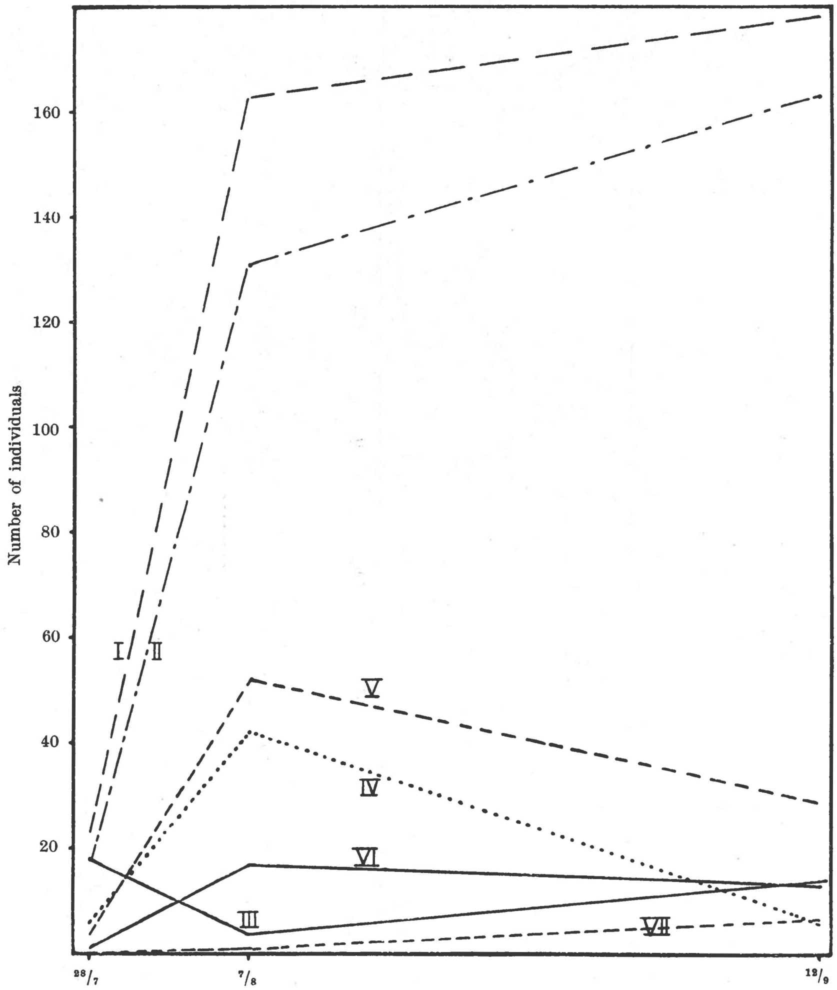


Fig. 25. Curve of the occurrence of the most important *Oribatidae* species on lake bank, Angmagssalik. The figures are average numbers of 10, 5 and 10 samples respectively.

I *Platynothrus peltifer* (total).
II — — nymphs.
III *Brachychthonius brevis*.
IV undetermined nymphs.
V *Melanozetes ?mollicomus*.
VI *Tectocepheus velatus*.
VII *Platynothrus lapponicus*.

first and foremost has its habitat here and presumably winters here, has its breeding season rather late, in the latter part of July and the beginning of August, though the season continues for a very long time right into the month of September. On the contrary, the other species which presumably do not immigrate into the biotope until in the course of the summer, likewise have their season in the latter part of July and the beginning of August, but they end the season a little earlier, whereafter they presumably leave the biotope or perish.

The occurrence of the oribatids in bog (fig. 27) is somewhat different. The oribatids that are characteristic of bog, *Platynothrus peltifer* (I—II), *Trimalaconothrus novus* (III), *Melanozetes ?mollicomus* (V) and *Oppia neerlandica* (VII) all have a definite maximum on the 7th of August. The curve for *Platynothrus peltifer* nymphs (II) follows their course (there are no undetermined nymphs from here). On the 18th of July most of these species are represented by a rather good population,

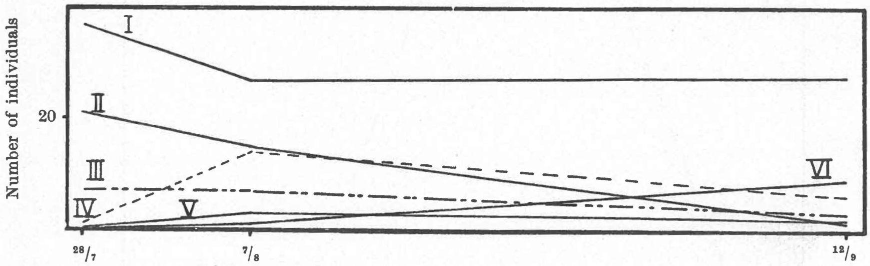


Fig. 26. Curve of the occurrence of the most important *Collembola* species on lake bank, Angmagssalik. (Compare fig. 25.)

I *Folsomia quadrioculata.*
II *Isotoma viridis.*
III *Onychiurus armatus.*
IV *Isotoma violacea.*
V *Tetracanthella wahlgreni.*
VI *Proisotoma tenella.*

which has nearly disappeared on the 3rd of September. This means that the breeding season for the species that dominate the biotope commences earlier than in lake bank, viz. in the beginning or the middle of July and continues into the first part of August; the end comes much earlier. The small number of individuals on the 3rd of September is presumably due to the fact that these late samples were nothing like desiccated when the expulsion process was discontinued because of the departure of the expedition. The number seems to be somewhat greater. But anyhow, the rather small population at this time of the summer seems to signify that only those individuals that are to winter in the biotope are left, while the others have either perished—as most of the young animals do—or have left the biotope in order to winter elsewhere. The curves for the species of oribatids not characteristic of this biotope do not all take the same course (compare lichen heath).

For lichen heath (fig. 29) the curves of the occurrence of the oribatids during summer have a course somewhat different from that for lake bank and bog. The maximum occurs on the 7th of August or thereabouts for the oribatids, *Oribatula exilis* (V), *Calyptozetes sarekensis* (II) and *Camisia horrida* (VIII), that are characteristic of the biotope. Previous

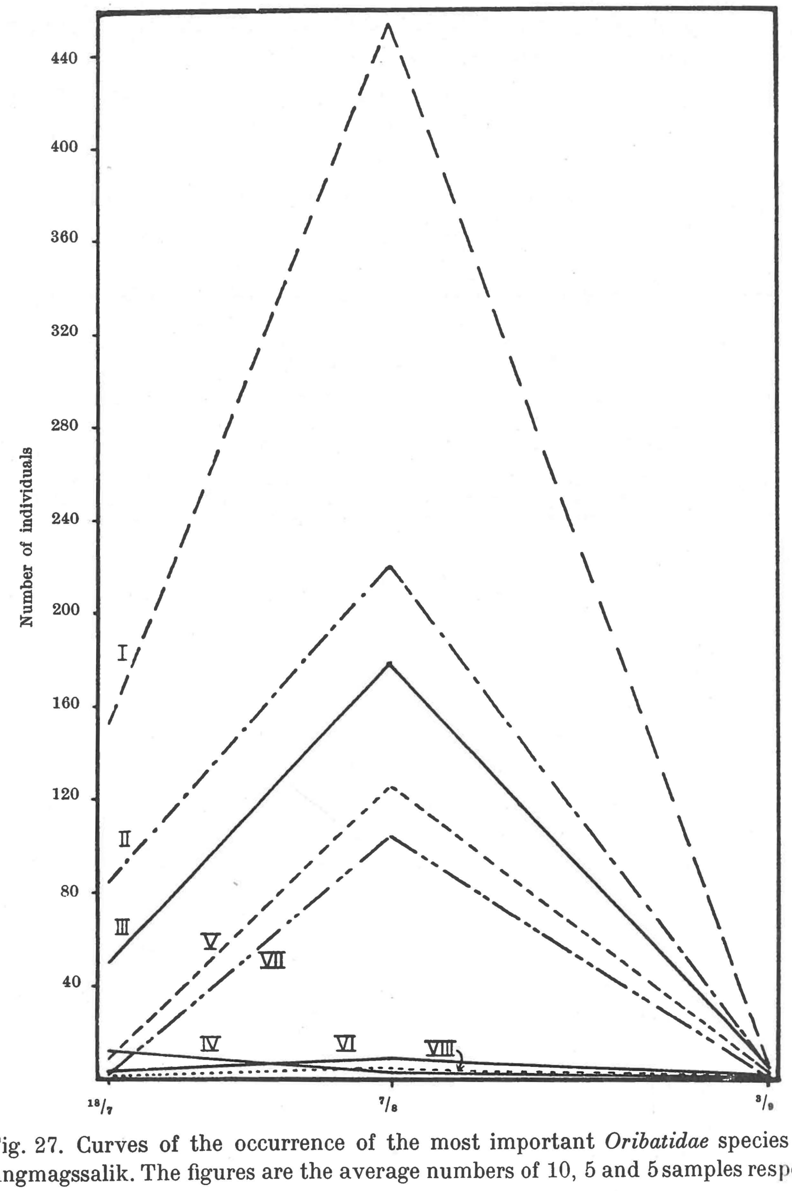


Fig. 27. Curves of the occurrence of the most important *Oribatidae* species on bog, Angmagssalik. The figures are the average numbers of 10, 5 and 5 samples respectively.

I *Platynothrus peltifer* (total).
II — — (nymphs).
III *Trimalaconothrus novus.*
IV *Nothrus borussicus.*
V *Melanozetes ?mollicomus.*
VI *Pelops sp.*
VII *Oppia neerlandica.*
VIII *Tectocepheus velatus.*

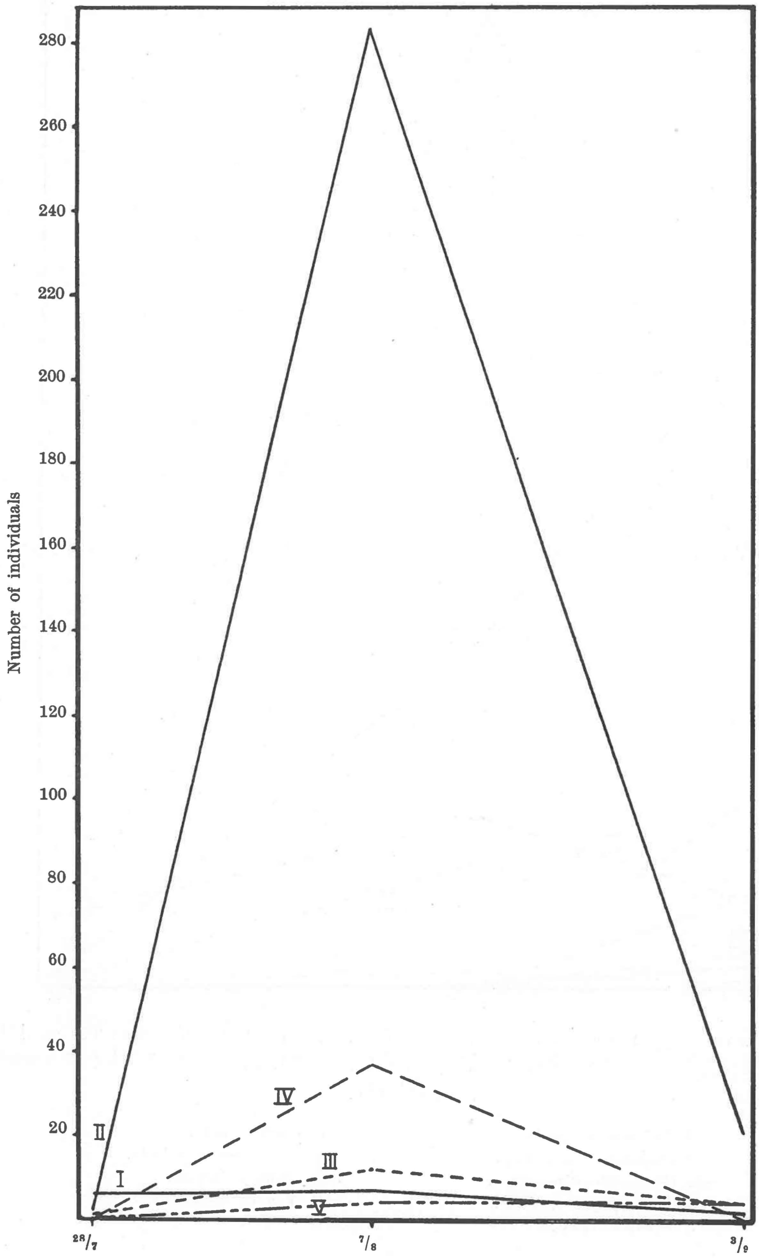


Fig. 28. Curves of the occurrence of the most important *Collembola* species on bog, Angmagssalik (compare fig. 27).

I *Proisotoma tenella.*
II *Folsomia quadrioculata.*
III *Tetracanthella wahlgreni.*
IV *Friesea quinquespinosa.*
V *Onychiurus armatus.*

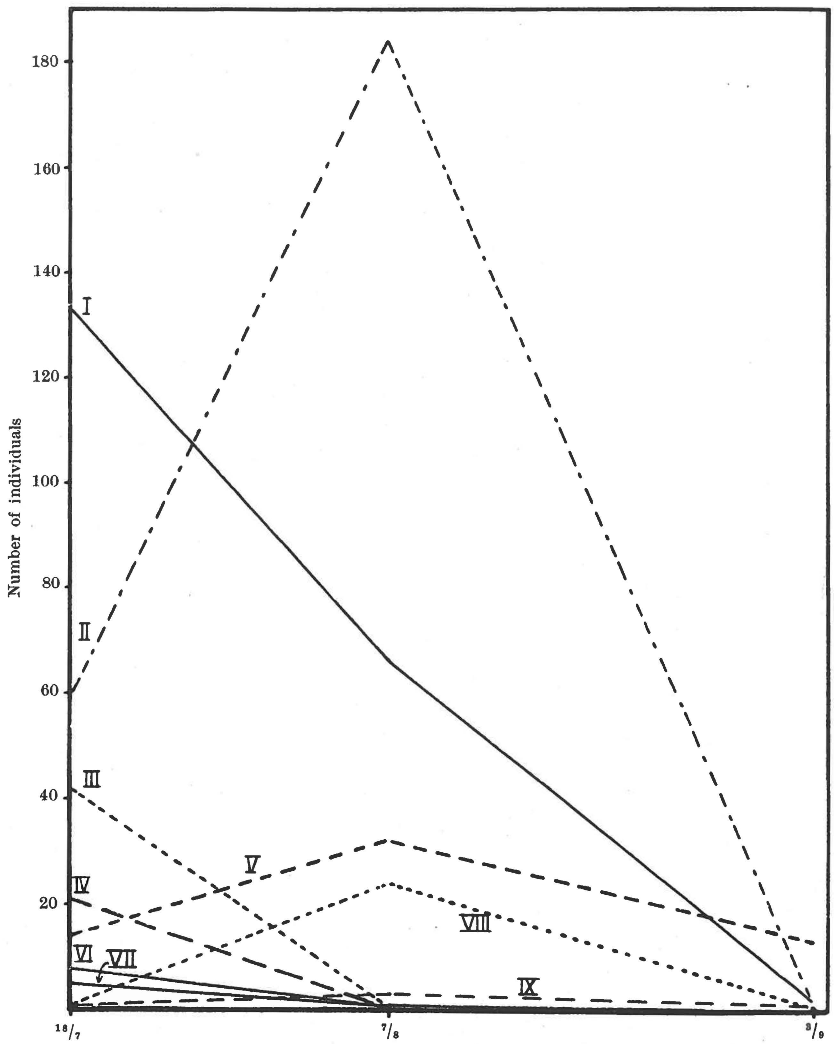


Fig. 29. Curves of the occurrence of the most important *Oribatidae* species on lichen heath, Angmagssalik. The figures are average numbers of 4, 5 and 5 samples respectively.

I *Tectocepheus velatus.*
II *Calyptozetes sarekensis.*
III *Ceratozetes thienemanni.*
IV *Chamobates cuspidatus.*
V *Oribatula exilis.*
VI *Oppia ornata.*
VII — *quadricarinata.*
VIII *Camisia horrida.*
IX *Nothrus borussicus.*

to and after this time, the population of these species is rather low. The other species, *Ceratozetes thienemanni* (III), *Chamobates cuspidatus* (IV), *Oppia ornata* (VI) and *Oppia quadricarinata* (VII), which are frequent in dry biotopes but not characteristic animals of the *Oribatula exilis* community, reproduce much earlier, having their maximum before

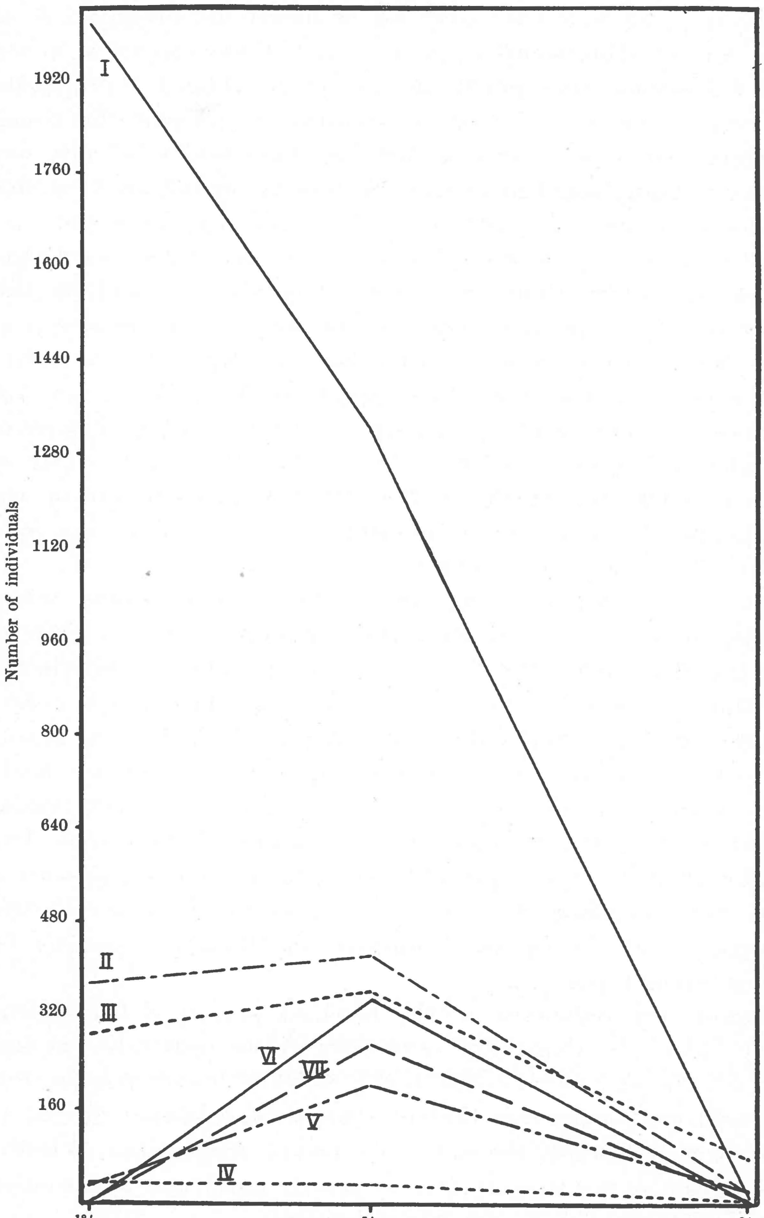


Fig. 30. Curves of the occurrence of the most important *Collembola* species on lichen heath, Angmagssalik (compare fig. 29).

I *Folsomia quadrioculata.*
II *Isotoma coeruleo-griseus.*
III *Tetracanthella wahlgreni.*
IV *Isotoma violacea.*
V *Willemia anophthalma.*
VI *Isotoma minor.*
VII undetermined nymphs.

the 18th of July, whereas they have all, or nearly all, disappeared on the 7th of August. This seems to indicate that these species in lichen heath, which desiccates very quickly in summer, are obliged to propagate at a time when there is still sufficient moisture to prevent the young from perishing, whereas the species that are characteristic of very dry biotopes can certainly stand more extreme desiccation and are thus able to reproduce at a somewhat later time. Nutrition may have some influence on the various situations of the maximum, as for instance *Calyptozetes sarekensis*, which feeds on lichens—it is always found on this vegetation—is able to procure these all the summer, whereas species feeding on fungi are only able to thrive here so long as the humidity is still sufficient to soften their food (see Chap. VII). All in all, the breeding season in lichen heath occurs still earlier than in bog. The curve of the number of undetermined nymphs is not plotted (on the 18th of July there were 600 individuals, on the 7th of August 420 and on the 3rd of September 20). Many species of oribatids seem to disappear completely after the reproduction season.

If now we examine how one species, *Tectocepheus velatus*, which occurs everywhere, behaves in the various biotopes, we find that its curves on the whole follow the characteristic course of the curves in the biotopes; thus it seems to reproduce on lake bank (fig. 25, VI) over a long period, right into September; in bog (fig. 27, VIII) the season coincides with the season of the dominating species; in lichen heath (fig. 29, I), where it is very numerous, it is among the early-mating species, but on the 7th of August the population is still large. This means that each of the species probably has different breeding seasons in the various biotopes where it occurs, determined by the water content and temperature of the biotope (compare the flowering seasons for various vegetation types p. 20).

As regards the maximum of the breeding season of the collemboles, they behave in almost the same way as the oribatids. On lake bank (fig. 26) the curve of the only really moisture-loving species, *Proisotoma tenella* (VI), resembles that of *Platynothrus peltifer* (fig. 25, I), having an increase towards the end of the period investigated. Whether the course of this curve is accidental or real is uncertain, but another occurrence curve (fig. 36, V) describes the same course. All the other species have a fairly equal population during a great part of the summer, as have the oribatids, though some of them have apparently their maximum before the beginning of the period investigated, viz. the 28th of July. This might suggest that these species have their breeding seasons before the oribatids of the biotope.

In bog (fig. 28) the position on the whole is the same as for the oribatids, with the maximum on the 7th of August or thereabouts, although the collemboles probably mate somewhat later, as the population on the 18th of July is very small; thus the season presumably lies in the first half of August.

In lichen heath (fig. 30) the season is earlier than in bog and lake bank, as is also the case as regards several oribatid species; this is true of *Folsomia quadrioculata* (I), *Isotoma coeruleo-griseus* (II), *Tetracan-*

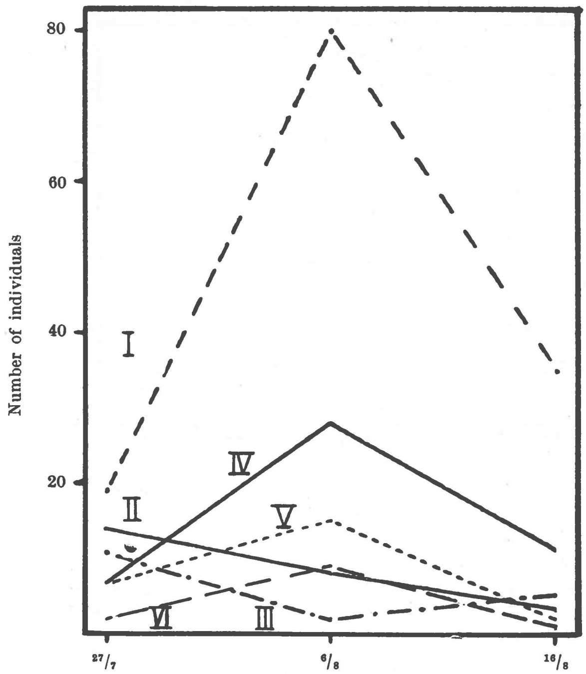


Fig. 31. Curves of the occurrence of the most important *Oribatidae* species on mixed *Chamaephyte* vegetation I, Scoresby Sound (moist). The figures are average numbers of 15, 10 and 11 samples respectively.

I *Oppia translamellata.*
II *Oribatula exilis.*
III *Trichoribates trimaculatus.*
IV *Brachychthonius brevis.*
V undetermined nymphs.
VI *Tectocepheus velatus.*

thella wahlgreni (III), *Willemia anophthalma* (V) and *Isotoma violacea* (IV); others, like *Isotoma minor* (VI) must have their maxima somewhat later, as this species is absent as late as the 18th of July, at a time when several of the other species are in the middle of their breeding season.

On observing the curves of some definite species, e. g. *Folsomia quadrioculata*, which is common everywhere in these biotopes, we shall see that their course on the whole is like the curves of the oribatid *Tectocepheus velatus.* This means that the collemboles also adapt themselves to the biotopes in which they live.

Turning now to a brief summary of the results arrived at regarding the time of the breeding season at Angmagssalik, we see that for the oribatids, the breeding season mostly sets in earliest (before the 1st of August) in dry biotopes (lichen heath), later (about the 1st of August) in bog, and still later (after the 1st of August) on lake bank. Generally speaking the collemboles behave mostly in the same way, though the

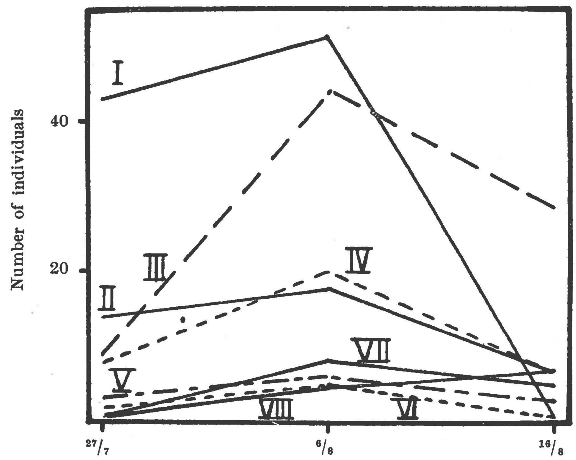


Fig. 32. Curves of the occurrence of the most important *Collembola* species on mixed *Chamaephyte* vegetation I, Scoresby Sound (moist) (compare fig. 31).

I *Tetracanthella wahlgreni.*
II *Folsomia quadrioculata.*
III — *diplophthalma.*
IV *Isotoma sensibilis.*
V *Hypogastrura armata.*
VI *Willemia anophthalma.*
VII *Hypogastrura purpurascens.*
VIII *Anurida granaria.*

season is somewhat earlier on lake bank, in bog a little later than is the case with the oribatids.

At Scoresby Sound investigations have been made in dry and in moist biotopes (not wet; the moist is considered as belonging to the dry community), four and three times respectively in the course of a month. A comparison with the results from previous investigations reveals that here too the animals mate at different times, according to the character of the biotope, and they behave quite as was found before. In the moist biotope, the mixed *Chamephyte* vegetation I (fig. 31), there is a great number of undetermined oribatid nymphs (V) on the 27th of July; the number rises to a maximum on the 6th of August, but on the 16th of August there are still some few nymphs. The curves of most species describe the same course. The fairly great number of individuals on the 16th of August might signify that the breeding season has not yet expired. Most collemboles (fig. 32) behave in the same way. (An exception is *Tetracanthella wahlgreni* (I), which has almost disappeared

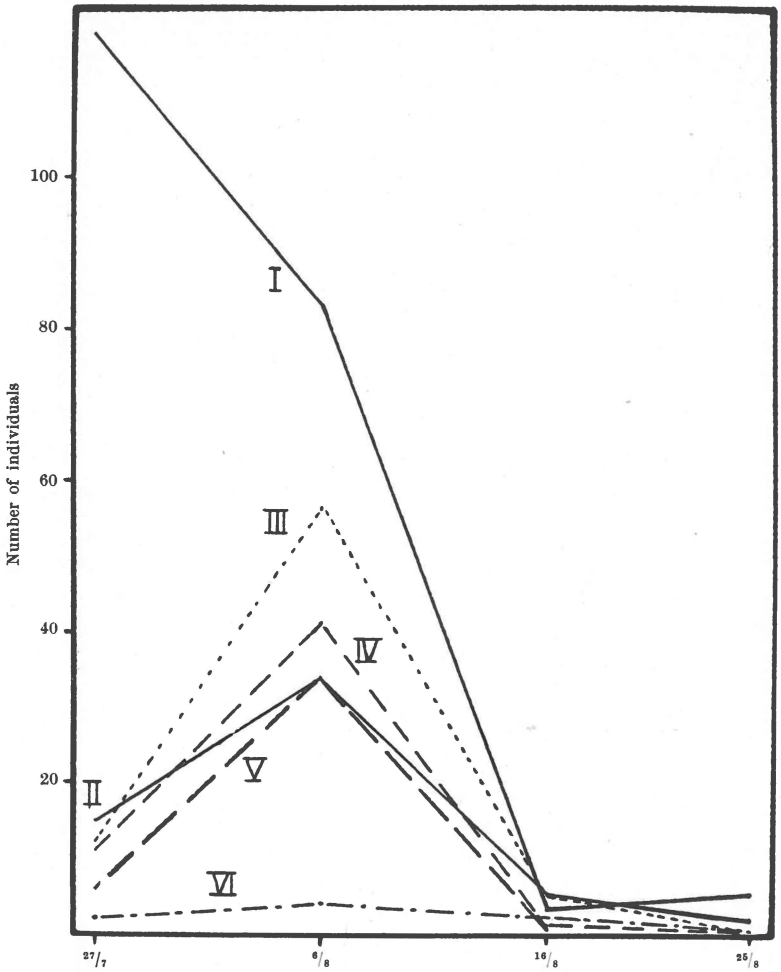


Fig. 33. Curves of the occurrence of the most important *Oribatidae* species on mixed *Chamaephyte* vegetation II, Scoresby Sound (dry). The figures are average numbers of 11, 14, 14 and 9 samples respectively.

I *Brachychthonius brevis.*
II *Oribatula exilis.*
III undetermined nymphs.
IV *Oppia translamellata.*
V *Tectocepheus velatus.*
VI *Trichoribates trimaculatus.*

on the 16th of August.) The breeding season must here be presumed to start in the middle of July and continue until the last half of August, i. e. a comparatively lengthy season, as in the wet biotope on Ella Island and at Angmagssalik. In the dry biotope (fig. 33—34) the conditions are slightly reminiscent of those in lichen heath at Angmagssalik, with a season which, for some species—e. g. *Brachychthonius brevis* (I) —on an average falls earlier than in the moist biotope and at any rate expires more quickly. Already on the 16th of August the animal life of

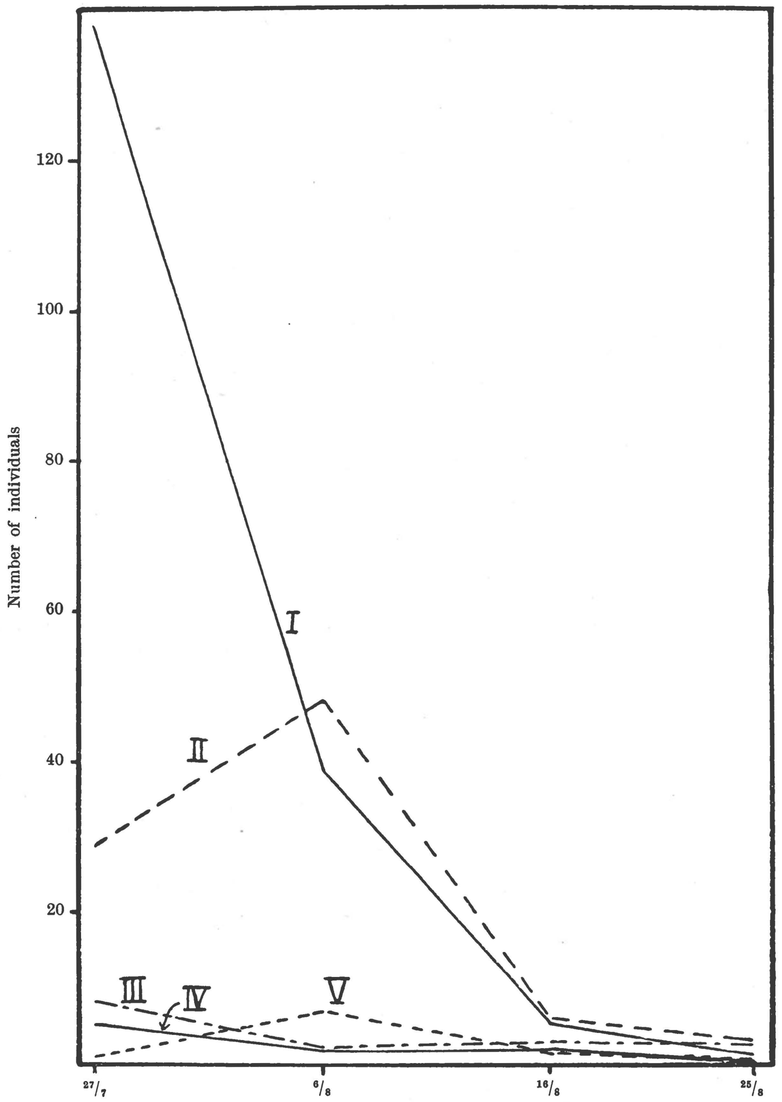


Fig. 34. Curves of the occurrence of the most important *Collembola* species on mixed *Chamaephyte* vegetation II, Scoresby Sound (dry) (compare fig. 33).

I *Folsomia quadrioculata.*
II — *diplophthalma.*
III *Hypogastrura armata.*
IV *Onychiurus groenlandicus.*
V *Isotoma sensibilis.*

this biotope is reduced to the usual winter population, while life in the moist biotope as yet is far from having reached this stage (compare *Oppia translamellata*, *Brachychthonius brevis* and the collembole *Folsomia diplophthalma* in the two biotopes). The breeding season in the dry biotope starts presumably in the middle of July (perhaps earlier) and is already over about the middle of August. The reason why the breeding season probably expires already in August, even in the moist biotope, while it lasts far into September on lake bank at Angmagssalik, is that this biotope dries up during summer and thus it cannot be compared direct with the wet biotopes proper. That the season in the dry biotope for most species does not begin before that of the moist biotope,

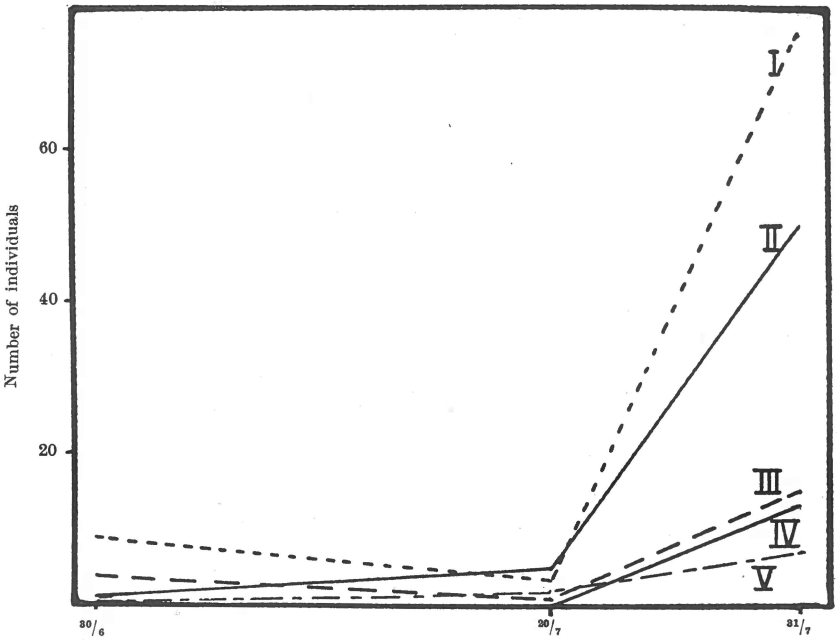


Fig. 35. Curves of the occurrence of the most important *Oribatidae* species on bog, Upernavik. The figures are average numbers of 3, 4 and 4 samples respectively.

I undetermined nymphs.
II *Brachychthonius laetepictus.*
III *Trichoribates trimaculatus.*
IV *Platynothrus peltifer.*
V *Oribatula exilis.*

is presumably due to its character; according to Th. Sørensen (verbal communication) no really dry plant community occurs at Scoresby Sound and the moist biotope is very like the dry one (p. 34).

In the Upernavik area samples were taken three times in the course of one month in bog, fell-field and mixed *Chamaephyte* vegetation, of which the two latter represent the dry biotope.

In the bog it will be seen that exactly similar conditions prevail for the oribatids (fig. 35) as on lake bank at Angmagssalik (fig. 25). Until the 20th of July the population is small, but already on the 31st of July it has increased greatly; from the curve of undetermined nymphs (I) it becomes clear that this is really a case of an addition of newly hatched individuals. Thus the breeding season begins here in the last part of July, as it does on lake bank at Angmagssalik. What the course is later on, how long the period lasts, whether it expires quickly or continues for a time, cannot be decided by these curves, which record only the beginning of the period.

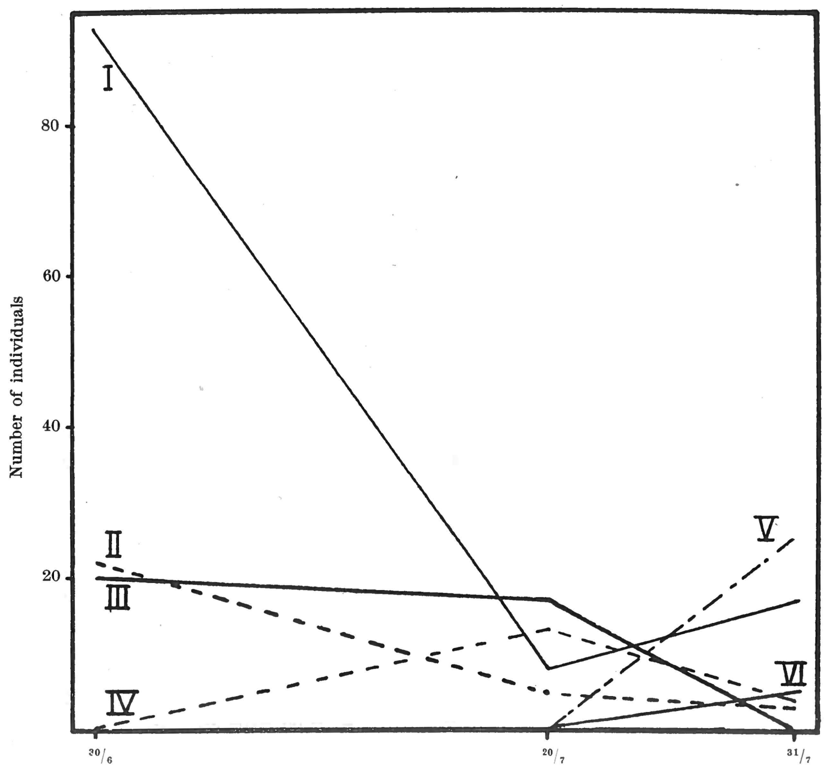


Fig. 36. Curves of the occurrence of the most important *Collembola* species on bog, Upernavik (compare fig. 35).

I *Folsomia quadrioculata.*
II *Isotoma sensibilis.*
III *Tetracanthella wahlgreni.*
IV *Hypogastrura armata.*
V *Xenylla humicola.*
VI *Hypogastrura purpurascens.*

The curves showing the behaviour of the collemboles (fig. 36) are somewhat different; only *Xenylla humicola* (V), which is most frequent in wet localities, and *Hypogastrura purpurascens* (VI) describe the same course in their curves as the oribatids (compare *Proisotoma tenella* on lake bank at Angmagssalik (fig. 26 VI). The other species mate somewhat earlier, in June-July (compare *Folsomia quadrioculata* (fig. 36, I) with *F. quadrioculata* on lake bank, Angmagssalik (fig. 26, I)).

In the dry biotope (fell-field, mixed *Chamaephyte* vegetation) the course of the curves of each of the oribatid species (fig. 37) deviates somewhat from the curves for the previously mentioned dry biotopes. However, there is a tendency in the same direction, showing that the species which though found here are not characteristic of dry biotopes, e. g. *Oppia quadricarinata* (III) reproduce earlier (June—July) than the species that are characteristic of the biotope, in this case species able

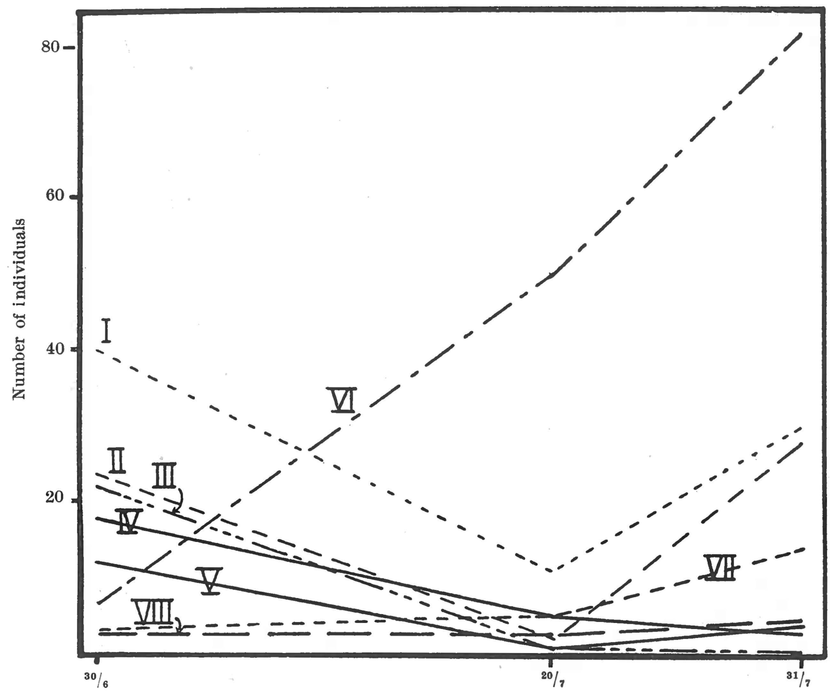


Fig. 37. Curves of the occurrence of the most important *Oribatidae* species on fell-field—mixed *Chamaephyte* vegetation, Upernavik. The figures are average numbers of 7, 6 and 6 samples respectively.

I undetermined nymphs.
II *Oppia translamellata.*
III — *quadricarinata.*
IV *Brachychthonius laetepictus.*
V *Hammeria groenlandica.*
VI *Oribatula exilis.*
VII *Eremaeus oblongus.*
VIII *Tectocepheus velatus.*

to stand much drought, such as *Oribatula exilis* (VI), which reproduces in July—August.

Turning to the collemboles (fig. 38) the course of the curves is nearly the same. The large number of *Tetracanthella wahlgreni* (I) on the 31st of July is mainly due to a single sample where *Tetracanthella* was very numerous, containing 588 specimens, while the six other samples in which this species was found, had only 20 individuals altogether.

The samples taken on the 20th of July were not processed for the necessary time, as previously mentioned. Expulsion was interrupted while they were still moist. The figures for this date are thus probably too low (p. 25). All in all, only slight knowledge may be obtained from the samples from Upernavik about the time of the breeding season by comparison with similar biotopes in other regions; to draw conclusions

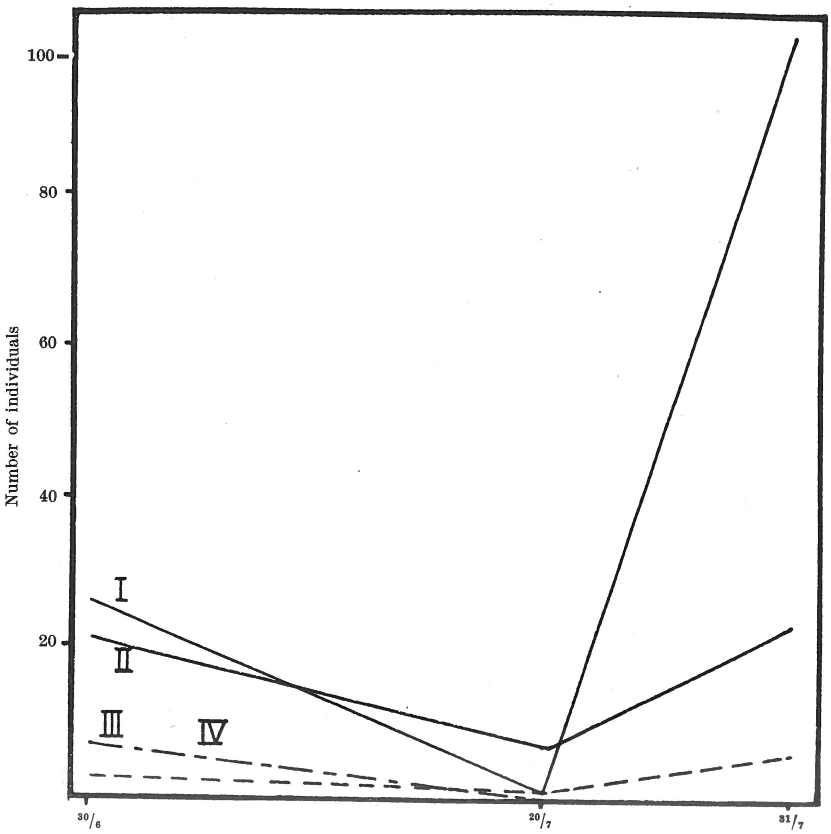


Fig. 38. Curves of the occurrence of the most important *Collembola* species on fell-field—mixed *Chamaephyt* vegetation, Upernavik (compare fig. 37).

I *Tetracanthella wahlgreni.*
II *Folsomia quadrioculata.*
III *Isotoma coeruleo-griseus.*
IV — *sensibilis.*

from this material alone is not feasible. By comparing the curves of the same species, e. g. *Brachychthonius laetepictus* (figs. 35 II and 37 IV) from the dry and the wet biotopes it becomes clear that the oribatids, as at other places, reproduce earlier in dry than in wet biotopes.

On comparing the time of the reproduction season (table 17) with the time of the flowering periods (p. 20), tabled by TH. SØRENSEN (1941) and the climatic conditions within each area and biotope, it will be seen that the reproduction season on the whole is simultaneous with the flowering season, i. e. at the time most favourable in each biotope as to humidity and temperature.

Ella Island has a dry, continental climate with early summers as a consequence of the strong insolation. In snowfree or early thawing localities (fell-field, mixed *Chamaephyte* vegetation) the flowering season occurs from the end of June until the middle of July or a little later (aestival aspect p. 20). In these vegetation types (table 17, Ella Island, dry) the breeding season of the *Oribatidae* is also in June—July, i. e. simultaneously with the flowering season.

Table 17. Reproduction seasons of the *Oribatidae* in dry and wet biotopes.

Ella Island	dry		June—July
	wet		end of July—beginning of August
Scoresby Sound	dry		middle of July—beginning of August
	moist		middle of July—end of August
Angmagssalik	dry		July
	wet	bog	middle of July—beginning of August
		lake bank	end of July—(beginning of August—) September
Upernavik	dry		June(?)—July
	wet		end of July—?

In bog things are somewhat different. The breeding season is in the last part of July and the first part of August, but the flowering season is earlier (aestival aspect), as was the case on fell-field and in mixed *Chamaephyte* vegetation. When the animals propagate at a later time it is probably the result of the special conditions of humidity in the biotope, which consists of tussocks surrounded by water (p. 32). The water dries up in the course of the summer, but the tussocks where the samples were taken retain some moisture all the summer (communicated by Th. Sørensen). Thus the animals are able to reproduce at a later time when the temperature, because of the disappearance of the water, is higher and the humidity still sufficient, whereas the plants, which no doubt require more moisture, end their flowering season earlier.

At Scoresby Sound the summer is shorter and commences rather later than on Ella Island, as a consequence of the high atmospheric humidity (fog). The quite dry plant communities are lacking on account of the oceanic climate. In the biotopes investigated (dry and moist mixed *Chamaephyte* vegetation (aestival aspect)) the breeding season was from the middle of July to the beginning of August and from the middle of July to the end of August respectively. This seems to agree well with the climatic conditions and the flowering, which here, at the outer coast, is retarded compared with Ella Island (p. 20).

At Angmagssalik the summer is likewise later than on Ella Island. The breeding season in dry biotope (lichen heath) in July is presumably simultaneous with the flowering season at the same place. At any rate, fell-field was in full bloom at the time when the first samples were taken (mid-July). In wet biotopes the season commences a little later and at about the same time as on Ella Island. The bog on Ella Island was almost dry at this time; at Angmagssalik it was not so, on account of the later arrival of the summer. On lake bank which is wet all through the summer, the animals are able to propagate as long as the temperature permits.

The early breeding season in dry biotopes (June—July) at Upernavik cannot very well be correct. Samples taken on the 20th of July (figs. 35—38) are probably much too small (compare p. 25). A greatly increased number of individuals at this time will produce a maximum in July, which is the probable time of the breeding season. This would also agree with the climatic conditions which are about the same as at Scoresby Sound, where the reproduction season is in July—August. In the wet biotope (figs. 35—36) an increase of the population on the 20th of July will have the effect that the reproduction season which, according to the curve, commences in the latter part of July, will be shifted towards the left (commencing earlier); nevertheless the increase would have to be very great if it were to alter the tendency, which reveals a later reproduction season, as in the other wet biotopes investigated. As wet biotopes have not been investigated at Scoresby Sound, the wet biotope at Upernavik will have to be compared with the one at Angmagssalik. Owing to the speedily decreasing temperature, however, the season at Upernavik cannot continue so long as at Angmagssalik.

The investigation of the breeding seasons of the microfauna in various biotopes reveals that they apparently set in everywhere simultaneously with the flowering seasons of the corresponding plant associations. As it is the same factors that govern the flowering and the breeding season of the animals, and as the animals are very closely associated with the vegetable world, it was only to be expected that the time of the highest activity of life would coincide. This should not be interpreted as meaning that all individuals propagate at the same time within the time stated; this is the time of the maximum, but all through the summer there are individuals which reproduce somewhat before or after the time of the maximum. This coincidence of the flowering time and the reproduction season may be of some significance to the nutrition of the animals; it has been found that many oribatids and collemboles feed on pollen grain, spores, sclerotia and pieces of hyphae of fungi, pieces of leaves and the like (Strebel 1938), of which the pollen grains in any case are easiest to procure during the flowering season. As they are very rich in albumen they may very well be necessary for the young animals during their growth.

Why do the oribatids and collemboles propagate so relatively late in summer when the temperature in the surface of the soil already from the beginning or the middle of May (table 5) is sufficiently warm for the hatching of the eggs? When the biology of the reproduction of these animals is known it will be seen that there is a possibility of the hatching of the eggs in May, June, July and August, perhaps also in the first part of September, as hatching can take place when the temperature is below 5° C. (for sminthurids, Agrell 1941). Maclagan (1932) sets the lowest limit for the hatching of eggs at 3° C. mean temperature for *Sminthurus viridis*; at this temperature the production of eggs is virtually nil, the optimum being at 7° C. If 5° C. is put as the lowest limit for hatching, it may theoretically take place in the months stated, when the temperature of the surface of the soil at mid-day is far higher than this temperature. Sig Thor (1931) is inclined to believe that some mating takes place beneath the snow, as the most favourable time for mating is very brief. However, this can hardly be the case, as the temperature beneath the snow does not rise above zero (p. 19).

As regards the adult individuals, Agrell (1941) has demonstrated, by means of thermo-preferanda tests, that *Isotoma sensibilis* in Lapland, where it lives under almost the same conditions as in Greenland, at a temperature of 5° C. behaves normally, while at lower temperatures it becomes steadily less mobile. This means that adult individuals also show life very early in the spring time, when the temperature of the surface of the soil where they live is only some few degrees above zero. Th. Sørensen (1941) has shown that the plants commence their growth when the temperature of the surface of the soil reaches zero, and that they are able to avail themselves of the warm hours in the middle of the day at the time when the mean temperature of the air is still negative and when most of the twenty-four hours there have a negative temperature. Thus there is a great probability that the same is the case with the animals, which presumably are not injured by the cold part of the twenty-four hours. By means of a long series of thermo-preferenda tests Agrell (1941) has shown that a very great part of the Lapland collemboles can stand several degrees beneath zero without becoming stiff with cold; the lower temperature limit for *Isotoma sensibilis* was found to be between—4 and—8 degrees. By an investigation of winter insects TAHVONEN (1942) found several species of collemboles moving about on the snow at very low temperatures (*Isotoma sensibilis* at — 6.2° C., *Isotoma viridis* at — 6 and *Isotoma violacea* at — 4° C.). That these are not exceptional cases will be seen from the enormous number of individuals of *Isotoma olivacea* observed. At 2—3° of cold up to 6000 specimens were found per square metre. That collemboles may appear in such teeming multitudes on the snow is also known from the famous phenomenon of the mass occurrence, when they are to be seen in layers several centimetres thick, most often in spring and in winter (FRENZEL 1939, SCHÖTT 1896). Even if many oribatids and collemboles may thus be able to stand very low temperatures in the spring, it is probable that egg-laying does not take place until a certain temperature and light intensity are reached; the state of nutrition must likewise play a considerable rôle. Still another reason why egg-laying cannot take place at once is that not all the hibernating individuals are fully grown and mature when they appear in the spring. It has been stated for plants that growth will commence, at least as regards trees, when there are growth hormones in the buds, and that light and warmth influence the creation of growth hormones (HUSTICH 1940). In analogy with this we may imagine something of the same nature as regards animals, so that development of the eggs in the ovaries, which probably is set going by hormones, does not accelerate until a certain temperature and light intensity are reached. SIG THOR (1931) states, that with mites the period of incubation of eggs is often two or three weeks, sometimes one, four, or more weeks, according to the temperature. Like their incubation, so the laying of the eggs is also dependent on the temperature. MACLAGAN (1932) sets the optimum for the egg production of *Sminthurus viridis* at 7° C. At 3° this species lays hardly any eggs. RIPPER (1930) proved that the temperature interval in which *Hypogastrura manubrialis* normally lives and is able to propagate, is between about 6° C. and 22—24° C. Unfortunately I know nothing of the temperatures at which the oribatids begin to appear in the spring. As the oribatids and the collemboles undoubtedly hibernate in all stages of development (no eggs have been found, but quite small, newly-hatched individuals), the hatching of overwintering eggs, according to what was stated above, may take place early in the spring, when the surface of the soil has attained a temperature of 5° C. or thereabouts. Egg-laying, on the other hand, will probably begin later on. The time of incubation is stated to be 19 days at 22° C. for *Hypogastrura manubrialis*, 36 days at 10° C. (RIPPER 1930). As to *Hypogastrura purpurascens* it has been stated to be 19 days at least; in the months October to April 26 days on an average, in May to September 19—21 days (STREBEL 1932). With several *Prostigmata* (mites) the eggs are hatched after the passing of three weeks (rarely one or six weeks) (Sig Thor 1931). After a lifetime of two or three weeks, according to temperature and nutrition, the collemboles are fully grown and capable of propagation (Handschin 1926). Strebel (1932) states the time for *Hypogastrura purpurascens* to be four weeks. Ripper (1930) sets the time of development until maturity at five to seven weeks for *Hypogastrura manubrialis*.

Purely theoretically speaking, on the basis of the above information as to the length of time of the development of the eggs and of the development of the animal, it is possible to calculate when the maximum in the breeding season approximately sets in. If we assume that the overwintered eggs are hatched about the 5th of May (table 5), and that the animals take four weeks to attain maturity, there will be adult and mature individuals on the 5th of June or thereabouts (first generation). If these individuals propagate the same summer, and the time of incubation is put at 36 days (at 10° C.)—which presumably is too long—the second batch of individuals will appear about the 10th of July (second generation).

Eggs laid in the spring, for instance on the 5th of May, will hatch approximately 36 days later, i. e. about the 20th of June. Thus a new generation appears on the 20th of June as well as on the 10th of July. In the curves of the annual rhythm (figs. 23—24) only one maximum is seen; as the two maxima are very near each other, it would certainly be curious if the annual curve were to show them, as a slight aberration will make the two peaks merge together. There is also the possibility that the supposed second generation on the 10th of July is so small, because only a small percentage of the eggs have overwintered, that this generation is not discernible in the already uneven population. Finally it may be imagined that the second generation is not developed at all if it should happen that individuals hatched from overwintered eggs do not lay eggs until the following year, or that the eggs overwinter.

If then it is considered that development in dry biotopes goes on more quickly on account of the higher temperature, that in wet biotopes it is slower on account of the slower heating, and that all the periods of development mentioned have only been estimated according to what is known from other sources, it will be seen that the theoretically determined maximum will occur at the same time as that actually found from the course of the curves (figs. 23—24). That means that the duration of the various phases of development follows the oscillations of the temperature so exactly that the whole development arrives at a maximum at the same time as flowering reaches its peak. If spring comes late, the development of plants as well as of animals is retarded;

if it comes early, the development of both is accelerated; thus they will always be simultaneous because the same factors determine both.

Oscillations in population and number of generations.

With the intention of determining the causes of the oscillations in the populations of collemboles and mites, investigations have been made in many countries like those made in Greenland, where I found that temperature and humidity in the middle of the summer produce a maximum which has its cause in a lively reproduction.

THOMPSON (1924) made investigations in England on various forms of pastures and cultivated soil every fourteenth day throughout two years; he found a maximum in winter and a minimum in summer, a maximum at a time totally different from that in Greenland. The reason for this is undoubtedly the widely different climatic conditions. The winter maximum in England is due to the fact that drought is relatively rare in winter when the water content is more constant. The maximum is caused by an increase of both larvae and fully grown individuals. The summer minimum is caused by drought, which is usually fatal if it lasts more than a short time (THOMPSON 1924). FORD (1937—38) showed that collemboles and mites have oscillations in the population, with maxima in November—December, early February and later in February, with minima in between. The minimum in February was simultaneous with a period of cold and dry weather, whereby the animals were killed. It was proved that they had not gone deeper down into the soil. The three maxima in winter are probably one single maximum, dispersed by unfavourable temperature periods; thus we have, as shown by THOMPSON, one maximum in winter. No investigations were made in summer.

FRENZEL (1936) has made similar investigations of collemboles and mites in meadows in Germany. He found that the strongest development takes place in the autumn when the soil contains a considerable quantity of moisture, and the amount of humus in the soil has reached a maximum because of fallen and decaying plant remains. The highest number of individuals is found in September—October. Towards winter the number decreases slowly. Usually the minimum falls in February; the reason for this is the drought caused by the frozen soil. In the spring, until April—May, comes an increase, whereas the summer months, June, July and August again cause a decrease in the population on account of the drought.

In contradistinction to FRENZEL, FRANZ (1943) found no decrease in the population of the minute animals of the soil during the summer months. This has to do with the fact that the precipitation at Admont, where Franz made his investigations, is very great and greatest during the summer months.

From these investigations into the oscillations in the population of mites and collemboles, where now one, now two maxima were observed in the course of the year, it has become clear that moisture is the factor that first and foremost stimulates propagation. A high temperature cannot play any large part in this relation, as it nearly always coincides with dry periods, which mean devastation to the animals. In the countries where investigations have been made, the temperature in the autumn (Germany) and in the winter (England) is apparently sufficiently high for breeding. In Greenland, however, where conditions are quite different, the period in which propagation is possible is very brief. Here too the maximum occurs outside the dry period proper (before the biotope dries up), but on account of the short time when propagation is possible, the period that is most favourable because of humidity is simultaneous with a period when the temperature is also favourable, whereby the reproduction season presumably becomes brief and intense. This may be the reason for the very great numbers of individuals which are found in Greenland in the middle of the best summer time (figs. 27—30).

All these investigations of the behaviour of mites and collemboles at the various seasons have been undertaken with the animal groups in question taken as a whole, regardless of the various species. A more detailed investigation of the time for the propagation of some species of collemboles has been made by Strebel (1938). From this we learn something very interesting, namely that the maxima of the various species sets in at different times in the year. *Lepidocyrtus cyaneus* has its maxima in May and October and a minimum in between. *Entomobrya nivalis* was found in May, June, July, September and October (where the maximum lies is not mentioned, according to a table apparently in October); other species show maxima at other times in the summer. Agrell (1941) too has investigated the occurrence of each particular species throughout the year. In Lapland, where the external conditions are nearly as in Greenland, he found that several collembole species have 2 maxima (generations). He has shown, among other things, that the following species, which also occur in Greenland, have 2 annual generations: *Folsomia quadrioculata* 2: an early spring and a summer generation, *Isotoma bipunctata (notabilis)* 2: a spring and an autumn generation, *Arrhopalites pygmaeus* also 2 generations: an early spring generation and a later one, the time not stated, and *Achorutes muscorum* 1 (2): probably a late autumn generation, perhaps also a spring generation. In Greenland too it may be supposed that the collemboles may have two generations if the species in question hibernates in the egg stage (p. 129). With species that do not overwinter as eggs it is not probable that there is more than one generation in the middle of the summer in the period most favourable as to temperature and humidity. In the curves for the annual occurrence of the collemboles on Ella Island (figs. 23—24) there is only one maximum of immature individuals. In the event of there being two generations, they must be very near each other as to time. In the other regions, where only the actual summer months have been investigated, it cannot be decided whether there may also be an earlier or a later generation; but according to the results hitherto found—that the breeding season of the animals in all biotopes takes place exactly at the time most favourable as to temperature and humidity—there is very little probability that particular species should deviate from the others and have two generations instead, of which one, perhaps both, would make their appearance either before or after this time. The curves of the species concur with amazing regularity, and nowhere can one see the beginning or the end of a generation displaced outside the breeding season.

As regards the oribatids, HAARLØV (1942) assumes that the individuals that hibernate, both young and old, lay eggs when they arrive at maturity in the spring; from this issues a generation which winters in the larva and nymph stages. This means that the year has one generation only. From the occurrence of the animals during the breeding season (for instance figs. 25 and 27), it will be seen that the number of adult animals and of nymphs increases rapidly at the commencement of the period; later on, towards the end of the breeding season, the number of both adults and nymphs decreases, and thus HAARLØV cannot very well be right in saying that the generation that issues from eggs laid by individuals, which have hibernated as larvae, nymphs and mature individuals, cannot attain the fully grown stage but overwinter as undeveloped individuals. The great majority does grow up and dies shortly after, while a smaller part, consisting of adult individuals, nymphs and larvae, probably of the same generation, hibernate (figs. 21—22).

Very little is known about the life cycle of oribatids and collemboles. SIG THOR (1931) says about *Acarina* generally: "Bei einzelnen Gattungen (besonders in wärmeren temperierten Gegenden) treten mehrere Generationen im Jahre auf; gewöhnlich gibt es aber einen jährlichen Zyklus". That two annual maxima, each possibly with several generations, may occur, under conditions where the cold does not paralyse the animal life most of the year, as found by FRENZEL, is very probable.

Chapter IX.

The origin of the fauna in Greenland.

For many years lively discussions have been going on as regards the origin of the fauna in Greenland, Iceland, Spitzbergen, Bear Island, etc. Did the fauna survive the Glacial Age, or is it of a later origin? And in the latter case, along what roads did it come to these remote, isolated islands?

It seems that most people agree in thinking that the primitive forms within the microfauna of these lands spring from an earth period when Greenland, Spitzbergen, etc. were connected with North America, the north Atlantic Islands and Europe. (Sig Thor 1930, Haarløv 1942).

Most of the primitive forms are common to these areas (Chap. V). When the various Arctic regions had been severed from each other and from the European continent by the sea, the higher forms are then supposed to have originated on the continent (Sig Thor 1930). On account of the isolating seas the approach to the Arctic islands for the higher forms was difficult, and therefore many more or less imaginable roads by which an immigration may have taken place have been suggested.

Schäffer (1900) points out that the reason for the almost complete absence of the higher collembole forms in Greenland, *Sminthuridae* and *Entomobryidae*, is due to their slight power of resistance rather than to difficult approach, and also to the fact that their preferred environment —luxuriant vegetation and the bark of trees—are lacking. In the coastal regions of the Asiatic part of the Arctic, where a richer vegetation can exist, the fauna has an altogether different composition with highly developed forms such as *Sminthurus*, *Papirius*, *Tomocerus*, *Sira*, *Orchesella* and others. In support of his theory that the slight power of resistance and the want of suitable environment are the causes why the highly developed forms are absent in Greenland, Schäffer calls attention to Wahlgren's investigations (1899 a) of the collembole fauna on the outermost skerries along the east coast of Sweden. Wahlgren found that the greater part of the collembole fauna on these rocks consists of *Poduridae* (here *Hypogastrura* and *Xenylla*) and *Aphoruridae* (here *Anurida*), which are the most hardy, the most widely distributed collemboles, those from which the collembole fauna on snow and ice in the countries in the temperate zone originates, and which in the high Arctic countries constitute the great majority of the collemboles there. On account of their greater power of resistance they are able to live under extremely poor conditions, such as prevail on the outer skerries and in the Arctic areas.

Is it possible that the oribatid and collembole fauna, with their strong blending of primitive forms, have survived the glacial period?

As regards Greenland it is presumed that high, snowfree rock summits (nunataks) or fairly large snow-free areas jutted above the glacial masses and that many particularly hardy plant species probably survived the maximum of the glacial period in these ice-free regions (OSTENFELD 1926). OSTENFELD estimates the number of such species at 60. As an example of an area that presumably was not glaciated one may instance the inner fjord at Angmagssalik; here, on Cassiope Mountain (lat. 66°07′N.) there is an extensive *Cassiope tetragona* heath with several other northern species (the only place where *Cassiope tetragona* has been found in this region). As the mountains moreover are of alpine character, it is probable, according to GELTING (1934), that this was an unglaciated region. Several similar areas are known on both the east and the west coast.

Even if these areas were covered with snow during winter, animal forms like oribatids and collemboles may very well thrive under such conditions, when they are snowfree in summer and the summer temperature is sufficiently high, so that propagation may take place. According to WOLDSTEDT (1929) the temperature during the glacial period in Arctic regions was 3° (— 4) lower than nowadays. Apparently it was not severe cold but abundant precipitation that caused the glacial phenomenon. As the lowering of the temperature mainly affected the summer (which can be shown in several ways which need not be entered into here (WOLDSTEDT 1929)), such a lowering of the temperature may be rather serious for the more highly developed insects such as butterflies, but scarcely for oribatids, collemboles and the like, which live on the surface of the soil or just beneath it. As insolation was just as strong then as now (BÄBLER), the conditions for existence in summer on snowfree mountain summits in the Alps—according to BÄBLER (1910)—must have been about the same as nowadays. Knowing how far the temperature of the surface of the soil in Greenland may rise during summer as a result of insolation, there seems to be nothing to prevent hardy forms associated with e. g. the lowest vegetable forms—lichens and mosses—from surviving the glacial period on ice-free patches, even if subjected to a slightly lower temperature. If higher, specialized forms lived in Greenland long before the glacial period—in the Cretaceous and the early Tertiary Period, when Greenland had a luxuriant vegetation, known to us from deposits in West Greenland—these must have perished as the climate deteriorated and the vegetation shrank to within the smallest possible limits (lichens, mosses, hardy rock plants).

AD. S. JENSEN (1928) mentions that the geologist A. KORNERUP in 1878 at Jensen's nunataks (70 km from the fringe of the ice and 1600 m above sea level) found 1 *Lepidoptera* larva and 2 spiders, wherefore it may be supposed that other animals may also have lived there to serve as food for the spiders.

On the Karajak-nunatak in the inner part of the Umanak Fjord, VANHÖFFEN (1897) made an investigation of the life of the lower terrestrial and fresh-water animals. Here among other he found the oribatids *Leiosoma globifer* and *Platynothrus peltifer*, which were fished out of a small pool together with fresh-water *Crustaceae*. VANHÖFFEN presumes that on nunataks during the glacial period conditions were such that the easily satisfied fresh-water fauna could exist there. In shallow pools near the inland ice the temperature measured was 15° C., but larvae of *Culicidae*, *Rotifera*, *Nematoda* and *Tardigrada* would thrive at 3° too.

LACK (1934) has likewise investigated the animal life on a nunatak (the Scoresby Sound region), where it may be assumed that the animals live under the hardest of life conditions outside the glaciated regions: here he found 3 species of collemboles, 1 *Diptera* (*Chironomidae*) and 1 spider in the sparse vegetation, which consisted of *Chryptogamae* and *Phanerogamae*. From this he draws the conclusion that collemboles and chironomids, perhaps also spiders might probably survive a glacial period, provided that some patches of land remained ice-free. LINDROTH (1931) has demonstrated that as far as climate is concerned practically the entire insect fauna in Iceland can exist 1200—1400 m from the fringe of the glacier (Öräfi), even if the temperature in this area should fall by 2°, whereby the conditions would closely approximate the supposed conditions in ice-free regions during the glacial period. He found, too, that the glacial masses had no injurious influence on the flora or the fauna.

Investigations of the 'cryoconite' holes and their fauna seem to indicate that lower animals such as *Tardigrada* and *Rotifera* have survived the glacial period—in their case in water-filled holes (cryoconite holes) in the inland ice itself (STEINBÖCK 1936).

If thus I presume that the most primitive forms, which have also turned out to be the most hardy, have survived the glacial period, it is an open question how the present element of higher developed forms came to Greenland.

Various hypotheses have been set up, and they all have their champions. The immigration may have taken place across the ice, by driftwood or drift-ice, by birds, by the wind, by ships or along a land bridge.

Across the ice. This form of immigration cannot play any great part as regards small and not very active animals like oribatids and collemboles, all the more so as here it is a question of the higher developed and presumably most frail species. As regards larger animals, we know that Greenland's mammals immigrated in this way and that foxes and reindeer came for instance to Bear Island across the ice (BERTRAM and LACK 1938).

By drift-wood or drift-ice. Most oribatids and collemboles could hardly stand being in salt water for a year or so; this mode of distribution can therefore come into consideration only for those forms that normally live on the beach. *Archisotoma besselsi*, which is very often found beneath sea-weed or the like on the coasts of the Atlantic and Arctic, has such a distribution (HAMMER 1938) that in all probability it proceeded by means of currents in the sea; with drift-wood this species may have been carried from coast to coast, presumably hidden in the tree-trunks, where it found sufficient nutrition in the *Algae* and the like which are also its food under normal conditions. VITZTHUM (1943) holds the view that during their youthful stages oribatids may be spread in this manner. At the eruption of Krakatao in 1883 all life was extinguished; but already in 1921 there were oribatids on the island; apparently they cannot have arrived there but by having been hidden in pieces of wood carried across from Java or Sumatra, a distance of about 40 km. With such short distances a distribution by means of floating timber or the like may be possible. WAHLGREN (1899 a) too supposes that within short distances distribution by means of water is possible. The collemboles on the outer rocks may be carried by waves from rock to rock and thus be distributed all along the coast. But across great distances, where the drift-wood may be tossed about in the sea perhaps for years, it may be presumed that only those species which are able to adapt themselves to existing circumstances in so far as they may breed and feed there, can be distributed. SELLNICK (1940) is of the opinion that currents in the sea, for instance the Gulf Stream, play a part in the spreading of mites, but I do not think that this way of dispersion can be of much significance.

ELTON (1925) mentions that collemboles may probably be carried upon drift-ice from Siberia to Spitzbergen by the same currents that carry the drift-wood, as *Ågrenia bidenticulata* has the habit of wandering across snow fields, probably in order to eat pollen blown out there. Drift-ice cannot be credited with much significance as regards the transportation of these animal groups to Greenland.

By birds. A frequent reason why this possibility of distribution is mentioned by many authors (WAHLGREN 1899, LINDROTH 1931, ELTON 1925, HAARLØV 1942 and others) is that very often a rich collembole and mite fauna is found in birds' nests. This abundance of animals found in this special biotope may, however, be due to other factors, as for instance higher temperature, special and ample nutrition, and is not necessarily connected with distribution by means of birds. *Oromurcia lucens* and *Camisia horrida* are stated (HENRIKSEN and LUNDBECK 1917) to have been found on *Lagopus mutus*, and *Nothrus borussicus* (HENRIKSEN and LUNDBECK 1917: *Nothrus biciliatus* p. 41) on *Harelda glacialis*, but I presume that the birds were dead. That birds may have some share in the distribution of oribatids and collemboles across short distances cannot be denied. ELTON (1925) mentions that kittiwakes at Bear Island were seen to carry large tufts of kittiwakes where they were brooding. In the nests were many flies and collemboles, apparently brought with the moss. The finding of *Ameronothrus lineatus* on lake bank at Angmagssalik can hardly have any other explanation than that it had been brought there by birds, as this oribatid otherwise is found exclusively on the beach (p. 88). Together with other sorts of material, particularly moss and the like, it is not at all improbable that oribatids, collemboles, etc. may be carried over short distances, but over long distances only those forms can be distributed which in the youthful stages are specially adapted for adhesion (certain mites: *Hydracarinae*, *Uropodidae*), or like certain *Gamasidae* which, in order to be transported, cling to beetles etc. LINDROTH (1931) presumes that *Poduridae* (lower collemboles) are the insects which as grown individuals are best adapted for transportation by means of birds, as they are very sluggish and are unable to spring, because the furcula is often lacking. That *Anurida tullbergi* (1 specimen) was found at Myvatn, where there is a very rich bird life, he ascribes to birds. As it was found only at this one locality in Iceland, it is difficult to explain its distribution except by the help of birds. However, the number of LINDROTH'S collemboles is rather small, so that this conclusion may be somewhat precipitate. S. L. TUXEN tells me that *Anurida tullbergi* is common in the soil near hot springs in Iceland and is also found in other places on the island.

By the wind. In recent years many investigations have been made in order to ascertain what significance wind or air currents have in the transportation of animals from one land to another. It has been found that the air, even in the very high strata (GLICK (1939) found a spider as far up as 5000 m) harbours a special air plankton, mostly consisting of small, light, frail insects with a large wing-area in proportion to the size of the body, such as aphids, small *Diptera* and the like. These animals are considered as being too small and weak in their flight to take an active part during the transportation. It has been established that oribatids and collemboles constitute only a very slight part of the fauna in the higher atmospheric strata. In the course of their "catchings" over the North Sea HARDY and MILNE (1937, 1938) found neither oribatids nor collemboles. BERLAND (1935), who made some similar investigations concerning air plankton over France, likewise found no oribatids, but he did find one *Sminthurid* at a height of 1000—1200 m. From a comprehensive investigation of the dispersal of insects, spiders and mites through the air, made by GLICK (1939) over the Mississippi areas, it becomes clear that oribatids and collemboles may be distributed by means of air currents. In proportion to most other insect groups, however, oribatids and collemboles were very sparsely represented in the air. Of about 30,000 animals caught, mites and collemboles totalled 44 and 26 individuals respectively. A great part (33 individuals) of the mites was represented by *Gamasidae* and their brood, which were found adhering to the host animals (*Tipulidae* and *Carabidae*[1])). Thus the number of oribatids that was carried by air currents was very small, as only one *Dameosoma sp.* (*Oppia*) and some few undetermined individuals were found. The oribatids and collemboles were caught at heights of about 1000 m and 3500 m respectively. As 3000 m was the greatest height from where it could with certainty be determined that the animals were alive, it may be assumed that part of the collemboles taken at about 3500 m height most probably were dead; thus the number of dispersable individuals is further diminished. Considering the fact that in about 1360 flights made in the course of five years only such a small number of oribatids and collemboles were caught, the chance that these animal groups may be dispersed over large areas of the sea is very slight. Besides, it is one thing to demonstrate that there are animals in the air over such an enormous stretch of land as that investigated, where there are constantly augmentations from the earth, and another to be able to exist in the air over seas where there are hundreds of kilometres on all sides and where the density of individuals in the air is probably diminished the longer the transportation lasts, and the death rate increases as a consequence of the low temperature and especially of the drought in the higher strata of the air. If dispersal by means of the wind is to have a positive result, the number of individuals at the outset must be extraordinarily great. ELTON (1925) tells how an aphid (*Dilachnus piceae*) followed by a fly (*Syrphus ribesii*), the larvae of which presumably lived on the aphids, by a strong wind from the south, which lasted for six hours, were blown in over Spitzbergen in hundreds of thousands, perhaps millions. On the following days many individuals were found alive and with dry wings, but after only four days every vestige was gone. The animals had perished during a subsequent storm. As these two species had not been found on Spitzbergen before, and as there were nowhere any trees (*Picea*) from which the aphides might have come, they must have been carried there by the wind, probably from the Kola peninsula, a stretch of just under 1500 km as the crow flies. This tallies with the fact that in those same days strong southerly and southeasterly winds were blowing. According to the

[1]) According to TRÄGÅRDH (1943) oribatids may also be found upon various insects. This only happens by accident, however, as the oribatids have no power of adaptation for transportation on insects. All the same, such observations are very interesting as they prove that oribatids may accidentally be dispersed by means of insects (TRÄGÅRDH 1943).

strength and the direction of the wind the flight was calculated to have taken from 12 to 24 hours. When such a colossal mass immigration apparently turned out negatively (whether these animals were found later on I do not know), it was presumably first and foremost because of the want of host plants, in this case *Picea*. As other syrphids, *Syrphus tarsatus* Zett. live on Spitzbergen together with an aphid, the new arrivals, the syrphids, would have had a possibility of living there, even if it were small. There is not much doubt that there are small chances of getting a foothold for animals which are present in the air in such small numbers as oribatids and collemboles, even if most of these forms might be fairly sure of finding nutrition possibilities everywhere.

On the east coast, where an invasion might take place, judging from the European origin of the microfauna (p. 58), the wind rarely blows from the east (p. 14), and this fact further diminishes the possibility of dispersal by means of the wind. However, the prevailing wind direction presumably plays no very great rôle, as a few hours' wind from the right direction is apparently sufficient for a colonization to take place, provided that a sufficient number of individuals participate and that some few gain a foothold, i. e. that they immediately find a host plant or suitable means of nutrition. Such a case is presumably very rare. Dispersion by means of the wind over such great distances as would be in question in order to reach Greenland from the surrounding European regions, may be considered as very doubtful indeed as regards oribatids and collemboles. Thor (1930) writes about immigration possibilities for oribatids and collemboles into Spitzbergen: "Eine Überführung aller dieser kleinen ungeflügelten Lebewesen durch den Wind von Europa, Asien oder Amerika darf ohne Bedenken abgelehnt werden. Sie sind zu schwer, zu klein und zu glatt."

By ship. Knowing how easily even larger animals such as geckos, snakes, bird-eating spiders and others undetected may be carried with bananas or the like across very great distances, there is nothing whatever to prevent the dispersal of very small animals by means of ships. Elton (1925) mentions several cases when the Spitzbergen fauna temporarily was augmented by means of ships. Apparently none of these animals obtained any lasting foothold on the island, as the animals concerned were southerly species, carried from the south of Europe by ships coming for fish cargoes. If dispersal by means of ships is to gain any significance, it must be species that live under conditions similar to those prevailing in the areas to which they are conveyed. A distribution of oribatids and collemboles from other northern regions with about the same fauna and climatic conditions will probably succeed.

In the course of this investigation of the oribatid fauna of Greenland one cannot help seeing that it consists, as it were, of two elements, one composed of species common to the other North Atlantic islands (p. 58) and one of species which, as far as most species are concerned, are also to be found in Iceland, but not on the North Atlantic Arctic islands. These last named species live also in Central Europe and several of them in Lapland. They are the following 11 species: *Trhypochthonius tectorum*, *Heminothrus thori*, *Oppia quadricarinata*, *Oppia splendens*, *Eremaeus oblongus*, *Liebstadia similis*, *Chamobates cuspidatus*, *Notaspis punctatus*, *Notaspis coleoptratus*, *Pelops septentrionalis* and *Phthiracarus piger*.

An investigation of the occurrence of the oribatids in various biotopes in Iceland (TUXEN 1943) shows that 6 of these 11 species live on fell-field, 5 on heath, 5 on home field, 3 in swamp and 5 in bog, which means that these species generally are very commonly distributed in Iceland.

How is this fauna element, common to Iceland and Greenland, to be explained? Looking at the distribution of these species, it is tempting to presume that they may have been carried by ships from Iceland to Greenland. These species are mostly found in southwest Greenland. In the various regions investigated the distribution is as follows: Franz Joseph Fjord region 3, Scoresby Sound region 0, Kangerdlugssuaq region 3, the southeast coast 7, Godthaab-Julianehaab region 8, Disco Fjord region 3, and Upernavik region 2—thus there are most in southwest Greenland (Godthaab-Julianehaab region). Of the 8 species occurring here, 6 are found on the southeast coast, which, moreover, has one not found on the southwest coast. The Franz Joseph Fjord region and the Upernavik region have likewise one species each not hitherto found on the southwest coast. However, as this region is the least thoroughly investigated region, but the richest in species all the same, it may be presumed that the species mentioned will probably also be found by further investigations. Thus it is the natural thing to do to connect the great similarity between the fauna of southwest Greenland and that of Iceland with the colonization of Greenland by the Norsemen, which started at about the year 985. It is known from the literature that when the Norsemen sailed to Greenland they carried domestic animals with them as well as fodder. This fodder most probably consisted for the greater part of hay, harvested from the home field and from bogs and fens. There would be a great chance for numerous mites and collemboles to be carried with it, and in this hay, which probably was not perfectly dry, they would easily survive the voyage even if it lasted weeks or perhaps months at that time. That they are able to tolerate isolation from their natural surroundings for a long time is shown in the following: in a small casually taken sample, collected in West Greenland on the 26th of July and put into a small tobacco tin, the animals remained alive several months, as they were not forced out until the 9th of March, that is after about seven and a half months. The sample contained about 1700 animals (oribatids and collemboles). Naturally it may be presumed that the moisture conditions in the tin were favourable; but even in the not wholly dry hay oribatids ought in any case to be able to live for a couple of months. SIG THOR (1930) demonstrated by experiments that *Nothrus*, *Hermannia*, *Ceratoppia*, *Murcia*, *Oribata*, *Oribatula*, *Dameosoma* and others after the lapse of 3 to 5 months were all dead. He makes no mention of the exact conditions under which these oribatids were kept, but presumably it was in open jars, where the relative humidity has dwindled quickly. On the other hand he goes on to say that he has kept several of these and other genera alive for two years in a collecting glass closed by means of a cork and apparently without any nourishment, as in comparison he relates that he has several times kept various *Hydracarina* alive two or three years in small glasses with pure water without any other nourishment; only he had to be careful that the water was kept clean.

The oribatid species mentioned may have arrived in Iceland in the same manner, carried by Celts about the year 800 and by Norsemen about 875 at the time of the colonization of Iceland. But as the fauna of Iceland, being of European origin, to a great extent presumably immigrated by means of some land connection during the last interglacial period, the oribatids mentioned most probably came to Iceland in this way.

From southwest Greenland, where the Norsemens' East Settlement (Julianehaab) and West Settlement (Godthaab) were founded, the oribatids may have been dispersed to more remote regions. This dispersal may have taken place partly actively and partly passively. By their own efforts they could not very well have spread so widely as has been shown above. However, they were not restricted to using their own means of transportation, but may have been carried about with the Greenlanders on their travels along the coasts. One of my companions on the expedition told me that he used to put his soiled plates away into the vegetation whenever he had eaten. A few hours later there was a swarm of animals, mostly collemboles, in the remains from the meal, where it was very easy to catch a lot of them. In the like manner oribatids and collemboles may have been carried about with the Greenlanders' pots and pans, which are always put direct upon the ground and are presumably not washed very often after use. The various climatic conditions may stop the distribution, so that there will always be most of the species mentioned in South Greenland, where the climate is milder and the vegetation consequently more abundant.

Apparently these are not the only animals which the Norsemen may have brought with them from Iceland. AD. S. JENSEN (1928) calls attention to the curious distribution of beetles in Greenland, where by far the most of the species also occurring in Europe are found in southwest Greenland only "in the regions where the Norsemen in the olden days had their abodes—some of them in fact mostly or exclusively under the stones of the old ruins, and the same species occur in Iceland too. It has been shown by investigations made by botanists that in the same areas there are a good many plants which must have been carried from Iceland to Greenland by the Norsemen, and I believe that something similar is the case as regards the insects."

But this occurrence of certain species of oribatids, beetles and perhaps also other animal groups in southwest Greenland might rather indicate a climatic delimitation, i. e. one may perhaps suppose that originally they were spread over the same regions as the rest of the species, but that in most places they perished as a consequence of deteriorating climatic conditions before or during the glacial period. At places with a milder climate, as in southwest Greenland and Iceland, they may have survived until the present time. This is not so very improbable if it be maintained that Greenland still is in the middle of a glacial period. As it is a fact that nowadays, with only a small part of the country ice-free, so many different forms of animal life are able to live —from mammals to thermophil insects like the *Macrolepidoptera*—why should it not be possible some few thousand years ago, when the land perhaps was not so very different in appearance from now, and when the climate was only a little colder, for such easily satisfied animals as for instance the aforesaid oribatids to live there? These oribatids may thus be considered as vestiges of a fauna that once was much more widely distributed. In any case it is a fact that both fauna and flora are richer in southwest Greenland than in any other part of that country.

As GRAVERSEN (1931) found *Notaspis coleoptratus*—just one of the 11 species mentioned—subfossil in strata which, KNUD JESSEN informs me, belong to a warmth maximum of the time before the colonization of Greenland by the Norsemen, I am inclined to think that these species may have survived the glacial period too. Thus *Notaspis coleoptratus* cannot very well have been carried into the land by human beings. In my opinion this weakens the idea that the others were carried into the land by the Norsemen. What is true of one may also be true of the rest. Moreover, it seems curious to me that the plants mentioned by OSTENFELD (1926), which were carried into the land by the Norsemen, have not spread as far as the east coast, except a few species such as *Archangelica*, which may have been carried direct by the Greenlanders. If the plants did not spread to the east coast, I have great difficulty in imagining how the beetles, for instance the wingless *Otiorrhynchus arcticus*, should have done so. By its own help it can hardly have got as far north as Wiedemann's Fjord (lat. 68°30′ N.) on the Blosseville coast in the course of the thousand years that have passed since the Norsemens' colonization of Greenland. The only explanation of its rather wide distribution (p. 144), provided that it came to Greenland with the Norsemen, would be that dispersal took place partly by means of human agency, together with hay, i. e. besides grass probably other plants as well, for instance in pillows or the like (I saw the Greenlanders stuff pillows with hay); but as the plants have not spread as far as East Greenland, the occurrence of the beetles in East Greenland probably cannot be due to the Norsemen. It must be of earlier date. Thus I do not feel any inclination to ascribe to the Norsemen any great part in the occurrence of the said oribatids and beetles in Greenland.

However, it is not impossible that the Norsemen may have carried beetles as well as oribatids, collemboles and others with them, of which several are supposed to have existed there beforehand; part of the individuals brought have presumably perished in the course of rather a short period on account of unfavourable climatic conditions, etc., while a small part may still exist.

By means of a land bridge. When I suppose that the microfauna of Greenland dates from the time when America, Europe and Asia constituted a more or less continuous continent (p. 133) and most of the fauna thus survived the entire glacial period (p. 135), there is no need whatever of an interglacial or post-glacial land bridge to the surrounding countries in order to explain the occurrence of the microfauna in Greenland. However, part of Greenland's fauna, as more highly developed insects etc., cannot very well be supposed to have survived a glaciation, and a fresh immigration has therefore been explained by several authors by means of a land bridge, assumed to have stretched from Scotland (perhaps Norway) across the Faeroe Islands and Iceland to Greenland. Between these countries there is a submarine ridge, the Wyville Thomson Ridge. "It looks as if it were fairly certain that this ridge was land as late as in the Tertiary Period, in any case for the greater part of its extent. Some scientists take the view that the land bridge was not disconnected until the glacial period" (Vahl and Hatt 1922). For a land connection to have had any zoo-geographical significance, it should have existed either in the post-glacial or in the inter-glacial period, and in the latter case the immigrated fauna has been able to tolerate a stay on Greenland during the last glacial period. There is no geological evidence of a post-glacial connection by land.

As the depths over the Wyville Thomson Ridge are rather small —between Greenland and Iceland less than 600 m, with an average of 350 m, between Iceland and the Faeroe Islands up to 500 m—only a relatively small uplift would be sufficient to raise the ridge above water. From marine sediments in Greenland (Jensen and Harder 1910), Iceland, Franz Joseph Land and Spitzbergen (WAHLGREN 1920) and from Scandinavia we know that after the glacial period these lands were considerably lower than at the present time, and that at least as regards Scandinavia a constant emergence is taking place, at the centre measured at more than 275 m (WOLDSTEDT 1929). This uplift is due to the diminishing weight of the ice. The thought will then be natural that the uplift during the inter-glacial period, when the ice did not exert its enormous pressure upon the land masses, was so great that the Wyville Thomson Ridge emerged from the sea. Along this land bridge it is thought that an interchange of fauna elements took place between the various lands, west Arctic elements from North America having migrated towards the east (SPÄRCK 1929), and European elements towards the west.

As regards the soil fauna of Greenland, only DEGERBØL (1937) and HAARLØV (1942) work with the theory of a land bridge.

That *Otiorrhynchus arcticus* was found at the Blosseville coast caused DEGERBØL (1937) to reject AD. S. JENSEN's theory of the immigration of this species with the Norsemen. Despite the fact that *Otiorrhynchus arcticus* on the west coast ranges to lat. 70° N. and is found on the east coast from the south point to Wiedemann's Fjord (lat. 68°30′ N.), DEGERBØL holds the opinion that the occurrence on the Blosseville coast speaks in favour of immigration by means of a land bridge to Iceland. If the immigration had taken place in this manner, one might expect a fairly uniform distribution on both sides of the place where the land bridge ought to have ended in Greenland (the Blosseville coast). To be sure, the possibilities of spreading nowadays are presumably less toward the north than towards the south, because of the greater advance of the inland ice towards the sea; but as it must be assumed that the land bridge had a broad approach towards land, to judge from the depths along the coast (SCHOTT 1912, fig. 40) the possibilities of dispersal would presumably be the same both north and south. Of course, the greater distribution towards the south and west may be explained by the climate having prevented a further invasion north of the Blosseville coast. Thus I cannot support DEGERBØL's explanation of the immigration route of *Otiorrhynchus arcticus*. Its distribution in Greenland does not argue convincingly in favour of an immigration along some land bridge off the Blosseville coast.

DEGERBØL maintains, moreover, that similar conditions as to the route of immigration prevail for all the boreo-arctic species found both on the Blosseville coast and in Iceland, for instance *Orthezia cataphracta*, which has about the same distribution in Greenland as *Otiorrhynchus arcticus*, and the snail *Vitrina angelicae*.

HAARLØV (1942) explains the fact that in percentage there is a greater number of primitive forms within the microfauna in North

Greenland than in South Greenland, by assuming that an immigration took place of more highly specialized forms (mites) from Iceland along the supposed inter-glacial land bridge between Iceland and the east coast of Greenland (the Blosseville coast). The farther one comes from the place of immigration (the Blosseville coast) the smaller becomes the percentage of the higher specialized forms in the fauna "and in the composition of the microfauna of Mørke Fjord we noted, precisely, a more marked téndency of the primitive forms to dominate over the higher forms than in any other place on the east coast; this is in good accord with the fact that of all the localities so far investigated on the east coast of Greenland Mørke Fjord is the most distant from the centre of dispersal around the Scoresby Sound—Blosseville coast." If this were so, the Blosseville coast ought to have the greater blending of higher forms, as dispersal must have originated there. The more highly specialized oribatids: *Pelops*, *Phthiracarus* and *Hoploderma* for instance, have not been found north of Angmagssalik. *Phthiracarus* and *Hoploderma* are known only from southernmost Greenland (Lindenow Fjord and south of Julianehaab). Against this it might be objected that they may have immigrated to Greenland during a warmer period, and then in a subsequent cold period they may have been forced away from the place where they first came, surviving in the south as a relic of a warmer period. If this were the case, it might have been expected that the species in question would also be found in the inner, sheltered fjord regions (at Atingat in the inner part of Angmagssalik Fjord and on Ella Island in the Franz Joseph Fjord), but there they are not known. Haarløv generalizes on the basis of his knowledge of the fauna in Northeast Greenland without knowing the fauna of Southeast or West Greenland. Even if he had known the whole of Greenland's microfauna he would have observed, too, that there are fewer more highly specialized forms towards the north, most in Southwest Greenland—and not on the Blosseville coast. *Probably the more highly specialized forms did not immigrate independently, but existed before the glacial period together with the more primitive animals.* The spans of time concerned here are fairly short in proportion to the time in which these animals may be presumed to have existed. Already from the lower *Oligocene* period, when Greenland, probably together with America, Europe and Asia, constituted a united whole, we know of recent genera within the oribatids, also of highly specialized genera found in amber in North Germany, whence among others we also know of *Melanozetes mollicomus*, *Camisia horrida*, *Carabodes labyrinthicus*, *Suctobelba subtrigona*, *Ceratoppia bipilis* and *Eremaeus oblongus* which, however, deviate very slightly from the corresponding recent species, wherefore Sellnick (1931) calls them fossil forms.

That the northerly regions (Mørke Fjord on the northeast coast) are most inhabited by primitive forms is presumably due to the climate; HAARLØV—without being really convinced—mentions it: "As the conditions are increasingly severe the farther north we go, only the most resistant species would be capable of sustaining life there—that is to say, that provided the primitive forms were the most resistant, they would dominate increasingly in the composition of the fauna the farther north we go in Greenland." However, here we must distinguish between the inner fjord regions and the outer coast on account of the very different climatic conditions.

As the fauna of Greenland is very closely related to that of the other north Atlantic islands, a brief survey will be given here of the origin of these faunas.

According to the most recent investigations of the geological sculpture of the lands by ice, of marine sediments and of the composition of the fauna, it is presumed that in an earlier period the other north Atlantic islands were higher than in the present time, and that in that period they received a very considerable part of their fauna. A relatively slight elevation of the bottom of the sea between Spitzbergen, Bear Island, Norway, Novaja Semlja and Franz Joseph Land would have the consequence that a large, continuous region would be created. ANDR. HANSEN (1929) imagines that as a result of uplifts of the sea bottom between Greenland, Iceland, the Faeroe Islands and Norway, and also between Greenland and the Canadian-Arctic islands, this region may have been further extended towards the west. He further imagines that the flora and the fauna over this vast region from Siberia reached Scandinavia. Whether or not such a continuous region as described has ever existed is a question I would not venture to discuss; but according to IHERING (1927) and ANDR. HANSEN (1929) it may have existed in the Tertiary Period.

SIG THOR (1930) assumes that the fauna of Spitzbergen immigrated while Spitzbergen was connected with the surrounding lands. As regards the mites, he writes: "Je mehr ich den Bestand und die Verbreitung der Kleintiere, besonders der *Acarina* Svalbards betrachtet habe, um so mehr bin ich zu der Ueberzeugung gelangt, dass diese hier, wie in so vielen anderen Gebieten der Erde, ihre jetzige Existens einer ursprünglichen, einheimischen Fauna verdanken; sie dürfen deshalb "Urbewohner" genannt werden. Viele Elemente dieser alten kosmopolitischen oder zirkumpolaren Fauna erlagen den schweren Verhältnissen und gingen zu Grunde; deshalb ist Svalbards Fauna im Vergleich mit wärmeren Gegenden arm." THOR does not believe that there was a postglacial immigration later on through the medium of drift-wood, birds or the like.

After an investigation of the insect fauna of the European Arctic islands Wahlgren (1920) arrives at the result that the fauna, as a consequence of the many endemic species, is very old and thus for the greater part dates at least from the time prior to the maximum of the last glacial period. Spärck (1929) assumes that the fauna of the Faeroe Islands immigrated along some land bridge during the inter-glacial period.

A thorough description of the insect fauna of Iceland and of its origin was given by Lindroth (1931). According to that author, the fauna is typically European and thus of less interest than the fauna of the other North Atlantic Islands, which are Arctic in character; but as the problems concerning the immigration to all these remote islands are the same, and as Iceland has been much better investigated in this respect than the other North Atlantic islands, I shall here briefly mention the results. As the fauna of Iceland is lacking in endemic species, it must be very recent. Anyhow, it cannot date from the Tertiary North-Atlantic land bridge between Europe and North America, as this early fauna probably perished during the first part of the glacial period. As there was no post-glacial land bridge, and as dispersal by means of transportation by man, by the wind, ice, currents and the active flight of birds can at the utmost explain the presence of only half of the fauna, it is presumed that some inter-glacial connection existed with Europe, along which the fauna immigrated to Iceland, where it survived the last glacial period in ice-free regions on the southern part of the island.

From this it is seen that, in order to explain the occurrence of the fauna of the North Atlantic islands in the present time, investigators have resorted to the possibility that a land bridge between the islands existed during the last inter-glacial period, along which the fauna spread. Dispersal took place almost exclusively from east to west, apparently; there is no American Arctic element in the fauna of these islands, or at least it is very small.

Even if I have presented my arguments in favour of the possibility that all the microfauna may have survived the glacial period in Greenland, and that dispersal by means of ice, wind, birds, ships and along a land bridge probably did not augment the fauna, or only very slightly, the problem of the origin of the fauna has not been solved. It remains to decide whether the microfauna is of American or of European origin, and whether the answering of this question may throw a light on the problem of the origin of other fauna elements. I shall not here embark upon a discussion of later immigration routes via Iceland, Spitzbergen and others, but merely treat the question of whether the fauna originated in European or in American regions.

As I said just previously, the American element is very slight within the fauna of the North Atlantic islands. As to Greenland, however, the case is somewhat different. As a consequence of the proximity of America, Greenland has received several American species from there. An examination of whether the Greenland fauna originated in America or in Europe showed that opinions are very conflicting. STEPHENSEN (1921) goes so far as to say that "according to the composition of the fauna there cannot be the slightest doubt that it came to the land from America after the glacial period, though part of the flying fauna (birds and insects) may have arrived from Europe, *via* the Faeroes-Iceland". But the case is not quite so simple as that. If we take the microfauna (oribatids and collemboles) that are closely associated with the soil, and sluggish and difficult to spread by means of the wind, birds or the like, it becomes clear from table 9 (p. 61) that the 41 collemboles of Greenland are extraordinarily widely distributed all over the northern hemisphere, 29 species being known from North America and 37 from the European region and Arctic Siberia. Thus these animals, which are mostly cosmopolitan, tell us nothing of the origin of the fauna. On the other hand, of the 60 oribatids in Greenland (table 8, p. 59-60) 47 are known from the Arctic European islands and from Europe, whereas only 10 are known from North America. If the correctness of the determinations of the American species is to be relied on (p. 58) North America is very different in this respect from Europe and Greenland. If then we compare Greenland's oribatid fauna with that of Europe and of the North Atlantic Arctic islands (table 8), which, however, are rather poor as to species, the likeness is striking (p. 58) with the exception that Greenland has a good many species in common with Iceland that are absent on the other islands. *Thus it may be assumed that the greater part of the oribatid fauna is of common European origin and dates from a time when the lands in question were connected with one another.*

As regards other elements among the fauna, some very diverging opinions are held about the origin of many of the other animal groups in Greenland, as will be seen below.

WESENBERG-LUND (1894) considers that the fresh-water *Entomostraca* of Greenland arrived with birds, for instance as *ephippia*. As the migration of birds between America and Greenland mainly takes place across the Davis Strait far to the north, it might have been expected that the fauna of North Greenland would be of American stamp, but WESENBERG-LUND has demonstrated that the European element is predominant in the *Cladocera* fauna of Greenland. WESENBERG-LUND occupies himself particularly with the *Cladocera* as it is the best known animal group within the *Entomostraca*. He considers the survival of the fresh-water fauna during the glacial period as an impossibility. BREHM (1912), who examined the *Entomostraca* of the Danmark Expedition, arrives at the conclusion that these animals, which show slight deviations from those of the other areas, cannot have been brought in during the post-glacial period, but probably survived the glacial period. Thus it seems reasonable to assume that the *Cladocera* fauna too may have survived the glacial period like many other animal groups, for instance, as suggested by VANHÖFFEN (1897), in pools of water on the nunataks.

As regards the terrestrial *Arthropoda*, NIELSEN (1907) assumes that the greater part of the species belong to forms common to North and Central Europe. HENRIKSEN and LUNDBECK (1917) have calculated the distribution of terrestrial *Arthropoda* and found that most forms are either European or such as are found both in Palæ-Arctic and Neo-Arctic regions, in which case their main distribution is in the Palæ-Arctic region. Only very few forms (12 *Diptera*, 1 flea, 5 butterflies and 4 *Arachnida*) are purely American. AD. S. JENSEN (1928), however, has strong doubts as to whether HENRIKSEN and LUNDBECK may be right when they say that the fauna mostly consists of European species. The great endemic element within the *Hymenoptera*, *Diptera* and spiders he ascribes to insufficient knowledge of the real distribution of the species. He may certainly be right in this. Further investigation will probably reveal these species outside Greenland, perhaps also in Arctic North America, which is insufficiently investigated. Another group, the *Lepidoptera*, is for the greater part common to both Europe and America. The distribution of butterflies in Greenland shows, according to AD. S. JENSEN, that they originate in America. Even if these flying insect groups should turn out to have a greater number of American species than European, this need not affect HENRIKSEN and LUNDBECK's opinion that the great majority of forms of the insect fauna are European. AD. S. JENSEN then turns to the beetles, of which a great part are purely European, and he discusses their different origins. According to his opinion, some part of them were probably brought by the Norsemen or with timber or the like from Europe, and thus they mean nothing as regards the immigration of the fauna; but HENRIKSEN and LUNDBECK also do not enter into this. LINDROTH (1931) calls attention to the fact that the distribution of the beetles is of zoo-geographical significance only if we discern between flying and non-flying species. With the exception of 19 species which owe their dispersal to culture, there are 22 species in Greenland; of these 1 is endemic (*Micralymma brevilingue*); the other 21 species all occur in Europe, 15 in Iceland, whereas only 12 have hitherto been found in America. Taking the non-flying forms, of which 6 are found in Greenland, 1 is endemic (*Micralymma brevilingue*) and 1 probably was carried here by sea currents (*M. marinum*); the other 4 (*Otiorrhynchus arcticus*, *O. dubius*, *Lathrobium fulvi-*

penne and *Rhytidosomus globulus*) are all found in Europe, 3 in Iceland, but none in North America. LINDROTH may certainly be right in attaching most weight to the species that are connected with the soil and whose dispersal therefore takes place very slowly. Assuming this to be so, it will certainly be found—as HENRIKSEN and LUNDBECK also state—that the fauna consists mainly of European forms; moreover, it will be seen that it was further and mainly segregated from a common Greenlandic-European distribution region.

Finally, AD. S. JENSEN voices the opinion of the origin of the fauna that "some of the lower and most hardy of the animal forms may be of pre-glacial origin and may have survived the glacial period in those parts of the land that were elevated above the inland ice. The predominant part may presumably have come to Greenland from Arctic America during the post-glacial period, either by active immigration like the terrestrial mammals or, as regards the lower animals, carried passively by wind or birds. A small number of species have their origin in Europe; some of these, especially insects, were brought in by man with timber and other commodities; some may have been carried already by the Norsemen together with fodder and litter (hay, willow twigs, sea-weed etc.) for their cattle together with *Angelica* plants, while others may have arrived by other means." In support of his theory of the American origin of the fauna he refers to the botanist OSTENFELD's opinion (1926), namely that the greater part of Greenland's flora is probably of western origin. As regards the flora, BÖCHER (1938) writes that" it suffices to establish the fact that the most oceanic parts of Greenland are mostly European, whereas the continental parts are American as regards the composition of the flora."

From what has been said above it becomes clear that it is mostly the flying insect forms and partly the flora that are of American origin; this is easily explained by means of their having much greater possibilities of dispersal than the earth-bound animal forms.

REISINGER and STEINBÖCK (1930) are of the opinion that the *Turbellaria* of Greenland cannot have survived a glaciation. Probably they were brought to Greenland from America by the wind while they were in the egg stage.

With regard to the mammals, as AD. S. JENSEN (1928) states, they came over the ice from North America to North Greenland during the post-glacial period. A good many butterflies are assumed to have immigrated in this way too.

From these diverging opinions as regards the origin of the fauna there is a tendency towards the belief that winged species, and species that are capable of using other means of dispersal, probably mostly came from America. However, when judging the origin of the fauna of a land, the first consideration must be that part of the fauna which has the greatest difficulty in being dispersed, i. e. the earth-bound forms, and, as regards Greenland and the other North Atlantic islands, these point decidedly in the direction of Europe.

The apparently great disagreement in the conception of the origin of the fauna may perhaps be settled by the following explanation. *The fauna is partly European, partly American, as the earth-bound, non-mobile elements, such as mites, collemboles, spiders, beetles and others (all the species that may have survived a glaciation, for instance also the fresh-water fauna) belong to the very soil of the land and with it, when it was severed from Europe, made a sort of voyage towards the west. The non-earth-bound, mobile species, on the other hand are probably mostly of American origin.* This idea, that the flying forms are of American origin, whereas the earth-bound species are European, was previously expressed by Lindroth (1931).

Whether we think that this "voyage" was an actual displacement towards the west (Wegener), or merely a rupture of the connection with Europe (land bridge), the result was that the immigration of the fauna from Europe to Greenland ceased. In order to examine which of these possibilities is responsible for the European element in Greenland, Økland (1927) made an investigation of the distribution of several amphi-Atlantic species[1]).

Based upon this investigation he arrived at the conclusion that the presence of these species in North America is due to some pre-glacial land bridge across Greenland, Iceland and the Faeroe Islands to Europe; it was probably long and narrow, possibly with certain hindrances to dispersal, for instance it may have been disrupted at certain times. Probably it passed through regions with various climatic conditions. Only by accepting the idea of such a land bridge can he explain the small number of amphi-Atlantic species. If one goes by Wegener's theory (1922), according to which Greenland, Iceland and the Faeroe Islands right up to or into the Quaternary Period lay close together between America and Europe, which together formed one whole, a predominantly European fauna element in Greenland is difficult to understand. If such were the case, one should think that most of the species would have spread farther towards the west all over North America (Økland).

Whether we assume the existence of the one or the other land connection—both may possibly have existed in a form different from that usually presumed—the connection between Greenland and North America, whether pre-glacial or inter-glacial, cannot have been so close

[1]) Species that occur on both sides of the Atlantic Ocean but are absent in Asia.

as that between Europe and Greenland (see KÖPPEN and WEGENER 1924, figs. 15 and 19, SCHOTT 1912, fig. 19, which in the Miocene and Pliocene time demonstrated a yawning gap between North America and the greater part of the west coast of Greenland while the connection between Greenland and Europe was still close). There cannot very well have been any regular access for the crawling forms between America and Greenland. On the other hand, the short distance in our days has had the effect that flying and otherwise mobile species (for instance mammals, eggs of *Turbellaria*, *Cladocera ephippia* etc.) have been able to disperse from America to Greenland across the ice or through the air. This does not exclude the arrival of flying forms from European regions. About half of the birds in Greenland, for instance, are of American, and half of European-Asiatic origin (AD. S. JENSEN 1928).

In order, finally to come nearer to the question of whether the fauna is of pre-glacial or inter-glacial origin, I shall briefly compare points regarding the faunas of Greenland and Iceland.

As mentioned previously, LINDROTH (1931) says that the insect fauna of Iceland immigrated along a land bridge in the last inter-glacial time. If so, the very much discussed beetle, *Otiorrhynchus arcticus*, which accordingly only then came to Iceland, might in theory have spread to Greenland, whether this took place along a land bridge (DEGERBØL) or through the medium of Norsemen (AD. S. JENSEN). As in my opinion these two possibilities of dispersal are not very probable, its occurrence in Greenland will have to be explained in some other way. As *Otiorrhynchus arcticus* lives hidden among roots and beneath stones, there is nothing to prevent the suggestion that this species too might have survived not one glaciation but the entire glacial period as other earth-bound species may have done. However, LINDROTH maintains that the fauna of Iceland is very recent, and that the pre-glacial, Tertiary fauna perished during the Glacial Age. I shall not go further into this matter, but to me it would seen most natural that all the earth-bound animal groups (mites, collemboles, non-flying beetles and others) spread simultaneously over Greenland and simultaneously over Iceland, etc. Supposing that as regards Greenland it took place in the pre-glacial period, *Otiorrhynchus arcticus*, *Orthezia cataphracta* and others have apparently survived the glacial period, and the idea of some land bridge is not necessary in order to explain their occurrence in Greenland; however, if immigration into Greenland took place inter-glacially, as theorized by LINDROTH for Iceland, the species in question must apparently, together with the rest of the fauna, have made their entry into the various islands via some land bridge.

However, there is also another possibility, to my mind the most probable, that Iceland's fauna may very well have been extinguished during the first part of the Glacial Age and later, inter-glacially, have immigrated from the same regions from which it got its fauna originally, whereas Greenland's fauna has survived until the present time. Several Greenland collemboles have such a distribution in Europe and North America that they may be considered relics of the glacial period. As these species are very widely distributed in the North Atlantic regions but are absent in Iceland, this may further be designated as a slight sign that in Iceland these species may have perished, because of total glaciation, whereas there may have been places of refuge in the other Atlantic regions, to which the fauna resorted during the glaciations. This concerns the species mentioned on page 56: *Onychiurus sibiricus*, *Tetracanthella wahlgreni* and *Ågrenia bidenticulata*.

Apparently there is great difference in the age and composition of the faunas in Greenland and Iceland. That of Iceland is recent, it has no endemic species, it is typically European, has hardly any American elements (mostly among the *Lepidoptera*, the occurrence of which in Iceland may be explained by active flight-immigration), it has no originally Arctic element, as was to be expected if the fauna were of pre-glacial origin; this is due to its immigration during a period with a boreal climate.

On the other hand, the fauna of Greenland is ancient, it has many endemic species, a great part of it is Arctic, it has a large American element which may, however, easily be explained by the proximity of America.

If the following points are compared, there is much, in my opinion, that points towards a pre-glacial origin of Greenland's soil fauna: From Nordhagen (1933) we know that plants and animals have survived the last glacial period in snow-free rocky areas in North Scandinavia. Ostenfeld (1926) considers it as probable that about 60 species of plants have survived the whole glacial period in Greenland; Böcher (1938) is of opinion that up to 100 per cent. of Greenland's flora survived the last glacial period. The fauna must have survived one glacial period because the occurrence of the fauna in Greenland cannot be explained by post-glacial immigration. If parts of the flora have survived the entire glacial epoch, large parts of the fauna have done so too. Wahlgren (1920) says that the fauna dates from the time before the maximum of the last glaciation at least; Ad. S. Jensen (1928) says that some of the lower and most hardy animal forms may be of pre-glacial origin. Skorikov (1937) is of the opinion that the bumblebees of Greenland are primeval. The wide distribution of the Arctic forms and the relatively small percentage of genera which occur only in Arctic regions, point to a great age, according to Reinig (1937); this idea is strengthened further when one remembers the difficulties that dispersal has to contend with in regions with unfavourable conditions of life (REINIG). The many endemic and Arctic species make it probable that the fauna is very ancient, older than that of Iceland, which dates from the inter-glacial period. REINIG (1937) too thinks that the fauna of the Arctic tundra, in which he includes that of Greenland, is very ancient: "Nach unsere Theorie ist mithin die arktische Tundra zwar nicht so alt wie die arktotertiären Waldgebiete und frühtertiären Steppenformationen der Holarktis, von den sie abgeleitet wird, aber sie ist vermutlich doch viel älter als alle interglazialen und postglazialen Invationsfaunen und -floren der Nordhemisphäre".

This investigation of the microfauna (Orib. and Coll.) of Greenland, which is of European and, according to all appearances, of pre-glacial origin, has shown that the soil fauna of Greenland as a whole must likewise be of pre-glacial origin, segregated from some European area of distribution. In the post-glacial period the fauna was augmented with flying and other mobile forms, probably mostly from American regions.

SUMMARY

In the present work I have tried, based upon Berlese tests, to give an idea of the oribatid and collembole fauna of Greenland, collectively called the microfauna. As the microfauna is very much dependent on the climate, which varies much from one investigated area to another (fig. 2) I have briefly described the climate in these areas (see tables 1—3). On Ella Island in the Franz Joseph Fjord region, where most of the samples were taken, the climate is continental with warm summers, cold winters, slight precipitation and few foggy days in a year. The rest of the areas have an oceanic climate with relatively cold summers, relatively ample precipitation and many foggy days. The microclimate, i. e. the climate in and just above the surface of the earth, where the microfauna lives, is greatly influenced by the water content and the insolation.

The material was collected in many different biotopes, from lake bank, bog, mixed *Chamaephyte* vegetation, lichen heath and fell-field, to beach mounds, lagoons, etc. In all, 60 species of oribatids and 41 species of collemboles have so far been identified in Greenland (in the course of this investigation 55 oribatids and 35 collemboles). Three oribatids are new species, described by M. Sellnick, whose descriptions have been inserted here. The species are: *Brachychthonius grandis*, n. sp., *Iugoribates gracilis* n. gen. n. sp. and *Hammeria groenlandica* n. gen. n. sp.

Whereas the collembole faunas are apparently alike in East and West Greenland, this is not the case with the oribatid fauna, as in Southwest Greenland there are a good many species which do not occur on the East coast. This is probably connected with the milder climate in Southwest Greenland. Outside Greenland the Greenland collemboles are widely distributed, 29 species being found in North America and 37 in Europe. There is no doubt that the wide range of the collemboles in the northern hemisphere is connected with their high age. Of the Greenland oribatids, however, only 10 have been found in North America, whereas 47 occur in Europe. This suggests that the oribatids are of European

origin. The oribatid and collembole fauna in Greenland is closely related to the fauna on the other north Atlantic Arctic islands; thus the greater part of the microfauna of Jan Mayen, Bear Island and Spitzbergen is known in Greenland. But with Iceland Greenland has relatively few species in common. Thus Iceland differs essentially from the north Atlantic Arctic islands, not only by a different composition of species, but also by a richer microfauna.

For the biotopes investigated a calculation has been made for each species as to its individual density: its dominance number, i. e. the percentage of the species of the total fauna and also the distribution of the species in the various samples in the biotope: the constance number, i. e. the percentage of the samples in which the species in question was found; the average number of the species per sample is also calculated, as well as the highest number in one sample, etc. (tables 18—67). From these numbers a survey may be had of which species are characteristic of each biotope. It appears that wet biotopes (lake bank, bog and moss), which do not desiccate during the summer, have a fauna that differs from that in the dry biotopes (fell-field, lichen heath, mixed *Chamaephyte* vegetation, etc., also snow bed, which dry up late in summer), (tables 13—14). The fauna in wet biotopes constitutes the *Platynothrus peltifer* community with the characteristic animal *Platynothrus peltifer*, the frequent *Melanozetes ? mollicomus* and a number of species occurring now and then: *Trimalaconothrus novus*, *Heminothrus thori*, *Oppia neerlandica*, *Scheloribates pallidulus*, *Edwardzetes edwardsii* and the collemboles *Xenylla humicola*, *Friesea quinguespinosa*, *Isotoma bipunctata*, *I. viridis*, *Sminthurides malmgreni* and *Sminthurinus concolor*.

In the dry biotopes we find the *Oribatula exilis* community with the characteristic animal *Oribatula exilis*, the frequently occurring *Calyptozetes sarekensis* and *Camisia horrida*, together with a number of species occurring now and then: *Oppia quadricarinata*, *O. translamellata*, *O. ornata*, *Eremaeus oblongus*, *Chamobates cuspidatus*, *Iugoribates gracilis*, *Ceratozetes thienemanni*, *Hammeria groenlandica*, *Trichoribates sp.* and the collemboles *Willemia anophthalma*, *Tetracanthella wahlgreni*, *Folsomia diplophthalma*, *Isotoma minor* and *I. coeruleo-griseus*. Some species are almost just as common in wet as in dry biotopes, for instance *Tectocepheus velatus* and *Tricoribates trimaculatus*; the density of individuals of these species is also about the same in wet and in dry biotopes.

The *Platynothrus peltifer* and *Oribatula exilis* communities are not sharply delimited but overlap, as very few species within the oribatids as well as the collemboles are confined strictly to definite biotopes. Not all the representatives of the *Platynothrus peltifer* and the *Oribatula exilis* communities are found at the same time. The members of the communities vary from area to area, depending on their geographical distribution. Of the characteristic animals and of the most frequently occurring species *Pl. peltifer*, *Orib. exilis*, *Camisia horrida* and *Calyptozetes sarekensis* are distributed everywhere, whereas *Melanozetes ?mollicomus* in East Greenland has not been found north of Mikis Fjord. All these species are found in the investigated parts of West Greenland.

Besides the *Platynothrus peltifer* and the *Oribatula exilis* communities a special community, the beach community, is found on the beach where the tidal waters frequently surge over the biotope; it is characterized by the oribatid *Ameronothrus lineatus* and the collembole *Archisotoma besselsi*, both strictly associated with the shore; they never, or hardly ever, occur outside the beach community. In addition, a number of species occur here which may also be found in other communities, but perhaps most frequently by the sea, for instance *Hypogastrura viatica* and *Folsomia sexoculata. Onychiurus armatus* var. *arctica* is also found on the beach; it is distinctly a beach form and differs from the main form by its very considerable size.

Among the factors that determine the presence of the species in the biotopes, humidity seems to rank first. Besides a high relative atmospheric humidity, the collembole fauna at least demands also a certain amount of free water in the ground in order to soften the nutritive matter. As these animals are very thin-skinned they need a fairly large amount of water if they are not to shrink and die. Besides the humidity, nutrition also plays a great rôle in the choice of biotope. As most oribatids and collemboles live on decaying plant remains and fungus hyphae which are found almost everywhere, it is difficult to see why certain biotopes are preferred. Apparently these animals are not specialized to particular plant species. As regards certain sminthurids, however, they are constantly found on certain plants, whose pollen grains they devour. The temperature and degree of acidity of the soil do not seem to influence the microfauna in the choice of biotopes. Nevertheless, temperature plays an exceedingly great rôle in the life cycle of these animals; for instance the time of the breeding season in summer is dependent on the high temperatures.

In certain biotopes it is seen that the oribatids dominate the collemboles; in others the collemboles are more numerous. The reason for this alternation between oribatids and collemboles is difficult to explain. Apparently humidity plays a certain rôle, as a predominance of collemboles is often found in wet biotopes, whereas the oribatids are numerically predominant in the dry biotopes. Humidity alone, however, cannot be the reason for the alternation between the density of individuals of oribatids and collemboles, because one of the very driest of biotopes, lichen heath at Angmagssalik, was much richer in collemboles than in oribatids. Both animal groups were very richly represented as regards number of species and number of individuals; this may have something to do with specially favourable nutrition possibilities in this biotope. The reason why now one, now another group of animals is more numerous cannot be decided before we know the requirements of each species as to humidity, nutrition, etc.

In biotopes with various humidity conditions within the same geographical area the animals breed at various times. These times also vary from area to area. In dry biotopes on Ella Island in the Franz Joseph Fjord region the oribatid *Oribatula exilis* breeds earlier than in wet ones, the same is the case with the collembole *Onychiurus sibiricus* and probably with all the others whose circumstances have not been investigated. The explanation of this lies in the different water contents of the biotopes and the consequent differences of temperature. The dry biotopes, which are often snow-free in winter or quickly become snow-free and are not immersed by the meltwater, become dry early in summer and are quickly warmed by means of insolation. This has the effect that conditions here very quickly become favourable to the development of animal life. On the other hand, the humidity will quickly become insufficient for the young individuals, which have little resistance to excessive desiccation; all this means that the animals in the dry biotopes breed early in order to maintain their population. In the wet biotopes, which are flooded all the winter and in spring receive the meltwater, animal life cannot develop until later in summer when the meltwater has disappeared. On account of the high water content of these biotopes the temperature rises but slowly, so that the breeding season here does not occur until somewhat later on. Similar conditions were found in the other areas investigated. For instance, at Angmagssalik the breeding season of the oribatids on lake bank runs from the end of July till into September, in bog a bit earlier, from the middle of July to the beginning of August, and still earlier on lichen heath, in July. Whereas on lake bank and in bog, where the humidity is sufficient all the time, the curves for the various species are nearly alike, this is not the case on lichen heath. The species that are characteristic of and frequently occur in the *Oribatula exilis* community, *Oribatula exilis*, *Calyptozetes sarekensis* and *Camisia horrida*, breed later than the species which most often occur in dry biotopes but are not characteristic of this community. This might signify that in lichen heath which dries up rapidly in summer, the last mentioned species are obliged to breed at a time when the humidity is still sufficient to save the brood from perishing, whereas the species that are characteristic of very dry biotopes undoubtedly are capable of resisting a somewhat more advanced desiccation and therefore are able to breed at a somewhat later time.

If we examine the breeding time of a certain species in different biotopes, for instance *Tectocepheus velatus*, which occurs everywhere, we find that taken by and large, its curves follow the characteristic course of the curves for the biotopes which means that each species breeds at different times in the different biotopes. Th. Sørensen has shown that the same applies to the flowering seasons of plants. The collemboles behave in almost the same manner as the oribatids.

The time when the breeding season in each biotope occurs is determined by the climate of the place and occurs simultaneously with the flowering season of the plant association involved. On Ella Island, where the summer occurs early as a consequence of the strong insolation, the breeding season occurs earlier than at the coastal stations of Scoresby Sound, Angmagssalik and Upernavik where the summer begins later on account of fog.

When we know how long the eggs and the animals take to develop, (collemboles) we are in a position to calculate theoretically the approximate time when the maximum of the breeding season occurs. This form of calculation shows that the time of the maximum is the same as that found by means of the course of the curves.

The maximum at mid-summer is probably due to one first generation emanating from the hibernated individuals (young and old), but may also comprise a second generation, which in that case descends from individuals which have overwintered in the egg stage.

In other countries (England and Germany) it has been revealed that humidity is the factor which first and foremost favours reproduction, whereas a high temperature will not play any great rôle in this respect, as it almost always coincides with dry periods, which are destructive to the microfauna. In Greenland, where the period in which reproduction is possible is very brief, but favourable both as regards moisture and temperature, the reproduction period becomes short and intense. This may be the explanation of the very large numbers of individuals found in Greenland during the best summer time.

It is probable that the microfauna survived the glacial period in Greenland together with hardy rock plants in ice-free regions (nunataks). A post-glacial immigration across the ice, by means of drift-wood, birds, the wind and ships, cannot have augmented the fauna to any great extent. An immigration of higher, specialized species along a land bridge from Iceland via the Blosseville coast during the last inter-glacial period is very impracticable, judging from the occurrence of certain higher specialized *Oribatidae* species exclusively in South and Southwest Greenland. This occurrence may have some connection with the milder climate of these regions. The higher specialized forms probably survived the glacial period like the rest of the microfauna. As regards the origin of the microfauna the collemboles can tell us nothing, as they are widely distributed in the northern hemisphere; the distribution of the oribatids, on the other hand, argues a European origin. It is revealed by an investigation of the origin of some animal groups in Greenland, that the earth-bound, non-mobile forms such as mites, collemboles, spiders, beetles, etc. (all the animals that may be imagined to have survived a glacial period) apparently belong to the very soil of the land and with it were disrupted from connection with Europe. The non-earth-bound, mobile forms, on the other hand, are mostly of American origin, immigrated during the post-glacial period. A comparison with Iceland's fauna reveals much in favour of the assumption that large parts of Greenland's fauna are of preglacial origin.

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DANSK RESUMÉ

Overalt i naturen, hvor der findes blot den mindste antydning af vegetation som mosser og lichener, vil man kunne finde nogle smaa, oftest runde, mørkebrune, glinsende og haarde mider, oribatider, samt nogle smaa, vingeløse, haarede, ofte springende insekter, collemboler. Disse fugtighedskrævende dyr fører et meget skjult liv delvis i mikroskopiske hulrum i jordoverfladen, og da de tillige er meget smaa, har de unddraget sig almindelig indsamlingsteknik. Et specielt apparat, der ved udtørring af en prøve uddriver disse smaadyr, er konstrueret af den italienske zoolog A. Berlese, hvorfor apparatet kaldes et berleseapparat og den behandlede prøve en berleseprøve. Paa Grønland har disse for en del mikroskopiske smaadyr været meget lidt kendt tidligere, men efter at jeg gennem en halv snes aar har undersøgt talrige prøver fra Grønland, navnlig fra Østgrønland, hvor jeg selv har været som deltager i Knud Rasmussens 7. Thule-ekspedition, er kendskabet til disse dyregrupper stærkt forøget.

Den primære hensigt med dette arbejde var at undersøge om mikrofaunaen, der har meget ringe aktiv spredningsmulighed, kunde give nogle oplysninger om den grønlandske dyreverdens herkomst.

I. I nærværende afhandling har jeg paa grundlag af berleseprøver søgt at give et billede af Grønlands oribatid- og collembolfauna, der her sammenfattes under betegnelsen mikrofauna. Da mikrofaunaen er meget afhængig af klimaet, der er temmelig forskelligt i de undersøgte omraader (fig. 2), har jeg kort omtalt de undersøgte omraaders klima (jvf. tabellerne 1—3). Paa Ellaø i Franz Joseph Fjord omraadet, hvor de fleste prøver er taget, er klimaet kontinentalt med varme somre, kolde vintre, ringe nedbør og faa dage om aaret med taage. De øvrige omraader har oceanisk klima med forholdsvis kolde somre, forholdsvis rigelig nedbør og mange dage med taage. Mikroklimaet, d. v. s. klimaet i og lige over jordoverfladen, hvor mikrofaunaen holder til, er stærkt paavirket af jordens vandindhold og solindstraalingen.

III—IV. Indsamlingen af materiale er foretaget paa mange forskellige biotoper lige fra søbred, myr, blandet chamaephyt-vegetation, lichenhede og fjeldmark til strandvold, lagune m. m. Ialt er der hidtil konstateret 60 arter oribatider og 41 arter collemboler paa Grønland (i denne undersøgelse 55 oribatider og 35 collemboler). 3 oribatider er nye arter, opstillet af M. SELLNICK, hvis beskrivelser er indføjet her. Arterne er: *Brachychthonius grandis* n. sp., *Iugoribates gracilis* n. gen. n. sp. og *Hammeria groenlandica* n. gen. n. sp.

V. Medens collembolfaunaen tilsyneladende er ens paa Øst- og Vestgrønland, er dette ikke tilfældet med oribatidfaunaen, idet der i Sydvestgrønland findes en del arter, der ikke forekommer paa østkysten. Dette staar sandsynligvis i forbindelse med det mildere klima i Sydvestgrønland. Uden for Grønland er de grønlandske collemboler vidt udbredt, idet 29 arter findes i Nordamerika og 37 i Europa. Collembolernes vide udbredelse paa den nordlige halvkugle staar sikkert i forbindelse med deres høje alder. Af de grønlandske oribatider kendes derimod kun 10 fra Nordamerika, medens 47 findes i Europa. Heraf fremgaar det, at oribatiderne er af europæisk oprindelse. Grønlands oribatid- og collembolfauna er nær beslægtet med faunaen paa de øvrige nordatlantiske, arktiske øer; saaledes kendes størstedelen af Jan Mayens, Bjørneøs og Spitsbergens mikrofauna fra Grønland. Med Island har Grønland derimod kun forholdsvis faa arter fælles. Island adskiller sig saaledes væsentligt fra de nordatlantiske, arktiske øer, ikke blot ved en anden artssammensætning, men ogsaa ved en rigere mikrofauna.

VI. Paa de undersøgte biotoper er der for hver art opgjort, med hvor stor individtæthed arten optræder: dens dominanstal, d. v. s. den procent arten udgør af totalfaunaen, samt artens spredning i de forskellige prøver paa biotopen: konstanstallet, d. v. s. den procent af prøverne, som den paagældende art er fundet i; tillige er udregnet artens gennemsnitstal pr. prøve, det højeste antal i een prøve m. m. (tabellerne 18—67). Af disse tal faar man et skøn over hvilke arter, der er karakteristiske for hver enkelt biotope. Det viser sig, at vaade biotoper (søbred, myr og mos), der ikke tørrer ud i løbet af sommeren, har en fra de tørre biotoper (fjeldmark, lichenhede, bl. chamaephyt-vegetation m. m., ogsaa sneleje, der tørrer ud sent paa sommeren) afvigende fauna (tabellerne 13—14). Faunaen paa vaade biotoper udgør *Platynothrus peltifer* samfundet med karakterdyret *Platynothrus peltifer*, den hyppigt forekommende *Melanozetes ?mollicomus* og en række arter, der af og til forekommer: *Trimalaconothrus novus*, *Heminothrus thori*, *Oppia neerlandica*, *Scheloribates pallidulus*, *Edwardzetes edwardsii*, *Xenylla humicola*, *Friesea quinquespinosa*, *Isotoma bipunctata*, *I. viridis*, *Sminthurides malmgreni* og *Sminthurinus concolor*.

Paa de tørre biotoper findes *Oribatula exilis* samfundet med karakterdyret *Oribatula exilis*, de hyppigt forekommende *Calyptozetes sare-*

kensis og *Camisia horrida*, samt en række arter, der forekommer af og til: *Oppia quadricarinata*, *O. translamellata*, *O. ornata*, *Eremaeus oblongus*, *Chamobates cuspidatus*, *Iugoribates gracilis*, *Ceratozetes thienemanni*, *Hammeria groenlandica*, *Trichoribates sp.* og *Mycobates sp.* og collembolerne *Willemia anophthalma*, *Tetracanthella wahlgreni*, *Folsomia diplophthalma*, *Isotoma minor* og *I. coeruleo-griseus*. Nogle arter forekommer næsten lige almindeligt udbredt paa vaade og tørre biotoper, f. eks. *Tectocepheus velatus* og *Trichoribates trimaculatus*; ogsaa individtætheden hos disse arter er omtrent den samme paa vaade og tørre biotoper. *Platynothrus peltifer* og *Oribatula exilis* samfundene er ikke skarpt afgrænsede, men danner jævne overgange, da meget faa arter indenfor saavel oribatider som collemboler er strængt begrænset til bestemte biotoper. Alle de ovenfor nævnte repræsentanter for *Platynothrus peltifer* og *Oribatula exilis* samfundet findes ikke samtidig. Samfundets medlemmer varierer fra omraade til omraade betinget af deres geografiske udbredelse. Af karakterdyrene og de hyppigt forekommende arter er *Platynothrus peltifer*, *Oribatula exilis*, *Camisia horrida* og *Calyptozetes sarekensis* udbredt overalt, medens *Melanozetes ?mollicomus* paa Østgrønland ikke er fundet nord for Mikisfjord. Alle disse arter findes paa den undersøgte del af Vestgrønland.

Foruden *Platynothrus peltifer* og *Oribatula exilis* samfundene findes der ved stranden, hvor tidevandet jævnligt overskyller biotopen, et specielt samfund, strandsamfundet, der karakteriseres ved oribatiden *Ameronothrus lineatus* og collembolen *Archisotoma besselsi*, der begge er strengt knyttet til kysten og ikke eller yderst sjeldent forekommer uden for strandsamfundet. Desuden forekommer der her en række arter, der ogsaa kan træffes i de andre samfund, men maaske hyppigst ved havet, f. eks. *Hypogastrura viatica* og *Folsomia sexoculata*. Ved stranden træffes desuden *Onychiurus armatus* var. *arctica*, der er en udpræget strandform, og som adskiller sig fra hovedformen ved sin meget betydeligere størrelse.

VII. De faktorer, der er bestemmende for arternes tilstedeværelse paa biotoperne, er tilsyneladende først og fremmest fugtigheden. Foruden en høj rel. luftfugtighed kræver i hvert fald collembolfaunaen ogsaa en vis mængde frit vand i jorden til at blødgøre næringen. Da disse dyr er meget tyndhudede, kræver de et ret stort vandtilskud for ikke at skrumpe ind og dø. Foruden fugtigheden spiller sikkert ogsaa næringen en stor rolle ved valget af biotope. Da de fleste oribatider og collemboler ernærer sig af henfaldende plantedele og svampehyfer, der findes næsten overalt, er det vanskeligt at se, hvorfor bestemte biotoper foretrækkes. Tilsyneladende er disse dyr nemlig ikke specialiseret til bestemte plantearter. For visse Sminthurider gælder det dog, at de konstant træffes i bestemte planter, hvis pollenkorn de fortærer. Temperaturen og jordens surhedsgrad synes ikke at paavirke mikrofaunaen ved valget af biotope. Temperaturen spiller dog en overordentlig stor rolle for disse dyrs livsrytme, bl. a. er yngelperiodens beliggenhed om sommeren afhængig af de høje temperaturer.

Paa visse biotoper finder man, at oribatiderne dominerer over collembolerne, paa andre er collembolerne talrigest. Grunden til denne vekselvirkning mellem oribatider og collemboler er vanskelig at forklare. Tilsyneladende spiller fugtigheden en vis rolle, idet der ofte paa vaade biotoper findes en overvægt af collemboler, medens oribatiderne talmæssigt er overlegne paa de tørre biotoper. Fugtigheden alene kan dog ikke være grunden til vekselvirkningen mellem oribatidernes og collembolernes individmængde, idet en af de aller tørreste biotoper, lichenhede ved Angmagssalik var meget rigere paa collemboler end oribatider. Begge dyregrupper var her meget rigt repræsenteret baade, hvad angaar antal arter og antal individer; dette maa hænge sammen med særlig gode ernæringsmuligheder paa denne biotope. Grunden til, at snart den ene, snart den anden dyregruppe er talrigest, kan ikke løses, før man kender de enkelte arters krav til fugtighed, ernæring m. m.

VIII. Paa biotoper med forskellige fugtighedsforhold inden for samme geografiske omraade yngler dyrene paa forskelligt tidspunkt. Dette tidspunkt varierer yderligere fra omraade til omraade. Paa tørre biotoper paa Ellaø i Franz Joseph Fjord omraadet yngler oribatiden *Oribatula exilis* tidligere end paa de vaade; det samme er tilfældet med collembolen *Onychiurus sibiricus* og sandsynligvis med alle de øvrige, for hvem forholdet ikke er blevet undersøgt. Dette hænger sammen med biotopernes forskellige vandindhold og deraf følgende forskellige temperaturforhold. De tørre biotoper, der ofte er snebare om vinteren eller hurtigt bliver snefri og ikke overskylles af smeltevandet, bliver tørre tidligt paa sommeren og hurtigt opvarmet paa grund af solens indstraaling. Dette bevirker, at forholdene her meget tidligt bliver gunstige for dyrelivets udfoldelse. Paa den anden side bliver fugtigheden sikkert hurtigt for ringe for de unge individer, der ikke taaler for megen udtørring; alt dette bevirker, at de tørre biotopers dyr maa yngle tidligt for at opretholde bestanden. Paa de vaade biotoper, der hele vinteren er oversvømmet og om foraaret modtager smeltevandet, kan dyrelivet derimod først udfolde sig senere paa sommeren, naar smeltevandet er forsvundet. Paa grund af disse biotopers store vandindhold varmes de langsomt op, saa yngleperioden her først indtræffer noget senere. Lignende forhold er fundet i de øvrige undersøgte omraader. Ved Angmagssalik f. eks. ligger yngleperioden for oribatiderne paa søbredden fra slutningen af juli til ind i september, paa myren lidt tidligere, fra midten af juli til begyndelsen af august og paa lichenhede endnu tidligere, i juli maaned. Medens kurverne for de enkelte arter paa søbredden og myren, hvor fugtigheden hele tiden er tilstrækkelig, nogenlunde følges ad, er dette ikke tilfældet paa lichenhede. De arter, der er karakteristiske for og hyppigt forekommende paa *Oribatula exilis* samfundet: *Oribatula exilis*, *Calyptozetes sarekensis* og *Camisia horrida*, yngler senere end de arter, der oftest forekommer paa tørre biotoper, men ikke er karakteristiske for dette samfund. Dette kunde tyde paa, at de sidstnævnte arter paa lichenhede, der hurtigt tørrer ind om sommeren, er nødt til at yngle paa et tidspunkt, hvor fugtigheden endnu er tilstrækkelig, for at ynglen ikke skal gaa til grunde, medens de arter, der er karakteristiske for meget tørre biotoper, sikkert kan taale en noget stærkere udtørring og derfor kan yngle paa et noget senere tidspunkt.

Hvis man undersøger, hvornaar en art, *Tectocepheus velatus*, der forekommer overalt, yngler paa forskellige biotoper, viser det sig, at dens kurver i store træk følger kurvernes karakteristiske forløb paa biotoperne, det vil altsaa sige, at den enkelte art yngler paa forskelligt tidspunkt paa de forskellige biotoper. Lignende er af Th. Sørensen vist for planternes blomstringsperioder. Collembolerne forholder sig omtrent paa samme maade som oribatiderne.

Det tidspunkt, hvor yngleperioden paa hver enkelt biotope indtræffer, er bestemt af stedets klima og falder samtidig med den paagældende planteassociations blomstringsperiode. Paa Ellaø, hvor sommeren kommer tidligt som følge af den stærke indstraaling, falder yngleperioden tidligere end ved kyststationerne Scoresbysund, Angmagssalik og Upernavik, hvor sommeren paa grund af taage begynder senere.

Naar man kender længden af æggenes og dyrenes udviklingstid *(Collembola)*, kan man rent teoretisk udregne, hvornaar omtrent maximet i yngleperioden maa indtræffe. Det har vist sig ved denne udregning, at maximet kommer til at ligge paa samme tidspunkt, hvor jeg har fundet det af kurvernes forløb.

Maximet midt paa sommeren skyldes sandsynligvis en 1. generation, der er afkommet af de overvintrede individer (unge og gamle), men kan maaske ogsaa rumme en 2. generation, der i saa tilfælde er afkommet af individer, der har overvintret som æg.

I andre lande (England og Tyskland) har det vist sig, at fugtigheden er den faktor, der først og fremmest fremmer formeringen, medens en høj temperatur ikke kommer til at spille nogen rolle i denne henseende, idet den næsten altid falder sammen med tørre perioder, der er ødelæggende for mikrofaunaen. I Grønland, hvor den formeringsmulige periode er meget kort, men gunstig baade hvad angaar fugtighed og temperatur, bliver formeringsperioden derfor kort og intens. Dette er muligvis grunden til de meget store individmængder, som man finder paa Grønland midt i den bedste sommertid.

IX. Mikrofaunaen har sandsynligvis overlevet istiden paa Grønland sammen med haardføre fjeldplanter paa isfri omraader (Nunatakker). En postglacial indvandring over isen, med drivtømmer, fugle, vinden og med skibe har sikkert ikke forøget faunaen væsentligt. En indvandring af højere specialiserede arter ad en landforbindelse med Island via Blossevillekysten i interglacialtiden er meget usandsynlig at dømme af visse højere specialiserede oribatidearters forekomst udelukkende i Syd- og i Sydvestgrønland. Denne forekomst staar sikkert i forbindelse med disse egnes mildere klima. De højere specialiserede former har sandsynligvis overlevet istiden lige som den øvrige del af mikrofaunaen. Hvad mikrofaunaens oprindelse angaar, kan collembolerne intet sige herom, da de er vidt udbredt paa den nordlige halvkugle; oribatidernes udbredelse taler derimod for en europæisk oprindelse. Af en gennemgang af nogle dyregruppers sandsynlige oprindelse paa Grønland fremgaar det, at de jordbundne, ikke mobile former som mider, collemboler, edderkopper, biller m. m. (alle de arter, der kan tænkes at have overlevet en nedisning) tilsyneladende hører til selve landets jordbund og med denne er løsrevet fra forbindelse med Europa. De ikke jordbundne, mobile former er derimod formodentlig væsentligst af amerikansk oprindelse, indvandret i postglacialtiden. Ved en sammenligning med Islands fauna er der meget, der taler for, at store dele af Grønlands fauna er af præglacial oprindelse.

Tables of the animal life in the biotopes.

Table 18.

North Fjord: Wet biotope. 2 samples. 28/7, 1/8 1932.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	60	30	60	1	50	30
Tectocepheus velatus	5	3	5	1	50	2
Hypogastrura armata	18	9	18	1	50	9
— *purpurescens*	1	1	1	1	50	+
Onychiurus groenlandicus	51	26	38	2	100	25
Folsomia quadrioculata	26	13	20	2	100	13
Isotoma olivacea	28	14	28	1	50	14
Sminthurinus concolor	3	2	3	1	50	1
Undeterm. *Collembola*	9	5	8	2	100	4
Total...	201					

Table 19.

North Fjord: Dry biotope. 5 samples. 30/7, 31/7, 2/8, 3/8 1932.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychtonius brevis	9	2	7	3	60	3
Trhypochthonius tectorum	127	25	127	1	20	39
Heminothrus thori	3	1	3	1	20	1
Tectocepheus velatus	24	5	24	1	20	7
Oribatula exilis	5	1	5	1	20	2
Trichoribates trimaculatus	6	1	4	2	40	2
Hypogastrura armata	44	9	42	2	40	14
— *purpurescens*	1	+	1	1	20	+
Onychiurus groenlandicus	15	3	15	1	20	5
— *sibiricus*	8	2	5	2	40	2
Folsomia quadrioculata	20	4	11	3	60	6
Isotoma sensibilis	2	+	2	1	20	1
Undeterm. *Collembola*	61	12	55	2	40	19
Total...	325					

Table 20.

Kempe Fjord: Dry biotope at Langdalsglacier. 300 m above sea level. 3 samples. 8/8 1934.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	1	+	+	1	33	+
Camisia horrida	12	4	7	2	67	4
Tectocepheus velatus	1	+	1	1	33	+
Oribatula exilis	2	1	2	1	33	1
Trichoribates trimaculatus	59	20	40	2	67	22
— *sp.*	2	1	2	1	33	1
Undeterm. *Oribatidae* nymphs	1	+	1	1	33	+
Willemia anophthalma	59	20	40	2	67	22
Onychiurus sibiricus	127	42	100	3	100	47
Folsomia fimetaria	3	1	2	2	67	1
Isotoma sensibilis	3	1	2	2	67	1
Total...	270					

Table 21.

Suess Land: Wet biotope. 2 samples. 15/8 1932.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	100	50	50	2	100	21
Heminothrus thori	33	17	28	2	100	7
Oppia neerlandica	1	1	1	1	50	+
Tectocepheus velatus	92	46	82	2	100	19
Oribatula exilis	4	2	4	1	50	1
Trichoribates trimaculatus	40	20	26	2	100	8
Hypogastrura armata	61	31	48	2	100	13
Onychiurus sibiricus	130	65	96	2	100	27
Undeterm. *Collembola*	20	10	20	1	50	4
Total...	481					

Table 22.

Suess Land: Fell-field. 3 samples. 15/8 1932.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Camisia horrida	6	2	5	2	67	7
Oppia neerlandica	1	+	1	1	33	1
Tectocepheus velatus	2	1	2	1	33	2
Oribatula exilis	38	13	34	3	100	45
Trichoribates trimaculatus	14	5	14	1	33	17
Onychiurus sibiricus	3	1	3	1	33	4
Undeterm. *Collembola*	20	7	20	1	33	24
Total...	84					

Table 23.

Suess Land: Dry biotope. 6 samples. 15/8 1932.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius sp.	100	17	50	4	67	26
Camisia horrida	11	2	4	5	83	3
Oppia neerlandica	10	2	8	2	33	3
— *translamellata*	1	+	1	1	17	+
Oribatula exilis	130	22	37	6	100	33
Trichoribates trimaculatus	22	4	9	4	67	6
Onychiurus sibiricus	83	14	50	3	50	21
Folsomia quadrioculata	2	+	2	1	17	1
Isotoma viridis	1	+	1	1	17	+
Undeterm. *Collembola*	31	5	25	2	33	8
Total...	391					

Table 24.

Suess Land: Moraine. 8 samples. 26/7 1934.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	53	7	25	4	50	3
Trhypochthonius tectorum	181	23	105	4	50	11
Camisia horrida	7	1	6	2	25	+
Oppia neerlandica	1	+	1	1	13	+
Tectocepheus velatus	325	41	180	4	50	20
Oribatula exilis	244	31	122	5	63	15
Trichoribates trimaculatus	54	7	19	5	63	3
— *sp.*	2	+	2	1	13	+
Hypogastrura armata	20	3	9	4	50	1
Onychiurus sibiricus	494	62	230	8	100	31
Folsomia quadrioculata	55	7	28	5	63	3
— *fimetaria*	83	10	60	4	50	5
Isotoma sensibilis	16	2	9	4	50	1
— *viridis*	32	4	22	2	25	2
— *olivacea*	3	+	3	1	13	+
Arrhopalites pygmaeus	2	+	2	1	13	+
Sminthurinus concolor	42	5	30	3	38	3
Total...	1614					

Table 25.

Ymer Island: Lake bank. 2 samples. 18/9 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Trichoribates trimaculatus	1	..	..	..	..	50
Onychiurus sibiricus	1	..	..	..	..	50
Total...	2					

Table 26.

Ymer Island: Bog. 1 sample. $^{18}/_{9}$ 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Trichoribates trimaculatus	3	..	..	..	..	2
Onychiurus sibiricus	181	..	..	..	..	95
Folsomia quadrioculata	7	..	..	..	..	4
Total...	191					

Table 27.

Ymer Island: Fell-field. 1 sample. $^{19}/_{9}$ 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Iugoribates gracilis	1	..	..	..	..	13
Trichoribates trimaculatus	1	..	..	..	..	13
Willemia anophthalma	4	..	..	..	..	50
Onychiurus sibiricus	1	..	..	..	..	13
Folsomia fimetaria	1	..	..	..	..	13
Total...	8					

Table 28.

Ymer Island: Mx. *Chamaephyte* veg. 2 samples. 18/9 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	1	1	1	1	50	1
Trichoribates trimaculatus	4	2	2	2	100	5
Hypogastrura armata	1	1	1	1	50	1
Willemia anophthalma	30	15	22	2	100	39
Onychiurus sibiricus	31	16	21	2	100	40
Folsomia quadrioculata	1	1	1	1	50	1
— *fimetaria*	9	5	5	2	100	12
Total...	77					

Table 29.

Ella Island: Lake bank I. 8 samples. 29/5, 15/6, 25/8 1932.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	14	2	12	3	38	+
Platynothrus peltifer	8100	1013	1963	7	88	88
Heminothrus thori	3	+	3	1	13	+
Oppia sp.	1	+	1	1	13	+
Oribatula exilis	2	+	2	1	13	+
Trichoribates trimaculatus	3	+	1	3	38	+
Hypogastrura armata	8	1	8	1	13	+
Onychiurus groenlandicus	10	1	10	1	13	+
— *sibiricus*	303	38	210	6	75	3
Folsomia quadrioculata	661	83	282	7	88	7
Isotoma sensibilis	41	5	20	6	75	+
— *viridis*	33	4	28	2	25	+
— *olivacea*	3	+	2	2	25	+
Sminthurides malmgreni	9	1	9	1	13	+
Sminthurinus concolor	1	+	1	1	13	+
Undeterm. *Collembola*	46	6	20	4	50	+
Total...	9238					

Table 30.

Ella Island: Lake bank II. 49 samples. Annual samples.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	62	1	35	5	10	3
Camisia horrida	1	+	1	1	2	+
Platynothrus peltifer	69	1	28	11	22	3
Heminothrus thori	13	+	11	3	6	1
Tectocepheus velatus	3	+	1	3	6	+
Oribatula exilis	2	+	2	1	2	+
Scheloribates pallidulus	4	+	3	2	4	+
Trichoribates trimaculatus	14	+	8	3	6	1
Hypogastrura armata	24	+	12	5	10	1
Friesea quinquespinosa	1	+	1	1	2	+
Onychiurus groenlandicus	10	+	4	6	12	1
— *sibiricus*	1222	25	748	13	27	62
Folsomia quadrioculata	35	1	6	13	27	2
— *fimetaria*	67	1	61	3	6	3
Isotoma sensibilis	10	+	6	5	10	1
— *bipunctata*	17	+	7	5	10	1
— *olivacea*	1	+	1	1	2	+
Sminthurides malmgreni	46	1	25	9	18	2
Sminthurinus concolor	336	7	85	8	16	17
Undeterm. *Sminthuridae*	48	1	20	4	8	2
Total...	1985					

Table 31.

Ella Island: Bog I. 9 samples. 20/5, 17/6, 29/6, 30/6, 26/8 1932.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	27	3	25	2	22	1
Camisia horrida	12	1	4	5	56	+
Heminothrus thori	721	80	210	7	78	15
Tectocepheus velatus	432	48	150	8	89	9
Oribatula exilis	1	+	1	1	11	+
Scheloribates pallidulus	223	25	46	8	89	5
Trichoribates trimaculatus	140	16	52	9	100	3
Hypogastrura armata	39	4	15	6	67	1
Onychiurus sibiricus	828	92	155	9	100	18
Folsomia quadrioculata	170	19	56	8	89	4
Isotoma sensibilis	54	6	18	7	78	1
— *viridis*	8	1	4	3	33	+
Lepidocyrtus lanuginosus	1	+	1	1	11	+
Sminthurinus concolor	84	9	34	7	78	2
Undeterm. *Collembola*	1925	214	555	7	78	41
Total...	4665					

Table 32.

Ella Island: Bog II. 69 samples. Annual samples.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	472	7	60	31	45	4
Trhypochthonius tectorum	163	2	81	11	16	1
Trimalaconothrus novus	5	+	5	1	1	+
Camisia horrida	29	+	9	12	17	+
Nothrus borussicus	80	1	43	6	9	1
Platynothrus peltifer	87	1	18	18	26	1
Heminothrus thori	23	+	18	5	7	+
— *paolianus*	4	+	3	2	3	+
Hermannia reticulata	2	+	2	1	1	+
Oppia quadricarinata	1	+	1	1	1	+
— *neerlandica*	2	+	2	1	1	+
— *translamellata*	132	2	84	5	7	1
Tectocepheus velatus	267	4	92	21	30	2
Oribatula exilis	222	3	42	19	28	2
Scheloribates pallidulus	192	3	45	25	36	2
Trichoribates trimaculatus	332	5	93	34	49	3
Trichoribates sp.	5	+	3	2	3	+
Undeterm. *Oribatidae*	6	+	5	2	3	+
Hypogastrura armata	118	2	12	37	54	1
— *purpurescens*	18	+	8	8	12	+
Willemia anophthalma	90	1	20	14	20	1
Friesea quinquespinosa	39	1	15	14	20	+
Onychiurus groenlandicus	55	1	35	6	9	+
— *sibiricus*	6585	95	1196	63	91	53
Folsomia quadrioculata	663	10	150	36	52	5
— *diplophthalma*	17	+	10	4	6	+
— *fimetaria*	958	14	200	39	57	8
Isotoma sensibilis	272	4	15	37	54	2
— *bipunctata*	583	8	82	48	70	5
— *viridis*	10	+	6	3	4	+
— *olivacea*	18	+	3	14	20	+
Sminthurides malmgreni	97	1	55	8	12	1
Arrhopalites pygmaeus	12	+	7	2	3	+
Sminthurinus concolor	691	10	88	35	51	6
Undeterm. *Sminthuridae*	85	1	20	15	22	1
Total...	12335					

Table 33.

Ella Island (Kap Oswald): Moist rock. 3 samples. $^{11}/_{5}$ 1934.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Isotoma sensibilis	2	1	1	2	67	100
Total...	2					

Table 34.

Ella Island: Fell-field I. 3 samples. $^{22}/_{5}$, $^{19}/_{6}$ 1932.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Camisia horrida	1	+	1	1	33	1
Platynothrus peltifer	1	+	1	1	33	1
Oppia neerlandica	6	2	6	1	33	9
Tectocepheus velatus	1	+	1	1	33	1
Oribatula exilis	9	3	4	3	100	13
Trichoribates trimaculatus	1	+	1	1	33	1
Hypogastrura armata	1	+	1	1	33	1
Onychiurus sibiricus	10	3	8	2	67	14
Folsomia quadrioculata	10	3	9	2	67	14
Sminthurinus concolor	1	+	1	1	33	1
Undeterm. *Collembola*	28	9	28	1	33	41
Total...	69					

Table 35.

Ella Island: Fell-field II. 67 samples. Annual samples.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	148	2	50	13	19	9
Camisia horrida	23	+	6	9	13	2
Platynothrus peltifer	1	+	1	1	1	+
Heminothrus paolianus	1	+	1	1	1	+
Belba sp.	1	+	1	1	1	+
Oppia quadricarinata	14	+	5	6	9	1
— *neerlandica*	200	3	72	13	19	12
Tectocepheus velatus	353	5	199	15	22	21
Oribatula exilis	257	4	45	26	39	15
Iugoribates gracilis	37	1	6	20	30	2
Trichoribates trimaculatus	28	+	9	8	12	2
Calyptozetes sarekensis	3	+	1	3	4	+
Hypogastrura armata	11	+	4	5	7	1
Willemia anophthalma	73	1	24	12	18	4
Friesea quinquespinosa	7	+	5	2	3	+
Onychiurus sibiricus	329	5	110	33	49	19
Folsomia quadrioculata	33	+	18	9	13	2
— *fimetaria*	92	1	28	17	25	5
Isotoma sensibilis	11	+	5	5	7	1
— *viridis*	73	1	18	18	27	4
— *violacea*	1	+	1	1	1	+
— *olivacea*	3	+	3	1	1	+
Sminthurinus concolor	3	+	2	2	3	+
Undeterm. *Sminthuridae*	2	+	1	2	3	+
Total...	1704					

Table 36.

Ella Island: Mx. *Chamaephyte* veg. I. 63 samples. Annual samples.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	291	5	200	15	24	6
Trhypochthonius tectorum	28	+	13	5	8	1
Camisia horrida	41	1	11	14	22	1
Nothrus borussicus	1	+	1	1	2	+
Platynothrus peltifer	6	+	3	3	5	+
Oppia quadricarinata	2	+	1	2	3	+
— *neerlandica*	46	1	40	5	8	1
— *translamellata*	256	4	256	1	2	5
Tectocepheus velatus	11	+	5	5	8	+
Oribatula exilis	330	5	98	38	60	6
Scheloribates pallidulus	1	+	1	1	2	+
Iugoribates gracilis	14	+	6	8	13	+
Trichoribates trimaculatus	116	2	16	30	48	2
— *sp.*	36	1	29	4	6	1
Calyptozetes sarekensis	6	+	2	4	6	+
Undeterm. *Oribatidae* nymphs	4	+	3	2	3	+
Hypogastrura armata	76	1	30	17	27	1
Willemia anophthalma	692	11	105	45	71	13
Friesea quinquespinosa	19	+	4	12	19	+
Onychiurus groenlandicus	22	+	22	1	2	+
— *sibiricus*	1614	26	339	53	84	31
Folsomia quadrioculata	134	2	96	20	32	3
— *diplophthalma*	127	2	50	19	30	2
— *fimetaria*	1134	18	200	49	78	22
Isotoma sensibilis	67	1	37	15	24	1
— *bipunctata*	23	+	5	12	19	+
— *viridis*	18	+	3	11	17	+
— *violacea*	1	+	1	1	2	+
Sminthurides malmgreni	1	+	1	1	2	+
Sminthurinus concolor	70	1	29	18	29	1
Undeterm. *Sminthuridae*	53	1	30	5	8	1
Total...	5240					

Table 37.

Ella Island: Mx. *Chamaephyte* veg. II. 6 samples. 10/5 1934.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	10	2	5	5	83	1
Oribatula exilis	2	+	1	2	33	+
Scheloribates pallidulus	3	1	3	1	17	+
Trichoribates trimaculatus	23	4	10	6	100	3
Hypogastrura armata	25	4	24	2	33	3
Friesea quinquespinosa	1	+	1	1	17	+
Onychiurus sibiricus	67	11	40	6	100	9
Folsomia quadrioculata	19	3	18	2	33	3
— *diplophthalma*	1	+	1	1	17	+
— *fimetaria*	267	45	220	6	100	36
Isotoma sensibilis	40	7	11	6	100	5
— *bipunctata*	12	2	5	4	67	2
— *viridis*	18	3	18	1	17	2
Sminthurinus concolor	253	42	110	6	100	34
Undeterm. *Sminthuridae*	2	+	2	1	17	+
Total...	743					

Table 38.

Ella Island: Mx. *Chamaephyte* veg. III. 4 samples. 14/5, 28/5 1934.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	1	+	1	1	25	1
Camisia horrida	1	+	1	1	25	1
Oppia quadricarinata	1	+	1	1	25	1
— *neerlandica*	1	+	1	1	25	1
Tectocepheus velatus	7	2	7	1	25	4
Oribatula exilis	3	1	2	2	50	2
Hypogastrura armata	39	10	38	2	50	21
Willemia anophthalma	3	1	3	1	25	2
Onychiurus sibiricus	15	4	7	3	75	8
Tullbergia krausbaueri	1	+	1	1	25	1
Folsomia quadrioculata	7	2	7	1	25	4
— *diplophthalma*	2	1	2	1	25	1
— *fimetaria*	60	15	44	3	75	32
Isotoma sensibilis	7	2	7	1	25	4
— *violacea*	1	+	1	1	25	1
Sminthurinus concolor	36	9	26	3	75	19
Total...	185					

Table 39.

Ella Island: Dry biotope. 39 samples. 19/5, 26/8 1932.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	47	1	15	8	21	1
Trhypocthonius tectorum	112	3	64	6	15	3
Camisia horrida	73	2	18	18	46	2
Nothrus borussicus	24	1	22	2	5	1
Platynothrus peltifer	1	+	1	1	3	+
Heminothrus thori	1	+	1	1	3	+
Oppia quadricarinata	13	+	7	4	10	+
— *sp.*	23	1	15	5	13	1
Tectocepheus velatus	198	5	61	15	38	6
Oribatula exilis	229	6	92	28	72	6
Trichoribates trimaculatus	209	5	92	16	41	6
Hypogastrura armata	18	+	4	11	28	1
Onychiurus sibiricus	914	23	109	29	74	26
Folsomia quadrioculata	103	3	37	10	26	3
Isotoma sensibilis	26	1	8	7	18	1
— *viridis*	3	+	3	1	3	+
Sminthurides malmgreni	1	+	1	1	3	+
Sminthurinus concolor	91	2	40	10	26	3
Undeterm. *Collembola*	1487	38	487	21	54	42
Total...	3573					

Table 40.

Ella Island: Dry biotope at Fimbul. 400 m above sea level. 4 samples. 23/10 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	5	1	5	1	25	22
Hypogastrura sp.	2	1	2	1	25	9
Isotoma sensibilis	8	2	5	2	50	35
Sminthurinus concolor	8	2	8	1	25	35
Total...	23					

Table 41.

Ella Island: Lagoon. 2 samples. $^5/_9$ 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Archisotoma besselsi	6	3	6	1	50	100

Table 42.

Ella Island: Beach mound. 9 samples. $^5/_9$ 1933, $^{11}/_5$, $^{12}/_6$ 1934.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Belba sp.	1	+	1	1	11	+
Hypogastrura viatica	13	1	10	4	44	3
Onychiurus sibiricus	26	3	26	1	11	7
— *armatus*	110	12	48	7	78	28
Folsomia sexoculata	1	+	1	1	11	+
— *fimetaria*	47	5	44	2	22	12
Archisotoma besselsi	182	20	154	3	33	47
Isotoma viridis	1	+	1	1	11	+
— ? *violacea*	3	+	3	1	11	1
Undeterm. *Sminthuridae*	5	1	5	1	11	1
Total...	389					

Table 43.

Traill Island: Dry biotope. 9 samples. 3/7 1932.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	16	2	10	4	44	3
Camisia horrida	13	1	10	3	33	3
Oppia neerlandica	5	1	4	2	22	1
— *?ornata*	10	1	10	1	11	2
Ceratoppia bipilis var. sph.	8	1	7	2	22	2
Tectocepheus velatus	44	5	26	4	44	9
Trichoribates trimaculatus	48	5	18	7	78	9
Hypogastrura armata	5	1	5	1	11	1
Onychiurus sibiricus	177	20	40	9	100	35
Folsomia quadrioculata	112	12	45	9	100	22
Isotoma sensibilis	7	1	4	3	33	1
— *olivacea*	2	+	2	1	11	+
Sminthurinus concolor	2	+	1	2	22	+
Undeterm. *Collembola*	61	7	31	6	67	12
Total...	510					

Table 44.

Scoresby Sound: Mx. *Chamaephyte* veg. I. 36 samples. 27/7, 6/8, 16/8 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	495	14	110	20	56	7
Camisia horrida	3	+	1	3	8	+
Hermannia reticulata	132	4	105	10	28	2
Oppia translamellata	1420	39	420	25	69	20
Ceratoppia bipilis var. sph.	67	2	15	21	58	1
Tectocepheus velatus	132	4	58	13	36	2
Oribatula exilis	315	9	73	22	61	5
Trichoribates trimaculatus	229	6	85	27	75	3
Calyptozetes sarekensis	11	+	5	6	17	+
Undeterm. *Oribatidae* nymphs	267	7	120	21	58	4
Hypogastrura armata	127	4	41	18	50	2
— *purpurescens*	140	4	45	11	31	2
Willemia anophthalma	96	3	50	7	19	1
Anurida granaria	144	4	76	11	31	2
Onychiurus groenlandicus	143	4	25	22	61	2
— *armatus*	53	1	20	7	19	1
Tullbergia krausbaueri	51	1	50	2	6	1
Tetracanthella wahlgreni	1173	33	335	20	56	17
Folsomia quadrioculata	469	13	120	29	81	7
— *diplophthalma*	885	25	200	30	83	13
Isotoma sensibilis	394	11	65	29	81	6
— *bipunctata*	126	4	49	14	39	2
— *viridis*	4	+	3	2	6	+
— *olivacea*	1	+	1	1	3	+
Sminthurides malmgreni	12	+	5	5	14	+
Arrhopalites pygmaeus	1	+	1	1	3	+
Sminthurinus concolor	9	+	2	8	22	+
Undeterm. *Collembolae*	101	3	50	7	19	1
Total...	7000					

Table 45.

Scoresby Sound: Mx. *Chamaephyte* veg. II. 48 samples. 27/7, 6/8, 16/8 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	2300	48	500	35	73	25
Camisia horrida	11	+	4	7	15	+
Nothrus borussicus	21	+	6	8	17	+
Hermannia reticulata	47	1	23	10	21	1
Belba sp. nymph	1	+	1	1	2	+
Oppia translamellata	584	12	155	26	54	6
Ceratoppia bipilis var. sph.	20	+	6	9	19	+
Tectocepheus velatus	454	9	180	23	48	5
Oribatula exilis	625	13	104	29	60	7
Trichoribates trimaculatus	108	2	35	20	42	1
Calyptozetes sarekensis	124	3	40	18	38	1
Undeterm. *Oribatidae* nymphs	823	17	160	23	48	9
Hypogastrura armata	174	4	34	20	42	2
— *purpurescens*	6	+	6	1	2	+
Willemia anophthalma	2	+	1	2	4	+
Onychiurus groenlandicus	120	3	22	27	56	1
— *armatus*	5	+	5	1	2	+
Tullbergia krausbaueri	21	+	4	9	19	+
Tetracanthella wahlgreni	140	3	28	15	31	2
Folsomia quadrioculata	2135	44	660	29	60	24
— *diplophthalma*	1103	23	322	37	77	12
— *fimetaria*	26	1	17	3	6	+
Archisotoma besselsi	1	+	1	1	2	+
Isotoma sensibilis	134	3	33	23	48	1
— *bipunctata*	17	+	5	7	15	+
Sminthurinus concolor	3	+	3	1	2	+
Undeterm. *Collembola*	33	1	15	11	23	+
Total...	9038					

Table 46.

Mikis Fjord: Moss. 5 samples. 8/9 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Platynothrus lapponicus	310	62	127	5	100	19
Tectocepheus velatus	388	78	147	5	100	24
Oribatula exilis	1	+	1	1	20	+
Melanozetes ? mollicomus	1	+	1	1	20	+
Trichoribates trimaculatus	1	+	1	1	20	+
Undeterm. *Oribatidae*	1	+	1	1	20	+
Hypogastrura armata	1	+	1	1	20	+
Onychiurus groenlandicus	492	98	105	5	100	30
Folsomia quadrioculata	6	1	3	3	60	+
— *diplophthalma*	129	26	57	5	100	8
Isotoma sensibilis	302	60	84	5	100	18
Total...	1632					

Table 47.

Mikis Fjord: *Salix herbacea* veg. 4 samples. 21/8, 8/9 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Tectocepheus velatus	108	27	70	3	75	29
Oribatula exilis	131	33	72	3	75	35
Trichoribates trimaculatus	18	5	9	3	75	5
— *sp.*	9	2	9	1	25	2
Calyptozetes sarekensis	2	1	1	2	50	1
Undeterm. *Oribatidae* nymphs	1	+	1	1	25	+
Hypogastrura armata	1	+	1	1	25	+
Willemia anophthalma	47	12	24	2	50	13
Onychiurus groenlandicus	27	7	27	1	25	7
Folsomia seoculata	13	3	13	1	25	3
Isotoma sensibilis	15	4	5	4	100	4
Total...	372					

Table 48.

Mikis Fjord: *Empetrum* veg. 4 samples 26/8, 8/9 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	164	41	164	1	25	5
Trhypochthonius tectorum	2	1	1	2	50	+
Camisia horrida	7	2	7	1	25	+
Nothrus borussicus	1312	328	549	3	75	41
Platynothrus peltifer	1	+	1	1	25	+
Suctobelba subtrigona	6	2	6	1	25	+
Tectocepheus velatus	241	60	101	3	75	7
Oribatula exilis	34	9	18	3	75	1
Melanozetes ?mollicomus	22	6	21	2	50	1
Trichoribates trimaculatus	17	4	15	2	50	1
Calyptozetes sarekensis	26	7	18	3	75	1
Undeterm. *Oribatidae* nymphs	65	16	63	2	50	2
Hypogastrura armata	63	16	32	3	75	2
Willemia anophthalma	375	94	375	1	25	12
Onychiurus groenlandicus	62	16	26	3	75	2
Folsomia sexoculata	4	1	4	1	25	+
— *fimetaria*	607	152	600	2	50	19
Isotoma sensibilis	13	3	6	3	75	+
— *minor*	192	48	170	3	75	6
— *bipunctata*	5	1	4	2	50	+
Sminthurinus concolor	1	+	1	1	25	+
Undeterm. *Collembola*	10	3	10	1	25	+
Total...	3229					

Table 49.

Mikis Fjord: Lichen heath. 6 samples. 20/8, 8/9 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	27	5	9	6	100	3
Trhypochthonius tectorum	14	2	6	4	67	1
Camisia horrida	40	7	23	5	83	4
Nothrus borussicus	117	20	48	5	83	12
Suctobelba subtrigona	46	8	20	3	50	5
Oppia quadricarinata	56	9	20	5	83	6
Tectocepheus velatus	202	34	64	6	100	20
Oribatula exilis	83	14	21	6	100	8
Chamobates cuspidatus	35	6	20	5	83	3
Calyptozetes sarekensis	131	22	68	6	100	13
Undeterm. *Oribatidae* nymphs	93	16	42	6	100	9
Hypogastrura armata	23	4	14	4	67	2
Willemia anophthalma	54	9	26	5	83	5
Folsomia fimetaria	51	9	23	5	83	5
Isotoma sensibilis	45	8	31	6	100	4
Total...	1017					

Table 50.

Atingat: Bog c. 5 m above sea level. 2 samples. 3/8, 9/8 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Platynothrus peltifer	421	211	318	2	100	35
— *lapponicus*	2	1	2	1	50	+
Oppia neerlandica	92	46	54	2	100	8
Tectocepheus velatus	213	107	206	2	100	17
Oribatula exilis	6	3	4	2	100	+
Edwardzetes edwardsii	5	3	5	1	50	+
Melanozetes ? mollicomus	15	8	13	2	100	1
Trichoribates trimaculatus	42	21	40	2	100	3
Pelops sp.	25	13	19	2	100	2
Undeterm. *Oribatidae* nymphs	50	25	30	2	100	4
Willemia anophthalma	1	1	1	1	50	+
Friesea quinquespinosa	28	14	14	2	100	2
Onychiurus groenlandicus	12	6	12	1	50	1
— *sp.*	3	2	3	1	50	+
Tetracanthella wahlgreni	10	5	10	1	50	1
Folsomia sexoculata	1	1	1	1	50	+
— *quadrioculata*	220	110	120	2	100	18
Isotoma coeruleo-griseus	17	9	10	2	100	1
— *bipunctata*	50	25	50	1	50	4
— *viridis*	5	3	3	2	100	+
Total...	1218					

Table 51.

Atingat: Moss. 1 sample. 2/8 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Nothrus borussicus	2	..	..	..	..	6
Platynothrus lapponicus	2	..	..	..	..	6
Tectocepheus velatus	7	..	..	..	..	20
Edwardzetes edwardsii	3	..	..	..	..	9
Melanozetes ?mollicomus	4	..	..	..	..	11
Pelops sp.	4	..	..	..	..	11
Undeterm. *Oribatidae* nymphs	3	..	..	..	..	9
Willemia anophthalma	1	..	..	..	..	3
Onychiurus sp.	1	..	..	..	..	3
Folsomia quadrioculata	1	..	..	..	..	3
Isotoma bipunctata	7	..	..	..	..	20
Total...	35					

Table 52.

Atingat: *Salix herbacea* veg. 2 samples. 31/7, 13/8 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Camisia horrida	5	3	4	2	100	3
Oppia neerlandica	1	1	1	1	50	1
Tectocepheus velatus	11	6	10	2	100	7
Oribatula exilis	11	6	9	2	100	7
Melanozetes ?mollicomus	1	1	1	1	50	1
Trichoribates trimaculatus	23	12	22	2	100	15
— *sp.*	1	1	1	1	50	1
Pelops sp.	73	37	62	2	100	47
Willemia anophthalma	2	1	2	1	50	1
Onychiurus sp.	1	1	1	1	50	1
Folsomia quadrioculata	15	8	14	2	100	10
Isotoma coeruleo-griceus	9	5	9	1	50	6
— *violacea*	2	1	2	1	50	1
Total...	155					

Table 53.

Atingat: Lichen heath. 1 sample. 5/8 1933.	Total	Per cent. of total individuals: dominance number
Camisia horrida	2	1
Nothrus borussicus	11	7
Oppia neerlandica	1	1
Tectocepheus velatus	73	47
Oribatula exilis	33	21
Chamobates cuspidatus	2	1
Calyptozetes sarekensis	14	9
Undeterm. *Oribatidae*	6	4
Onychiurus sp.	2	1
Folsomia quadrioculata	9	6
Isotoma sensibilis	1	1
— *coeruleo-griseus*	1	1
Total...	155	

Table 54.

Angmagssalik: Lake bank 20 m above sea level. 25 samples. 28/7, 7/8, 12/9 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	330	13	100	10	40	5
Trhypochthonius tectorum	1	+	1	1	4	+
Nothrus borussicus	5	+	2	3	12	+
Platynothrus peltifer	2833	113	341	23	92	45
— *lapponicus*	79	3	42	9	36	1
Oppia neerlandica	26	1	11	9	36	+
Tectocepheus velatus	228	9	39	18	72	4
Ameronothrus lineatus	1	+	1	1	4	+
Oribatula exilis	7	+	3	4	16	+
Edwardzetes edwardsii	3	+	2	2	8	+
Chamobates cuspidatus	1	+	1	1	4	+
Melanozetes ? mollicomus	586	23	114	19	76	9
Trichoribates trimaculatus	32	1	11	7	28	1
Calyptozetes sarekensis	19	1	4	9	36	+
Pelops sp.	3	+	1	3	12	+
Undeterm. *Oribatidae*	10	+	3	6	24	+
— *Oribatidae* nymphs	331	13	140	16	64	5
Friesea quinquespinosa	38	2	12	13	52	1
Onychiurus groenlandicus	1	+	1	1	4	+
— *armatus*	138	6	25	22	88	2
Tetracanthella wahlgreni	34	1	11	14	56	1
Folsomia sexoculata	110	4	20	11	44	2
— *quadrioculata*	782	31	200	25	100	12
Proisotoma tenella	93	4	17	11	44	1
Isotoma minor	5	+	5	1	4	+
— *coeruleo-griseus*	5	+	5	1	4	+
— *viridis*	293	12	57	17	68	5
— *violacea*	138	6	69	12	48	2
Sminthurides malmgreni	28	1	6	11	44	+
Undeterm. *Collembola*	153	6	146	2	8	2
Total...	6313					

Table 55.

Angmagssalik: Bog c. 50 m above sea level. 20 samples. 18/7, 7/8, 3/9 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	30	2	8	8	40	+
Trimalaconothrus novus	1423	71	374	18	90	15
Camisia horrida	1	+	1	1	5	+
Nothrus borussicus	163	8	67	8	40	2
Platynothrus peltifer	3918	196	841	20	100	42
— *lapponicus*	2	+	2	1	5	+
Oppia neerlandica	533	27	213	6	30	6
Tectocepheus velatus	27	1	12	7	35	+
Oribatula exilis	20	1	14	5	25	+
Edwardsetes edwardsii	4	+	2	3	15	+
Chamobates cuspidatus	2	+	2	1	5	+
Melanozetes ?mollicomus	727	36	224	17	85	8
Trichoribates trimaculatus	140	7	87	12	60	1
— *sp.*	2	+	1	2	10	+
Pelops sp.	80	4	20	9	45	1
Undeterm. *Oribatidae* nymphs	134	7	34	12	60	1
Xenylla humicola	71	4	34	10	50	1
Friesea quinquespinosa	186	9	83	6	30	2
Achorutes muscorum	2	+	2	1	5	+
Onychiurus armatus	47	2	22	7	35	1
Tetracanthella wahlgreni	90	5	61	4	20	1
Folsomia quadrioculata	1539	77	671	14	70	16
Proisotoma tenella	101	5	23	11	55	1
Isotoma viridis	55	3	16	13	65	1
— *violacea*	21	1	11	3	15	+
Sminthurides malmgreni	18	1	9	4	20	+
Arrhopalites pygmaeus	3	+	2	2	10	+
Undeterm. *Collembola*	8	+	4	3	15	+
Total...	9347					

Table 56.

Angmagssalik: Moss c. 20 m above sea level. 7 samples. 25/7, 2/8 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	379	54	180	4	57	9
Camisia horrida	21	3	9	4	57	+
Nothrus borussicus	99	14	73	3	43	2
Platynothrus peltifer	350	50	89	7	100	8
— *lapponicus*	17	2	7	3	43	+
Oppia neerlandica	12	2	4	4	57	+
— *ornata*	8	1	4	3	43	+
Tectocepheus velatus	145	21	42	7	100	3
Liebstadia similis	19	3	12	4	57	+
Oribatula exilis	3	+	2	2	29	+
Edwardzetes edwardsii	91	13	48	5	71	2
Chamobates cuspidatus	3	+	2	2	29	+
Ceratozetes thienemanni	1	+	1	1	14	+
Melanozetes ?mollicomus	33	5	11	7	100	1
Trichoribates trimaculatus	113	16	99	5	71	3
Calyptozetes sarekensis	4	1	2	3	43	+
Pelops sp.	4	1	2	2	29	+
Undeterm. *Oribatidae* nymphs	1705	244	633	7	100	39
Friesea quinquespinosa	3	+	1	3	43	+
Achorutes muscorum	4	1	2	2	29	+
Onychiurus armatus	43	6	19	6	86	1
Folsomia quadrioculata	421	60	125	7	100	10
Isotoma viridis	45	6	16	6	86	1
— *violacea*	26	4	11	6	86	1
Sminthurides malmgreni	3	+	3	1	14	+
Arrhopalites pygmaeus	6	1	4	2	29	+
Sminthurinus concolor	1	+	1	1	14	+
Undeterm. *Isotomidae*	838	120	251	7	100	19
Total...	4397					

Table 57.

Angmagssalik: Fell-field 75 m above sea level. 5 samples. 28/7 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Oppia neerlandica	1	+	1	1	20	+
— *splendens*	36	7	34	2	40	14
Tectocepheus velatus	42	8	21	5	100	16
Oribatula exilis	25	5	12	5	100	10
Melanozetes ?mollicomus	1	+	1	1	20	+
Trichoribates trimaculatus	4	1	2	3	60	2
Calyptozetes sarekensis	32	6	14	5	100	12
Pelops sp.	2	+	2	1	20	1
Undeterm. *Oribatidae*	23	5	9	4	80	9
Xenylla humicola	2	+	1	2	40	1
Willemia anophthalma	14	3	8	5	100	5
Folsomia quadrioculata	81	16	25	5	100	31
Total...	263					

Table 58.

Angmagssalik: Lichen heath 50—75 m above sea level. 14 samples. $^{18}/_{7}$, $^{7}/_{8}$, $^{3}/_{9}$ 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number	Per cent of total individuals ÷ Folsomia quadrioculata
Brachychthonius brevis	1	+	1	1	7	+	+
Trhypochthonius tectorum	5	+	4	2	14	+	+
Trimalaconothrus novus	1	+	1	1	7	+	+
Camisia horrida	121	9	41	7	50	+	1
Nothrus borussicus	27	2	13	9	64	+	+
Platynothrus peltifer	1	+	1	1	7	+	+
— *lapponicus*	3	+	2	2	14	+	+
Oppia quadricarinata	26	2	9	5	36	+	+
— *ornata*	33	2	19	2	14	+	+
— *splendens*	1	+	1	1	7	+	+
Tectocepheus velatus	871	62	197	12	86	3	6
Oribatula exilis	282	20	48	13	93	1	2
Chamobates cuspidatus	86	6	31	5	36	+	1
Ceratozetes thienemanni	166	12	64	4	29	1	1
Melanozetes ?mollicomus	2	+	2	1	7	+	+
Trichoribates sp.	2	+	1	2	14	+	+
Calyptozetes sarekensis	1155	83	291	9	64	4	8
Mycobates sp.	112	8	60	7	50	+	1
Pelops sp.	25	2	16	4	29	+	+
Willemia anophthalma	824	59	389	11	79	3	6
Tetracanthella wahlgreni	3446	246	802	14	100	12	24
Folsomia quadrioculata	14727	1052	4505	14	100	51	÷
Isotoma sensibilis	20	1	20	1	7	+	+
— *minor*	1747	125	870	6	43	6	12
— *coeruleo-griceus*	3676	263	2000	13	93	13	26
— *viridis*	4	+	2	2	14	+	+
— *violacea*	307	22	72	9	64	1	2
Sminthurinus concolor	2	+	2	1	7	+	+
Undeterm. *Collembola* nymphs	1350	96	550	4	29	5	9
Total...	29023						
Total ÷ *Folsomia quadrioculata*...	14296						

Table 59.

Angmagssalik: Grassy slope 50 m above sea level. 5 samples. 7/8 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	11	2	5	3	60	+
Camisia horrida	8	2	5	3	60	+
Nothrus borussicus	49	10	20	4	80	1
Oppia neerlandica	1	+	1	1	20	+
— *ornata*	69	14	61	4	80	2
Tectocepheus velatus	27	5	7	5	100	1
Liebstadia similis	172	34	71	5	100	4
Oribatula exilis	453	91	144	5	100	11
Edwardzetes edwardsii	2	+	1	2	40	+
Chamobates cuspidatus	1	+	1	1	20	+
Melanozetes ?mollicomus	2	+	1	2	40	+
Trichoribates trimaculatus	26	5	9	5	100	1
— *sp.*	12	2	10	3	60	+
Calyptozetes sarekensis	861	172	322	5	100	21
Pelops sp.	97	19	47	5	100	2
Undeterm. *Oribatidae*	21	4	11	4	80	1
Willemia anophthalma	483	97	247	5	100	12
Folsomia quadrioculata	1374	275	589	5	100	34
Isotoma viridis	8	2	2	4	80	+
— *violacea*	350	70	96	5	100	9
Total...	4027					

Table 60.

Angmagssalik: *Salix herbacea* veg. 50 m above sea level. 10 samples. 18/7 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Camisia horrida	1	+	1	1	10	+
Platynothrus lapponicus	1	+	1	1	10	+
Tectocepheus velatus	556	56	125	10	100	20
Oribatula exilis	461	46	143	10	100	17
Chamobates cuspidatus	1	+	1	1	10	+
Melanozetes ? mollicomus	25	3	13	3	30	1
Trichoribates trimaculatus	109	11	22	10	100	4
— *sp.*	521	52	140	10	100	19
Calyptozetes sarekensis	157	16	35	8	80	6
Pelops sp.	34	3	29	5	50	1
Undeterm. *Oribatidae* nymphs	723	72	269	10	100	26
Xenylla humicola	1	+	1	1	10	+
Friesia quinquespinosa	1	+	1	1	10	+
Tetracanthella wahlgreni	14	1	5	6	60	1
Folsomia quadrioculata	133	13	133	1	10	5
Isotoma coeruleo-griseus	3	+	3	1	10	+
— *viridis*	6	1	3	4	40	+
Total...	2747					

Table 61.

Angmagssalik: Grass-*Salix*-snow bed 25 m above sea level. 5 samples. 28/7 1933.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	84	17	76	2	40	5
Oppia ornata	38	8	37	2	40	2
Tectocepheus velatus	44	45	21	4	80	3
Liebstadia similis	2	+	2	1	20	+
Oribatula exilis	189	38	69	5	100	12
Ceratozetes thienemanni	39	8	29	4	80	3
Trichoribates trimaculatus	10	2	6	2	40	1
Calyptozetes sarekensis	10	2	6	3	60	1
Pelops sp.	23	5	20	2	40	1
Willemia anophthalma	81	16	65	4	80	5
Folsomia quadrioculata	930	186	822	5	100	60
Isotoma coeruleo-griseus	82	16	41	5	100	5
— *viridis*	8	2	4	2	40	1
Total...	1540					

Table 62.

Lindenow Fjord: Moss. 4 samples. 30/7 1935.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Trimalaconothrus foveolatus	6	2	6	1	25	1
Camisia horrida	3	1	2	2	50	+
Nothrus borussicus	1	+	1	1	25	+
Platynothrus peltifer	173	43	129	3	75	22
— *lapponicus*	1	+	1	1	25	+
Hermannia reticulata	4	1	4	1	25	1
Oppia neerlandica	41	10	40	2	50	5
— *translamellata*	3	1	2	2	50	+
Tectocepheus velatus	37	9	32	3	75	5
Liebstadia similis	13	3	13	1	25	2
Oribatula exilis	22	6	22	1	25	3
Melanozetes ? mollicomus	7	2	4	2	50	1
Trichoribates trimaculatus	1	+	1	1	25	+
Pelops sp.	25	6	24	2	50	3
Willemia anophthalma	190	48	190	1	25	25
Anurida granaria	16	4	16	1	25	2
Onychiurus groenlandicus	5	1	5	1	25	1
— *armatus*	3	1	3	1	25	+
Folsomia quadrioculata	182	46	152	3	75	24
Proisotoma tenella	6	2	6	1	25	1
Isotoma minor	24	6	24	1	25	3
— *viridis*	1	+	1	1	25	+
— *olivacea*	1	+	1	1	25	+
Arrhopalites pygmaeus	1	+	1	1	25	+
Undeterm. *Isotomidae*	8	2	8	1	25	1
Total...	774					

Table 63.

Lindenow Fjord: Wet rock. 1 sample. 30/7 1935.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Oppia translamellata	1	..	..	..	..	+
Tectocepheus velatus	1	..	..	..	..	+
Proisotoma tenella	1796	..	..	..	..	100
Total...	1798					

Table 64.

Lindenow Fjord: Dry biotope. 4 samples. 30/7 1935.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Nothrus borussicus	15	4	9	2	50	1
Platynothrus lapponicus	9	2	9	1	25	1
Heminothrus paolianus	4	1	3	2	50	+
Hermannia reticulata	4	1	4	1	25	+
Suctobelba subtrigona	1	+	1	1	25	+
Oppia neerlandica	10	3	10	1	25	1
— *translamellata*	557	139	450	4	100	49
— *ornata*	50	13	50	1	25	4
Tectocepheus velatus	130	33	90	2	50	11
Carabodes labyrinthicus	1	+	1	1	25	+
Oribatula exilis	203	51	200	2	50	18
Ceratozetes thienemanni	13	3	13	1	25	1
Trichoribates trimaculatus	2	1	2	1	25	+
— *sp.*	2	1	2	1	25	+
Calyptozetes sarekensis	17	4	14	2	50	1
Phthiracarus piger	4	1	3	2	50	+
Willemia anophthalma	8	2	5	2	50	1
Onychiurus armatus	5	1	5	1	25	+
Tetracanthella wahlgreni	1	+	1	1	25	+
Folsomia quadrioculata	59	15	23	4	100	5
Isotoma minor	31	8	22	3	75	3
— *violacea*	12	3	9	3	75	1
— *sp.*	2	1	2	1	25	+
Total...	1140					

Table 65.

Upernavik: Bog or bog-like biotope. 11 samples. 30/6, 20/7, 31/7 1936.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius brevis	4	+	3	2	18	+
— *laetepictus*	223	20	200	4	36	14
Platynothrus peltifer	53	5	30	4	36	3
— *lapponicus*	1	+	1	1	9	+
Hermannia reticulata	2	+	1	2	18	+
Oppia translamellata	26	2	26	1	9	2
Tectocepheus velatus	3	+	3	1	9	+
Oribatula exilis	37	3	18	4	36	2
Melanozetes ? mollicomus	22	2	15	4	36	1
— *sp.*	5	+	2	3	27	+
Trichoribates trimaculatus	75	7	35	9	82	5
Oromurcia lucens	14	1	9	2	18	1
Mycobates sp.	3	+	3	1	9	+
Undeterm. *Oribatidae* nymphs	313	28	250	8	73	19
Hypogastrura armata	65	6	49	3	27	4
— *viatica*	2	+	2	1	9	+
— *purpurescens*	20	2	15	2	18	1
— *sp.*	2	+	1	2	18	+
Xenylla humicola	100	9	100	1	9	6
Willemia anophthalma	10	1	6	2	18	1
Anurida granaria	1	+	1	1	9	+
Onychiurus groenlandicus	14	1	5	5	45	1
Tetracanthella wahlgreni	129	12	59	5	45	8
Folsomia quadrioculata	379	34	270	9	82	23
— *diplophthalma*	2	+	2	1	9	+
Isotoma sensibilis	86	8	65	2	18	5
— *bipunctata*	5	+	5	1	9	+
— *viridis*	10	1	5	5	45	1
— *sp.*	10	1	10	1	9	1
Sminthurides malmgreni	2	+	1	2	18	+
Sminthurinus concolor	3	+	2	2	18	+
Total...	1621					

Table 66.

Upernavik: Fell-field. 5 samples. 30/6, 20/7, 31/7 1936.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius laetepictus	23	5	15	2	40	1
Camisia horrida	8	2	3	4	80	1
Hermannia reticulata	14	3	13	2	40	1
Oppia quadricarinata	2	+	1	2	40	1
— *neerlandica*	2	+	2	1	20	+
Eremaeus oblongus	27	5	16	3	60	2
Tectocepheus velatus	42	8	31	4	80	3
Oribatula exilis	256	51	232	3	60	17
Iugoribates gracilis	6	1	4	2	40	+
Hammeria groenlandica	38	8	37	2	40	2
Trichoribates trimaculatus	18	4	14	4	80	1
Undeterm. *Oribatidae* nymphs	195	39	145	2	40	13
Willemia anophthalma	8	2	6	3	60	1
Tetracanthella wahlgreni	719	144	588	4	80	47
Folsomia quadrioculata	102	20	102	1	20	7
— *diplopthalma*	2	+	2	1	20	+
— *fimetaria*	19	4	19	1	20	1
Isotoma sensibilis	50	10	34	3	60	3
Sminthurinus concolor	9	2	9	1	20	1
Total...	1540					

Table 67.

Upernavik: Mx. *Chamaephyte* veg. 14 samples. 30/6, 20/7, 31/7 1936.	Total	Average per sample	Highest number	Found in number of samples	Found in per cent. of samples: constance number	Per cent. of total individuals: dominance number
Brachychthonius laetepictus	152	11	50	8	57	7
Camisia horrida	14	1	6	5	36	1
Nothrus borussicus	1	+	1	1	7	+
Platynothrus lapponicus	1	+	1	1	7	+
Hermannia reticulata	19	1	7	5	36	1
Oppia quadricarinata	157	11	150	3	21	7
— *neerlandica*	4	+	2	3	21	+
— *translamellata*	341	24	165	6	43	15
Eremaeus oblongus	102	7	56	7	50	5
Tectocepheus velatus	30	2	13	8	57	1
Liacarus globifer	1	+	1	1	7	+
Oribatula exilis	584	42	249	13	93	26
Iugoribates gracilis	3	+	1	3	21	+
Melanozetes sp.	2	+	2	1	7	+
Hammeria groenlandica	72	5	25	7	50	3
Trichoribates trimaculatus	64	5	27	10	71	3
Calyptozetes sarekensis	15	1	8	4	29	1
Mycobates sp.	8	1	5	3	21	+
Undeterm. *Oribatidae* nymphs	228	16	100	8	57	10
Hypogastrura armata	16	1	9	5	36	1
Willemia anophthalma	30	2	19	5	36	1
Tetracanthella wahlgreni	72	5	43	4	29	3
Folsomia quadrioculata	226	16	75	11	79	10
Isotoma sensibilis	7	1	3	4	29	+
— *coeruleo-griseus*	49	4	48	2	14	2
— *bipunctata*	18	1	14	3	21	1
— *viridis*	23	2	17	3	21	1
— *violacea*	4	+	2	3	21	+
— *?olivacea*	1	+	1	1	7	+
Sminthurinus concolor	5	+	4	2	14	+
Total...	2249					

Færdig fra Trykkeriet den 27. November 1944.