

MEDDELELSER OM GRØNLAND

UDGIVNE AF

KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND

Bd. 121 · Nr. 15.

THE ZOOLOGY OF EAST GREENLAND

ARANEINA

BY

JENS BRÆNDEGAARD

WITH 49 FIGURES IN THE TEXT

KØBENHAVN

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BIANCO LUNOS BOGTRYKKERI A/S

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PREFACE

In the present publication it has been my intention to give a summary of all that has hitherto been published on the East Greenland spiders. The greater part of the collected material of spiders is to be found in the Zoological Museum of Copenhagen, and all of this I have examined in detail in order to obtain as broad a basis as possible for an attempt to solve the systematic, biological and zoogeographical problems offered by the collected material. A number of problems, more particularly of a systematic nature, have however been solved in my former publications dating from 1937₁, 1938₁, 1939 and 1940, and so reference is made to these, whenever it is a question of a problem, which had there found its final or preliminary solution, and only where subsequent investigations have thrown new light on some of the preliminary results, the latter have been subjected to a renewed revision. Thus the present publication forms a whole together with those already mentioned.

INTRODUCTION

The first information referring to the spider fauna of East Greenland originates from L. KOCK, who determined the material brought home by the 2. German Polar Expedition 1869—70. These determinations, which were published in 1874, only show the occurrence of a single species, *Lycosa aquilonaris*, which L. KOCH described as new, but which subsequently proved to be synonymous with *Pardosa glacialis* THORELL 1872. Beyond the description of the species L. KOCH is very sparing with facts, and we are not even told how great a number of this species were found.

It was not until 1898 that WILLIAM SØRENSEN'S "Arachnida Groenlandica" supplied a comparatively copious list of the East Greenland species. The material of this important publication was almost exclusively collected in the course of GUSTAV HOLM'S expedition to Angmagssalik 1883—85 and C. H. RYDER'S expedition to Scoresbysund 1891—92, the actual collecting being in the former case undertaken by P. EBERLIN, in the latter by the expedition's physician H. DEICHMANN. When WILLIAM SØRENSEN'S "Arachnida Groenlandica" did not attain the importance it deserved, this was owing to the fact that he did not provide the descriptions of the 17 new species established with figures of the epigynes of the females or the palpi of the males.

Besides the *Pardosa glacialis* mentioned above, WILLIAM SØRENSEN'S publication comprises the following species identified in East Greenland, viz. *Hahnia glacialis*, *Arctosa alpigena*, *Pardosa furcifera*, *Pardosa groenlandica*, *Pardosa saltuaria*, *Dictyna major*, *Micryphantes nigripes*, *Cornicularia karpinskii*, *Hilaira curvitaris*, *Hilaira glacialis*, *Hilaira frigida*, *Erigone psychrophila*, *Tetragnatha extensa*, *Gnaphosa islandica*, *Drassodes signifer* and *Xysticus labradorensis*. The number of East Greenland species known was thus 17, and a long time was to elapse, that is until 1934, before this number was increased.

In 1931 the Three-Years' Expedition to Christian X's Land set off under the leadership of LAUGE KOCH, and in immediate succession the 6. and 7. Thule expeditions to Southeast Greenland (1931—33), under

the leadership of KNUD RASMUSSEN, and the Scoresby Sound Committee's 2nd East Greenland Expedition to King Christian IX's Land (1932) under the leadership of EJNAR MIKKELSEN. The Cambridge University Expedition to East Greenland only started in 1933, but its not very large material of spiders was published before that of any of the other expeditions, that is, "Notes on Arctic Spiders obtained in 1933" by A. RANDALL JACKSON. Here mention is made of 12 species, four of which are new to East Greenland. These species are: *Coryphaeolana holmgreni*, *Coryphaeolana thulensis* sp. n., *Islandiana princeps* and *Erigone tirolensis*. The next publication was the material of land Arthropods from "The Scoresby Sound Committee's 2nd East Greenland Expedition in 1932" (BRÆNDEGAARD, HENRIKSEN and SPÄRCK 1935). It consisted of 6 species of spiders, of which *Dictyna borealis* was new to the fauna of East Greenland. The material brought home by the 6. and 7. Thule expeditions to Southeast Greenland (BRÆNDEGAARD 1937₁) consisted of 26 species, the following 14 being new to the fauna of East Greenland: *Enoplognatha intrepida*, *Bolyphantes index*, *Lepthyphantes audax*, *Lepthyphantes turbatrix*, *Micryphantes nigripes jacksoni* subsp. n., *Oreonetides vaginatus*, *Microerigone spitsbergensis*, *Rhaebothorax morulus*, (*Caledonia evansi*), *Coryphaeolana lapidicola*, *Erigone whymperei*¹), (*Tiso aestivus*), *Typhochraestus borealis* and *Xysticus durus*. A few months before then ÅKE HOLM had recorded the occurrence of *Caledonia evansi* and *Tiso aestivus* in the material collected from Kangerdlugssuak by an English expedition under the leadership of L. R. WAGER, and so the credit of first having demonstrated the occurrence of these two species in East Greenland is due to him. The actual publication of this material only took place in 1939, in which year I also published "Supplementary List to Spiders from Southeast Greenland". This list contained no new species from East Greenland, but among its 4 species was *Drassodes signifer*, which does not occur in the principal list, the number of species thus being increased to 36. Together with this list I published "*Arctosa alpigena* DOL. and *Arctosa insignita* TH.", in which it was demonstrated that these two species are not synonymous, as had hitherto been supposed. Thus *Arctosa insignita* was added to the number of species new to the fauna of East Greenland.

The last of the series was "Spiders from Northeast Greenland between lats. 70°25' and 76°50' N." by JENS BRÆNDEGAARD, which was published in 1940. This list comprises 16 species, only one of which, viz. *Erigone sibirica orientalis* subsp. n. is new to the East Greenland fauna. The importance of this publication lies in an entirely different field, seeing that from the point of view of the numbers of individuals

¹) WILL. SØRENSEN'S record of *E. w.* from Gaaseland is due to an erroneous determination.

it is by far the most comprehensive existing list of East Greenland spiders. It therefore gives a very reliable picture of the spider fauna north of Scoresbysund, and there is no doubt that the most thoroughly elucidated fauna of spiders is at present that from these northern areas. However, the areas south of Scoresbysund may also be said to be fairly well known.

My four former publications (1937₁, 1938₁, 1939 and 1940) contain 43 figures in the text, nearly all of these being original drawings of the epigynes of the females or the palpi of the males. In the present paper there are a number of figures of the same kind, which supplement those of the preceding publications, in such a manner that nearly all of the East Greenland species can be determined by means of the collected material of illustrations. An exception is *Tetragnatha extensa* which, I take it, is so generally known that it is superfluous to represent it graphically. Otherwise I have only in the case of a few species omitted figuring one of the sexes, when the latter has not yet been identified in Greenland, or is not to be found in the Greenland collections of the Zoological Museum. Figs. 7, 8, 9 (1937₁) and figs. 2, 4, 5 (1939) are, however, designed from Icelandic specimens. Where, in exceptional cases, a similar proceeding has been followed in this publication, it either appears from the text or is told in the signature of the figure. In order to obtain a full agreement, a comparison has, however, always in such cases been made between the drawing and the individuals found in Greenland.

Most of the localities mentioned in connection with records of the distribution of the individual species in East Greenland are frequently more or less unknown names, only very few of which are to be found in the ordinary maps of Greenland. Therefore, the approximate geographical latitude has been affixed to the name of the locality which, it is to be presumed, will be of assistance for those who by means of the map would attempt to identify the approximate position of the locality on the long coast. The numbers given in parenthesis after each locality refer to the places where the individuals have been recorded.

Acknowledgments.

The present publication is, at any rate for the time being, intended as the final stage of my work on the spiders of Greenland, and so I should like to tender my most sincere thanks to the leader of the Three-Years' Expedition, LAUGE KOCH, Ph.D., and to Professor R. SPÄRCH, Ph.D., in 1932 the leader of the party of biologists of that expedition. I am not only indebted to them for general helpfulness and for good comradeship and collaboration, but also because through them I was

permitted—if only for a short Polar summer—to experience East Greenland, and thus to receive indelible impressions, which have been of great importance for me in working up the publications, of which the present is the last. Further, I extend my cordial thanks to the third department of the Zoological Museum, more particularly to the late keeper of the museum KAI L. HENRIKSEN, Ph.D. and to S. L. TUXEN, Ph.D., who were always ready to help, whenever I was in need of any of the material to be found at the museum. I also owe a debt of gratitude to Docent ÅKE HOLM, fil. lic. of Upsala, who has helped me in various ways, and whom I beg to thank more particularly for the trouble he has taken in tracing THORELL's "lost" types of *Dictyna hamifera*.

I am also indebted to: SV. G. LARSSON, Ph. D., Professor ARNE NOE-NYGAARD, Ph. D., HELGE PETERSEN, Director of the Meteorological Institute, Professor A. ROSENKRANTZ, INGOLF SESTOFT, Head of Department of the Meteorological Institute, GUNNAR THORSON, Ph. D. and NIELS L. WOLFF, Civil Engineer, who have helped me in various ways.

I. SYNOPSIS OF THE SPECIES

1. *Hahnia glacialis* SØRENSEN 1898.

Hahnia glacialis SØRENSEN 1898, p. 219.

East Greenland records:

1. WILL. SØRENSEN 1898, p. 221.
2. JENS BRÆNDEGAARD 1937¹, p. 4, figs. 1 and 2.
3. ÅKE HOLM 1939², p. 73, fig. 2.

Occurrence in East Greenland:

Only 14 specimens are known from the following localities:

Scoresbysund area: Opposite to Røde Ø 70°30' (1).

Kangerdlugssuaq area: Kangerdlugssuaq 68°05' (3).

Sydøstkyst area: Nûk in Sermilik 66°15' (2), Angmagssalik 65°35' (2), Nukarfik 63°25' (2), Serkit nûat 61° (1)¹, eastern Ikerasak 59°50' (2).

Distribution:

Outside East Greenland the species is only known from West Greenland, where it has been found at Ilua (59°55') and Kangersunek (68°45').

Systematic remarks:

ÅKE HOLM has corrected SØRENSEN's description of the eyes in the following manner: "The posterior row of eyes is slightly procurved (the anterior tangent of the central eyes goes through the centre of the lateral eyes), the posterior central eyes are separated from each other by an interval only somewhat larger than their diameter, and the area of the central eyes is a little shorter than broad behind. The height of the clypeus is twice as great as the diameter of the anterior lateral eyes."

As to the colour SØRENSEN states: "Abdomen luridum." This information may be due to the fact that his types have been greatly bleached by being kept too long in alcohol; on the newly caught specimens from Southeast Greenland, examined by me, the abdomen is light-grey.

¹) SØRENSEN calls the place Serketnua, but this is surely a misspelling for this deserted place, which is situated at the coast north of Danells Fjord in about lat. 61° N.

Biology:

Frequently occurring beneath stones and at Kangerdlugssuak found at an altitude of 300 m. Judging by the localities, from which it is known, it must be considered a humid arctic species.

2. *Arctosa alpigena* DOLESCHALL 1852.

Lycosa alpigena DOLESCHALL 1852, p. 643.

Arctosa alpigena BRÆNDEGAARD 1939, p. 5, figs. 2, 4 and 5.

East Greenland records:

1. WILL. SØRENSEN 1898, p. 232 (*Trochosa insignita* ad. part.).
2. JENS BRÆNDEGAARD 1935, p. 17.
3. — 1937¹, p. 4.

Occurrence in East Greenland:

Only 13 individuals are known from the following localities:

Scoresbysund area: Heklahavn 70°30' (1).

Kangerdlugssuaq area: Mikis Fjord 68°10' (2 and 3), Kangerdlugssuaq 68°05' (2).

Sydøstkyst area: Kangerdlugssuatsiaq 66°25' (3), Angmagssalik 65°35' (3), Nukarfik 63°25' (3), Ūmánaq¹) 62°55' (1 and 3), eastern Ikerasak 59°50' (3).

Distribution:

East Greenland (is not known from West Greenland), Iceland, the British Isles, Norway, Sweden, Denmark, Germany, Poland, the Alpine countries, the Murman coast, western Siberia, Canada and U.S.A.

Systematic remarks:

As appears from his diagnosis, DOLESCHALL's type must have been a male. Attention has, however, not been called to this fact, nor is it mentioned that the two sexes are rather different as regards colour and maculation. In his description of the abdomen he only mentions the colour of the hairs. This is presumably caused by the fact that his type has been a dried specimen, so that he has not been able to distinguish the coloration, as it appears when the animal is seen lying in alcohol (BRÆNDEGAARD 1939, fig. 2). When he writes: "am Vorderrücken ein dreilappiger, kleeblattähnlicher weisser Fleck, dessen Mittellappen der längste ist, und sich zugleich durch seine rein weisse Farbe auszeichnet", it is clear that "Mittellappen" is the heart spot, which owing to its white hairs can only with difficulty be distinguished from the areas

¹) SØRENSEN calls the place Amanak, but this is a misspelling of Ūmánaq on Griffenfeldts Ø.

covered with whitish hairs, which are to be found anteriorly on each side of it.

A. RANDELL JACKSON wrote (1937, p. 549): "In the great uncertainty as to what the types of *A. alpigena* really are, I propose to revert to Cambridge's name of *A. biunguiculata* for the British form. At all events we know what that is." This is, however, on his part only to be regarded as a proposal for consideration. The reason for JACKSON's uncertainty is the information given shortly before, viz. that *A. alpigena* DOL. and *A. insignita* TH. were not synonymous (BRÆNDEGAARD 1934, p. 47), and that both species occurred in Greenland. Now both of these species have been characterized (BRÆNDEGAARD 1939), so that it is possible to distinguish them from each other, and so the uncertainty is removed. DOLESCHALL's diagnosis of the species is, it is true, quite brief, as was common at an older period, and it was not possible by means of it to determine, which of the two species (*A. alpigena* or *A. insignita*) we are here dealing with, nor is it possible to do this by means of the more detailed diagnoses of THORELL or CAMBRIDGE. Now, however, it is known that *A. insignita* does not occur in Europe, so that DOLESCHALL's type must have belonged to the species hitherto called *A. alpigena*, and therefore there is no reason to give up the traditional name.

SØRENSEN (1898) considers *Tarentula exasperans* CAMBRIDGE (1877, p. 283, pl. VIII, fig. 7) as being synonymous with *A. alpigena*. There is also a slight resemblance as regards the palpus organ, but according to CAMBRIDGE's diagnosis the coloration and the hairs both on the cephalothorax and abdomen deviate so much from those of *A. alpigena* that the two specimens cannot be synonymous. The locality, Discovery Bay (81°44') in Ellesmere Land, which not only SØRENSEN but also STRAND (1906) and I myself (1932) mention as belonging to the area of distribution of *A. alpigena* must, therefore, be left out, nor has it been included in my list of 1939.

Biology:

At Kangerdlugssuaq it has been found at a height of 200 m and in Mikis Fjord beneath stones. The species only seems to occur in humid areas, which also makes against its living in the northern part of Ellesmere Land. In the temperate zone it most frequently occurs in alpine areas. In addition it occurs in sphagnum growths in bogs on the lowland.

3. *Arctosa insignita* THORELL 1872.

Trochosa insignita THORELL 1872, No. 2, p. 160.

Arctosa insignita BRÆNDEGAARD 1939, p. 5, figs. 1 and 3.

East Greenland record:

WILL. SØRENSEN 1898, p. 232 (*Trochosa* i. ad. part.).

Occurrence in East Greenland:

Sydøstkyst area: Only one specimen, viz. a young female from Kangerdluarq (60°35'), is known.

Distribution:

East Greenland, West Greenland, where it has been found from Ilua (59°55') as far as Jakobshavn (69°15'). Whereas 32 individuals are known from Greenland, only 9 have up to the present been identified from other countries, the latter showing that the species also lives in Baffin Land, Labrador and Canada. Thus it is only known from the nearctic area.

Systematic remarks:

Until a few years ago (BRÆNDEGAARD 1934, p. 47) this species was regarded as being synonymous with *A. alpigena*, from which at least the adult female is easily distinguished by means of the epigynum plate. The palpus organs of the males are very nearly identical in the two species, but both sexes, also the young individuals, are recognizable by the shape and colour of the heart spot (BRÆNDEGAARD 1939).

Biology:

A. insignita must be supposed to be a heliophile species, which requires more arid living conditions than *A. alpigena*. This may explain the fact of its not having been able to spread along the southern east coast of Greenland (BRÆNDEGAARD 1939, p. 11).

4. *Lycosa sp.*

East Greenland record:

JENS BRÆNDEGAARD 1937₁, p. 5.

Occurrence in East Greenland:

Sydøstkyst area: Kap Tordenskjold (61°25').

Systematic remarks:

Only two young individuals (♂ and ♀) having been found, I have not been able to identify them as to species. They presumably belong to a species already described from the nearctic area.

5. *Pardosa furcifera* THORELL 1875.

Lycosa furcifera THORELL 1875, p. 499.

Pardosa furcifera GERTSCH 1933, p. 16, fig. 25 and p. 20, fig. 33.

East Greenland records:

1. ?WILL. SØRENSEN 1898, p. 233 (*Lycosa f.*).
2. JENS BRÆNDEGAARD 1937₁, p. 5.

Occurrence in East Greenland:

Scoresbysund area: (? at Røde Ø 70°30') (1).

Sydøstkyst area: Narssaq in Lindenows Fjord 60°30' (2), Tiningnertôq 60°25' (2), Igdlorsuit 60°10' (2).

That the species occurs in the very southernmost part of East Greenland is only what would be expected, as it is common in West Greenland, but its entirely isolated occurrence at Røde Ø, more than a thousand kilometres farther north, is surprising. This record is perhaps

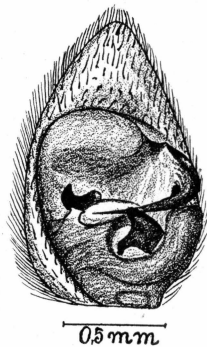


Fig. 1. *Pardosa furcifera* ♂. Tarsal joint of right palpus seen from the under side.

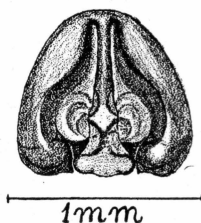


Fig. 2. *Pardosa furcifera* ♀. Epigynum.

an error. At least it has not been possible to find the individuals from Røde Ø in the collections of the Zoological Museum.

Distribution:

East Greenland, West Greenland, where it is of common occurrence, having been found in 225 specimens from Ilua (59°55') as far as Holsteinsborg¹⁾ (66°55'), Labrador, Iceland.

Systematic remarks:

It is a nearctic species, which until recently by American arachnologists (PETRUNKEVITCH 1911, p. 573) was regarded as synonymous with *Pardosa glacialis*. For this reason no more is known at the present time of its distribution than was known forty years ago.

6. *Pardosa glacialis* THORELL 1872.

Lycosa glacialis THORELL 1872, No. 2, p. 159 (♀).

Lycosa glacialis CAMBRIDGE 1877, p. 281 (♂).

East Greenland records:

1. L. KOCH 1874, p. 400 (*Lycosa aquilonaris*).
2. WILL. SØRENSEN 1898, p. 234 (*Lycosa g.*).

¹⁾ WILL. SØRENSEN gives Tasiussak (73°28') as the most northerly occurrence of the species, but this is due to an error. See p. 57.

3. J. H. EMERTON 1918, p. 145.
4. A. RANDELL JACKSON 1930, p. 641 (*Lycosa g.*).
5. — 1934₁, p. 613 (*Lycosa g.*).
6. JENS BRÆNDEGAARD 1935, p. 17.
7. ÅKE HOLM 1937₁, p. 2 (*Lycosa g.*).
8. A. RANDELL JACKSON 1937, p. 547 (*Lycosa g.*).
9. JENS BRÆNDEGAARD 1940, p. 5.

Occurrence in East Greenland:

Nordøstkyst area: Danmarks Havn 76°50' (1, 3, 9), Kap Rink on Hochstetter Forland 75°10' (9).

Franz Joseph Fjord area: Kap Mary 74°10' (9), Eskimonæs on Clavering Ø 74°05' (9), Kap Stosch 74°05' (9), Loch Fyn about 74° (9),

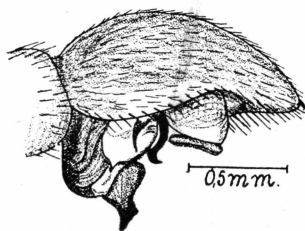


Fig. 3. *Pardosa glacialis* ♂. Tarsal joint of right palpus, seen from the outer side.

Hudson Land at Nordfjord 73°50' (9), Brogede Dal on Strindberg Land at Nordfjord 73°45' (9), Gauss Halvøen at Moskusoksefjord 73°45' (9), Mackenzie Bugt 73°30' (7), Renbugten on Ymer Ø 73°25' (9), Mt. Celsius on Ymer Ø 73°10' (7), Kap Humbolt on Ymer Ø 73°05' (9), Fulach Dal at Dickson Fjord 72°50' (9), Kap Alfred at Kempe Fjord 72°50' (9), Narhvalsund 72°50' (9), Ella Ø 72°50' (9), Kongeborgen 72°30' (9), Kap Petersen at Kong Oskar Fjord 72°25' (9).

Scoresbysund area: Liverpool Land and Jameson Land 71°—70°30' (4, 5), Kap Hope 70°25' (9), Kap Dalton 69°24' (6).

Kangerdlugssuaq area: Kangerdlugssuaq Fjord about 68° (8).

South of Scoresbysund this species has only been found in two localities. It may, therefore, be taken for granted that the species does not occur in the more southerly areas. In the arid regions north of Scoresbysund it is, on the other hand, so common that it may be designated as the type animal of these areas. In these areas 675 spiders in all have been taken, 280 or more than 41 per cent belonging to *Pardosa glacialis*. It must thus be an arid arctic species.

Distribution:

East Greenland, West Greenland (from 64°10' to 74°44'), North Greenland (Foulke Fjord 78°20'), Ellesmere Land (Havnefjord 76°40',

Hages Sound 79° and Discovery Bay 81°44'), Baffin Land, Southampton Island and Manitoba in Canada.

Pardosa glacialis is a nearctic species, its area of distribution extending far towards north. The credit of having found it in the northernmost locality, viz. Discovery Bay (81°44') on the north coast of Ellesmere Land is due to G. S. NARES' North-Polar Expedition. In the course of the Polaris Expedition and Fram's Second Polar Expedition it has been found in several more southerly localities of Ellesmere Land. As it is

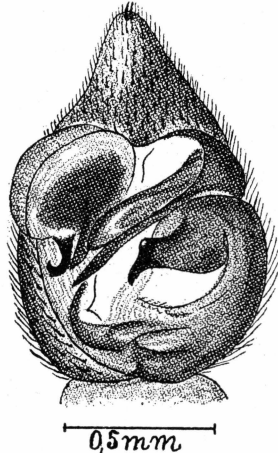


Fig. 4. *Pardosa glacialis* ♂. Tarsal joint of right palpus, seen from the under side.

also known from Baffin Land, it must be supposed to be of common occurrence in the Canadian archipelago. From Baffin Land it is, however, only known from one locality in the northern area. From the Canadian continent it is also only known with certainty from one locality (Manitoba). The species must, however, be supposed to be far more common in the arctic arid regions of Canada than appears from this single locality.

Systematic remarks:

J. H. EMERTON (1895, p. 424), it is to be regretted, was of the opinion that there may be great variations in the genital organs of *Pardosa glacialis*. He pictures a number of epigynes (Pl. IV: 2b, 2c, 2d, 2e, 2f, 2i), of which only 2c belongs to *Pardosa glacialis*, but maintains that they all belong to variations of this species, and unfortunately all American arachnologists concurred in his conclusion for nearly forty years. In "Synonymic Index-Catalogue of Spiders of America" by A. PETRUNKEVITCH (1911, p. 573) eight synonymities of *Pardosa modica* BL. were given, and among these are *P. glacialis*, *P. furcifera*, *P. fuscula*

and *P. concinna*, four of THORELL's types, which must all be regarded as genuine species (W. J. GERTSCH 1933, pp. 17, 20 and 25). In EMERTON's opinion *P. glacialis* should have an area of distribution, extending from the very northernmost Greenland to the boundary of Mexico, but the truth is that very little is known as to the distribution of the species on the Canadian continent, and nothing at all from U.S.A. At the same time that W. J. GERTSCH rejected EMERTON's view, A. RANDALL JACKSON (1933, p. 147) was able to prove that *P. fuscula* and *P. glacialis* are two different species.

It also clearly appears from the East Greenland material that *P. glacialis* and *P. furcifera* are different species. Here they are found,

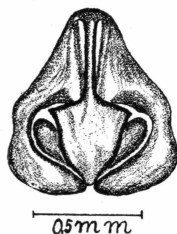


Fig. 5. *Pardosa glacialis* ♀. Epigynum.

each in their area, *P. furcifera* only in the very southernmost part of the southeast coast area and *P. glacialis* in the three most northerly areas. If, as already mentioned (p. 13), the record from Røde Ø is due to an error, the areas of the two species nowhere encroach upon each others' boundaries, but are, on the contrary, divided by a distance of nearly 1000 km from Lindenows Fjord ($60^{\circ}30'$) to Kangerdlugssuaq (68°). Besides, their genital organs are decidedly different, and in none of the areas of the two species individuals have been found, whose genital organs approach what may be termed transition forms.

Biology:

Although the material of *P. glacialis* is comparatively large, it only contains few adult males (table I). This is only natural, because adult males, as is common with spiders, only have a short life.

Males just before the last moulting (ecdysis) are easily recognized, in that the cymbium and bulb are seen to be nearly fully developed under the skin on the tarsus of the palpus. The last moulting (table I) must take place medio June, and after the pairing the adult males die at the end of June.

Whereas the material of males just before the last moulting and sexually ripe males is so numerically slight that no exact statistic proof can be built on it, the material of adult females is so large as to have

Table I. Time of the last moulting of *Pardosa glacialis* ♂.

Date	Locality	Latitude	Number ♂ jun. just before last moulting	Number ♂ ad.
Maj 10, 1934	Ella Ø	72°50'	1	..
June 10, 1925	Kap Hope	70°25'	3	1
— 15, 1907	Danmarks Havn.....	76°50'	1	..
— 17, —	—	—	..	3
— 19, 1930	Kap Rink	75°10'	..	1
— 27, 1933	Kap Hope	70°25'	..	4

a convincing effect and to substantiate the conclusion, which can be drawn from table I.

The last moulting of the females only takes place after medio June. Table II shows that adult females have never been found until June 18,

Table II. *Pardosa glacialis* ♀♀ ad. and their breeding conditions.

Date	Locality	Latitude	Number ♀ ad.	Breeding conditions
June 18, 1934	Kap Humbolt.....	73°05'	1	before the laying of eggs
— 21, —	Ella Ø	72°50'	1	— —
— 27, 1933	Kap Hope	70°25'	3	— —
end of June 1908	Danmarks Havn...	76°50'	1	— —
— — —	— ...	—	1	with egg cocoon
July 10, 1930	Kap Mary	74°10'	2	— —
— 12, —	—	—	2	— —
— 15, 1908 ¹⁾	Danmarks Havn...	76°50'	3	— —
— 19, 1932	Kap Stosch	74°05'	1	— —
— 21, 1929	Kap Mary	74°10'	1	— —
— 27, 1934	at Narhval Sund...	72°50'	1	— —
— 28, 1932	Brogede Dal	73°45'	3	— —
— 29, 1932	east of Nordfjord..	73°50'	2	before the laying of eggs
— 30, 1930	Loch Fyn.....	74°	1	with egg cocoon
— 31, 1932	Brogede Dal	73°45'	1	after the hatching of the eggs
Aug. 6, 1907	Danmarks Havn...	76°50'	1	— —
— 12, 1933	Ella Ø	72°50'	2	— —
— 13, 1929	at Moskusoksefjord.	73°45'	2	with egg cocoon
— 13, 1930	—	—	1	after the hatching of the eggs
— 14, 1932	Eskimonæs.....	74°05'	1	— — —
— 17, 1930	Ella Ø	72°50'	2	— — —
— 23, 1906	Danmarks Havn...	76°50'	4	— — —
— 24, 1907	— ...	—	1	with 18 pull

¹⁾ The date June 15, 1908 (BRÉNDEGAARD 1940, p. 6) is a misprint.

that is, slightly later than the males, but this is common in the case of the spiders. Late in June the first females with egg cocoons are to be found, and a month later the eggs have been hatched. In August females without egg cocoons are therefore again to be found, but whereas the females in June had abdomens swelling with eggs, the abdomens of the females caught in August are shrunk, the egg-laying stage being over and the egg cocoon gone, because the hatching has taken place. The finds of July 29 and August 13 are a couple of specimens, the development of which, for some reason or other, has been retarded. Although the situation of Danmarks Havn is nearly 700 km farther north than Kap Hope, there does not seem to be any noticeable difference as regards the commencement of maturity and the laying or hatching of eggs.

As tables I and II comprise all the adult males and females found north of Scoresbysund, it appears that only one brood is able to become sexually ripe in the course of the summer, and as the hatching of a new brood takes place about August 1, this brood must winter as very small young; for towards the end of August summer is past, and the animals lie dormant. These hibernating small young cannot possibly become sexually ripe until the following summer, as the winter is only at an end about Maj 15, and as long as the state of dormancy lasts, all growth is suspended. The life cycle of the species must thus extend over several years, which is also corroborated by other observations.

Late in summer 8 ♂ jun. in all have been found in the following localities: Danmarks Havn August 23, 1906, Loch Fyn July 28 and 30, 1930, Brogede Dal August 4, 1932, at Moskusoksefjorden August 13, 1929 and August 13, 1930 and on Ella Ø August 21, 1934. The specimen from Brogede Dal has been caught directly after the moulting had taken place, and on the under side of the tarsal joint of the palpus a rounded light spot is to be seen, viz. the incipient bulb. This character is found in all of them and shows that we are here dealing with individuals, which have passed the last moulting but one. As individuals at this stage of development are not known from the time before July 28, the last moulting but one must have taken place at the end of July or the beginning of August, that is, simultaneously with the hatching of the new brood. It further proved that these 8 individuals were of the same size as the 5 ♂ jun. of table I. The diameter of the broadest part of the cephalothorax varied in the late summer individuals from 2.0 mm to 2.4 mm, the average size being 2.2 mm. For the five early summer individuals the corresponding measures varied from 2.2 mm to 2.4 mm, and the average size was 2.3 mm. It is to be presumed that all of these young males are individuals, which have only one moulting left, that is, the hibernating takes place between the last but one and the last moulting.

It appears that when several individuals have been found at the same time in the same locality, they generally vary so much in size that they must belong to several generations. This is clearly shown by the finds at Kap Hope June 27, 1933, and in Brogede Dal July 28, 30 and 31, 1932. On the strength of measurements of the cephalothorax the seven animals from Kap Hope can be divided into four age groups with the following average measurements: 2.6 mm (♀ ad), 2.3 mm (♀ jun.), 1.8 mm (♂, ♀ juv.) and 1.4 mm (juv.). Four ♂ ad. have not been included, because there were no adult males to compare them with from Brogede Dal. The 15 specimens from here may, on the other hand, be divided into five age groups with the following average measurements: 2.7 mm (♀ ad.), 2.4 mm (♀ jun.), 1.9 mm (♀ juv.), 1.3 mm (juv.) and 0.9 mm (juv.). As the newly hatched young (pull.) do not occur in these finds, this suggests a life cycle of up to five years.

The material suitable for this investigation is so sparse that some of the groups only consist of one individual, and so it is not possible, on the strength of this, to decide the duration of the life cycle of the individuals. There is, however, no doubt that it covers several years.

7. *Pardosa groenlandica* THORELL 1872.

Lycosa grænlandica THORELL 1872, No. 2, p. 157.

Lycosa groenlandica JACKSON 1933, pl. I, fig. 4.

East Greenland records:

1. WILL. SØRENSEN 1898, p. 233 (*Lycosa g.*).
2. A. RANDELL JACKSON 1934₁, p. 613 (*Lycosa g.*).
3. JENS BRÆNDEGAARD 1935, p. 17.
4. — 1937₁, p. 5.
5. ÅKE HOLM 1937₁, p. 2 (*Lycosa g.*).
6. JENS BRÆNDEGAARD 1939, p. 4.
7. ÅKE HOLM 1939₂, p. 77, figs. 3 and 4 (*Lycosa g.*).
8. JENS BRÆNDEGAARD 1940, p. 6.

Occurrence in East Greenland:

Franz Joseph Fjord area: West of Mt. Harder on the Gauss peninsula 73°25' (5), Mt. Celcius on Ymer Ø 73°10' (5), Ella Ø 72°50' (8), Traill Ø at Vega Sund east of Scott-Keltie Øerne 72°40' (8), Kongeborgen at Kong Oskar Fjord 72°30' (8).

Scoresbysund area: Jameson and Liverpool Land 70°50' (2), Røde Ø and Heklahavn 70°30' (1), Rosenvinges Bugt 70°25' (8), Kap Dalton 69°24' (3).

Kangerdlugssuaq area: d'Aunay Bugt 69° (3), Ravns Fjord 68°30' (3), Mikis Fjord 68°10' (3, 4), Kangerdlugssuaq 68°05' (4, 7).

Sydøstkyst area: Tugtulik 66°20' (4), Tasiussaq in Sermilik 66°15' (4), II. Fjord in Sermilik 66°05' (4), Pikiutdleq in Sermilik 66° (4), Sarfaq in Sermilik 65°55' (4), Atingat in Ikerasagssuaq 65°50' (4), Angmagssalik 65°35' (4), Ørsteds Ø 65°05' (4), Nukarfik 63°25' (4), Skjoldunge Ø 63°15' (4, 6), Ūmánaq 62°55' (4), Tingmiarmiut 62°35' (4), Kap Rantzau 61°45' (4), Kap Tordenskjold 61°25' (4), Taterait and Auarqat 61°15' (4), Serkit nūat 61° (1), Iluileq 60°50' (4), Kùtsit Fjord 60°40' (4), Kangerdluaraq 60°35' (1), Tiningnertôq 60°25' (4), Dronning Louises Ø 60°20' (1), Kekertatsiak 60°10' (1), Qaqarssuaq Sund 60°05' (4).



Fig. 6. *Pardosa groenlandica* ♂. Tarsal joint of right palpus seen from the under side.

Just as *Pardosa glacialis* is the most commonly occurring spider in the areas north of Scoresbysund, *Pardosa groenlandica* is the most commonly occurring spider in the southern areas. From the country between Scoresbysund and Kap Farvel 435 spiders in all have been brought home, 160 or about 37 per cent of which belong to *Pardosa groenlandica* and may thus be termed the type animal of these humid areas.

Distribution:

East Greenland, West Greenland (from 59°52' to 69°45'¹⁾), where it is stated to be the most commonly occurring spider), Iceland, Labrador? and Montana in U.S.A.

Systematic remarks:

There is reason to entertain some doubt as to the occurrence of the species in Labrador. Only one individual (♀ ad.) is recorded from here. It is true that this record is made by such an authority as THORELL,

¹⁾ WILL. SØRENSEN gives Tasiussak 73°28' as the most northerly occurrence of the species, but this is owing to a mistake. See p. 57.

which makes one hesitate to express any doubt, but from the island of Akpatok, due north of Labrador, A. RANDELL JACKSON (1933, p. 146) has described a new species, viz. *Pardosa disjuncta*, which here replaces *Pardosa groenlandica* and is very closely related to it. It is distinguished from *Pardosa groenlandica* by having concolorous legs and a slightly deviating shape of the epigynum. Perhaps the two species might, with equal justice, be termed two races of the same species. It is possibly *Pardosa disjuncta* which at Labrador, as at Akpatok, replaces *Pardosa groenlandica*. None of the some 400 individuals of this species from West and East Greenland, which I have had the opportunity to investigate, belong to *Pardosa disjuncta*.

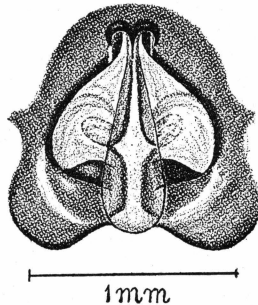


Fig. 7. *Pardosa groenlandica* ♀. Epigynum.

As to the occurrence of *Pardosa groenlandica* on the American continent only little is known with certainty, as this species, like the preceding one, was regarded by EMERTON (1895, p. 423) as synonymous with other closely related species, which have been described by THORELL; but these THORELL species have proved to be indubitable (GERTSCH 1834, p. 18).

ÅKE HOLM (1939, p. 79) has given information of a number of spiders found in the Kangerdlugssuaq area. Among these there are 3 *Pardosa groenlandica* ♂ ad., of which he says: "In the males of the present collection the embolus is somewhat broader than in the figured specimen, which belongs to THORELL's collection." As THORELL's type originates from West Greenland, there was consequently a possibility of at least a racial difference between the individuals from the east and the west coast respectively. In order to decide this problem I have investigated the entire material of *Pardosa groenlandica* ♂ ad., which is to be found in the Zoological Museum of Copenhagen. This material comprised 7 specimens from the east coast, and by comparing these with ÅKE HOLM's fig. 4b, it appeared that they all had a slightly broader and more tapering embolus (fig. 6) than THORELL's type. There can consequently be no doubt that there is a complete agreement between

these animals and the specimens from Kangerdlugssuaq mentioned by HOLM. Further, there were 29 specimens from the west coast, and four of these, which had been taken in the Ivigtut valley in May 1873, had a slightly slenderer embolus than the others, although its form was the same. This insignificant deviation is undoubtedly due to the fact that they were all comparatively small individuals. Only one specimen from Kangerdlarsuanguak Fjord had an embolus, which was less pointed than in the others, though of the same width. No systematic importance can be attached to these few and insignificant deviations, which must be regarded as individual variations. It is only unfortunate that the individual, which was used as a type, should have been such a variation.

Biology:

Judging by the finds there can hardly be any doubt that this species, like the preceding one, has a life cycle covering several years, but as only a few individuals have been found at the same time and in the same locality, it is impossible to give any information as to the number of years a cycle lasts.

8. *Pardosa saltuaria* L. KOCH 1870.

Lycosa saltuaria CHYZER et KULCZYNSKI 1891, p. 56, pl. II, fig. 12.

East Greenland record:

WILL. SØRENSEN 1898, p. 234 (*Lycosa hyperborea*).

Occurrence in East Greenland:

Scoresbysund area: Heklahavn 70°30'.

Sydøstkyst area: Serkit nûat 61°.

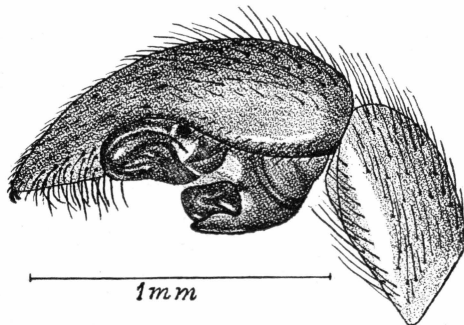


Fig. 8. *Pardosa saltuaria* ♂. Left palpus seen from the outer side.

Distribution:

East Greenland, West Greenland (from 59°55' to 65°25'). The species is not known from the nearctic area, but *Pardosa hyperborea* GERTSCH

(1934, p. 24) presumably belongs to the same species. In that case it is known from Canada (Quebec, Manitoba) and from U.S.A. (Maine). From the palaearctic area it is known from Riesengebirge, the Alps, the

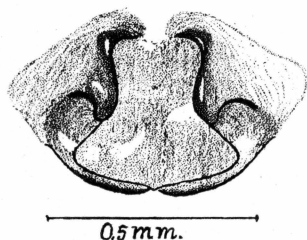


Fig. 9. *Pardosa saltuaria* ♀. Epigynum.

Pyrenees and the Balkan peninsula. The race belonging to the same species, viz. *Pardosa saltuaria hyperborea* THORELL is, on the other hand, distributed in Fennoscandia, on the Kola peninsula, in eastern Prussia and Poland (Wilno).

Systematic remarks:

In the Zoological Museum of Copenhagen there are 102 individuals belonging to this species, all originating from Greenland. One of these has been determined by EMERTON, the remainder by WILLIAM SØRENSEN as *Pardosa hyperborea* THORELL. HANS TAMBS-LYCHE (1940, p. 28) demonstrated that *Pardosa hyperborea* is synonymous with *Pardosa saltuaria*, but he also pointed out some constant differences between the North-European and the Central-European alpine individuals. The former he, therefore, refers to a special race, viz. *Pardosa saltuaria hyperborea*. It proves that the Greenland species do not agree entirely with this race, but are distinguished from it in the following characters:

P. s. hyperborea TH. from Scandinavia:

1. The males have ventrally on tarsus I two rows of short, pointed spines.

2. Dorsally on tarsus I near its base there is, in both sexes, a brush-like hair, which is not so long as the longest of the hairs projecting beyond the claws.

P. saltuaria L. K. from Greenland:

1. The males lack this double row of spines.

2. This hair is always longer than the longest hairs, projecting beyond the claws.

3. The light median band on the cephalothorax varies so that it may sometimes resemble the median band on *Pardosa tarsalis herbigrada*, seeing that it becomes so broad in front as to merge into the lateral bands.

4. The epigynum varies considerably in shape (TAMBS-LYCHE 1940, p. 31, figs. 2a, b, e, f, g, h).

3. The light median band is always narrow, and between the hindmost eyes it always anteriorly runs out into a point.

4. In all the 58 ♀ ad. only insignificant deviations from fig. 9 were observed.

Therefore, the Greenland individuals must belong to *Pardosa saltuaria* typicala.

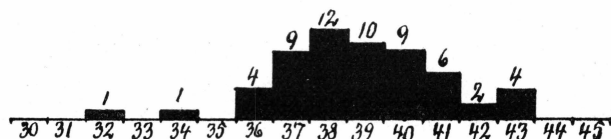


Fig. 10. Graphical description of proportions of size of *Pardosa saltuaria* from Greenland. The length of the cephalothorax is measured: standard of measurement $\frac{1}{15}$ mm. The figures above the column indicate the number of individuals in each group. The average size: $\frac{2251}{58.15} = 2.6$ mm.

As THORELL set up *Pardosa hyperborea*, he called, at the same time, attention to the fact that the species included a variety, which he named *pusilla*, and which was distinguished from the typical species by its colour and its smaller size. However, FR. DAHL (1908) maintains that the only constant difference between the variety and the typical species is its size, and on the strength of his measurements of 15 ♀ ad. TAMBS-LYCHE arrives at the conclusion that there cannot be any constant difference in size. In order to find out whether this was also the case in *Pardosa saltuaria* from Greenland, I undertook a measuring of all adult Greenland females. There were 58 ♀ ad., and fig. 10 shows that I arrived at the same result as TAMBS-LYCHE. That there are two individuals in age group 42 as against four in 43, must be regarded as being due to chance, as should be taken into account in a material, which is not very large. Beyond this there is nothing about the curve, which seems to suggest a tendency to two type varieties. Thus, *pusilla* neither occurs in *Pardosa s. hyperborea* nor in the typical *Pardosa saltuaria*.

9. *Dictyna borealis* CAMBRIDGE 1877.

Dictyna borealis CAMBRIDGE 1877, p. 273, pl. VIII fig. 1.

East Greenland records:

1. WILL. SØRENSEN 1898, p. 218 (*Dictyna hamifera* ad part.).
2. J. H. EMERTON 1918, p. 144, figs. 3, 4, 5 and 6 (*Dictyna hamifera*).
3. A. RANDELL JACKSON 1934₁, p. 611, pl. XVIII, fig. 2.
4. JENS BRÆNDEGAARD 1935, p. 16.
5. ÅKE HOLM 1939₂, p. 72, fig. 1.
6. JENS BRÆNDEGAARD 1940, p. 7, figs. 1, 3 and 5 (*Dictyna hamifera*).

Occurrence in East Greenland:

Nordøstkyst area: Danmarks Havn 76°50' (2).

Franz Joseph Fjord area: Sand Ø in Tyrolerfjord 74°15' (6), Eskimonæs 74°05' (6), Kap Stosch 74°05' (6), Hudson Land at Nordfjord 73°50' (6), Brogede Dal at Nordfjord on Strindberg Land 73°45' (6), Renbugten on Ymer Ø 73°25' (6), Ella Ø 72°50' (6), Fulach Dal at Dickson Fjord 72°50', at Korgeborgen in Kong Oskar Fjord 72°30' (6).

Scoresbysund area: Jameson Land 70°50' (3), Heklahavn and Røde Ø 70°30' (1).

Kangerdlugssuaq area: d'Annay Bugt 69° (3), Mikis Fjord 68°10' (4), Kangerdlugssuaq 68°05' (5).

Distribution:

East Greenland, West Greenland (from 59°55' to 74°), Akpatok, Northwest Territories (Arctic Canada). On the nearctic continent this species has only been found by the Canadian Arctic Expedition (1913—18). EMERTON determined the Arachnid material of the expedition, but as only young individuals were found, he is not sure as regards the determination of this species.

This species is of common occurrence in the arid areas north of Scoresbysund, from which in all 120 individuals are known. In the Kangerdlugssuaq area, where the climate is more humid, only 15 individuals have been found, which means that *Dictyna borealis* must be rather rare in these parts. From the area of the southern and very humid southeast coast there is no record of it whatsoever, and so it can be characterized as an arid arctic species,

When it is also found in West Greenland, although only sparsely in the southern part, this must be due to the special climatic conditions of the west coast. The ice-free land here forms so broad a belt that only the climate of the coast land has an oceanic character, whereas the hinterland is comparatively arid.

Systematic remarks:

As formerly mentioned (BRÆNDEGAARD 1940, p. 9) the opinion entertained at the Swedish zoological museums was that THORELL'S

types of *Dictyna hamifera* had been lost. Consequently, the only support for the clearing up of the synonymy of this species was THORELL's diagnosis, and on the strength of this I considered myself entitled to establish the synonymy of *Dictyna hamifera* with *Dictyna borealis*. The species was therefore called *Dictyna hamifera*, this name having the priority. However, the Swedish arachnologist, ÅKE HOLM, has later communicated to me that he had found THORELL's type at Riksmuseet at Stockholm. The reason why it had been considered lost, was that the label was inscribed with *Erigone hamifera* instead of *Dictyna hamifera*. The investigation undertaken by ÅKE HOLM established that the types closely agreed with my figures of *Dictyna major* (1940, figs. 2, 4, and 6). My conclusion, based upon the diagnosis only, was thus an erroneous inference, and *Dictyna hamifera* must be reduced to being synonymous with *Dictyna major*.

THORELL's types are a ♂ ad. and a ♀ ad. from Disko. When THORELL writes that the female is a jun., this is a mistake on his part.

Biology:

As appears from the finds (BRÆNDEGAARD 1940, p. 7) individuals at various stages of development are nearly always found at the same time and in the same locality. Fig. 11 shows that 18 individuals, taken at the same time and in the same locality, are distributed over three age groups, which are designated juv., ♀ jun. and ♀ ad. The males have not been included, as they generally deviate somewhat from the females

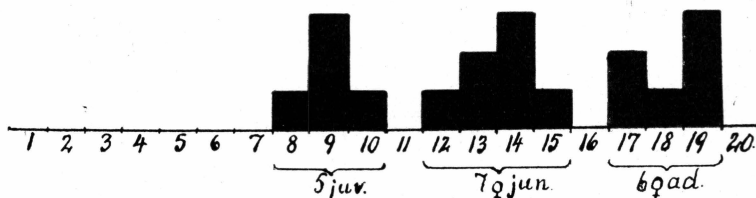


Fig. 11. *Dictyna borealis*. The figures on the abscissa indicate the width of the cephalothorax. Standard of measurement: $\frac{1}{20}$ mm. The ordinate indicates the number of individuals: 18 females taken 29. July 1932 in an alluvial cone on the eastern bank of Nordfjord. 1 ♀ ad. had laid eggs.

in size. Even though the material is numerically very slight, it may, however, be presumed that the three age groups represent three broods. As to these individuals an inaccuracy has, I regret to say, crept into the list of the fauna (1940, p. 7). This is due to the fact that my division of the animals into the various groups was based upon a rough estimate. The find of July 29, 1932: 6 ♀ ad. 4 ♀ jun. 2 ♀ juv. 6 juv. proved, when measured, to be 6 ♀ ad. 7 ♀ jun. and 5 juv. This points towards this

species having a life cycle covering three years, but at any rate there can be no doubt of its extending over more than one year.

10. *Dictyna major* MENGE 1869.

Dictyna major SIMON 1914, p. 65, figs. 114 and 121.

Dictyna hamifera THORELL 1872, No. 2, p. 156.

Dictyna major BRÜNDEGAARD 1940, p. 8, figs. 2, 4 and 6.

East Greenland record:

JENS BRÜNDEGAARD 1937₁, p. 6.

Occurrence in East Greenland:

Sydøstkyst area: Atingat in Ikerasagssuaq at Angmagssalik 65°50', Angmagssalik 65°35', Tiningnertôq 60°25'.

Distribution:

East Greenland, West Greenland (from 59°55' to 69°15'), Scotland, Northern France, Holland, Denmark, Danzig, East Prussia, Hungary, Kamtschatka.

Whereas this species is comparatively common in West Greenland, it has only been found scattered and as a rule in few specimens within the remaining area of distribution. It must be designated as a rare species in West and Central Europe, and it is not reported from the Faroes and Iceland.

Biology:

It only seems to live, where the climate or the locality is of a humid character.

11. *Enoplognatha intrepida* SOERENSEN 1898.

Theridium intrepidum SØRENSEN 1898, p. 190.

Enoplognatha intrepida JACKSON 1930, p. 642, pl. XVII, fig. 7.

East Greenland record:

JENS BRÜNDEGAARD 1937₁, p. 6.

Occurrence in East Greenland:

Sydøstkyst area: Tiningnertôq 60°25', Igdlorsuit 60°10', Qaqarssuaq Sund 60°05'.

From the east coast the species is thus unrecorded, except from the very southernmost part, south of Lindenows Fjord. It is improbable that the species lives further up the east coast, as it is a comparatively large species, which could not easily be overlooked by an efficient collector.

Distribution:

East Greenland, West Greenland (from $59^{\circ}55'$ to $66^{\circ}55'$), where in all 23 individuals have been found in 9 localities. On the east coast only 3 individuals have been found in 3 localities. It is a peculiar, though not unique phenomenon that the species lives so far north in West Greenland, but has hardly been able to penetrate northwards in East Greenland. This is presumably due to the fact that like *Arctosa insignita*, *Pardosa furcifera* and *Pardosa saltuaria* it is a heliophile species, which cannot live in the pronouncedly oceanic climate on the south-east coast, while it thrives very well in the comparatively arid and more

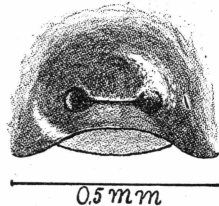


Fig. 12. *Enoplognatha intrepida* ♀. Epigynum seen obliquely from behind.

summer-like hinterland of the west coast. We are possibly here dealing with a boreal species, which under these climatic conditions has been able to penetrate far towards the north.

Enoplognatha intrepida is only known from Greenland, but it is not probable that it should be a species endemic to Greenland.

Systematic remarks:

The male is unknown. WILL. SØRENSEN described the species and called it *Theridium intrepidum*, but A. RANDELL JACKSON (1930, p. 642) rightly refers it to the genus *Enoplognatha*. Both the dentation on the margins of the claw furrows of the mandibles and the dorsal maculation of the leaf-like abdomen show that it is a genuine *Enoplognatha*.

12. *Bolyphantes index* THORELL 1856.

Linyphia index THORELL 1856, p. 107.

Bolyphantes index SIMON 1929, p. 727, figs. 843, 844.

East Greenland record:

JENS BRÆNDEGAARD 1937₁, p. 6.

Occurrence in East Greenland:

Sydøstkyst area: Atingat in Ikerasagssuaq at Angmagssalik $65^{\circ}50'$. Only one ♀ ad. is known from this single locality in the whole of Greenland.

Distribution:

East Greenland, Iceland, the Faroes, (?Orkney Isles), Norway, Sweden, France (the Alps and the Pyrenees), Germany, Switzerland, Austria, southern Poland, northern Russia and northern Siberia.

Bolyphantes index was recorded from the Orkney Isles by W. S. BRISTOWE (1931₁, p. 952), but he is not himself sure of the correctness of the determination, as the only specimen found was a young animal. From the nearctic area *Bolyphantes index* is only known from Angmagssalik, this being the most westerly outpost within the area of

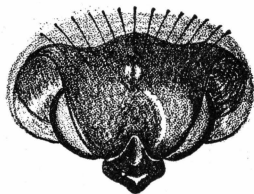


Fig. 13. *Bolyphantes index* ♀. Epigynum.

distribution of the species, which towards east extends as far as Jenissei in Siberia.

Bolyphantes index is a boreo-arctic species, which in the boreal area has almost exclusively been found in alpine localities.

13. *Lepthyphantes audax* SOERENSEN 1898.

Leptyphantes audax SØRENSEN 1898, p. 196.

Leptyphantes cacuminum JACKSON 1914, p. 118, pl. II, figs. 1, 2, 3, 4, 5 and 6.

East Greenland record:

JENS BRÆNDEGAARD 1937₁, p. 6.

Occurrence in East Greenland:

Sydøstkyst area: Tingmiarmiut 62°35', Narssaq in Lindenows Fjord 60°30'¹⁾. In East Greenland this species is thus only known from the very southernmost part. Like a number of the preceding species (*Arctosa insignita*, *Pardosa saltuaria*, *Pardosa furcifera* and *Enoplognatha intrepida*) it is not actually indigenous to East Greenland, but is a West Greenland species. Here in the very southernmost part, where there is no geographical boundary between West and East Greenland, it is only to be expected that West Greenland species should also be found on the east coast.

¹⁾ When the position of Narssaq (BRÆNDEGAARD 1937₁, p. 6) is given as 61°35', this is due to a misprint.

Distribution:

East Greenland, West Greenland (from 59°55' to 69°45' nine individuals have been found), Akpatok, Iceland (825 m above sea level), Lapland, Spitzbergen, Scotland (1200 m above sea level) and Switzerland (2000 m above sea level).

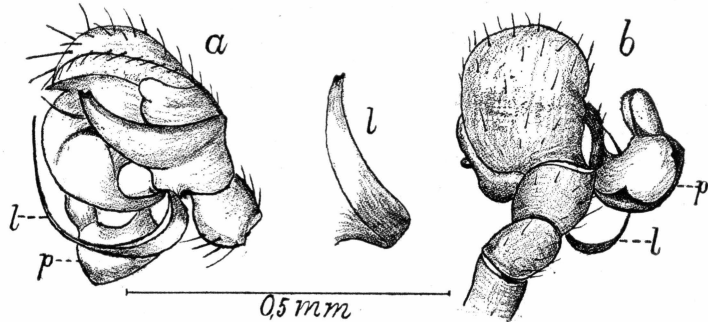


Fig. 14. *Lepthyphantes audax* ♂. Right palpus. *a* ventral view, *b* dorsal view, *l* Lamella characteristic, *p* Paracymbium. In the centre Lamella characteristic seen from the outer side.

Outside Greenland *Lepthyphantes audax* has only been recorded four times: on the mountain Nyrðri Súgur in Iceland, (Lapland, Spitzbergen), the Highlands of Scotland, Unter-Engadin in the Alps and at Akpatok. The occurrence in Lapland and on Spitzbergen is not yet recorded, but ÅKE HOLM has informed me that he possesses individuals of this species from those two localities. *Lepthyphantes audax* can be characterized as a boreo-arctic species, which is also of alpine occurrence in the temperate zone in Europe.

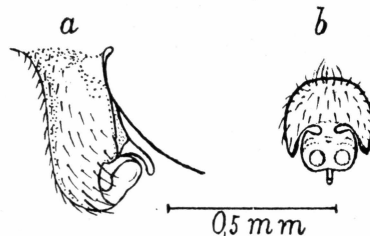


Fig. 15. *Lepthyphantes audax* ♀. Epigynum, *a* lateral view, *b* posterior view. Designed after an Icelandic specimen.

Systematic remarks:

As this species (BRÆNDEGAARD 1932, p. 12) was recorded from Iceland, E. SCHENKEL informed me that, by looking at the drawing of the epigynum of the female, he had arrived at the conclusion that

Leptyphantes cacuminum JACKSON must be synonymous with *L. audax*. By sending a *L. audax* ♀, determined by WILL. SØRENSEN, to A. RANDELL JACKSON the synonymity was further corroborated.

14. *Lephtyphantes turbatrix* CAMBRIDGE 1877.

Linyphia turbatrix CAMBRIDGE 1877, p. 281.

Linyphia groenlandica LENZ 1897, p. 73, figs. 1, 2, and 3.

East Greenland record:

JENS BRÉNDEGAARD 1937₁, p. 7.

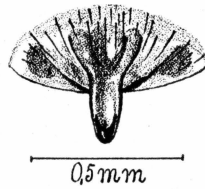


Fig. 16. *Lephtyphantes turbatrix* ♀. Epigynum.

Occurrence in East Greenland:

Sydøstkyst area: Tiningnertôq 60°25', Augpilagtoq 60°15'.

Lephtyphantes turbatrix is, like the preceding one, a West Greenland species, which in the very southernmost part, where the two coast lands join, or are only divided by small areas of the Inlandice, is also to be found on the east coast.

Distribution:

East Greenland, West Greenland (from 60°50' to 70°30'). The Danish collections from West Greenland have only supplied 7 individuals from 6 localities. CAMBRIDGE's types originate from the region between Jakobshavn 69°10' and the Nuggsuak peninsula, where E. WHYMPER undertook various voyages of investigation at the end of the sixties or the beginning of the seventies of the 19. century. LENZ' types are from Ũmánaq Fjord (the Drygalski Expedition); *Lephtyphantes turbatrix* is only known from Greenland.

Systematic remarks:

The Danish collections have not supplied adult males, but LENZ has described a male and made a drawing of it. WILL. SØRENSEN (1898, p. 195) did not regard *Lephtyphantes turbatrix* as being synonymous with *L. groenlandica* LENZ. CAMBRIDGE's description which, it is true, is brief rather corresponds with *L. groenlandica*, and this more particularly applies to his description of the epigynum: "The adult female, however, may be at once distinguished by a rather slender prominent bent process,

directed backwards from the larger process, connected with the genital aperture." I therefore felt nearly sure that *Lepthyphantes turbatrix* CB. and *L. groenlandica* LENZ were synonymous, and A. RANDELL JACKSON, to whom I sent a *L. groenlandica* ♀, determined by WILL. SØRENSEN, was kind enough to compare it with CAMBRIDGE'S type, which is kept at Oxford, and he was able to establish the synonymity.

15. *Micryphantes nigripes* SIMON 1884.

Microneta nigripes SIMON 1884, p. 439, figs. 222, 223 and 224.

Ischnyphantes nigripes SIMON 1929, p. 718.

East Greenland records:

1. WILL. SØRENSEN 1898, p. 200 (*Tmeticus Levinseni* ad part.).
2. A. RANDELL JACKSON 1934₁, p. 615 (*Meioneta nigripes*).
3. JENS BRÆNDEGAARD 1937₁, p. 7.
4. ÅKE HOLM 1939₂, p. 75 (*Meioneta nigripes*).
5. JENS BRÆNDEGAARD 1940, p. 11.

Occurrence in East Greenland:

Nordøstkyst area: Danmarks Havn 76°50' (5).

Franz Joseph Fjord area: Eastern coast of Nordfjord at the Waltherhausen glacier 73°50' (5), Brogede Dal on Strindberg Land at Nordfjord 73°45' (5), Ella Ø 72°50' (5).

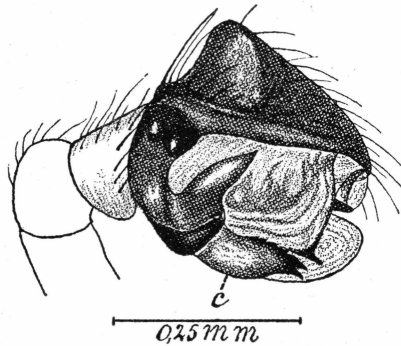


Fig. 17. *Micryphantes nigripes* ♂. Right palpus seen from the outer side.
c Lamella characteristic.

Scoresbysund area: Hurry Fjord east of Fame Øerne 70°50' (5), Jameson Land 70°50' (2), Heklahavn and Kap Stewart 70°30' (1).

Kangerdlugssuaq area: D'Aunay Fjord 69° (2), Kangerdlugssuaq 68°05' (3, 4).

Sydøstkyst area: Sermilik 66°05' (3), Sarfaq 65°55' (3).

Distribution:

East Greenland, West Greenland (from 67°20' to 68°42'), Jan Mayen, Spitzbergen, Novaja Zemlya, the Faroes, Scotland, Sweden, the French, Swiss and Tyrolean Alps.

Micryphantes nigripes is a palaeartic species, which in the nearctic area is only known from northern Greenland. Its southern boundary is here Angmagssalik and Tatsip-atâ¹), in East and West Greenland

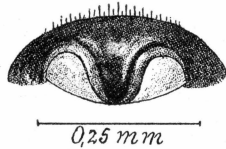


Fig. 18. *Micryphantes nigripes* ♀. Epigynum seen obliquely from behind.

respectively. South of this it is replaced by the race *Micryphantes n. jacksoni* BRGD., belonging to the same species.

Micryphantes nigripes is an arctic species which, however, is also of alpine occurrence in the temperate zone.

Systematic remarks:

WILL. SØRENSEN (1898) described it as a new species (*Tmeticus Levinsenii*) but considered it and *Micryphantes n. jacksoni* as identical. The whole of his material is to be found in the Zoological Museum of Copenhagen, but none of the individuals have been labelled as types. His diagnosis is however: "Oculi ordinis posterioris medii omnium maximi, inter se radio suo, paullo latius quam a lateralibus disjuncti", and so there can be no doubt that his type has been a *Micryphantes nigripes* Sr.

Biology:

The species lives both in pronouncedly humid regions (Jan Mayen and the Faroes) and in pronouncedly arid areas (Germania Land and the Franz Joseph Fjord area). In the arid part of East Greenland, where the species has been identified both by HOLGER MADSEN and myself, it was either found at a sandy fjord bank, beneath sparse vegetation at a sandy sea shore or at an alluvial cone, that is, in places where the microclimatic conditions may also be supposed to be humid.

16. *Micryphantes nigripes jacksoni* BRAENDEGAARD 1937.

Meioneta nigripes JACKSON 1933, p. 153.

Micryphantes nigripes jacksoni BRÆNDEGAARD 1937₁, p. 7.

¹) WILL. SØRENSEN writes Taitip ata, but this is an erroneous spelling.

East Greenland record:

WILL. SØRENSEN 1898, p. 200 (*Tmeticus Levinsenii* ad part.).

Occurrence in East Greenland:

Sydøstkyst area: Ûmánaq on Griffenfelds Ø 62°55'.

Distribution:

East Greenland, West Greenland (from 59°52' to 64°15'), the island of Akpatok in the Ungave bay north of Labrador.

Micryphantes n. jacksoni seems to replace *M. nigripes* south of about 65° lat. N. in Greenland.

Systematic remarks:

A. RANDELL JACKSON (1933) described *Micryphantes nigripes jacksoni* from Akpatok, but as it only deviated from the typical species in that the hindmost central eyes were nearly of the same size as the lateral eyes, he was of the opinion that it was an individual variation within the species and so did not give it any special name. As this variety, however, has also been identified in the southernmost part of Greenland, where the typical *Micryphantes nigripes* does not occur, it is at any rate justifiable to regard it as a geographical race.

17. *Oreonetides vaginatus* THORELL 1872.

Erigone vaginata THORELL 1872, No. 2, p. 153.

Macargus adipatus CHYZER et KULCZYNSKI 1894, p. 79, pl. III, fig. 19.

East Greenland record:

JENS BRÆNDEGAARD 1937₁, p. 8.

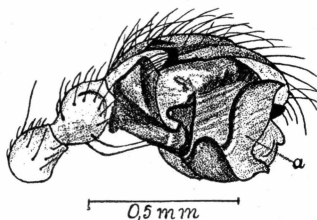


Fig. 19. *Oreonetides vaginatus* ♂. Right palp seen from the outer side.
a Lamella characteristic.

Occurrence in East Greenland:

Sydøstkyst area: Kûtsit Fjord 60°40', Narssaq in Lindenows Fjord 60°30'.

Oreonetides vaginatus is, like some of the preceding ones (*Arctosa insignita*, *Pardosa furcifera*, *Pardosa saltuaria*, *Enoplognatha intrepida*, *Lepthyphantes audax*, *Lepthyphantes turbatrix*), a West Greenland

species, which is only known from the very southernmost part of the east coast, where East and West Greenland either form a geographical unity or are only divided by inconsiderable areas of the Inlandice.

Distribution:

East Greenland, West Greenland (sparsely known from 59°55' to 69°), the island of Akpatok in the Ungave bay north of Labrador,

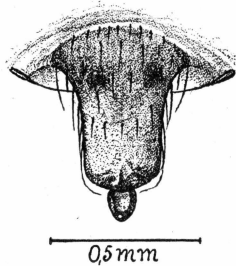


Fig. 20. *Oreonetides vaginatus* ♀. Epigynum.

northern Russia from Kamschatka as far as the Murman coast, northern Finland (Enare), northern Norway (Helgeland and Lofoten), northern Sweden (Abisko and Sarek), the Faroes, the British Isles, the Pyrenees, the French, Swiss and Tyrolean Alps and the Carpathian Mountains (Tatra).

It is a holarctic, humid boreo-arctic species, which is of alpine occurrence in the temperate zone.

18. *Cornicularia karpinskii* CAMBRIDGE 1873.

Erigone karpinskii CAMBRIDGE 1873, p. 447, pl. XLI, fig. 12.

Walckenaëra karpinskii LESSERT 1910, p. 180, figs. 103 and 104.

East Greenland records:

1. WILL. SØRENSEN 1898, p. 207 (*Walckenaëra insolens*).
2. A. RANDELL JACKSON 1934₁, p. 614.
3. JENS BRÆNDEGAARD 1940, p. 11.

Occurrence in East Greenland:

Franz Joseph Fjord area: Brogede Dal at Nordfjord on Strindberg Land 73°45' (3), Ella Ø 72°50' (3).

Scoresbysund area: Heklahavn 70°30' (1), Kap Dalton 69°24' (2).

Sydøstkyst area: Úmánaq on Griffenfelds Ø 62°55' (1).

Distribution:

East Greenland, West Greenland (Nikamiut 61°50', Nigerdlek 62°20', Egedesminde 68°45', Ritenbenk 69°45', Ryders Øer 74°40'), Akpatok,

Spitzbergen, northern Norway (Rösvand), Sweden (Abisko, Sarek), Great Britain, the Swiss Alps, Siberia (south of Lake Baikal).

It is peculiar that *Cornicularia karpinskii*, although known both from nearctic and palaeartic areas, does not occur in Iceland and in

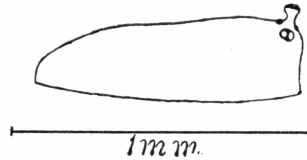


Fig. 21. *Cornicularia karpinskii* ♂. Cephalothorax.

the Faroes. Outside the arctic area it only seems to be of alpine occurrence, in the Alps (2500—2850 m) and in Great Britain (760—1335 m).

Systematic remarks:

In 1934 A. RANDELL JACKSON sent me a note and a female of this species from the Scoresbysund area, which he thought was synonymous with *Walckenaëra insolens* SØRENSEN. By means of a direct comparison with SØRENSEN's types it was possible to establish the synonymity.

Biology and morphological remarks:

In the typical *Cornicularia karpinskii*, as described and figured by CAMBRIDGE and LESSERT, the two apophyses on the tibia of the palpus are nearly equally robust; and their tips intercross, the external one transversing the interior one. This is only the case in one male from Ūmánaq in East Greenland. In two males, from Ella Ø and Heklahavn, the shapes of the apophyses were as shown on fig. 22. Here the two apophyses are nearly parallel, and the interior is much slenderer than

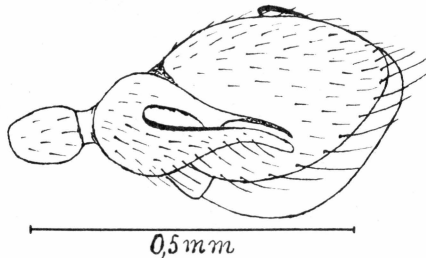


Fig. 22. *Cornicularia karpinskii* ♂. Right palpus seen from the upper side.

the exterior one. Finally, the apical part is entirely absent in a male from Ritenbenk in West Greenland, the interior apophyses being only about half the length of the external one. But for the male from Ūmánaq one might have supposed that the Greenland individuals constituted a special geographical race.

LESSERT states that the length of the cephalothorax is normally 0.9 mm, and as appears from the measurements (table III), the male from Ûmánaq is the only adult male, which has a normal size. The others are abnormally small and do not have normally developed apophyses. The smallest (0.76 mm) has also the least well developed apophyses, and it may therefore be supposed that it is here a question of individual variations, which are due to the ecological conditions farthest north being unfavourable to normal development. This supposition is further supported by the fact that, also among the females, only those which have been found in the most southerly districts are of normal size. The others are smaller.

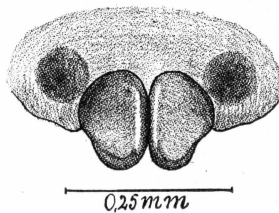


Fig. 23. *Cornicularia karpinskii* ♀. Epigynum.

E. SCHENKEL (1931, p. 960) observed that the tibia apophyses vary, and from this he draws the conclusion that the species occurs in several geographical races. Although this is an obvious conclusion, it seems, however, a little rash, when taking into consideration how the apophyses of the Greenland individuals vary in proportion to the size of the animal.

The species proves to be possessed of a considerable power of adaption, so that it may live under pronouncedly arid (Strindberg Land) as well as under pronouncedly humid conditions (Ûmánaq).

Table III. Proportion in size of *Cornicularia karpinskii* from Greenland.

Number	Sex	Locality	Length of cephalothorax
1	♂	Ûmánaq, East Greenland 62°55'	0.95 mm
1	♂	Hekla Havn — 70°30'	0.81 -
1	♂	Ella Ø — 72°50'	0.81 -
1	♂	Ritenbenk, West Greenland 69°45'	0.76 -
1	♀	Nikamiut, West Greenland 61°50'	0.90 mm
1	♀	Nigerdlek, — 62°20'	1.00 -
1	♀	Ritenbenk, — 69°45'	0.86 -
3	♀	— — —	0.81 -
1	♀	Strindberg Land, East Greenland 73°45'	0.86 -

19. *Hilaira curvitaris* SOERENSEN 1898.

Notioscopus(?) curvitaris SØRENSEN 1898, p. 211.

Hilaira whymperi JACKSON 1933, p. 152, pl. II, figs. 2 and 4.

East Greenland records:

1. WILL. SØRENSEN 1898, p. 214 (*Notioscopus(?) curvitaris*).
2. A. RANDELL JACKSON 1934₁, p. 613 (*Hilaira whymperi*).
3. ÅKE HOLM 1937₁, p. 1 (*Hilaira vexatrix*).
4. JENS BRÆNDEGAARD 1940, p. 12, figs. 7, 8 and 9.

Occurrence in East Greenland:

Nordøstkyst area: Danmarks Havn 76°50' (4), Hochstetter Forland west of Kap Rink 75°10' (4).

Franz Joseph Fjord area: Kap Mary 74°10' (4), Eskimonæs 74°05' (4), Brogede Dal at Nordfjord on Strindberg Land 73°45' (4), Mt. Celsius on Ymer Ø 73°10' (3), Mineralbugten on Suess Land 72°50' (4), Kap Alfred at¹ Kempe Fjord 72°50' (4), Ella Ø 72°50' (4), Trail Ø 72°30' (4).

Scoresbysund area: Jameson Land, Fame Øerne and Liverpool Land 70°50' (2), Heklahavn and Kap Steward (70°30' (1), Kap Hope 70°25' (4).

Distribution:

East Greenland, West Greenland (from 68°45' to 70°35'), Akpatok in the Ungave bay north of Labrador, north-eastern Baffin Land.

Systematic remarks:

This species is so closely related to *Hilaira glacialis* THORELL (1871) that it is only possible with certainty to distinguish the adult males of the two species from each other. It was first recorded from Ūmánaq Fjord (Drygalski Expedition) in West Greenland by H. LENZ (1897, p. 74, figs. 4 and 5), who erroneously referred it to *Hilaira frigida* THORELL. WILL. SØRENSEN (1898) described it as a new species, but referred it to the genus *Notioscopus(?)*, the mark of interrogation, however, clearly showing that he doubted the correctness of this. A. RANDELL JACKSON demonstrated its occurrence at Akpatok and Jakobshavn in West Greenland (1933). In the latter locality it was found in 1870 by E. WHYMPER. JACKSON also described it as a new species, *Hilaira whymperi*. Finally, ÅKE HOLM (1937₁, p. 7) was of the opinion that the species was synonymous with *Erigone vexatrix* CAMBRIDGE 1877. Here, however, he does not seem to be right (BRÆNDEGAARD 1940, p. 13), *Erigone vexatrix* CB. being rather synonymous with the subsequent species.

Biology:

Hilaira curvitaris only seems to occur under arid arctic conditions. Here it is most frequently found beneath stones or in the upper moor bed under the vegetation, where the microclimatic conditions are of a comparatively humid nature.

20. *Hilaira glacialis*(?) THORELL 1871.*Erigone glacialis* THORELL 1871, p. 694.*Hilaira glacialis* JACKSON 1933, p. 152, pl. II, figs. 1, 5 and 6.

East Greenland record:

WILL. SØRENSEN 1898, p. 211 (*Araeoncus ruderalis*).

Occurrence in East Greenland:

Scoresbysund area: Kap Stewart 70°30'.

Distribution:

East Greenland, West Greenland (Upernavik 72°50', Saunders Ø 76°35'), Ellesmere Land, Grant Land (Discovery Bay 81°44'), Alaska, Spitzbergen. With certainty *Hilaira glacialis* is, however, only known from Spitzbergen.

Systematic remarks:

WILL. SØRENSEN (1898) described two females as a new species, *Araeoncus ruderalis*. An investigation showed that these females deviate so little from the typical *Hilaira curvitaris* that I would presumably have regarded them as individual variations of the same species, if I had not known that *H. curvitaris* and *H. glacialis* were difficult to distinguish from each other. ÅKE HOLM (1937₁, p. 8) is thus of the opinion that the females of these two species cannot be distinguished with any degree of certainty. A. RANDELL JACKSON (1933), however, thinks it possible to distinguish the females of these two species by means of the epigynes. On the strength of his figures I have considered myself entitled to refer *Araeoncus ruderalis* to *Hilaira glacialis* TH. This also applies to three females from Ellesmere Land, which EMBR. STRAND (1907) erroneously recorded as *Hilaira frigida* TH. (BRÉNDEGAARD 1936, p. 129).

As it has not been possible for JACKSON to find CAMBRIDGE's type of *Erigone vexatrix* (1877, p. 280) from Discovery Bay, it is impossible with certainty to decide which species is in reality meant, but the zoogeographical conditions go to show that it should be classed with *Hilaira glacialis* TH. The *H. glacialis* recorded by J. H. EMERTON (1921, p. 165) from Saunders Ø in the Thule district is presumably correctly determined, and this possibly also applies to the *H. glacialis* from Alaska, recorded by him from the same locality.

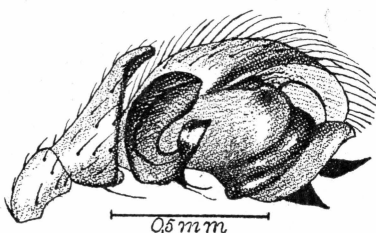
As it is only possible with full certainty to determine this species, when the material includes adult males, which was not the case here, it is uncertain whether *Hilaira glacialis* occurs in Greenland, as well as in Ellesmere Land, Grant Land and Alaska.

21. *Hilaira frigida* THORELL 1872.*Erigone frigida* THORELL 1872, No. 2, p. 152.*Tmeticus niger* CAMBRIDGE 1891, p. 80, pl. II, fig. IV.*Hilaira færoica* SCHENKEL 1925₁, p. 398, fig. 1.

East Greenland records:

1. WILL. SØRENSEN 1898, p. 199 (*Tmeticus frigidus*).
2. A. RANDELL JACKSON 1934₁, p. 613.
3. JENS BRÆNDEGAARD 1935, p. 16.
4. — 1937₁, p. 8.
5. — 1939, p. 4.
6. ÅKE HOLM 1939₂, p. 75.
7. JENS BRÆNDEGAARD 1940, p. 14.

Occurrence in East Greenland:

Franz Joseph Fjord area: Kap Alfred at Kempe Fjord 72°50' (7).*Scoresbysund area*: Fame Øerne 70°50' (2), Hekla Havn 70°30' (1).*Kangerdlugssuaq area*: d'Auny Fjord 69° (2), Ravns Fjord 68°30' (3), Mikis Fjord 68°10' (4), Kramers Bugt and Kangerdlugssuaq 68°05' (3, 6).*Sydøstkyst area*: Kangerdlugssuatsiaq 66°20' (4), Sermilik 66°05' (4), Orpigssuit 66°05'¹⁾, Apusinek 66° (4), Ikarasagssuaq 65°55' (4), Atingat 65°50' (4), Angmagssalik 65°35' (4), Ørsteds Ø 65°05' (4), Nukarfik 63°25' (4), Tingmiarmiut 62°35' (4), Auarqat 61°15' (4), Iluileq 60°50' (4), Kútsit Fjord 60°40' (4), Kangerdluaraq 60°35' (1), Augpilagtoq 60°15' (4),Fig. 24. *Hilaira frigida* ♂. Right palpus seen from the outer side.

Qaqarssuaq Sund 60°05' (4), Ikerasak 59°55' (5), eastern Ikerasak 59°50' (4).

The species is common in the whole of the humid part of East Greenland. A single female has, however, been found in the pronouncedly arid area (Kap Alfred).

Distribution:

East Greenland, West Greenland (of common occurrence from 59°52' to 69°45'; a single female has, however, been found as far north as at Upernavik), Baffin Land, Akpatok in the Ungave bay north of Labrador,

¹⁾ 1 ♂ ad., KRUSE leg. July 31, 1902.

the Murman coast, Norway, Sweden (Sarek and Abisko), Great Britain, Ireland, the Shetland Isles, the Faroes, Iceland, Grims Island north of Iceland, Jan Mayen.

It has formerly been thought that *Hilaira frigida* also occurred on Ellesmere Land (STRAND 1907), but this is due to an erroneous determination (see *Hilaira glacialis* p. 39). It clearly appears from the conditions of distribution that the species only lives where the climate is of a pronouncedly humid character. Outside the arctic area it is most frequently of alpine occurrence.

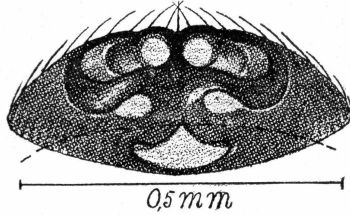


Fig. 25. *Hilaira frigida* ♀. Epigynum, seen from behind. The area seen below the dotted line is hidden in the epigastric furrow.

Systematic remarks:

Hilaira rudis CB. and *Hilaira montigena* L. K. have formerly been regarded as synonyms of *Hilaira frigida* TH. (SIMON 1926, p. 530). E. SCHENKEL has, however, (1923, p. 95 and 1927, p. 248) demonstrated that *Hilaira rudis* and *Hilaira montigena* are closely related, but independent species. It appears from SCHENKEL'S account of these two alpine species that none of them can be synonymous with *Hilaira frigida*, and consequently *Hilaira frigida* cannot be known from Kamtschatka, from where it has been recorded by L. KULCZYNSKI (1926, p. 32). He calls attention to the fact that the female, which he determined as *Hilaira frigida*, is synonymous with *Hilaira rudis*. Thus, it is not *Hilaira frigida*, which has been found at Kamtschatka, but the alpine species *Hilaira rudis*, with which species KULCZYNSKI (1894, p. 78 and 1897, p. 322) is extremely familiar from the Carpathian Mountains.

22. *Microerigone spitsbergensis* THORELL 1871.

Erigone Spetsbergensis THORELL 1871, p. 692.

East Greenland records:

1. JENS BRÆNDEGAARD 1937₁, p. 8, figs. 3 and 4.
2. ÅKE HOLM 1939₂, p. 76.

Occurrence in East Greenland:

- Kangerdlugssuaq area*: Kangerdlugssuaq 68°05' (2).
Sydøstkyst area: Angmagssalik 65°35' (1).

Distribution:

East Greenland, West Greenland (Kuánerssuit on Disko), Arctic America (Thetis Island off the north coast of Alaska), Spitzbergen, Novaja Zemlya (21 localities from the northern and southern island), the New Siberian Isles, Siberia (most southerly locality $69^{\circ}15'$, most northerly Cape Tscheljuskin $77^{\circ}33'$). J. H. EMERTON (1919, p. 3) states that *Microerigone spitsbergensis* has been found "by the English Polar Expedition of 1875—6 in latitude $82^{\circ}33'$ ". *Erigone provocans* CAMBRIDGE, which has been found in this locality, is perhaps synonymous with *M. spitsbergensis*, but no evidence is at hand, as EMERTON seems to think.

From a zoogeographical point of view *Microerigone spitsbergensis* is a typically arctic species, which has never been met with outside the arctic area.

Systematic remarks:

Only one male and one female are known from East Greenland. This male is slightly larger and of lighter colour than the typical individuals from Spitzbergen. There is also a small deviation in the structure of the palpus organ, but this may be due to individual variations (BRÆNDEGAARD 1937, p. 9).

23. *Rhaebothorax morulus* CAMBRIDGE 1872.

Nerienne morula CAMBRIDGE 1872, p. 545, pl. XLVI, fig. 16.

East Greenland record:

JENS BRÆNDEGAARD 1937¹, p. 9 (*Rhaebothorax broccha*).

Occurrence in East Greenland:

Sydøstkyst area: Angmagssalik $65^{\circ}35'$.

Distribution:

East Greenland, Iceland, Great Britain, Ireland.

Systematic remarks:

Among English arachnologists it has been a widely distributed opinion that *Erigone (Rhaebothorax) broccha* L. KOCH 1872 and *Nerienne (Rhaebothorax) morula* CAMBRIDGE 1872 are synonymous (BRISTOWE 1939, p. 82). The only specimen, a female, found in East Greenland, was determined by A. RANDELL JACKSON who, however, did not feel quite certain of the synonymy, for together with his answer he sent me a specimen of a *R. broccha* from the Alps. A direct comparison showed that the two individuals were somewhat different from a morphological point of view, but their epigynes were entirely identical. Consequently, I

referred (1937, p. 9) the East Greenland specimen to *R. braccha*, as I was of the opinion that it might be an individual variation. ÅKE HOLM has later on informed me that he has had Swiss and English specimens

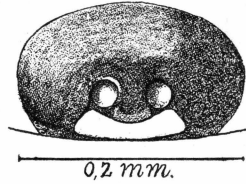


Fig. 26. *Rhaebothorax morulus* ♀. Epigynum.

for comparison, and that they proved to be distinctly different. The two species consequently cannot be regarded as synonymous, though it is possibly only a difference in race.

Biology:

In East Greenland only one female has been found in a Berlèse sample. On Iceland a male was once found 1135 m above sea level. In Great Britain and Ireland it is also of alpine occurrence.

24. *Caledonia evansi* CAMBRIDGE 1894.

Caledonia evansi CAMBRIDGE 1894, p. 20.

East Greenland records:

1. JENS BRENDGAARD 1937₁, p. 10.
2. ÅKE HOLM 1939₂, p. 76.

Occurrence in East Greenland:

Kangerdlugssuaq area: Kangerdlugssuaq 68°05' (2).

Sydøstkyst area: Sermilik 65°55' (1), Atingait 65°50' (1), Angmagsalik 65°35' (1).

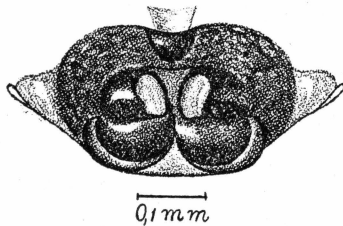


Fig. 27. *Caledonia evansi* ♀. Epigynum. Designed after an Icelandic specimen.

Distribution:

East Greenland, Grims Island, Iceland, Norway (Tromsø), Sweden (Jämtland and Lapland), the Shetland Isles, Great Britain.

ÅKE HOLM writes (1939₂, p. 76) that this species occurs in Sweden. As there is no record of this, I applied to ÅKE HOLM, who kindly supplied me with information as to the occurrence of the species in Sweden.

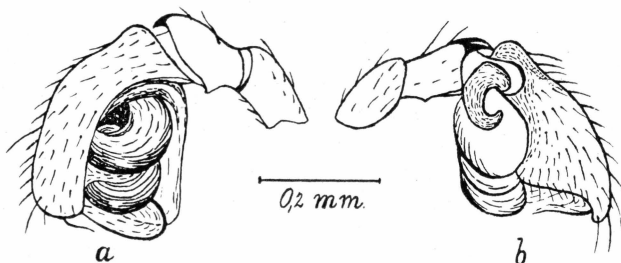


Fig. 28. *Caledonia evansi* ♂. Right palpus, *a* seen from the inner side, and *b* from the outer side. Designed after an Icelandic specimen.

Biology:

The species is only known from such geographical areas, where the climate is of a pronouncedly humid character.

25. *Coryphaeolana holmgreni* THORELL 1871.

Erigone Holmgrenii THORELL 1871, p. 691.

Erigone mendica L. KOCH 1878, No. 5, p. 52, pl. II, fig. 7.

East Greenland records:

1. A. RANDELL JACKSON 1934₁, p. 614.
2. JENS BRÆNDEGAARD 1937₁, p. 10.
3. A. RANDELL JACKSON 1938, p. 547.
4. ÅKE HOLM 1939₁, p. 76.
5. JENS BRÆNDEGAARD 1940, p. 14, figs. 10 and 11.

Occurrence in East Greenland:

Franz Joseph Fjord area: Kap Stosch River 74°05' (5).

Scoresbysund area: Jameson Land and Liverpool Land 70°50' (1), Charcots Havn on Milne Land 70°50' (5), Rosenvinges Bugt 70°25' (1).

Kangerdlugssuaq area: d'Aunay Fjord 69° (1), Kangerdlugssuaq 68°05' (2, 3, 4).

Sydøstkyst area: Kangerdlugssuatsiaq 66°25' (2), Sermilik 65°55' (2), Puissortoq 61°55' (2), Kap Tordenskjold 61°25' (2), Kåtsit Fjord 60°40' (2).

Distribution:

East Greenland, West Greenland (65°—73°), Baffin Land, Akpatok (island in the Ungave bay north of Labrador), Jan Mayen, Bear Island, Spitzbergen, Novaja Zemlya, Grims Island, Iceland, the Faroes, northern Norway, Scotland, Siberia (at Jenissej 68°45'—70°40'), Kamtschatka.

It is a pronouncedly arctic species which is, however, also of alpine occurrence (near the snow line) in the boreal area. In northern Iceland it has only been found in alpine localities.

Systematic remarks:

Erigone groenlandica LENZ (1897) and *Walckenaëra similis* SOERENSEN (1898) are synonyms. A detailed list of synonyms has been published on an earlier occasion (BRÆNDEGAARD 1940, p. 15).

Biology:

It is a peculiarity of this species that in some isolated arctic islets it plays an almost entirely dominating part. This e. g. applies to Jan Mayen. In August 1921 W. S. BRISTOWE collected some 300 spiders in this locality, about 200 of them belonging to this species, whereas about 100 were distributed over four other species. This is a still more apparent in the case of Bear Island, where an English expedition in 1932 collected in all 460 spiders, and of those 450 were *Coryphaeolana holmgreni*, whereas only 10 belonged to *Erigone tirolensis* L. KOCH.

Coryphaeolana holmgreni must be particularly adapted to live under such extreme climatic conditions as are to be found on these islands, viz. a short, coldish humid summer with very little sunshine. It is, therefore, only natural that it lives on Grims Island and on the Faroes, and that it has been found just below the snow line on Iceland and in Scotland. In East Greenland it has only been found once outside the humid area, that is beneath stones at the Kap Stosch River, but here the microclimatic conditions may very well be imagined to have been in agreement with its ecological requirements. It is likely that it thrives in a similar way in other arid arctic regions.

In order to understand the presence of the species on islands, the situation of which is so isolated as Jan Mayen and Bear Island, one must undoubtedly also consider the conditions as to the ecology of distribution. It is in all probability a unique aeronaut.

26. *Coryphaeolana lapidicola* SOERENSEN 1898.

Gongylidium lapidicola SØRENSEN 1898, p. 204.

Scotinotylus ungavensis JACKSON 1933, p. 150, pl. II, fig. 9.

East Greenland record:

JENS BRÆNDEGAARD 1937₁, p. 10, figs. 5 and 6.

Occurrence in East Greenland:

Sydøstkyst area: Kap Tordenskjold 61°25', Narssaq in Lindenows Fjord 60°30', Augpilagtoq 60°15'.

Distribution:

East Greenland, West Greenland (known from 6 localities, between Kagssiarssuk 60°55' and Ritenbenk 69°45'), Akpatok (island in the Ungave bay north of Labrador).

From Akpatok *Coryphaeolana lapidicola* is only represented by one specimen. On Greenland it belongs zoogeographically to the species, which are comparatively widely distributed on the west coast, but only have been able to spread to the very southernmost part of the east coast. It is a nearctic species.

27. *Coryphaeolana thulensis* JACKSON 1934.

Coryphaeolanus thulensis JACKSON 1934₁, p. 615, pl. XVIII, figs. 3, 4, 5, 6 and 7.

East Greenland records:

1. A. RANDELL JACKSON 1934₁, p. 614.
2. JENS BRÆNDEGAARD 1940, p. 16, figs. 12 and 13.

Occurrence in East Greenland:

Nordøstkyst area: Danmarks Havn 76°50' (2).

Franz Joseph Fjord area: Kap Stosch 74°05' (2).

Scoresbysund area: Jameson Land 70°50' (1), Fame Øerne in Hurry Fjord 70°50' (1).

Distribution:

East Greenland, Spitzbergen.

28. *Erigone psychrophila* THORELL 1871.

Erigone psychrophila THORELL 1871, p. 689.

Erigone psychrophila CROSBY and BISHOP 1928, p. 38, figs. 66, 67, 68 and 70.

East Greenland records:

1. WILL. SØRENSEN 1898, p. 200.
2. J. H. EMERTON 1918, p. 143, figs. 1 and 2.
3. A. RANDELL JACKSON 1934₁, p. 615.
4. JENS BRÆNDEGAARD 1937₁, p. 12.
5. — 1940, p. 17, figs. 14 and 22.

Occurrence in East Greenland:

Nordøstkyst area: Danmarks Havn 76°50' (2 and 5).

Franz Joseph Fjord area: Hold with Hope 73°30' (1).

Scoresbysund area: Jameson Land 70°50' (3), Kap Stewart¹⁾ 70°30' (1), Kap Dalton 69°25' (3).

¹⁾ WILL. SØRENSEN has recorded a ♂ and a ♀, but the female belongs to *E. tirolensis* L. KOCH.

Sydøstkyst area: Kangerdlugssuatsiaq 66°15' (4), Angmagssalik 65°35' (4).

The species has been sparsely found in East Greenland, which is possibly due to the fact that it lives hidden. It has also been stated that several specimens have been taken beneath stones (Danmarks Havn and Kangerdlugssuatsiaq) and one in a Berlèse sample.

Distribution:

East Greenland, West Greenland (Wandels Land 74°35'), North Greenland (Polaris Bugt 81°30'), Grant Land¹⁾ (82°33'), Ellesmere Land (78°46' and 76°49'), the arctic sea coast of Alaska, Kamtschatka, northern Siberia (62°15'—77°33' Kap Tscheljuskin), New Siberian Islands, the Waigatsche island, Novaja Zemlya, Franz Joseph Land, Spitzbergen, northern Norway, the Faroes.

Erigone psychrophila is a pronouncedly arctic species, which outside the arctic area proper has only been found on the Faroes, in Siberia and at Kamtschatka.

Systematic remarks:

As to the possibility of a reliable determination of this and other *Erigone* females the reader is referred to a former publication (BRÆNDEGAARD 1940, p. 26).

29. *Erigone sibirica orientalis* BRÆNDEGAARD 1940.

Erigone s. orientalis BRÆNDEGAARD 1940, p. 17, figs. 15 and 26.

East Greenland record:

JENS BRÆNDEGAARD 1940, p. 17.

Occurrence in East Greenland:

Nordøstkyst area: Danmarks Havn 76°50', Hochstetter Forland 75°10'.

Franz Joseph Fjord area: Brogede Dal on Strindberg Land at Nordfjord 73°45', Ella Ø 72°50'.

Scoresbysund area: Hurry Fjord at Fame Øerne 70°50', the bay west of Røde Ø 70°30', Gaaseland 70°15' (A ♀ which WILL. SØRENSEN (1898, p. 201) recorded as *Erigone whympersi*, belong to *E. s. orientalis*).

Distribution:

East Greenland. The typical *Erigone sibirica* KULC. is known from Alaska, Kamtschatka and northern Siberia.

¹⁾ Only the geographical latitude of the locality has been given, but as the find was made by Capt. FIELDEN, who was attached to the "Alert", one of the vessels of the Nare's Expedition wintering off Grant Land, it undoubtedly originates from this place.

Systematic remarks:

The typical *Erigone sibirica* has been described by KULCZYNSKI 1908, pp. 2 and 18–21, pl. I, figs. 9–12. *E. sibirica* as well as *E. s. orientalis* can easily be mistaken for *E. arctica*

Biology:

Adult males have been found in Berlèse samples taken during the winter (October 12 and April 12). It is therefore to be supposed that the last moulting takes place late in summer, immediately before the hibernation. Adult individuals have been found in the summer months of June and August. The former are presumably the animals which have wintered in an adult state, whereas those dating from August are the new adult brood. This decidedly points towards a life cycle extending over several years.

As opposed to what is generally the case with spiders, there are far more adult males than females in the material found (7 ♂ ad. and 3 ♀ ad.), but this may be due to chance.

30. *Erigone tirolensis* L. KOCH 1872.

Erigone tirolensis KULCZYNSKI 1902, p. 545, figs. 10, 26, 40, 52, 64, 70 and 71.

Erigone tirolensis JACKSON 1914, p. 126, pl. III, figs. 12, 13 and 14.

East Greenland records:

1. A. RANDELL JACKSON 1934₁, p. 615.
2. JENS BRÆNDEGAARD 1935, p. 16.
3. — 1937₁, p. 12.
4. A. RANDELL JACKSON 1938, p. 546.
5. ÅKE HOLM 1939₂, p. 76.
6. JENS BRÆNDEGAARD 1939, p. 4.
7. — 1940, p. 20, figs. 18 and 24.

Occurrence in East Greenland:

Scoresbysund area: Charcots Havn on Milne Land 70°50' (7), Kap Stewart 70°30' (2), Kap Hope 70°25' (7), Kap Dalton 69°25' (1, 2).

Kangerdlugssuaq area: d'Aunay Fjord 69° (1), Kangerdlugssuaq 68°05' (4, 5).

Sydøstkyst area: Kangerdlugssuatsiaq 66°15' (3), Sermilik 66°05' (3), Sarfak in Sermilik 65°55' (3), Kap Dan 65°30' (6).

Distribution:

East Greenland, the island of Akpatok north of Labrador, Jan Mayen, Bear Island, Iceland, Spitzbergen, Novaja Zemlya, the Murman coast, northern Siberia, Sweden (Abisko), Scotland, the French, Swiss and Tyrolean Alps, the Carpathian Mountains (Tatra).

Systematic remarks:

The males of this species may easily be mistaken for males belonging to *Erigone whymperi*, though a reliable determination is possible. The females of the two species are, on the other hand, more easily distinguished (BRÆNDEGAARD 1940, pp. 20—21, figs. 18, 19 and pp. 26—27, figs. 23, 24).

Biology:

Outside the arctic area *Erigone tirolensis* has only been found in alpine localities. In East Greenland it has only been found in localities, where the climate is rather humid, and this more or less seems to be the case wherever it occurs.

31. *Erigone whymperi* CAMBRIDGE 1877.

Erigone Whymperi CAMBRIDGE 1877, p. 276, pl. VIII, fig. 2.

Erigone whymperi CROSBY and BISHOP 1928, p. 42, fig. 75.

East Greenland records:

1. JENS BRÆNDEGAARD 1937¹, p. 12.

2. — 1940, p. 21, figs. 19 and 23.

WILL. SØRENSEN (1898 p. 201) recorded one ♀ from Gaaseland, but this individual has proved to belong to *E. s. orientalis*.

Occurrence in East Greenland:

Scoresbysund area: Charcots Havn 70°50' (2).

Sydøstkyst area: Augpilagtoq 60°15' (1).

Augpilagtoq properly speaking belongs to West Greenland, being situated to the west of the narrow tongue of the Inlandice extending down to Prins Christians Sund. Thus only these two individuals have been found from Charcots Havn on the east coast, as against 99 from the west coast.

Distribution:

East Greenland, West Greenland (from 60°55' to 69°45'¹), Ellesmere Land (76°40'), and the island of Akpatok north of Labrador.

A. RANDELL JACKSON (1933, p. 148) regards the individuals found on Akpatok as a special race, *Erigone w. minor*.

WILL. SØRENSEN (1898, p. 201 and 1904, p. 425) states that this species also occurs in Iceland; but this was due to an error, a male *E. tirolensis* having been determined as *E. whymperi*.

Systematic remarks:

See *Erigone tirolensis*.

¹) WILL. SØRENSEN (1898, p. 201) gives Jakobshavn 69°15' as the most northerly locality, but a ♀ from Ritenbenk, determined as *E. arctica*, also belongs to this species.

32. *Islandiana princeps* BRÆNDEGAARD 1932.*Islandiana princeps* BRÆNDEGAARD 1932, p. 22.*Aduva alata* BISHOP and CROSBY 1936₂, p. 39, pl. I, figs. 1, 2 and 3.

East Greenland records:

1. A. RANDELL JACKSON 1934₁, p. 614.
2. JENS BRÆNDEGAARD 1937₁, p. 12, figs. 7, 8 and 9 (*Islandiana alata*).
3. — 1940, p. 21 (*Islandiana alata*).

Occurrence in East Greenland:

Franz Joseph Fjord area: Kap Stosch 74°05' (3), Fulach Dal at Dickson Fjord 72°50' (3).

Scoresbysund area: Jameson Land 70°50' (1).

Sydøstkyst area: Angmagssalik 65°35' (2), Úmánaq 62°55' (2), Kap Tordenskjold 61°25' (2).

Distribution:

East Greenland, Iceland, Canada?, U.S.A.?

Systematic remarks:

The explanation (BRÆNDEGAARD 1937, p. 13) of the systematic conditions of this species has proved untenable, and it is to ÅKE HOLM that the honour is due of having refuted the conclusion, which I had then arrived at with the assistance of A. RANDELL JACKSON and C. R. CROSBY. In a letter ÅKE HOLM informed me that *Gongylidiellum flavum* HOLM (1939₁, p. 23, fig. 11) is synonymous with *Tmeticus (Islandiana) alatus* EMERTON. He has investigated the types of *Islandiana princeps*, which are kept at the Göteborg Museum, and compared them with his own material of *Gongylidiellum flavum* from Lapland, with the result that they must either belong to two closely related species or at least to two different races of the same species.

The epigynum of *Gongylidiellum flavum* seems to agree entirely with the epigynum of *Tmeticus alatus* EMERTON (1919, fig. 7), which the epigynum of *Islandiana princeps* does not. The difference is so great that I (1937) could not regard *Tmeticus alatus* ♀ as synonymous with *Islandiana princeps* ♀, whereas I thought that the males were synonymous. The difference which can be demonstrated between EMERTON's figure of the palpus of the male (1919, figs. 5 and 6) and my figure of the same organ of *Islandiana princeps* (1937, figs. 7 and 8) is so slight that it might be due to individual variations in the two types; but ÅKE HOLM has proved that these differences are constant. *Islandiana princeps* is thus known from Iceland and East Greenland, whereas the closely allied *Islandiana alata* lives in Lapland and in Canada. *Islandiana princeps* presumably also lives in Canada and U.S.A. The figures of palpus and epigynum given by BISHOP and CROSBY distinctly point in that direction.

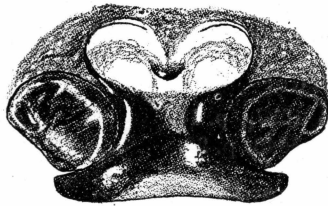
Thus *Islandiana princeps* is a nearctic species or race, which has spread to Iceland, whereas the closely allied *Islandiana alata* is known from Lapland and Cockburn Point, Northwest Territory, Canada. These will, it is to be supposed, prove to be the two extremes of the area of distribution of the species, which in that case extends from Lapland (northern Sweden) and eastwards as far as Hudson Bay.

As far as the Greenland animals are concerned, the diagnosis of the species may be supplied with the fact that there is frequently a dorsal spine on tibia III as well as on tibia IV.

Whereas the animals from the Sydøstkyst area had very nearly the same light-grey colour as the Icelandic ones, the two individuals (♂ and ♀) from Jameson Land, which A. RANDELL JACKSON sent me for investigation, were a good deal darker, their abdomens being nearly dark-grey. The specimen from Kap Stosch was still darker. In Greenland it thus seems, as if the individuals of the species have a tendency towards melanism in the northernmost latitudes. The animal from Dickson Fjord was, however, lighter in colour than the individuals from Jameson Land.

Biology:

In Iceland and South Greenland, where the species occurs, the climate is of a pronouncedly humid character. The Franz Joseph Fjord area, on the other hand, has an arid climate. As to one of the finds from this area it was stated to have been made at the Kap Stosch river, beneath stones. This suggests that the microclimatic conditions, in which the animal lives, also here have been of a humid character.



0,2 mm

Fig. 29. *Tiso aestivus* ♀. Epigynum.

33. *Tiso aestivus* L. KOCH 1872.

Tiso aestivus CHYZER et KULCZYNSKI 1894, p. 127, pl.V, figs. 7a, b, c, d and e.

East Greenland records:

1. JENS BRÉNDEGAARD 1937₁, p. 13.
2. ÅKE HOLM 1939₂, p. 77.

Occurrence in East Greenland:

Kangerdlugssuaq area: Mikis Fjord 68°10' (2), Kangerdlugssuaq 68°05' (1 and 2).

Distribution:

East Greenland, Iceland, Sweden (Abisko), northern Norway, Great Britain (Scotland, Wales), Tyrol, the Carpathian Mountains (Tatra), Roumania, Kamtschatka.

Outside Greenland and Iceland *Tiso aestivus* only seems to be of alpine occurrence.

Biology:

This species only seems to exist where the climatic conditions are of a comparatively humid character.

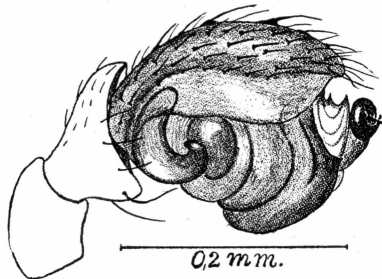


Fig. 30. *Typhochraestus borealis* ♂. Right palpus seen from the outer side.

34. *Typhochraestus borealis* JACKSON 1930.

Typhochrestus borealis JACKSON 1930, p. 649 (♂, nec. ♀), pl. XVII, figs. 11, 12, 13 and 14.

Typhochrestus borealis JACKSON 1933, p. 151, pl. II, fig. 10 (♀).

East Greenland records:

1. JENS BRÜNDEGAARD 1937¹, p. 14.
2. — 1940, p. 22.

Occurrence in East Greenland:

Nordøstkyst area: West of Kap Rink 75°10' (2).

Franz Joseph Fjord area: Eskimonæs 74°05' (2), Brogede Dal at Nordfjord on Strindberg Land 73°45' (2), Ella Ø 72°50' (2).

Scoresbysund area: The Scoresbysund settlement 70°25' (2).

Kangerdlugssuaq area: Mikis Fjord 68°50' (1).

Sydøstkyst area: Atingait 65°50' (1).

Distribution:

East Greenland, West Greenland (Disko), the Akpatok island north of Labrador, Spitzbergen, Sweden (Lapland). On Spitzbergen and in Sweden the closely related race *Typhochraestus b. thori* JACKSON lives.

Typhochraestus borealis presumably lives in the whole of the holarctic area, but until now it has only been found, where collections have been made according to modern technique.

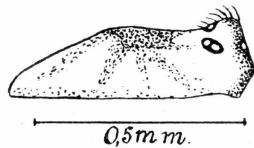


Fig. 31. *Typhochraestus borealis* ♂. Cephalothorax, lateral view.

Systematic remarks:

The species was first described by A. RANDELL JACKSON in 1930. The types originated from West Greenland, but whereas the male had been found on Disko, the female came from Godthaab Fjord, so that it was not obvious that they belonged to the same species, although they decidedly were of the same genus, and it has also subsequently proved that they belong to two different species. JACKSON, however, used the male as a type of *T. borealis*, and from Akpatok he had identified it together with the female. The latter he described exhaustively (1934₂, p. 339). The female from Godthaab Fjord he named *Typhochraestus septentrionalis* (1934₂, p. 342).

From West Greenland one more species of the same genus is known, viz. *T. (Cnephallocotes) pygmaeus* SOERENSEN. That also the latter is of a different species from *T. borealis*, I have been able to establish by a direct comparison between SOERENSEN's types and the individuals of *T. borealis* found on East Greenland. A male and two females (*T. borealis*)

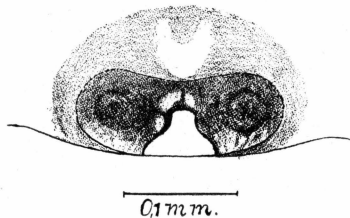


Fig. 32. *Typhochraestus borealis* ♀. Epigynum.

from East Greenland (Eskimonæs) have been sent to A. RANDELL JACKSON, who indorsed fully the agreement with the types of the species.

Biology:

In East Greenland 34 individuals in all were found belonging to this species. Of these 26 were found in the Berlèse samples and six in moist moor, beneath fertile grass- or Cassiope-vegetation. This points

towards the species leading a hidden existence in the upper moor bed. Here we surely also find the explanation of the fact that the species is able to live in the pronouncedly humid south-east coast area, as well as in the equally pronounced arid areas north of Scoresbysund. The micro-climatic conditions in the moor bed under the vegetation is also of a humid character, even in the pronouncedly arid regions of East Greenland.

35. *Tetragnatha extensa* LINNAEUS 1758.

Tetragnatha grænlandica THORELL 1872, No. 2, p. 151.

Tetragnatha groenlandica SØRENSEN 1904, p. 417.

Tetragnatha extensa SEELEY 1928, p. 113, pl. II, figs. 17, 18, 19 and 20.

East Greenland record:

WILL. SØRENSEN 1898, p. 188.

Occurrence in East Greenland:

Sydøstkyst area: Kangerdlugssuatsiaq 62°15'. This locality is not known to me, being presumably an Eskimo name of Mogens Heinesens Fjord. The find (♂ jun.) was made by P. EBERLIN, who as a zoologist took part in GUSTAV HOLM's Umiak-Expedition to East Greenland 1883—85. The destination of the expedition was Angmagssalik, and HOLM himself stated that EBERLIN had not been farther north than Ūmánaq (62°55'), so that it cannot be a case of mistaken identity with the well-known fjord Kangerdlugssuatsiaq (66°20').

Distribution:

East Greenland, West Greenland (60°08'—69°30'), Labrador, Nova Scotia, Canada, U.S.A., Mexico, Alaska, Japan, China, Asiatic and European Russia, Irak, Armenia, Finland, Sweden, Norway, Denmark, Iceland, the British Isles, Holland, Belgium, France, Germany, the Danubian countries, Switzerland, the Balkan countries, Italy, Corsica, Mallorca, the Pyrenean peninsula, Tunis, Algiers, Madeira, the Azores, New Zealand.

Systematic remarks:

A. RANDELL JACKSON (1930, p. 643) has demonstrated that *Tetragnatha groenlandica* THORELL (1872) is a synonym of *T. extensa* L.

36. *Gnaphosa islandica* SØRENSEN 1898.

Gnaphosa islandica SØRENSEN 1898, p. 222.

East Greenland record:

WILL. SØRENSEN 1898, p. 225.

Occurrence in East Greenland:

Scoresbysund area: Heklahavn and Røde Ø 70°30'.

As compared with Iceland this species must be very rare in East Greenland, being only known from these two localities in the interior

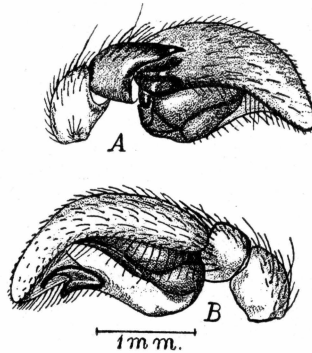


Fig. 33. *Gnaphosa islandica* ♂. Right palpus. *A* seen from the outer side, *B* seen from the inner side.

of the Scoresbysund fjord, and the RYDER-Expedition (1891—92), whose physician (H. DEICHMANN) was also the entomologist of the expedition, is the only expedition which has succeeded in finding *Gnaphosa islandica* in East Greenland.

Distribution:

East Greenland, Iceland, Sweden (Lapland), northern Finland and the Kola peninsula.

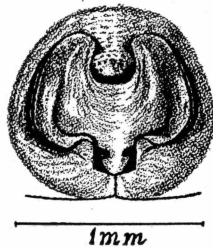


Fig. 34. *Gnaphosa islandica* ♀. Epigynum. Designed after an Icelandic specimen.

37. *Drassodes signifer* C. L. KOCH 1839.

Drassodes signifer SIMON 1914, p. 209, fig. 250.

East Greenland records:

1. WILL. SØRENSEN 1898, p. 222 (*Drassus troglodytes*).
2. JENS BRÉNDEGAARD 1939, p. 4.

Occurrence in East Greenland:

Sydøstkyst area: Nukarfik 63°25' (2), Kangerdluaraq 60°35' (1), Tiningnertoq 60°25' (2), Augpilagtoq 60°05' (2). The latter locality may just as well be reckoned as belonging to West Greenland.

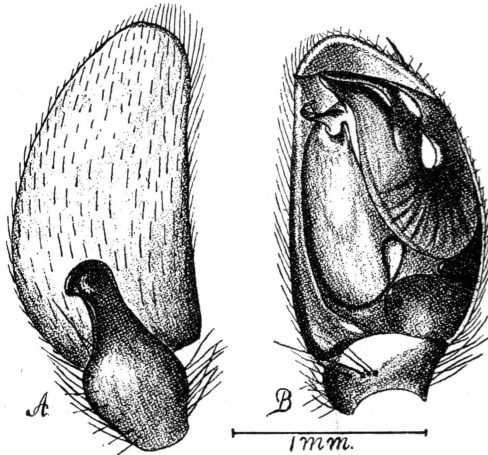


Fig. 35. *Drassodes signifer* ♂. Tibia and tarsus of right palpus. *A* upper side, *B* under side.

Distribution:

East Greenland, West Greenland (from 59°55' to 66°55'), U.S.A., Iceland, the Faroes, the British Isles, the Azores, Norway, Sweden, Denmark, Germany, Holland, France, Switzerland, Poland, Czecko-

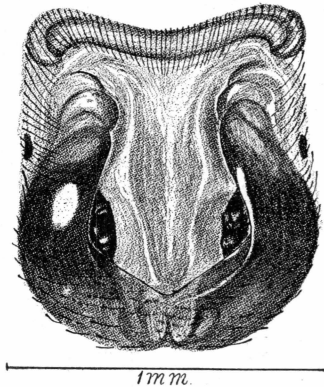


Fig. 36. *Drassodes signifer* ♀. Epigynum. Designed from a Danish specimen.

slovakia, Hungary, Spain, Corsica, Sardinia, Italy, Palestine, Irak, European and Asiatic Russia (as far as Tomsk), Mongolia.

It is a boreal species, which is also widely distributed in the sub-tropical regions. Within an arctic area it is only known from Greenland,

and it consequently caused some surprise, when SØRENSEN stated that W. LUNDBECK (1889) had found it as far north as Tasiussak ($73^{\circ}28'$). From the excursion diary of the latter, which is kept at the Zoological Museum of Copenhagen it appears, however, that he has never been farther north than Ritenbenk ($69^{\circ}45'$), and that in the days 23.—25. July, 1889, he made collections at the fjord of Tasiussak ($61^{\circ}40'$) in South Greenland. Thus SØRENSEN has confused the two localities of the same name.

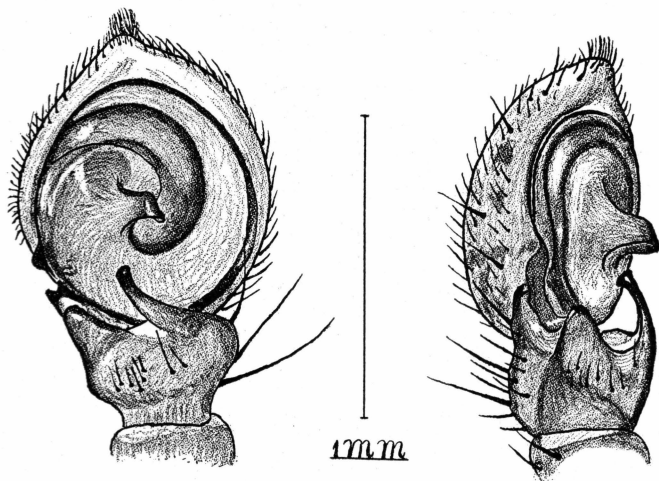


Fig. 37. *Xysticus durus* ♂. Right palpus. Under and outer side.

Of the 15 localities, in which this species has been identified, eight are situated south of Frederikshaab (62°) and the remaining seven between Frederikshaab and Holsteinsborg ($66^{\circ}55'$). As was to be expected, *Drasodes signifer* was most common in the very southernmost part of Greenland, and so it does not at all occur in the high-arctic area proper.

Biology:

It appears from the distribution of this species that it is able to live under arid as well as under pronouncedly humid climatic conditions.

38. *Xysticus durus* SOERENSEN 1898.

Oxyptila dura SØRENSEN 1898, p. 230.

Xysticus moestus GERTSCH 1939, p. 403, figs. 252, 253 and 267.

East Greenland record:

JENS BRÉNDEGAARD 1937₁, p. 14 (*Oxyptila dura*).

Occurrence in East Greenland:

Sydotkyst area: Tugtulik $66^{\circ}20'$, Angmagssalik $65^{\circ}35'$. Only two young females have been found in East Greenland.

Distribution:

East Greenland, West Greenland (from $59^{\circ}55'$ to $66^{\circ}55'$)¹), Canada and U.S.A. (in Rocky Mountains from Alberta to New Mexico).

Systematic remarks:

WILL. SØRENSEN referred this species to the genus *Oxyptila* SIMON. It has, however, the following morphological characters: The central eyes form a quadrangle, which is nearly as long as it is broad. The eyes of the front row are distinctly recurved, and the central eyes of this row are closer to the very large lateral eyes than to each other. Tibia I

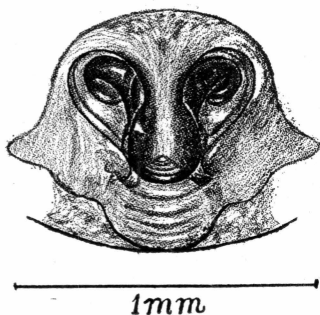


Fig. 38. *Xysticus durus* ♀. Epigynum.

is armed with four pairs of ventral spines and these, like the other spines of the animal, are pointed in the male. In the female, however, there are a number of bristles, the tips of which are blunt so that they rather resemble the club- or spatula-shaped hairs and bristles, which are characteristic of the genus *Oxyptila*. The claws on tarsus I are provided with four or five teeth. The cephalothorax is rather flat dorsally, and its sutures are practically invisible.

It is therefore obvious that the species belongs to the genus *Xysticus* C. L. KOCH, but whatever key of determination is used, whether that of E. SIMON (1932, p. 792) or that of W. J. GERTSCH (1939, p. 297), the genus arrived at is *Xysticus*.

There can hardly be any doubt that *Xysticus moestus* BANKS 1910 is a synonym of *Xysticus durus*. In the first place the likeness is striking between W. J. GERTSCH's figures of the palpus of the male and the epigynum and figs. 37 and 38 of the present article, which are drawn from Greenland individuals, and besides GERTSCH's rather detailed description of *Xysticus moestus* agrees well with the Greenland in-

¹) SØRENSEN, it is true, gives Tasiussak $73^{\circ}28'$ as the most northerly locality of the species, but here he has made the same mistake as that mentioned under the preceding species.

dividuals. There is, however, one exception in the case of the male. GERTSCH writes that the median stripe on the cephalothorax is “dorsum with an indistinct median longitudinal paler stripe, the posterior declivity paler”, but on all the three adult males from Greenland the longitudinal median stripe is much darker on the posterior declivity of the cephalothorax. In all the females the median stripe is, however, light-coloured throughout its whole extent and lightest in the posterior part.

As appears from table IV the individuals from Greenland seem to be larger than those from U.S.A. GERTSCH, however, states that “dried females from the Bean Collection are larger in size”, without giving the measurements of the latter. It is, therefore, possible that equally large individuals of the species occur on the American Continent or at least in Canada, as the dried specimens mentioned above have been found at Alberta. It would therefore be rash, on the strength of the information at hand, to set up the Greenland individuals as a special geographical race.

Table IV. The size of *Xysticus durus* as compared with W. J. GERTSCH's measurements of individuals from U.S.A.

	Cephalotorax	
	Length	Width
♂♂ from U.S.A. (after GERTSCH)	2.6 mm	2.5 mm
2 ♂♂ — West Greenland	2.9 -	2.8 -
1 ♂ — —	3.0 -	2.8 -
♀♀ from U.S.A. (after GERTSCH)	2.5 mm	2.4 mm
1 ♀ — West Greenland	3.3 -	3.1 -
1 ♀ — —	3.5 -	3.2 -
1 ♀ — —	3.6 -	3.4 -
1 ♀ — —	3.6 -	3.5 -
1 ♀ — —	3.7 -	3.5 -
1 ♀ — —	3.9 -	3.7 -
1 ♀ — —	4.1 -	3.8 -

39. *Xysticus labradorensis* KEYSERLING 1887.

Xysticus Deichmanni SØRENSEN 1898, p. 228.

Xysticus labradorensis GERTSCH 1939, p. 401, figs. 248, 249 and 268.

East Greenland records:

1. WILL. SØRENSEN 1898, p. 229 (*Xysticus Deichmanni*).
2. A. RANDELL JACKSON 1934₁, p. 612 (*Xysticus bimaculatus*).
3. JENS BRÆNDEGAARD 1940, p. 22, figs. 20 and 21 (*Xysticus deichmanni*).

Occurrence in East Greenland:

Nordøstkyst area: Danmarks Havn 76°50' (3).

Franz Joseph Fjord area: Eskimonæs 74°05' (3), Kap Stosch 74°05' (3), at Moskusokse Fjord 73°45' (3), Brogede Dal on Strindberg Land at Nordfjord 73°45' (3), Fulach Dal at Dickson Fjord 72°50' (3), Ella Ø 72°50' (3), Kongeborgen at Kong Oskar Fjord 72°30' (3).

Scoresbysund area: Liverpool Land and Jameson Land 70°50' (2), Heklahavn 70°30' (1), near Røde Ø 70°30' (1), Kap Hope 70°25' (3), Gaaseland 70°15' (1).

Distribution:

East Greenland, Canada (Labrador and Alberta), U.S.A. (in Rocky Mountains from Alaska to California), Sweden (Lagland)¹.

Systematic remarks:

In 1939 W. J. GERTSCH has proved that *Xysticus discursans* BANKS 1910, *Xysticus deichmanni* SOERENSEN 1898 and *Xysticus bimaculatus* EMERTON 1894 are synonyms of *Xysticus labradorensis*.

¹) Se footnote p. 97.

II. GENERAL REMARKS

Systematic Summary.

The two sub-orders, *Liphistiomorphae* and *Mygalomorphae*, are not represented in East Greenland, both consisting of comparatively primitive species, which are nearly indigenous to the tropical and subtropical zones. Thus all the East Greenland species belong to the sub-order *Arachnomorphae*, but the most primitive of these, the *Tetrasticta* group, is unrepresented in East Greenland. Only highly specialized types are met with here, which seems to hold good of the entire arctic area. The species are distributed among the following 8 families:

1. *Agelenidae*: 1 species (Synopsis of the species No. 1)
2. *Lycosidae*: 7 species (— - - — Nos. 2—8)
3. *Dictynidae*: 2 species (— - - — — 9—10)
4. *Theridiidae*: 1 species (— - - — No. 11)
5. *Linyphiidae*: 22 species (— - - — Nos. 12—34)
6. *Argiopidae*: 1 species (— - - — No. 35)
7. *Drassidae*: 2 species (— - - — Nos. 36—37)
8. *Thomisidae*: 2 species (— - - — — 38—39)

The Life-cycle of the Arctic Spiders.

As to the life-cycle of the arctic spiders MARIA DAHL says (1933, p. 3): "In diese kurze Zeit, die allerdings doppelt zählen muss, wegen des Polarsommers ohne Nachdunkelheit, drängen sich Kopulation, Eiablage, Schlüpfen der Jungen und Heranwachsen bis zur Reife zusammen." MARIA DAHL is thus of the opinion that the arctic spiders have a life-cycle extending over one year, and this opinion has, it seems, up to the present been the prevailing one. It is presumably due to the fact that the species from the temperate zones, when belonging to the same genera as the arctic ones, have a life-cycle of one year.

As appears from the investigations of *Pardosa glacialis* (pp. 16—19) and *Dictyna borealis* (pp. 26—27), these two species have a life-cycle extending over several years, and this undoubtedly holds good of all the other arctic species. It is also improbable that the animals should be able to attain full maturity, for which many moults are required, and at the same time to do all that is necessary for the reproduction of the species during the short arctic summer, which frequently only covers 2—3 months. On Ella Ø (72°50') practically all spiders buried themselves in the ground and retired from sight at the end of August 1932. The dating of the finds shows that the animals as a rule only emerge from their winter sleep about Maj 15. Farther north the hibernation lasts still longer, and in addition it must be realized that the ecological conditions are such that the animals can by no means gorge themselves. Therefore, their growth must surely also be a slower process than in temperate regions.

If therefore a species should be able to immigrate from a boreal to an arctic area, it is necessary that, instead of having a one-year life-cycle, it should be able to adapt itself to one extending over several years.

The laying of eggs always seems to take place so early in summer that the hatching is over, before the winter comes. The first wintering, it is true, always takes place, when the animals are quite young spiderlings. The few Berlèse samples, which have been taken in winter, all contain such small young that they cannot, with any certainty, be determined as to species.

This view is further endorsed by the investigations undertaken by NIELS HAARLØV at Mørkefjord in Northeast Greenland 1938—39. He writes as follows: "Nearly all the winter samples from fell-fields contained small spiders (*Erigonidae sp.* or *Dictynidae sp.*), but exclusively at such early stages of development that the segmentation of the abdomen was still quite distinct; they varied a little in size" (HAARLEV 1942, p. 58). In the Berlèse samples HAARLØV, however, never found fully developed individuals or such as only lacked one or two moultings in order to be sexually ripe, and from this he draws the hasty conclusion that these spiders must be annual.

It must be admitted that adult spiders are not very common in the Berlèse samples of the Three-Years' Expedition, but nevertheless more than twenty such have been found. Only five of these have been found in the three winter Berlèse samples, which were taken at Ella Ø on Oktober 12, 1933 and April 12, 1934, viz. 1 ♂ ad. and 2 ♀ ad. which belonged to the species *Hilaira curvitaris* and 2 ♂ ad. which belonged to the species *Erigone sibiria orientales* (BRÆNDEGAARD 1940, p. 12 and p. 18). To the species *Hilaira curvitaris* belong also 2 ♂ ad.

and 8♀ ad., which were taken on May 11, 1934, in the shore ridge consisting of stones and decaying fucus; and in four Berlèse samples, taken from May 11 to 16, 1934, 4♀ ad. have been found. The species *Typhochraestus borealis* is represented by 2♂ ad. and 5♀ ad. in five Berlèse samples taken at Ella Ø in the period May 20 to 24, 1932 (BRÆNDEGAARD 1940, p. 22). These species together belong to the group of Micro-Araneina, which are popularly termed *Erigonidae*. Of the family *Dictynidae* only 1♀ ad. has been found in the Berlèse sample. This female belongs to the species *Dictyna borealis*, and it was also found on May 11, 1934, at Ella Ø (BRÆNDEGAARD 1940, p. 7).

These adult animals, which were taken in May, must necessarily have wintered as sexually ripe individuals, or also as individuals lacking only the last moulting in order to be fully grown. These small species of spiders must, consequently, have had a life-cycle extending over at least two years, or, as is more likely over three (p. 26). When HAARLØV (1942, pp. 58—59) sets forth the opinion that the *Lycosa* species are at most biennial, this cannot be correct (pp. 16—19).

Endemic Species.

The first to give any information as to Greenland spiders is O. FABRICIUS (Fauna Groenlandica 1780). However, he identifies all his species with Scandinavian ones, described by LINNÉ, but already THORELL (1872) realized that this was a complete error, and as in his turn he was to determine a collection of spiders from Greenland, he described them all, with the exception of two, as new species. Of these one (*Microerigone spitsbergensis*) was known to him beforehand from Spitzbergen, and the other (*Pardosa groenlandica*) was a Greenland species, which he himself had described in his well-known publication "Remarks on Synonyms of European Spiders" (1872).

THORELL thus, as it were, founded a school, but in rather an unfortunate manner, for which, however, he cannot be wholly blamed. During the following thirty years all species found in Greenland were described as n. sp., unless they had been mentioned by THORELL, or were so common in Europe as to be familiar to every arachnologist.

THORELL (1872) described in all nine new species from Greenland (p. 64, table V: 2, 3, 5, 8, 14, 18, 24, 27, 34). Then followed L. KOCH (1874) with one (table V: 4); O. P. CAMBRIDGE (1877) with three (table V: 6, 11, 22); THORELL (1878) with one (table V: 35); E. SIMON (1889) with one (table V: 25); LENZ (1897) with three (table V: 7, 12, 19) and finally WILL. SØRENSEN (1898) with 17 species (table V: 1, 9, 10, 13, 15, 16, 17, 20, 21, 23, 26, 28, 29, 30, 31, 32, 33). In all: 35 n. sp.

Table V. Summary of species which have been supposed to be endemic of Greenland.

Name used when first described	Name used at present	Distribution	Literature
1. <i>Hahnia glacialis</i> SOER. 1898	<i>Hahnia glacialis</i> SOER.	Gr.	(p. 9)
2. <i>Trochosa insignita</i> TH. 1872	<i>Arctosa insignita</i> TH.	Gr. Baf. Lab. Ca.	BRÆNDEGAARD 1939, p. 5
3. <i>Lycosa glacialis</i> TH. 1872	} <i>Pardosa glacialis</i> TH.	Gr. Ell. Baf. Ca.	(p. 15)
4. <i>Lycosa aquilonaris</i> L. K. 1874			
5. <i>Lycosa grænlandica</i> TH. 1872	<i>Pardosa grænlandica</i> TH.	Gr. U. S. A. Icel.	(p. 20)
6. <i>Dictyna borealis</i> CB. 1877	} <i>Dictyna borealis</i> CB.	Gr. Ca.	(p. 25)
7. <i>Dictyna grænlandica</i> LZ. 1897			
8. <i>Dictyna hamifera</i> TH. 1872	<i>Dictyna major</i> MG. 1869	Gr. Eu.	SIMON 1914, p. 65
9. <i>Theridium intrepidum</i> SOER. 1898	<i>Enoplognatha intrepida</i> SOER.	Gr.	JACKSON 1930, p. 642
10. <i>Leptyphantes audax</i> SOER. 1898	<i>Lephtyphantes audax</i> SOER.	Gr. Ca. Icel. Eu.	(p. 30)
11. <i>Linyphia turbatrix</i> CB. 1877	} <i>Lephtyphantes turbatrix</i> CB.	Gr.	(p. 31)
12. <i>Linyphia grænlandica</i> LZ. 1897			
13. <i>Tmetiscus Levinsonii</i> SOER. 1898	<i>Micryphantes nigripes</i> SIM.	Gr. Eu.	(p. 33)
	<i>Micryphantes n. jacksoni</i> BRGD.	Gr. Ca.	(p. 34)
14. <i>Erigone vaginata</i> TH. 1872	<i>Oreonetides vaginatus</i> TH.	Gr. Ca. Eu. As.	(p. 34)
15. <i>Walckenaëra insolens</i> SOER. 1898	<i>Cornicularia karpinski</i> CB.	Gr. Ca. Eu. As.	JACKSON 1934 ₁ , p. 614
16. <i>Notioscopus curvitaris</i> SOER. 1898	<i>Hilaira curvitaris</i> SOER.	Gr. Baf. Ca.	(p. 38)
17. <i>Araeoncus ruderalis</i> SOER. 1898	<i>Hilaira glacialis</i> TH.	Gr. ? Ell. ? Al. ? Spi.	(p. 39)
18. <i>Erigone frigida</i> TH. 1872	<i>Hilaira frigida</i> TH.	Gr. Baf. Lab. Eu.	(p. 41)
19. <i>Erigone grænlandica</i> LZ. 1897	} <i>Coryphaeolana holmgreni</i> TH.	Gr. Baf. Ca. Eu. As.	BRÆNDEGAARD 1940, p. 14
20. <i>Walckenaëra similis</i> SOER. 1898			
21. <i>Gonyglidium lapidicola</i> SOER. 1898	<i>Coryphaeolana lapidicola</i> SOER.	Gr. Ca.	(p. 45)
22. <i>Erigone Whymperi</i> CB. 1877	<i>Erigone whymperi</i> CB.	Gr. Ell. Ca.	(p. 49)
23. <i>Cnephalocotes pygmaeus</i> SOER. 1898	<i>Typhochraestus pygmaeus</i> SOER.	Gr.	JACKSON 1937, p. 545
24. <i>Tetragnatha grænlandica</i> TH. 1872	<i>Tetragnatha extensa</i> L.	Gr. Nearc. Palaearc.	JACKSON 1930, p. 643
25. <i>Hyposinga grænlandica</i> E. S. 1889	<i>Araneus grænlandicus</i> E. S.	Gr.	JACKSON 1930, p. 645

(continued).

Table V (continued).

Name used when first described	Name used at present	Distribution	Literature
26. <i>Gnaphosa islandica</i> SOER. 1898	<i>Gnaphosa islandica</i> SOER.	Gr. Icel. Lapl. Fin. Kola P.	(p. 54)
27. <i>Thanatus arcticus</i> TH. 1872	<i>Thanatus arcticus</i> TH.	Gr.	SØRENSEN 1898, p. 225
28. <i>Oxyptila dura</i> SOER. 1898	<i>Xysticus durus</i> SOER.	Gr. Ca. U.S.A.	(p. 58)
29. <i>Xysticus Deichmanni</i> SOER. 1898	<i>Xysticus labradorensis</i> KEYS.	Gr. Ca. U.S.A.	GERTSCH 1939, p. 401
30. <i>Theridium petrense</i> SOER. 1898	<i>Theridion petrense</i> SOER.	Gr.	SØRENSEN 1898, p. 188
31. <i>Theridium Lundbeckii</i> SOER. 1898	<i>Theridion lundbecki</i> SOER.	Gr.	Ibid. p. 191
32. <i>Gonatum inflatum</i> SOER. 1898	<i>Gonatum inflatum</i> SOER.	Gr.	Ibid. p. 206
33. <i>Minicia gibbosa</i> SOER. 1898	<i>Minicia gibbosa</i> SOER.	Gr.	Ibid. p. 216
34. <i>Erigone modesta</i> TH. 1872	<i>Erigone modesta</i> TH.	Gr.	Ibid. p. 202
35. <i>Erigone penessa</i> TH. 1878	<i>Erigone penessa</i> TH.	Gr.	THORELL 1878, p. 394

In Table V (Distribution) the following abbreviations of geographical names are used: Al. = Alaska. As. = Asia. Baf. = Baffin Land, Ca. = Canada, Ell. — Ellesmere Land, Eu. = Europe, Fin. = Finland, Gr. = Greenland, Icel. — Iceland, Kola P. = Kola Peninsula, Lab. = Labrador, Lapl. = Lapland in Sweden, Nearc. = Nearctica, Palaearc. = Palaeartica, Spi. = Spitzbergen.

When ALEXANDER PETRUNKEVITCH (1911) published: "A Synonymic Index-Catalogue of American Spiders", these 35 spiders were still mentioned as endemic of Greenland. HENRIKSEN and LUNDBECH (1817), however, only reckon with 23 endemic species, and until about ten years ago nearly all of these species were looked upon as being endemic of Greenland. From table V it appears, how this change of view has been brought about during the following period. In the first column the endemic species are recorded with the names they were given at the time of their description; in the second column the systematic names now used are to be found together with information as to the distribution of the species (third column), and the fourth column contains literary references as to the systematics of the species. The figure at the side (in parenthesis) refers to the systematic facts given in this publication.

At the present moment the 35 species have dwindled to 12, which are only known from Greenland. The six at the bottom of the summary (nos. 30—35) have not been identified, since the types were found. The types of one of these species (*Erigone modesta* TH.) were young, not sexually ripe animals, so that it is doubtful, whether it will ever be possible to identify them with adult animals of the same species. It is probable that these six species have already been described under other

names. In return JACKSON has described two new species, *Typhochraestus septentrionalis* (1934₂, p. 342) and *Dismodicus variegatus* (1937, p. 549), which are also only known from Greenland. At the present time there are thus only 14 species, which may be endemic of Greenland. When at some future time Ellesmere Land, Baffin Land and the remaining part of Arctic America have been investigated as thoroughly, as Greenland has been at the present time, this number will undoubtedly be further reduced. When taking into consideration the closeness of Greenland to the areas mentioned, it is extremely probable that no endemic species whatsoever occur in Greenland.

From East Greenland only three species are known (*Hahnia glaciales*, *Enoplognatha intrepida* and *Lepthyphantus turbatrix*), which are recorded from nowhere else than from Greenland, and none which are endemic of East Greenland. Perhaps a single endemic race, *Erigone sibirica orientalis* BRGD., lives here; at any rate it has as yet only been recorded from East Greenland.

Climate and Fauna.

I. Climatic Conditions.

In order to understand the faunistic conditions in Greenland a fairly accurate knowledge of the climate is necessary.

As East Greenland extends from about 60° to 82° lat. N., it is obvious that the climatic conditions must vary considerably from south to north. There are, however, only few meteorological stations on this long stretch of coast. South of Angmagssalik there is none whatsoever, but the climatic conditions on the very southernmost part of the east and the west coast must be supposed to be so much alike that one hardly commits any error worth mentioning by making use of what is known from the southernmost station (Nanortalik) on the west coast. The observations at the northern station (Danmarks Havn) only cover a period of two years, during which period the Danmark-Expedition had its station on Germania Land. The meteorological information collected by the numerous expeditions, however, agrees so well with the results of the meteorological stations that it is possible, on the strength of what is known at present, to form a fairly accurate idea of the climatic conditions of the whole of East Greenland.

Fig. 39 shows that the summer farthest south lasts for at least six months, at Angmagssalik five, at Scoresbysund about three and at Danmarks Havn about two months and a half. The highest temperature for the warmest month occurs at Angmagssalik, where July has an average temperature of 7.1°, while at Danmarks Havn the corresponding temperature for July is only 4.4°. Thus, the climate is everywhere arctic,

but it appears from the curves that the climate farthest south has a pronouncedly oceanic character. The amplitude is only 11.5° . Farther north the climate becomes more and more continental, the amplitude

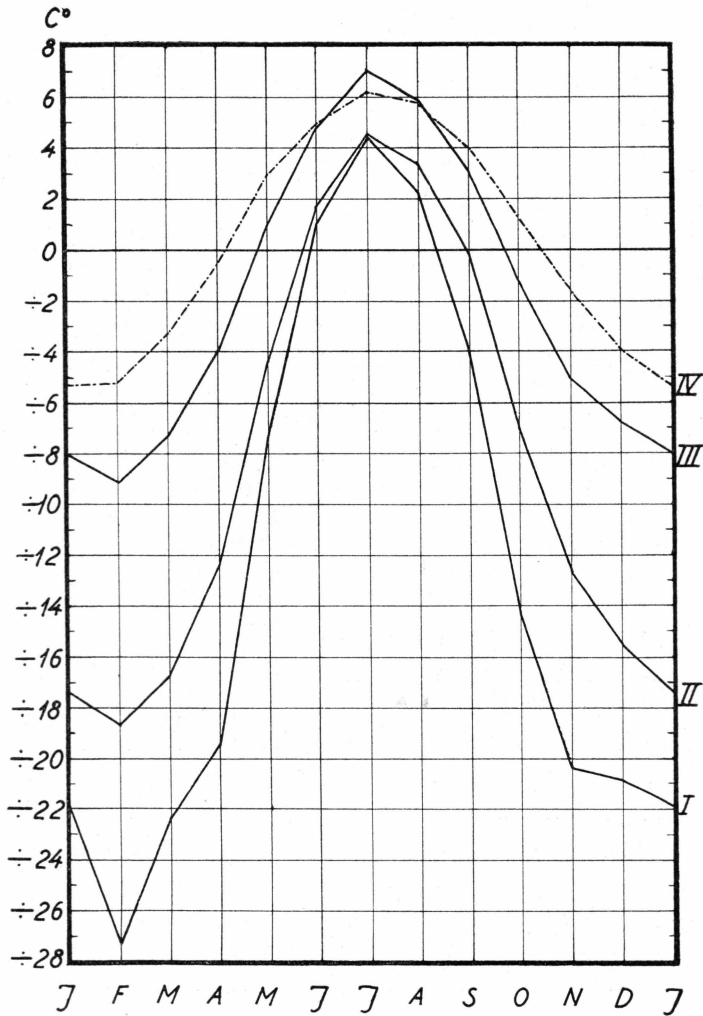


Fig. 39. Yearly change of temperature in: *I* Danmarks Havn $76^{\circ}46'$, *II* Scoresbysund $70^{\circ}30'$, *III* Angmagssalik $65^{\circ}37'$ and *IV* Nanortalik $60^{\circ}08'$.

at Danmarks Havn being 31.8° . North of Danmarks Havn the climate must be supposed to be still more pronouncedly continental.

The precipitation at Nanortalik is not known, but Ivigtut ($61^{\circ}12'$ lat. N.), which is situated a little more than a degree of latitude farther north, has a yearly precipitation of 1128 mm, and there can be no doubt that the southernmost part of the east coast has a similar amount of

precipitation. The Sydøstkyst area has thus a pronouncedly humid climate, and this more or less also applies to the Kangerdlugssuaq area. The farther north one gets, the sparser the precipitation (table VI). The Scoresbysund area is, at any rate in the neighbourhood of the coast, where the settlement is situated, a transition area; but the Franz Joseph Fjord and the Nordøstkyst areas are arid regions with a minimal yearly precipitation.

Table VI. The precipitation and cover of clouds at some Greenland stations.

East and West Greenland	Latitude	Yearly precipitation	Cover of clouds (00—100)
East Greenland			
Angmagssalik	65°37'	872 mm	62
Scoresbysund	70°30'	317 -	57
Danmarks Havn	76°46'	146 -	49
West Greenland			
Godthaab.....	64°11'	596 mm	69
Qornoq.....	64°26'	369 -	64
Jakobshavn.....	69°13'	231 -	46

It seems to hold good of the whole of the east coast that there is least precipitation in summer (fig. 40). In the arid area the summer precipitation is inconsiderable (fig. 40, I). Here a continuous vegetation is, therefore, only found where the melting water is able to keep the ground moist for the duration of the short summer. Large areas are thus practically bare fell-field. In the northern arid areas the cover of clouds is also considerably slighter than in the southern humid areas (table VI).

When comparing Godthaab with Angmagssalik, it appears that Angmagssalik has the greatest yearly precipitation (table VI). As in its turn Scoresbysund has a greater precipitation than Jakobshavn, it seems obvious that the southern humid areas of East Greenland have more precipitation than the corresponding parts of the west coast. Another characteristic difference, which is of still greater importance from a zoogeographical point of view, is due to the fact that East Greenland from Kap Farvel to Scoresbysund only consists of a narrow ice-free coast land, whereas the corresponding ice-free part of the west coast in certain places has a width of nearly 200 km. The importance of this, from a climatic point of view, clearly appears from the meteorological information at hand from the two stations Godthaab and Qornoq. They

are both situated in almost the same latitude, but whereas Godthaab lies nearly out at the open sea, Qornoq is situated in the interior of Godthaab Fjord, about 50 km from the sea and sheltered by cliffs, more than 1000 m in height. Fig. 41 (p. 70) shows that in here the climate is

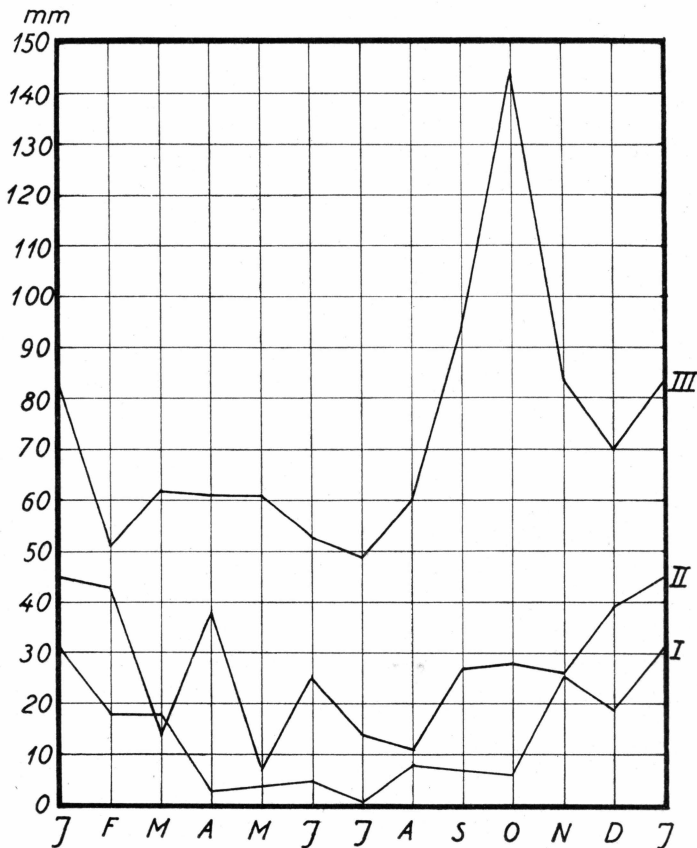


Fig. 40. Yearly precipitation in: I Danmarks Havn $76^{\circ}46'$, II Scoresbysund $70^{\circ}30'$ and III Angmagssalik $65^{\circ}37'$.

more continental with a higher summer temperature and a lower winter temperature. The conditions of precipitation show a still greater difference (fig. 42). The precipitation is not only less (table VI) throughout the year, but in particular considerably less later in summer. The cover of clouds is also smaller at Qornok, but the difference is most apparent when looking at the number of days with fog (fig. 43). Here it is also the summer which shows by far the greatest difference.

These two stations give a good idea of the change, which takes place in the climate according to the distance from the coast. The farther from the coast, the warmer and drier the summer with a clearer sky.

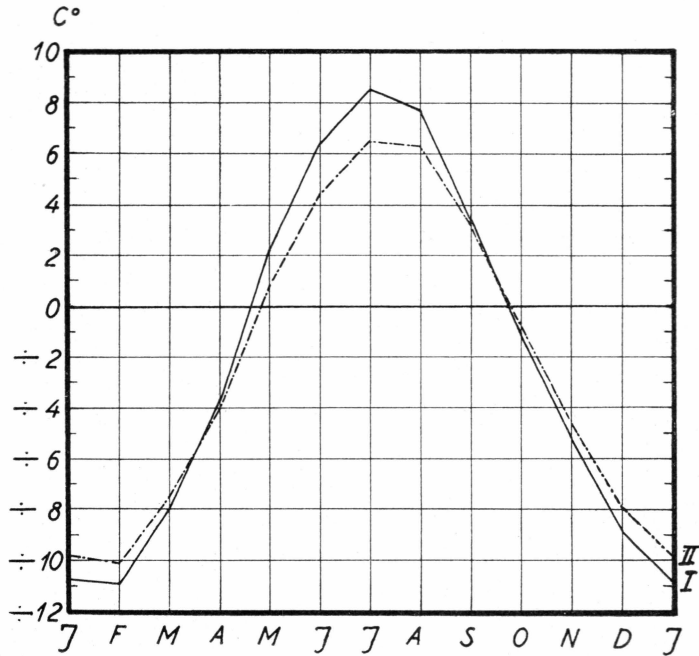


Fig. 41. Yearly change of temperature: I Qornoq 64°26' and II Godthaab 64°11'.

Near the Indlandice the climatic conditions, however, very much resemble conditions in East Greenland north of Scoresbysund. No

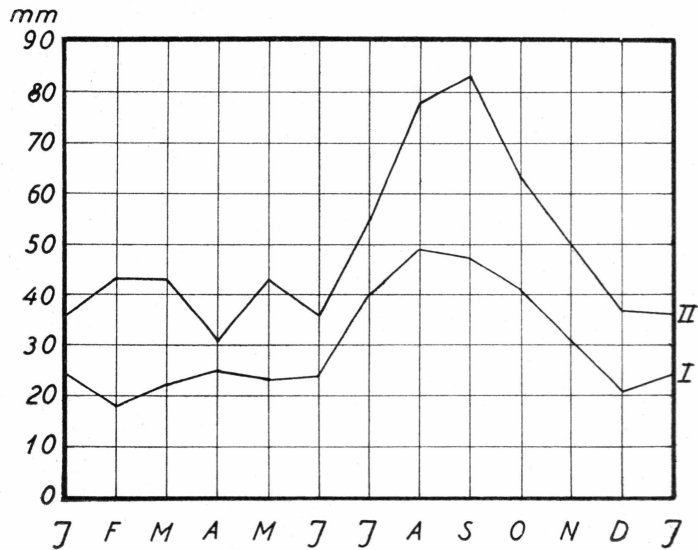


Fig. 42. Yearly change of precipitation: I Qornoq 64°26' and II Godthaab 64°11'.

climatic observations are at hand from the interior coast regions of West Greenland, but NORDENSKIÖLD has identified salt lakes, and in

these localities the climate must be very dry. In the interior of the Julianehaab district the summers are so warm that a boreo-arctic vegetation is met with, the tree-like plants straightening and becoming large bushes of 2—3 m. Here even large-leaved birches (*Betula odorata* and *Betula tortuosa*) occur and also roan (*Sorbus*). The latter may, in exceptional cases, attain a height of 5 m. Such fertile localities are frequent along the interiors of the numerous long fjords of West Greenland, but

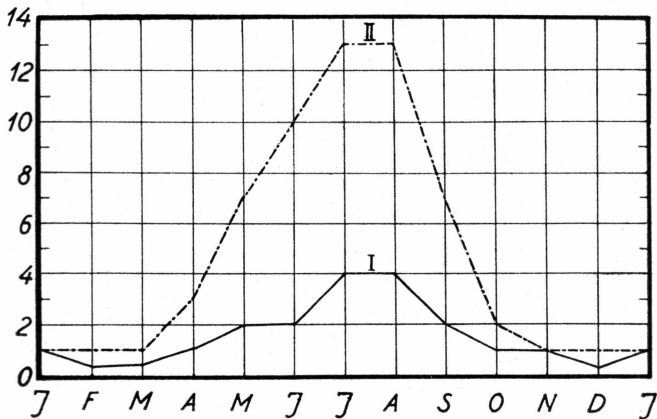


Fig. 43. Number of days with fog (mean): I Qornoq 64°26' and II Godthaab 64°11'.

farther north the vegetation is arctic. Here the copses consist of willow (*Salix glauca*) and other arctic bushes (WARMING 1928).

Anything corresponding with this is hardly known from the east coast south of Scoresbysund, but from here and northwards the ice-free coast land is so broad as to leave room for two of the largest fjord systems in the world, viz. the Scoresbysund and Frantz Joseph fjords. Here conditions similar to those on the west coast are met with. The most fertile vegetation is not found at the coast, but along the interiors of the fjords, where the summer days are warmer and clear sunshine common.

II. Climatic-Ecological Fauna Elements.

The East Greenland Arachnid fauna proves to consist of several climatic-ecological fauna elements, each of these including species, which have only been found in a few specimens. It is therefore uncertain whether such species have been placed in the right group; but within each of these there are some, which have been found in such great numbers that they characterize the fauna element to which they belong.

1. The Arid Boreal Fauna Element.

In the very most southerly part a number of species (table VII, nos. 1—10) occur, which are rare in East Greenland. Only 46 specimens in all have been found, and of these 38 south of 61° lat. N. The very few specimens, which have been found farther north, show that we are here faced with a fauna element, which cannot obtain a foothold in the pronouncedly humid soil in southern East Greenland between 60° and 70° lat. N.

In West Greenland these ten species have a far greater distribution, and here they have all been found in considerably greater numbers. Some of them have even been found so often that they must be of common occurrence in West Greenland. This at least holds good of *Pardosa furcifera*, *Pardosa saltuaria* and *Erigone whymperi*, which here have been found in 225, 100 and 99 specimens, respectively. They are a group of thermophilous or heliophilous species, which are indigenous to the more continental and arid hinterland of West Greenland.

South of 61° lat. N. there is either no natural boundary between East and West Greenland, or the part of the Inlandice, which separates the two coast lands from each other, is so inconsiderable in extent that animals, which are able to act as aeronauts, can easily cross it. Due north of 61° lat. N. the Inlandice, however, suddenly widens to more than 300 km, and such a barrier it is evidently difficult for the spiders to cross. Therefore, these species suddenly become of such rare occurrence on the east coast north of 61° lat. N., for there is no doubt that these species do not, properly speaking, belong on the humid east coast, but constantly immigrate there from the more arid areas in southern West Greenland.

These ten species must, however, be supposed to constitute two fauna elements, which have been more or less mixed up with each other. As to the first five species (table VII, nos. 1—5) it proves that they occur most numerously in the southern regions, more than half of the individuals found originating from the area south of Frederikshaab Isblink (62°30'). North of this latitude they are of rarer occurrence. Their centre of distribution in West Greenland is thus the boreo-arctic regions proper in the interior of the Julianehaab district. From here they spread, partly to southern East Greenland and partly in a northern direction to 65°—69° lat. N.

Whereas they can hardly be described as actually belonging to the east coast, they must be supposed to be established also north of Frederikshaab Isblink in the summer-warm, fertile valleys along the interiors of the long fjords. Together with *Araneus quadratus* CL., *Araneus cornutus* CL. and *Araneus patagiatus* CL., which live in the southern-

Table VII. Summary of the climatic-ecological fauna elements. The numbers in the third column indicate the amount of individuals found.

Distribution in West Greenland	Names of species	Distribution in East Greenland																
		60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°
60°-65°	1. <i>Pardosa saltuaria</i> .....	..	1	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..
60°-67°	2. <i>Pardosa furcifera</i>	6	..	..	..	..	..	..	..	..	..	1?	..	..	..	..	..	..
60°-67°	3. <i>Enoplognatha intrepida</i> ...	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60°-67°	4. <i>Drassodes signifer</i>	3	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..
60°-69°	5. <i>Tetragnatha extensa</i> .....	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60°-69°	6. <i>Arctosa insignita</i>	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60°-70°	7. <i>Lepthyphantes turbatrix</i> ..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60°-69°	8. <i>Oreonetides vaginatus</i>	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
61°-70°	9. <i>Coryphaeolana lapidicola</i> ..	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60°-70°	10. <i>Erigone whymperi</i>	12	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..
64°-75°	11. <i>Pardosa glacialis</i> .....	..	..	..	..	..	..	..	..	1	5	55	7	42	50	26	15	55
69°-71°	12. <i>Hilaira curvitaris</i> .....	..	..	..	..	..	..	..	..	..	..	10	..	29	10	2	1	3
73°-77°	13. <i>Hilaira glacialis?</i> .....	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..
60°-74°	14. <i>Dictyna borealis</i> .....	..	..	..	..	..	..	..	..	14	1	8	..	60	47	3	..	+
÷	15. <i>Coryphaeolana thulensis</i> ..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	4	..	2
÷	16. <i>Erigone s. orientalis</i> .....	..	..	..	..	..	..	..	..	..	..	3	..	2	4	..	1	3
÷	17. <i>Xysticus labradorensis</i> .....	..	..	..	..	..	..	..	..	..	..	14	..	7	2	2	..	1
60°-69°	18. <i>Hahnia glacialis</i>	1	1	..	2	..	4	2	..	3	..	1	..	..	..	..	..	..
60°-70°	19. <i>Pardosa groenlandica</i>	10	12	8	15	..	40	9	..	65	2	14	..	15	11	..	..	..
60°-67°	20. <i>Xysticus durus</i> .....	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..
60°-64°	21. <i>Micryphantes n. jacksoni</i> ..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60°-69°	22. <i>Dictyna major</i>	3	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..
60°-70°	23. <i>Lepthyphantes audax</i> ...	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60°-70°	24. <i>Hilaira frigida</i>	23	1	4	2	..	16	15	..	19	1	2	..	1	..	..	..	..
÷	25. <i>Arctosa alpigena</i>	2	..	2	1	..	2	1	..	4	..	1	..	..	..	..	..	..
÷	26. <i>Bolyphantes index</i> .....	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
÷	27. <i>Rhaebothorax morulus</i> .....	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
÷	28. <i>Caledonia evansi</i> .....	..	..	..	..	..	3	..	..	1	..	..	..	..	..	..	..	..
÷	29. <i>Erigone tirolensis</i> .....	..	..	..	..	..	5	8	..	4	5	3	..	..	..	..	..	..
÷	30. <i>Tiso aestivus</i> .....	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..
÷	31. <i>Gnaphosa islandica</i> .....	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..
67°-69°	32. <i>Micryphantes nigripes</i> ...	..	..	..	..	..	1	1	..	22	2	6	..	5	3	..	..	1
62°-75°	33. <i>Cornicularia karpinskii</i> ..	..	..	1	..	..	..	..	..	..	1	1	..	2	1	..	..	..
70°	34. <i>Microerigone spitsbergensis</i>	..	..	..	..	..	1	..	..	1	..	..	..	..	..	..	..	..
65°-73°	35. <i>Coryphaeolana holmgreni</i> ..	1	6	..	..	..	2	17	..	7	2	6	..	..	..	3	..	..
75°-81°	36. <i>Erigone psychrophila</i> ....	..	..	..	..	..	2	1	..	..	1	5	..	..	1	..	..	15
70°	37. <i>Typhochraestus borealis</i> ..	..	..	..	..	..	2	..	..	9	..	1	..	15	3	3	1	..
÷	38. <i>Islandiana princeps</i> .....	..	1	1	..	..	1	..	..	..	..	3	..	1	..	1	..	..

most part of West Greenland, these five species (*Pardosa saltuaria*, *Pardosa furcifera*, *Enoplognatha intrepida*, *Drassodes signifer* and *Tetragnatha extensa*) constitute a boreal fauna element. One of these species, *Enoplognatha intrepida*, is as yet only known from Greenland, whereas *Drassodes signifer* and *Tetragnatha extensa* have a very wide distribution (p. 100, table X, nos. 8 and 9).

2. The Arid Boreo-arctic Fauna Element.

The five species, *Arctosa insignita*, *Lepthyphantes turbatrrix*, *Oreonetides vaginatus*, *Coryphaeolana lapidicola* and *Erigone whymperi* (p. 73, table VII, nos. 6—10) have an area of distribution, which very nearly coincides with that of the boreal fauna element, but most of them spread somewhat farther north in West Greenland and are not of more numerous occurrence in the Julianehaab district than farther north. It must thus be the arid character of the climate which satisfies their ecological demands, whereas it is of no importance for them, whether or not the summer temperature is a few degrees higher as in the Julianehaab district.

Of these five species *Erigone whymperi* is the most numerous occurring, and it is also the only one of them which has spread to the Scoresbysund area, where it was found in two specimens in the interior of the fjord, the climate here also being of an arid character.

3. The Arid Arctic Fauna Element.

This fauna element includes the seven species: *Pardosa glacialis*, *Hilaira curvitaris*, *Hilaira glacialis*, *Dictyna borealis*, *Coryphaeolana thulensis*, *Erigone s. orientalis* and *Xysticus labradorensis* (p. 73, table VII, nos. 11—17). This element consists of heliophilous species, whose proper area of distribution are the arid, arctic regions north of Scoresbysund. From here only the two species, *Pardosa glacialis* and *Dictyna borealis*, which are also the most commonly occurring species in this area, have been able to penetrate into the climatic border area (70°—68°) south of Scoresbysund.

Four of these species are also known from West Greenland (table VII, nos. 11—14), but here three of them have spread somewhat farther south. This applies to *Hilaira curvitaris*, which is met with one degree of latitude farther south, *Pardosa glacialis*, which has been met with as far south as at Godthaab (64°), and *Dictyna borealis*, which has spread as far as Kap Farvel (60°). In East Greenland the two latter species are only met with at Kangerdlugssuaq (68°). Here the climatic-ecological difference between the two coasts appears most distinctly. The east coast south of Scoresbysund nearly completely lacks the arid hinterland, which is found so abundantly in the same degrees of latitude on the

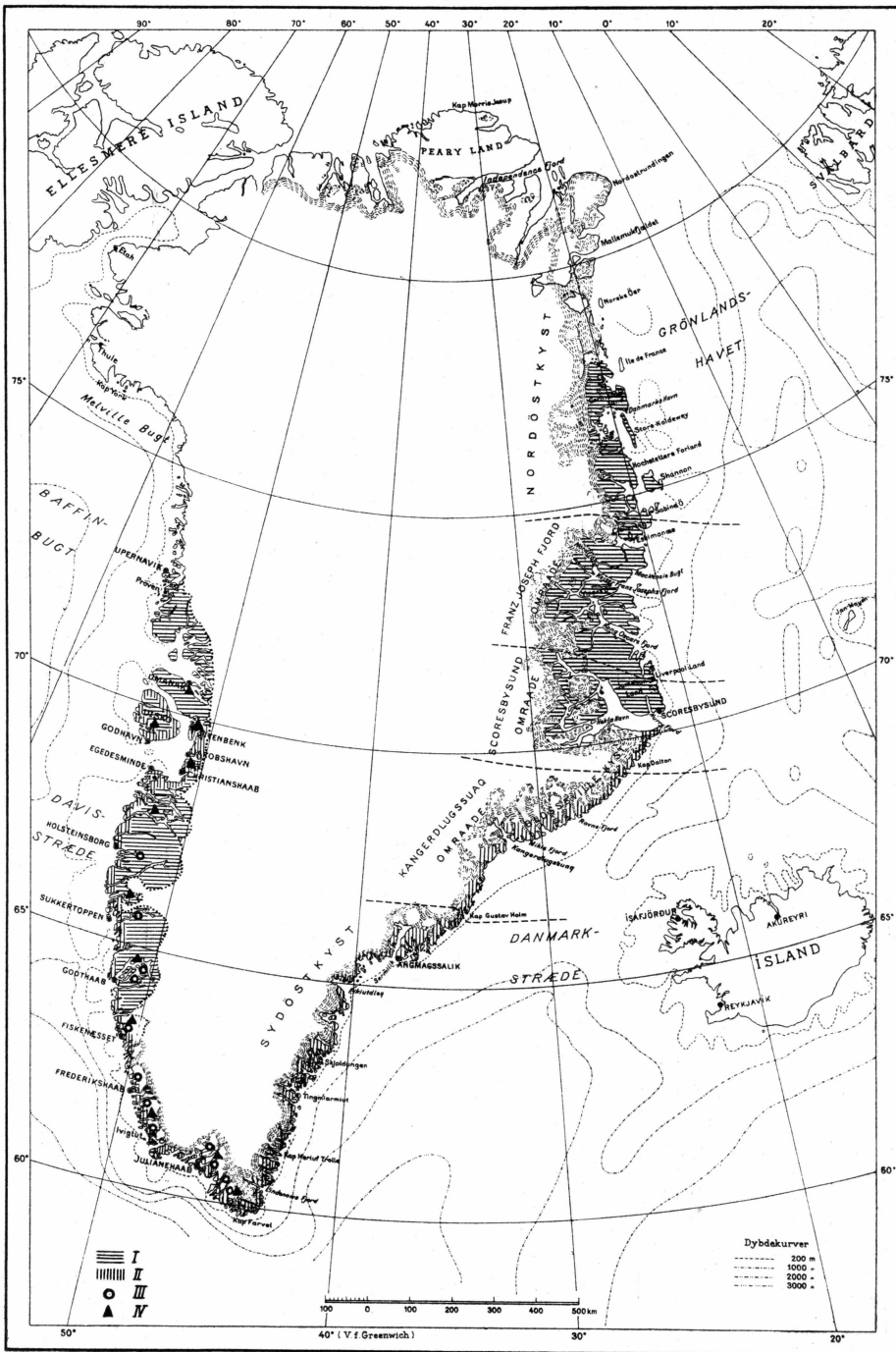


Fig. 44. The distribution of the climatic-ecological fauna elements. *I* The arid arctic fauna element. *II* The humid fauna element. *III* The arid boreal fauna element. *IV* The arid boreo-arctic fauna element. The euryoeqous fauna element occurs wherever the soil is not sterile.

west coast. The distribution of this fauna element must be conditioned by the arid climate, and when the species in East Greenland only occur as high-arctic, it is because these regions, also from a climatic point of view, are pronouncedly arid.

4. The Humid Fauna Element.

It is characteristic of this fauna element that its species, with the exception of *Pardosa groenlandica* and *Hilaira frigida*, have not been found north of Scoresbysund (p. 73, table VII, nos. 18—31). They live in the humid part of East Greenland between Kap Farvel and Scoresbysund. *Pardosa groenlandica* seems to fall outside this group, but this is only apparent. The 11 individuals which have been found as far north as 73° lat. N., all originate from alpine localities in the neighbourhood of the coast, that is, from the most humid localities in these otherwise arid regions. Of the 15 individuals, found in 72° lat. N., thirteen come from Ella Ø, which must be termed a pronouncedly arid locality, and they all originate from Berlèse samples. This means that *Pardosa groenlandica* in these parts nearly always keeps hidden in the loose soil, where the micro-climatic conditions must be supposed to be far more humid than on the surface, and where they are not worried by the sun, any more than in the more cloudy southern regions. *Pardosa groenlandica* is not quite established in these regions, and when it must nevertheless be supposed to live there constantly, this is due to a steady immigration from the more southerly humid areas, where the species is so extremely common.

The species *Hahnia glacialis*, *Pardosa groenlandica*, *Xysticus durus*, *Micryphantes n. jacksoni*, *Dictyna major*, *Lepthyphantes audax* and *Hilaira frigida* are as widely distributed in West Greenland as in East Greenland, nor is this strange, seeing that the climate in the outermost coast regions of West Greenland is nearly as humid as that of East Greenland in the same latitudes. It is rather to be wondered at that the other seven species, viz. *Arctosa alpigena*, *Bolyphantes index*, *Rhaebothorax morulus*, *Caledonia evansi*, *Erigone tirolensis*, *Tiso eastivus* and *Gnaphosa islandica* do not live in West Greenland. This is presumably due to causes connected with the immigration, as none of these species, with the exception of *Arctosa alpigena*, are known south of Angmagssalik. Besides, they are palaeartic species, whereas the seven, which are common to East and West Greenland, are either nearctic or holarctic. It is difficult to understand, why *Arctosa alpigena*, which is a holarctic species, does not occur in West Greenland, when it occurs as far as Kap Farvel in East Greenland. There is, however, the possibility that it lives in West Greenland, but has not yet been identified there.

Each of the four fauna elements, which have been mentioned until now, are dependent upon a definite climatic-ecological factor, being all of them stenoeqous, which does not apply to the following element.

5. The Euryoeqous Fauna Element.

As distinguished from all the preceding ones, these species (p. 73, table VII, nos. 32—38) are apparently quite independent of the arid or humid character of the climate. All of them are Micro-Araneina, which very frequently lurk beneath stones and vegetation or in the upper loose layers of earth, and so they have frequently been found in Berlèse samples. In the Franz Joseph Fjord and Nordøstkyst areas, where the climate is pronouncedly arid, 55 individuals in all have been found, all of them belonging to the various species of this fauna element. Of these 13 have been found beneath stones or vegetation and 16 in Berlèse samples. In the southern, humid regions of East Greenland comparatively far fewer individuals have been found beneath stones and vegetation or in the upper layers of earth. Thus, it is evident that these species in the arid regions try to get below the surface. Here the micro-climatic conditions are more humid than on the actual surface, and thus they are able to live both in arid and in humid regions.

All the species, with the exception of *Islandiana princeps*, are also recorded from West Greenland. There is, however, no reason to suppose that this species should not live in West Greenland. Up to the present it has only not been found there.

The Fauna Elements in Other Parts of Greenland.

Whereas it is easy to see that there are several fauna elements in East Greenland, whose areas of distribution are determined by climatic factors, conditions are entirely different in West Greenland. As to this area the opinion has hitherto been the prevailing one that there was no reason to adopt especially zoogeographical points of view, the West Greenland fauna consequently always being treated as a unity. This not only held good of the spider fauna, but also of the faunas of the other land Arthropods.

It was known that there were a few species, which were most common in the southern regions, and others, which were more common farthest north; but generally speaking the land Arthropod fauna seems to constitute a unity from Kap Farvel to Ritenbenk (about 70° lat. N.). On this stretch the humid fauna element was met with along the coast, and farther inland the arid boreal and the arid boreo-arctic. The species

of the euryoeqous element might naturally occur everywhere in these regions. The arid boreal fauna element, it is true, was most numerous in the most southerly regions, but *Tetragnatha extensa* was found as far north as 69° lat. N. *Pardosa furcifera*, *Enoplognatha intrepida* and *Drasodes signifer* have been recorded as far north as 67° lat. N. and only *Pardosa saltuaria* had never been met with north of 65° lat. N. Of species belonging to the arid arctic element *Dictyna borealis* lives as far south as the Julianehaab district (60° lat. N.), while *Pardosa glacialis* has been recorded from Godthaab (about 64° lat. N.). *Hilaira curvitaris*, it is true, was not known south of 69° lat. N. and *Hilaira glacialis* not south of 73° lat. N., but the material is too slight to distinguish this element from the others.

Owing to the great power of distribution of the spiders, some of the individuals of the arid fauna elements were found right out at the coast, and in return some of the individuals of the humid element were found within the arid hinterland. Therefore, it was difficult to distinguish the existence of the various elements, and still more so because the only large systematic collection undertaken in West Greenland, that of WILL. LUNDBECK 1889—1890, extended from Julianehaab to Ritenbenk and chiefly took place in the coast regions.

Systematic collections undertaken across the country, for instance from the outermost to the innermost parts of Julianehaab Fjord, Godthaab Fjord and Søndre and Nordre Strømfjord would have given a clearer picture of the composition of the West Greenland fauna. However, the distances are here so short that we could never have attained such a definite idea of the existence of the various fauna elements as of those of the east coast.

From North Greenland, that is the country between Melville Bugt and Nordøstrunden, only two species are recorded, viz. *Erigone psychrophila*, which was found at Polaris Bugt (81°30') by the Polaris-Expedition, and *Pardosa glacialis*, which is known from Foulke Fjord (78°20'). These two species must be supposed to be of common occurrence in North Greenland. *Erigone whymperi*, *Hilaira glacialis* and *Thanatus arcticus*, which also live on Ellesmere Land, but are only known from the southernmost part of this island (76°40'), may likewise be expected to be indigenous of North Greenland. The species of the arid arctic and the euryoeqous fauna element, which has been met with at Danmarks Havn, may presumably also be expected to occur in North Greenland. Besides those already mentioned, these species are: *Dictyna borealis*, *Coryphaeolana thulensis*, *Erigone s. orientalis*, *Xysticus labradorensis* and *Micryphantès nigripes*, or at most some ten species.

The Relation between the Faunas of East and West Greenland.

From Greenland are known in all 50 species of spiders. Of these 27, that is more than half, are common to West and East Greenland, which hardly agrees with the list of the Chironomid fauna of Greenland, published by R. SPÄRCK (1943, p. 432). According to this, the number of Chironomid species should be in all 83, only 11 of which are common to East and West Greenland. However, SPÄRCK's material practically contains nothing from the humid part of the east coast. When therefore leaving out the species of spiders, which are only known from the east coast between 60°—70°, the number of species is reduced to 46 in all; only fourteen of these are, however, common to the east and the west coasts, though these figures in a considerably higher degree recall the Chironomids.

Of the 38 species recorded from East Greenland there are only 11, which are unknown from West Greenland. In return, there are 12 species from West Greenland, which have never been found in East Greenland. Even though this difference between the spider faunas of the areas is not great, it is, however, difficult to explain it on the strength of the climatic-ecological conditions only. Also the immigration, which has taken place at various times and along various routes, must be taken into account.

Ecology of Distribution.

Before forming an authentic idea of the manner in which the immigration has taken place, it is necessary to realize how the different species may spread, and the methods of distribution, which may have been used when the immigration to Greenland took place.

As to the part played by the wind in the spreading of spiders, the reader is referred to what I have previously written on this subject (1937₂, 1938_{1&2}). Here it has been demonstrated that aeronautic spiders occur in arctic regions, and that the wind must be regarded as the most important factor of distribution in these areas, because the greater part of the species belong to the family *Linyphiidae*, which are known as particularly good aeronauts. Of the 38 East Greenland species 22 (58%) belong to *Linyphiidae*. Nearly all the other species, however, belong to genera or families, which must be supposed to be able to act as aeronauts, because it is known that other species of these groups have been identified as animal air plankton.

Only the three species, viz. *Hahnia glacialis*, *Gnaphosa islandica* and *Drassodes signifer*, cannot be reckoned as aeronauts. *Hahnia*

glacialis belongs to *Agelenidae* and the two latter to *Drassidae*. Species belonging to these two families have never been found floating in the air. Therefore, it must be taken for granted that the ancestors of these species have arrived in Greenland in another way than as air plankton.

CARL H. LINDROTH (1931) entirely dismisses the thought that spiders and small insects might have been carried by the wind from western Europe to Iceland, seeing that he erroneously takes it as his starting point that the animals can only be transported in the lower air strata under the Nimbus clouds. This, however, has not proved to hold good, and spiders have been identified at an altitude of 3000 m (COAD 1931). In addition, the observations of C. S. ELTON from Spitzbergen (1925) show that animal plankton has been carried alive over a distance of more than 1500 km, that is, considerably longer than from Scotland to Iceland.

The distances over which light, live Arthropods, under favourable conditions, can be carried by air currents seem almost unlimited, but this is surely not generally the case. In the higher air strata the animals are exposed both to very low temperatures and drought, and when the journey is very long, this may easily cause their death. As the greater part of the surface of the earth is covered by the sea, most of the plankton of the air must find its way there, when after the termination of the air voyage it again reaches the surface of the earth. For the animals this also means death. One may therefore say that it is a piece of extraordinary good luck, if a sufficient number of individuals of the same species should arrive in a locality, where the species is able to continue to live. It is not sufficient that a male and a female should land so near one another that they may meet and complete their pairing, or that a pregnant female should arrive in the place. The ecological conditions must be of such a nature that the species is able to live there, and therefore it is hardly of any importance, if e. g. tropical animals arrive in Greenland or vice versa. On the other hand the periods, within which the distribution may have taken place, are so long that one is entitled to believe that such a piece of manifold good luck may have occurred several times in every part of the earth.

Thus E. P. FELT (1928) has demonstrated that the insect fauna of Hawaii has, in all probability, mainly been carried through the air to those remote islands, and the reason given is that several families are entirely lacking on the islands, their species being either poor aeronauts or too heavy to be able to float. Thus the *Scarabaeidae* family is entirely unknown from Hawaii.

Somewhat later the English arachnologist W. S. BRISTOWE (1931₂, pp. 1394—1395) put forth the same point of view regarding the Arachnid

fauna on Hawaii and Samoa. It here appears that the groups of spiders which, as far as is known, do not act as aeronauts, either are not represented at all or only occur very sparsely on these remote islands. As most of the species on Hawaii and Samoa, as far as is known, are endemic, long periods must have elapsed, since the ancestors of these species arrived in the islands. But as has been proved, it can never be an everyday occurrence that living air plankton with breeding possibilities arrives in such remote localities. Greenland, on the other hand, is situated rather close to the other large islands (Iceland, Baffin Land and Ellesmere Land), nor is it particularly far removed from the two continents, North America and Eurasia. For this reason, the conditions of immigration through the air are more favorable in the case of Greenland, and it agrees well with this fact that there are only few or perhaps no endemic species on Greenland.

In the Danish summary of her thesis MARIE HAMMER writes that it appears from an investigation of the probable Greenland origin of certain animal groups that those which are earth-bound, i. e. not mobile forms, such as mites, colomboles, spiders, weevils etc. (all of which species may be supposed to have survived a glaciation) apparently belong to the very soil of the country, and with the latter have been carried away from connection with Europe.

I shall not express a definite opinion on what is here said of mites, colembolles and weevils, but only state that according to my comparatively limited knowledge of the biology of these animal groups, it seems to me that MARIE HAMMER may have some justification for her characterization of these as earth-bound, whereas it is absolutely incorrect as regards the spiders of Greenland. By far the greater part of them are anything but earth-bound, as clearly appears from my publications on Aeronautic Spiders (BRÉNDEGAARD 1937₂, 1938₁, 1938₂). However, it appears from MARIE HAMMER's bibliography that she is unacquainted with these publications and also with what was demonstrated by JOHN BLACKWALL, as early as 1827, that is more than a hundred years ago, according to which statement there were excellent aeronauts among the spiders. That MARIE HAMMER is also unacquainted with what CHARLES DARWIN, HENRY MC. COOK, S. C. BISHOP and C. R. CROSBY, W. S. BRISTOWE and B. R. COAD have proved as to the occurrence of spiders as animal air plankton is only added for the sake of completion.

I did, however, think that every Danish zoologist was familiar with this subject, as it is quite impossible to move about in our own Danish countryside without meeting the phenomenon "Flyvende Sommer" (ø: flying summer or gossamer). Personally I have observed this natural phenomenon at least several times every summer, and more

especially on the clear, sunny autumn days, when the night temperature approaches zero (E. NIELSEN 1928, p. 133 and 1932, p. 44).

Whereas the wind must be regarded as the most important factor of distribution, one may surely, in the case of East Greenland, set aside the possibility that species have been brought there by human agency. In West Greenland one might, on the other hand, reckon with the importation of species as an obvious possibility, because for more than two hundred years there has here been a regular communication with Europe, but as the otherwise omnipresent cosmopolitan, *Tegenaria derhami* (the domestic spider) has not been found in West Greenland, it is not probable that communication has played any very great part in the case of Greenland.

The Norsemen, who in 986 settled in Greenland, brought their domestic animals along with them from Iceland, and so they must also have had fodder for them. *Drassodes signifer* is afraid of light and lurks beneath stones, in lichen, moss or other dense bottom vegetation, where the females are also in the habit of building their nests. It may thus have kept hidden in the fodder, which was to serve as food for the animals during the journey, and there is a possibility that egg-webs of *Araneus cornutus* CL., *Araneus patagiatus* CL. and *Tetragnatha extensa* L. may have been carried along in the same manner. However, all of these four species also live in America, and it is as probable that they may have immigrated from there. In that case the most probable mode of distribution must, for the three latter species, be by the agency of the wind, as spiders generally also spread in that manner, even when there is a land connection. Further more it must be supposed that nearly all the fodder for the feeding of the cattle had been consumed before the arrival in Greenland, and the importation of spiders in this manner is therefore not very probable.

Whereas *Drassodes signifer* and *Tetragnatha extensa* have been recorded from the east coast, the two *Araneus* species have not. As to *Drassodes signifer* it cannot be supposed to spread by the agency of the wind, and it is also difficult to imagine it as having been carried by human agency as far north as Nukarfik (63°25') on the east coast, East Greenland being an area very little frequented by man. Eskimos have passed along the coast and settled at Angmagssalik. This numerically insignificant migration has probably taken place by means of the well-known Eskimo skin-boats, umiaks and kayaks, but it is almost unthinkable that *Drassodes signifer* should have been carried there from West Greenland in this manner. *Tetragnatha extensa*, the newly hatched young of which are aeronauts, may on the other hand have arrived on the east coast in the shape of air plankton, and as formerly mentioned, this also applies to all the other species, with the exception of *Drassodes signifer*,

Gnaphosa islandica and *Hahnna glacialis*. Neither is it possible that Europeans have played any part in the importation of spiders to the east coast. Until 1894 there had been no other communication with Europe than the one brought about by means of scientific expeditions. Since then there has been a regular communication between Angmagssalik and Copenhagen, and from 1925 between Scoresbysund and Copenhagen.

Table VIII. Species living both in Denmark and East Greenland.

	Angmagssalik	Scoresbysund
<i>Arctosa alpigena</i>	+	+
<i>Dictyna major</i>	+	÷
<i>Tetragnatha extensa</i>	÷	÷
<i>Drassodes signifer</i>	÷	÷

The four species mentioned in table VIII are the only ones common to Denmark and East Greenland. It is true that *Arctosa alpigena* occurs both at Angmagssalik and Scoresbysund, but in Denmark it is so rare that only one specimen has been found. *Dictyna major*, which is known from Angmagssalik, is also rare in Denmark, where it is only known from Ulfshale on the island of Møen. Here, however, it has been taken in ten specimens. *Tetragnatha extensa* and *Drassodes signifer* is comparatively common in Denmark, but occurs neither at Angmagssalik nor at Scoresbysund. Add to this that *Arctosa alpigena*, *Tetragnatha extensa* and *Drassodes signifer* were found in East Greenland by P. EBERLIN, a member of GUSTAV HOLM'S Umiak-Expedition 1883—85, that is ten years before the regular communication with Angmagssalik was started. It may, therefore, be taken for granted that hardly one of the species, which are common to East Greenland and Europe, have been carried there by human agency.

There is no evidence at hand that spiders may be spread by birds, neither is it very probable that this has taken place. No examples are known of spiders sheltering beneath the plumage of birds, and that they should attach themselves to the outside of the plumage is also unthinkable. Spiders do not catch hold of any foreign solid underlayer, if they feel the air rushing past; for then they give themselves to the air current, if it is in their nature to act as aeronauts, which applies to nearly all the species of East Greenland.

With the packice a quantity of Siberian driftwood comes to East Greenland. It must, however, be considered as out of the question that spiders have been carried to East Greenland by this means (BRÆNDEGAARD 1928, p. 23). CARL H. LINDROTH (1931, p. 530) arrives at the same result as far as Iceland is concerned.

It has been thought that the eggs of spiders, which are always enveloped in a thick web, should be able to cross the Arctic Sea by means of driftwood (BRISTOWE 1925). This theory has already formerly been contested. The investigations in East Greenland further show that most, possibly all species lay eggs so early in the season that the hatching takes place during the same summer, and consequently they do not winter as eggs, but as quite small young, which have only undergone one or two moultings. That this is the case is shown both by the finds of females with egg cocoons and by the occurrence of a great quantity of pull. in Berlèse samples, which have been taken in the course of the autumn, the winter and the early spring. As a great number of the pull. found in the Berlèse samples could not, with certainty, be determined as to species, not nearly all of them have been included in the published lists of fauna (BRÆNDEGAARD 1935, 1937₁, 1939, 1940), which therefore do not give a correct impression of the numerousness of these small young in the samples mentioned. As it was a necessary presupposition of this theory that wintering as eggs should take place, one is entitled in the future not to pay any attention whatsoever to this hypothesis of spreading. Thus the species, which are common to Greenland and Siberia, cannot have come to East Greenland with driftwood from Siberia.

As, however, there are species in East Greenland, which cannot be supposed to spread by the agency of the wind, it is necessary to presume a land connection, along which these species may have immigrated.

The Immigration of the Species.

WILLIAM SØRENSEN concludes his "Danmarks, Færøernes og Islands Edderkopper" (1904, p. 426) with a remark to the effect that it will be of great interest to know the fauna of Iceland more thoroughly, in order to form an idea of the wandering of the species after the cessation of the glacial period, Iceland, as it were, forming a bridge between Scandinavia and Greenland. SØRENSEN would have been equally justified in mentioning the Faroes in addition to Iceland, as they are lying as a bridge between the British Isles and Iceland. At that time it was impossible to form an idea of the wanderings of the spiders, as only 6 species were known from the Faroes as against 43 at the present time, and 18 from Iceland as against 60 now. There is no doubt that so much is known at present of the spider fauna of the Faroes and Iceland that it is possible to form an authentic idea of the species, which have immigrated from western Europe via Iceland to Greenland and vice versa.

Greenland is, however, a part of Nearctica, even though it is situated on the outskirts of the latter. Together with Iceland and the Faroes it makes a bridge between the nearctic and the palæarctic areas, and there-

fore it is of great zoogeographical importance to possess a thorough knowledge of the Greenland fauna. The comprehensive knowledge possessed of the fauna of this important island bridge is mainly owing to Danish initiative and enterprise, though it would be unjust, if Danish investigators were to try to usurp for themselves the whole honour. The collections undertaken on Iceland by the Swede CARL H. LINDROTH and his publications on this subject are, up to the present, the foundation of our knowledge of the land-arthropod fauna of that island.

Unfortunately only little is known of the spider fauna on the whole of the Canadian archipelago west of Greenland, and this also to a certain extent applies to Labrador and New Foundland towards south. An oasis in the whole of this rather unknown area is the island of Akpatok in the Ungave bay on the north coast of Labrador. In 1931 the Oxford University sent out an expedition to those parts, and the material of spiders collected was prepared by A. RANDELL JACKSON. It may surely be taken for granted that the species found on Akpatok live both in Baffin Land and in Labrador. This is a valuable help from a zoogeographical point of view, but not sufficient to permit of drawing conclusions as to the conditions of distribution of the nearctic species occurring in Greenland, equally accurate as those which can be drawn in the case of the palæarctic species. This void will presumably be filled at the end of the war, all that is necessary being that British scientific initiative should concentrate on this task, in a similar manner as Denmark has done in Greenland.

The Immigration of the Holarctic Fauna Elements.

1. The Euryoeqous Holarctic Immigration Element.

Species belonging to the same climatic-ecological element have not always immigrated together, but this very nearly seems to be the case, as far as the euryoeqous fauna element is concerned. The latter element consists of the seven species at the bottom of table VII (p. 73). It is a fact that the following five species: *Microerigone spitsbergensis*, *Coryphaeolana holmgreni*, *Erigone psychrophila*, *Typhochraestus borealis* and *Cornicularia karpinskii* are all holarctic (fig. 45). *Micryphantes nigripes* has a similar distribution, if the race *Micryphantes n. jacksoni* is included in the area of distribution of the principal species (p. 100, table X, nos. 1—6). This race lives in South Greenland and on Akpatok. On the other hand *Islandiana princeps* falls entirely outside the zoogeographical scope of the six firstmentioned species. It is only with certainty known from East Greenland and Iceland. There is hardly any reason to doubt that it is a nearctic species, but in U.S.A. the two species, viz. *Islandiana princeps* BRGD. and *Islandiana alata* EM. have hitherto been mixed

up with each other. The euryoeqous species are all arctic, but most of them have also been found in the temperate zone, where they only seem to be of alpine occurrence.

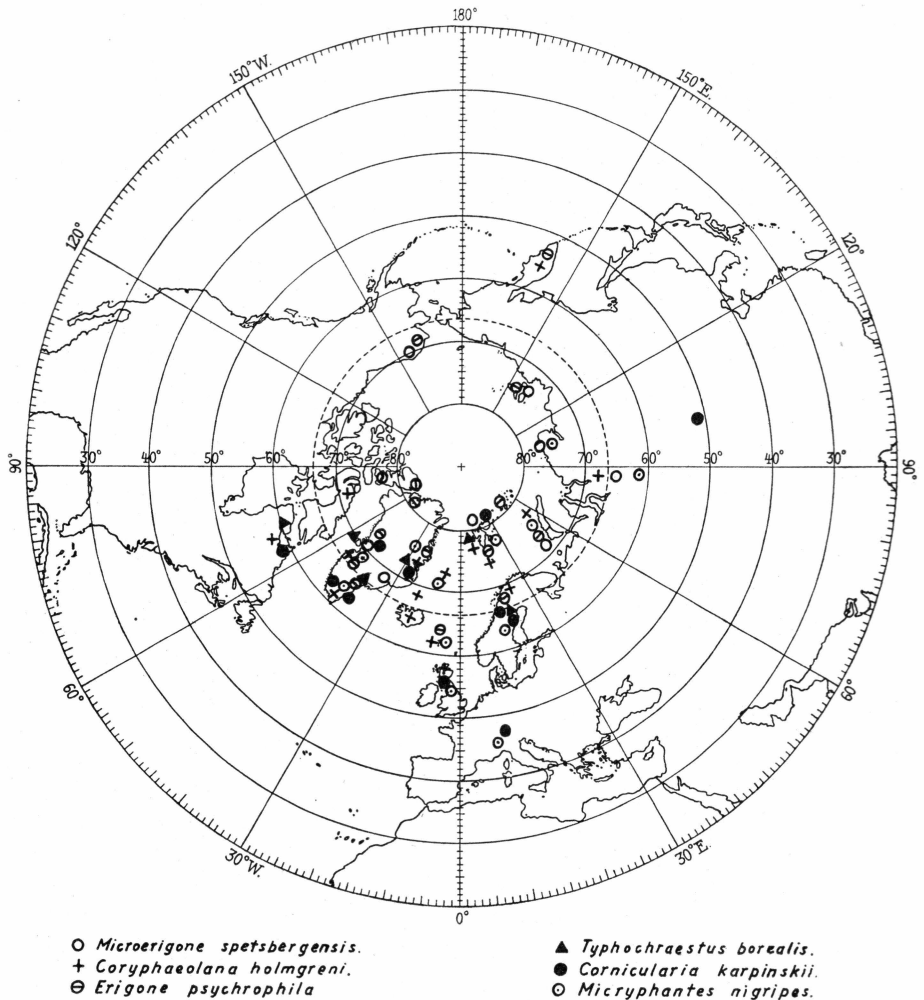


Fig. 45. The distribution of the euryoeqous holarctic immigration element.

The wide distribution of these six species suggests a very old fauna element, possibly the oldest in Greenland. When considering the power of survival under the most varying ecological conditions which may occur in arctic regions, it is natural that they have at least been able to survive the last glaciation of the Quaternary period (Würm)¹.

¹) According to KÖPPEN and WEGENER (1924, p. 228) the names used in Europe of the various large glaciation periods correspond with the American names in the following manner: Günz = Illinoian, Mindel = Iowan, Riss = Early-Wisconsin and Würm = Late-Wisconsin.

There is a possibility that this may have taken place, since it is known that Greenland has never been entirely covered with ice. This for instance holds good of the greater part of Peary Land, and also several mountain

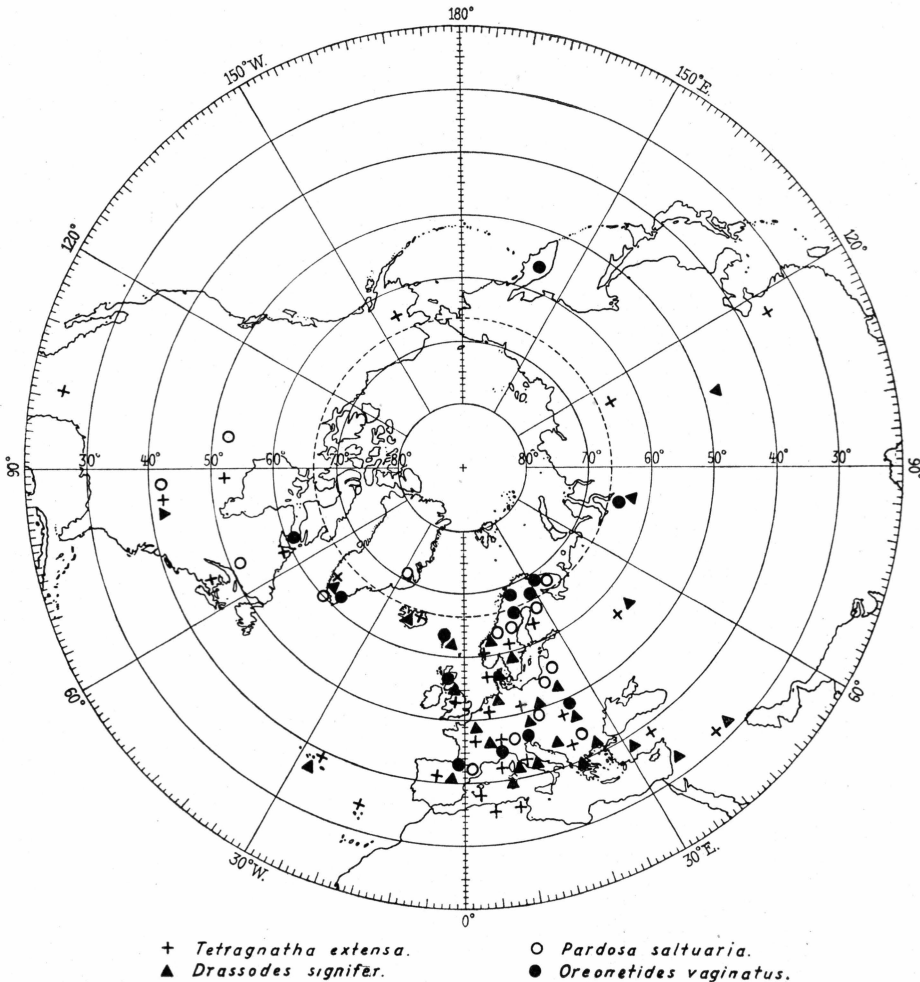


Fig. 46. The distribution of the boreal holarctic immigration element.

regions in the present ice-free coast land bear distinct traces of never having been completely glaciated.

2. The Boreal Holarctic Immigration Element.

The four species: *Pardosa saltuaria*, *Drassodes signifer*, *Tetragnatha extensa* and *Oreonetides vaginatus* constitute a fauna element, which on account of its wide distribution is entitled to be classed with the preceding ones. The three first-mentioned are boreal species, whereas the last one

is boreo-arctic, and so within the Greenland area belongs to another climatic-oecological fauna element. As appears from table X (p. 100, nos. 7—10) and fig. 46 *Tetragnatha extensa* and *Drassodes signifer* in particular have a wide distribution. They do not live in the temperate zone only, but are also known from the sub-tropics.

As formerly mentioned (pp. 79—80) *Drassodes signifer* cannot be supposed to have spread through the air. As this species may hardly have been imported to Greenland by human agency (p. 82), the immigration must have taken place at a time, when Greenland was still connected by land with the American or European continent. The three other species have undoubtedly immigrated together with *Drassodes signifer*, all of them by their wide distribution belonging to an old fauna element.

Pardosa saltuaria is particularly interesting from a zoogeographical point of view, in that the Greenland individuals and presumably also those from North America, like those from Central Europe, belong to the typical species, whereas those from northern Europe belong to the race *Pardosa s. hyperborea* (pp. 23—24). The conditions of immigration are in this case presumably of a similar kind as those known from the reindeer (A. JACOBI 1931). As is well known, JACOBI demonstrated that the reindeer living in Central Europe during the glacial period belonged to the same race as the present American tundra reindeer, whereas the reindeer, which at the present time lives in northern Europe, is of the same race as the Siberian reindeer and has immigrated from the east after the glacial period. There is, however, the difference that *Pardosa saltuaria*, unlike the North-American tundra-reindeer, is not extinct in Europe, and *Pardosa s. hyperborea* has not crossed via Spitzbergen to Greenland; but the reindeer being an arctic animal, whereas *Pardosa saltuaria* is a boreal species, this is easily intelligible.

This fauna element is evidently so old in origin that Central Europe and North-America were connected with each other, when the holarctic distribution took place.

According to KÖPPEN and WEGENER (1924) the first and the last parts of the last interglacial period (Riss-Wärm) was considerably warmer, whereas the middle part of it was as at the present time or even colder. It is therefore the most likely supposition that the immigration into Greenland of this thermophilous fauna element has taken place from the south at the beginning of the last interglacial period.

The orb-weavers, viz. *Araneus patagiatus* CL., *Araneus cornutus* CL. and *Araneus quadratus* CL. which live in the southern part of West Greenland, but are not known from East Greenland, also belong to the boreal fauna element and have undoubtedly immigrated at the same time as *Drassodes signifer*. *Araneus patagiatus* and *Araneus cornutus* are

both holarctic species, and particularly the latter has a very large distribution. *Araneus quadratus*, on the other hand, is a palaeartic species, the only known occurrence of which in the nearctic area is in the southernmost part of West Greenland. As practically nothing is on record as regards the Arachnid fauna of New Foundland, it is not known whether it occurs there, though there seems to be some probability of it. *Araneus quadratus* is not known from Iceland, so it has not been imported by the old Norsemen, who in medieval times settled in the Øster- and Vesterbygd. That it does not live in Iceland, is also in favour of its having immigrated from the south.

Dictyna major presumably also belongs to the same immigration element. It is a humid boreal and arctic species, which has been able to spread northwards along the coasts of Greenland. In West Greenland it has spread as far as Disko and in East Greenland to the regions round Angmagssalik (65°50'). It is not known from Iceland, or the Faroes or Norway, but from Scotland, Denmark and Central Europe. This is in favour of its having arrived in Greenland from the south, together with *Pardosa saltuaria*, *Drassodes signifer*, *Tetragnatha extensa*, *Oreonetides vaginatus*, *Araneus patagiatus*, *Araneus cornutus* and *Araneus quadratus*. This immigration element thus consists of eight species, five of which (p. 100, table X, nos. 7—11) are known from East Greenland.

When these boreal species have been able to survive the last glacial period (Würm) in South Greenland, the North Pole cannot, as was the opinion of KÖPPEN and WEGENER (1924), at that time have been situated near Disko (about 70° lat. N.), that is, only 10° from Kap Farvel. According to more recent calculations (KÖPPEN u. WEGENER 1940) the North Pole during that period has been situated farther north, so that the southernmost part of Greenland was at least 16° removed from the North Pole. This being so, it is possible that the boreal species, under very favorable geographical conditions, may have survived the last part of the glacial period in South Greenland.

R. SPÄRCK mentions (1943, p. 439) that "19 West Greenland species not found in East Greenland, but with a wide palaeartic and perhaps nearctic distribution, have probably reached West Greenland from the west". These Chironomids evidently constitute an immigration element corresponding with the eight species of spiders. As the expression "from the west" used by SPÄRCK must mean from a nearctic area, we are practically in agreement as to the routes of immigration.

3. The Humid Holarctic Immigration Element.

This element consists of the four species: *Hilaira frigida*, *Lepthyphantes audax*, *Arctosa alpigena* and *Erigone tirolensis*. They are arctic

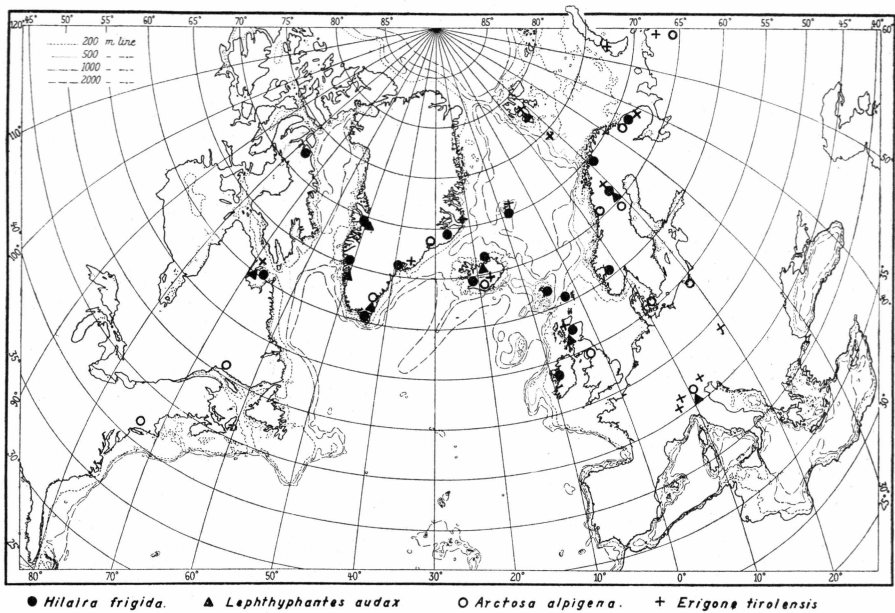


Fig. 47. The distribution of the humid holarctic immigration element.

or boreo-arctic species, which are also of alpine occurrence in the temperate zone. They are, however, best characterized as pronouncedly humid species, and they have a peculiar holarctic distribution (fig. 47 and p. 100, table X, nos. 12—15).

The three species: *Lepthyphantes audax*, *Arctosa alpigena* and *Eriogone tirolensis* live in the Alps, which *Hilaira frigida* does not. There are, however, two *Hilaira* species, viz. *Hilaira rudis* Cb. and *Hilaira montigena* L. K. which resemble *Hilaira frigida* to such an extent that they are easily mistaken for each other. The three species first mentioned can surely, with good justice, be described as a glacial relict fauna in the Alps. Now their chief areas of distribution are the coast lands of the northern Atlantic, the Greenland and the Barents Seas. They are, however, entirely lacking along the greater part of the western shores of the Greenland Sea, the Franz Joseph Fjord area and Northeast Greenland, where the climate is of a pronouncedly arid character. On the other hand, they follow the Gulf Stream and its ramifications into the arctic seas.

The origin of this distribution must be traced back to a time, when the European and the American continents were connected. When gradually the northern parts of the continents were separated and the coasts of the Atlantic pushed northwards, the species were forced to advance towards the north. These species can, therefore, be termed the vanguard of the Atlantic in its advance towards the Arctic Sea. And

everywhere along the coasts of the Greenland and the Arctic Seas, where the Gulf Stream makes its milder influence felt, one or more of these species are now met with.

The Palaearctic Immigration Elements.

4. The Boreo-arctic Palaearctic Immigration Element.

This element only consists of one species, *Gnaphosa islandica*, which also in other respects occupies a special position among the spiders of Greenland. Like *Drassodes signifer* it belongs to the small group of Greenland spiders, which cannot be supposed to act as aeronauts. It is a boreo-arctic species, which is only known from the Kola peninsula, Finland, Lapland in Sweden, Iceland and East Greenland. In the latter locality it is only known from Milne Land, in the interior of the Scoresbysund fjord, where several individuals ($\sigma\sigma$ ad. and ♀♀ ad.) have been found by H. DEICHMANN. *Gnaphosa islandica* presumably does not live elsewhere in Greenland, for it is a comparatively large species, and it is not to be imagined that it has been able to escape the attention of all the other collectors. As it is not known from any other nearctic area, it must be regarded as a palaearctic species, the most westerly outpost of which has just penetrated into a nearctic area.

At the time when this species immigrated to East Greenland, there must thus have been a land connection between Greenland and Iceland. To Iceland it must have immigrated at an earlier period from Scandinavia.

M. DEGERBØL (1937, p. 35) is undoubtedly right, when he sets forth as his opinion that it cannot have been a postglacial land connection, which the wingless weevil (*Otiorrhyncus arcticus* FABR.) used for its immigration from Europe to East Greenland. If for no other reason it is improbable because of the short time during which such a land bridge may have existed. *Gnaphosa islandica* is a sluggish animal, for which reason its immigration must also have been a slow process, and consequently it must be supposed to have immigrated to East Greenland during the last interglacial era (Riis-Würm). The immigration has probably taken place during the latter part of this period, and consequently the species has not been able to spread very much before the last glacial period. For climatic-ecological reasons *Gnaphosa islandica* was now dislodged from the Kangerdlugssuaq area, but in the interior of the Scoresbysund area, where the climate is pronouncedly continental and the summer temperature consequently higher, it has been able to survive the last glacial period.

5. The Arid Arctic Spitzbergen Element.

Among the Chironomids of East Greenland R. SPÄRCK (1943, pp. 436—438) has, he thinks, been able to prove the existence of an element consisting of "North-Eastern arctic species, comprising the twelve East Greenland species which, besides in East Greenland, occur in Spitzbergen, on Nowaya Zemlya, or in other extreme arctic regions east of the Atlantic, but are not found in Scandinavia". If there is a corresponding immigration element among the spiders, it can only comprise the two species: *Hilaira glacialis* and *Coryphaeolana thulensis* (p. 100, table X, nos. 16 and 17).

Coryphaeolana thulensis is only known from East Greenland and Spitzbergen, but as the species was not described until 1934, it is not unthinkable that it will be found at a later period in other arctic countries east of Spitzbergen.

Hilaira glacialis is also a typical arctic species; but as contradistinguished from *Coryphaeolana thulensis* it has perhaps a wider hol-arctic distribution. With certainty it is, however, only known from Spitzbergen. In Greenland and on Ellesmere Land only females have been found, so it cannot be decided with full certainty, whether the latter have been correctly determined or not (see p. 39). However, as *Hilaira glacialis* does not live on Novaja Zemlya or in Siberia, but is here replaced by the closely related *Hilaira nivalis* HOLM, there is nothing to show that *Hilaira glacialis* (and *Coryphaeolana thulensis*) have immigrated to Spitzbergen and Greenland from the east. It would rather seem that these two species have come into existence in the place where they now live during the glacial period, it being a likely supposition that Spitzbergen and North Greenland at that time were continentally connected with each other, while it is known that they were not completely covered with ice.

6. The Boreal Palaearctic Immigration Element.

This element consists of four species: *Caledonia evansi*, *Rhaebothorax morulus*, *Tiso aestivus* and *Bolyphantes index* (p. 100, table X, nos. 19—22). *Caledonia evansi* and *Rhaebothorax morulus* must, first and foremost, be characterized as pronouncedly humid species with a very limited area of distribution (p. 94, fig. 48). This being so, they must also be supposed to belong to a comparatively young fauna element, which has immigrated to East Greenland at a rather late period. They belong to the East-Atlantic boreal fauna element, which is particularly characteristic of the British Isles, but is also met with in Scandinavia, on the Faroes and in Iceland. This fauna element has thus been able to send a few outposts to East Greenland where, however, they occur very sparsely

(p. 73, table VII, nos. 27 and 28). This sparse occurrence also points towards a late immigration and an immigration by air. That they both belong to the *Linyphiidae* family greatly supports the supposition that they should have arrived in Greenland as aeronauts. This immigration has presumably only taken place in postglacial times, and there can hardly be any doubt that they have arrived there from Iceland.

When considering the occurrence of the palaeartic species in East Greenland and comparing them with Iceland (table IX) a striking difference makes itself felt. In Iceland two thirds of the species are of palaeartic origin, whereas the six East Greenland species, which have the same origin, only constitute 15 % of all the species of East Greenland. If there had been a postglacial land connection between Iceland and

Table IX. The distribution of the zoogeographical main groups in Iceland and East Greenland.

	Iceland		East Greenland	
	Number	Percentage	Number	Percentage
Holarctic species.....	17	28	16	41
Palaeartic —	40	67	6	15
Nearctic —	3	5	17	44
In all...	60	100	39	100

East Greenland, it was to be expected that there would be far more palaeartic species in East Greenland, as Iceland and East Greenland are situated comparatively close to one another. The few palaeartic species in East Greenland, in connection with their sparse occurrence, is a further proof that these species have exclusively immigrated to East Greenland through the air.

The two species: *Tiso aestivus* and *Bolyphantes index*, which are also humid species and belong to the *Linyphiidae* family must, everything considered, have immigrated within the same period as *Caledonia evansi* and *Rhaebothorax morulus*. The latter is closely related to *Rhaebothorax broccha* L. K. (see p. 42), which lives in the Alps. *Tiso aestivus* has a distribution, which greatly reminds of the total distribution of these *Rhaebothorax* species (p. 100, table X, no. 20). However, *Tiso aestivus* is said to have been found at Kamtschatka. The western part of the area of distribution of *Tiso aestivus* completely coincides with the area, where the East-Atlantic boreal fauna element belongs, and as their occurrence in East Greenland exactly resembles the occurrence of this fauna element (p. 73, table VII, no. 30), it is to be supposed that a contemporaneous immigration has taken place.

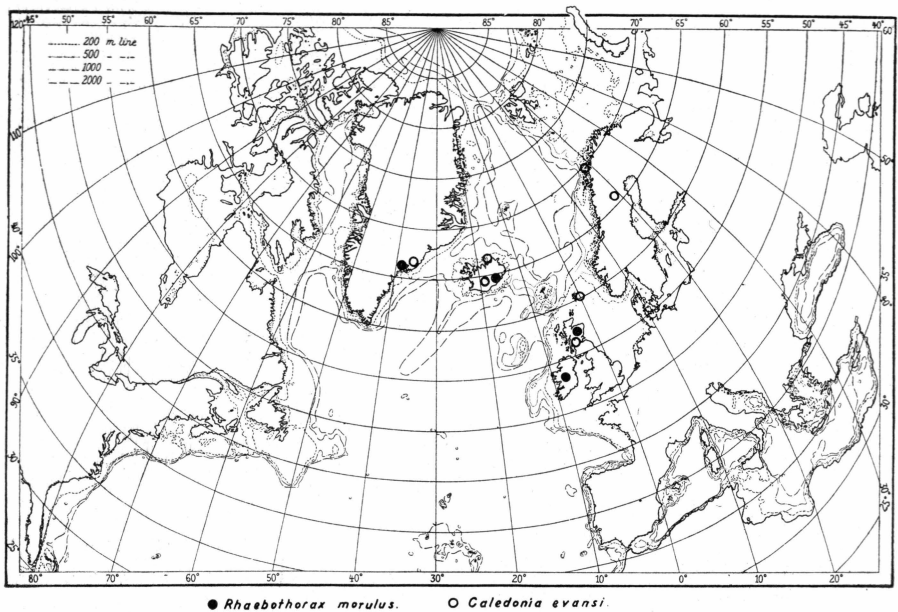


Fig. 48. The distribution of the two typical species belonging to the boreal palae-arctic immigration element.

Bolyphantes index deviates from the other species belonging to this immigration element, in that it is not a boreal but rather a boreo-arctic species (p. 100, table X, no. 19), which outside Iceland is only of alpine occurrence in western Europe. This species, which is not known with certainty (p. 29) from the British Isles, consequently does not belong to the East-Atlantic fauna element. When it must nevertheless be supposed to have immigrated to East Greenland together with the other three, this is partly due to the fact that the species lives in Iceland, and partly to the striking resemblance of its occurrence in East Greenland with that of the others (p. 73, table VII, no. 26).

This immigration element presumably corresponds with the Chironomid element, which SPÄRCK (1943, p. 438) designates as "Eastern arctic-boreal species found in East Greenland but not in West Greenland, and further in Iceland, the Faroes, Scandinavia or boreal Europe".

The Nearctic Immigration Elements.

As formerly mentioned, the facts regarding the occurrence of these species are rather sparse, as compared with what is known of the holarctic and palae-arctic species. Valuable information is, however, supplied by our knowledge of the holarctic and palae-arctic species, as well as of

the climatic-ecological fauna elements, to which the nearctic Greenland species belong, so that it is nevertheless possible to form an authentic idea of the main features of the immigration of the nearctic species into Greenland.

7. The Boreal and Boreo-arctic Nearctic Immigration Element.

This immigration element consists of the following six species: *Pardosa furcifera*, *Enoplognatha intrepida*, *Arctosa insignita*, *Lepthyphantes turbatrix*, *Coryphaeolana lapidicola* and *Erigone whymperi* (p. 101, table X, nos. 23—28). Of these the two former belong to the arid boreal and the remainder to the arid boreo-arctic fauna element (p. 73, table VII, nos. 2, 3, 6, 7, 9 and 10).

It is therefore most likely to suppose that these species have immigrated from a nearctic area together with the boreal holarctic immigration element (table X, nos. 7—11) that is, during the last interglacial period (Riss-Würm). When these nearctic species have not been able to spread to Europe, this must be due to the fact that they belong to a younger fauna element than the holarctic species. The direct connection between North-America and Europe has been interrupted by the Atlantic penetrating northwards at the time when the eastern distribution of the nearctic element became of immediate importance. Instead of this it has, together with the holarctic element, spread northwards under the influence of the dislocations of the coasts, brought about by the northward advance of the Atlantic.

Enoplognatha intrepida and *Lepthyphantes turbatrix* are as yet only known from Greenland, but owing to the nearness of this country to Baffin Land and Labrador it is most improbable that they are endemic species.

Nearctic Immigration in Postglacial Times.

When examining table IX (p. 93) one realizes that the nearctic species, which have penetrated as far as Iceland, are very few in number, three species in all or 5 per cent of all the spiders of Iceland. In Iceland they must constitute a very sparse population. The three species have only been found a few times, and every find is merely represented by comparatively few individuals. CARL H. LINDROTH's large material only comprised four specimens of one of these species (*Islandiana princeps*, BRÆNDEGAARD 1932, p. 22) from two localities in northern and north-eastern Iceland. The two others were recorded by WILL. SØRENSEN (1904, p. 424), one of them (*Pardosa groenlandica*) only being represented by three individuals, which were found between Reykjavik and Myvatn. Of the other species (*Pardosa furcifera*) four individuals have also been found between Reykjavik and Myvatn, and in addition WILL.

SØRENSEN states that E. SIMON has recorded a find of this species from Arnarfjord in the north-western part of the country.

All of these finds originate from western or northern Iceland, that is, the regions nearest Greenland, nor can there be any doubt that these species have immigrated from East Greenland. That only so few nearctic species have reached Iceland points towards a very late, or a postglacial immigration. Two of the species (*Pardosa groenlandica* and *Islandiana princeps*) are pronouncedly humid. For them the climatic-ecological conditions in Iceland would be ideal, but it is nevertheless to be taken for granted that they here constitute a very small fauna element. Whereas *Pardosa furcifera* and *Islandiana princeps* must be called rare in East Greenland, *Pardosa groenlandica* is very common south of Scoresbysund (p. 20). This points in the direction of all of these species having immigrated into Greenland through the air. Consequently they have arrived in Iceland in such a casual manner and at so late a period that they have not been able to find a place to live in Iceland, which at that time was fully populated by hol- and palaeartic species, with the same climatic-ecological requirements.

From this it is possible to conclude that these nearctic species may also have immigrated to East Greenland after the Würm glacial period, when the continental connection between Greenland and Iceland was broken off. They constitute two immigration elements, which have come to Greenland by widely different routes.

8. The Humid Nearctic Immigration Element.

Pardosa groenlandica is typical of this immigration element (p. 101, table X, nos. 29—33), being associated with *Hahnia glacialis*, *Micryphantes n. jacksoni* and *Xysticus durus*, which all belong to the humid fauna element in Greenland (p. 76). *Islandiana princeps*, which otherwise belongs to the eurycous fauna element in Greenland (p. 77) must, according to what is known of its area of distribution, also belong to the humid nearctic immigration element.

In Greenland *Pardosa groenlandica* has a distribution extending from an arctic to a boreo-arctic area. This may also be said of *Islandiana princeps* and with almost equally good justice of *Hahnia glacialis* (p. 73, table VII, nos. 18, 19 and 38). *Micryphantes n. jacksoni*, on the other hand, only occurs as boreo-arctic, and *Xysticus durus* must rather be characterized in the same manner (table VII, nos. 20, 21 and table X, nos. 32, 33). *Hahnia glacialis* is only known from Greenland, and seeing that, as far as is known, it cannot be spread by the wind, it possibly does not at all belong to this immigration group, to which it otherwise corresponds so closely from a climatic-ecological point of view. All the

other species are known from more southerly (boreo-arctic and boreal) nearctic regions.

Unfortunately the knowledge possessed of the distribution of these species on the nearctic continent is, as already mentioned, rather incomplete. As they are more particularly known in Greenland as pronouncedly humid species, there can hardly be any doubt that also outside Greenland they mainly live in humid localities, and New Foundland as well as the Atlantic coasts of Labrador, New Scotland and Maine are those which immediately present themselves. We know that some of them are also of alpine occurrence. In this respect they also suggest the East-Atlantic boreal fauna element, which they must be supposed to reflect from the point of view of geographical placing. It is therefore to be supposed that the species, which we know from Greenland, belong to a boreal and boreo-arctic fauna element, the most northerly outpost of which has come to Greenland after the last glaciation (Würm). This fauna element has presumably, like the East-Atlantic boreal one, developed south of the ice-covered area during the last period of the glacial era. As the last advance of the Würm glacial period, the Baltic advance, did not affect North-America, this wandering towards Greenland along the coasts of the Atlantic may have begun about 60.000 years ago.

9. The Arid Nearctic Immigration Element.

The species, which belong to this immigration element, are all arid arctic. As none of them are known from Iceland or Spitzbergen, it may be taken for granted that East Greenland, north of about 68° lat. N., forms the eastern boundary of this fauna element. These species are also rather sparsely known outside Greenland, but the finds recorded all more or less point towards west (p. 101, table X, nos. 34—38). It is a question of the five species: *Pardosa glacialis*, *Hilaira curvitaris*, *Dictyna borealis*, *Xysticus labradorensis*¹⁾ and *Erigone s. orientalis*, and their distribution area proper is surely arctic America from East Greenland to Alaska. In central and western North-America, where the climate is arid in character, they have been found so far towards south that it must be termed a boreal area (Montana). As to a few of these finds it has,

¹⁾ After this publication had gone into print ALBERT TULLGREEN published "Svensk Spindelfauna 3" (issued by Entomologiska Foreningen, Stockholm 1944). In this publication *Xysticus labradorensis* KEYS. is recorded from Lapland in the very northernmost part of Sweden (Kiruna). Up to the present only one ♂ has been found in Lapland, but this find points towards *Xysticus labradorensis* being a palaeartic and not a nearctic species, as has been taken for granted in the present publication. However, this does not make it less probable that *Xysticus labradorensis* belongs to the arid arctic fauna element, and that it has immigrated from the west together with the arid nearctic immigration element.

however, been stated that they have been made in Rocky Mountains, that is, in an alpine area.

Not the least trace of these species has been found in Iceland, and this is not strange, seeing that they are known to be so pronouncedly arid as hardly to be able to thrive in the Icelandic climate, which everywhere is of a rather pronouncedly humid character. Here the arid nearctic *Pardosa furcifera* has, however, been found, although of sparse occurrence; but *Pardosa glacialis*, which is so extremely common north of Scoresbysund, has never been found here, and it is not likely that it lives in this place. Nor is a single one of these species to be found on Spitzbergen, and here the difference in the climatic-ecological conditions cannot be a sufficient explanation of their non-occurrence.

These species must, as already mentioned, have arrived in Greenland at such a late period that any land connection with Iceland and Spitzbergen had been broken off long ago. We are here evidently confronted with the nearctic immigration element, which was the last to come to Greenland, and it can only have come from the west, that is, across Smith Sund from Ellesmere Land. By this route also came the musk ox (*Ovibos moschatus wardi*), the collared lemming (*Dicrostonyx groenlandicus*), the polar wolf (*Canis lupus tundrarum*), the polar fox (*Alopex lagopus*), the ermine (*Mustela arctica*) and the polar hare (*Lepus arcticus groenlandicus*) (DEGERBØL 1937, pp. 26—28), but why did this immigration element arrive so late?

Also to this an answer may be found in ALFRED WEGENER's theory on the continental drift, which everywhere in the preceding pages has been used as a working hypothesis. Fig. 49 shows the route along which, according to the calculations of WEGENER (1924), the North Pole has wandered from Miocene to the present time. It must not be forgotten that the situation of Greenland in the Tertiary period was so much farther east that it formed one continent together with Spitzbergen and north-western Europe. As Greenland was gradually displaced towards west, it came nearer the Pole, though the latter during the whole of the Quaternary period was situated in a westerly direction in relation to West Greenland. KÖPPEN and WEGENER have later on (1940) made a correction of this Pole route (the dotted line on fig. 49), so that instead of heading towards Disko it trended in a more northerly direction towards the Thule district. Here the Pole route bends sharply in a northern direction and very nearly follows the meridian 50° long. W. to its present situation. Since the Baltic advance the Pole has consequently been situated north of Greenland. Until the Würm glacial period it lay west of Greenland, and once during the Würm glacial period it has moved across the part of Northwest Greenland, which lies opposite to the northernmost part of Ellesmere Land.

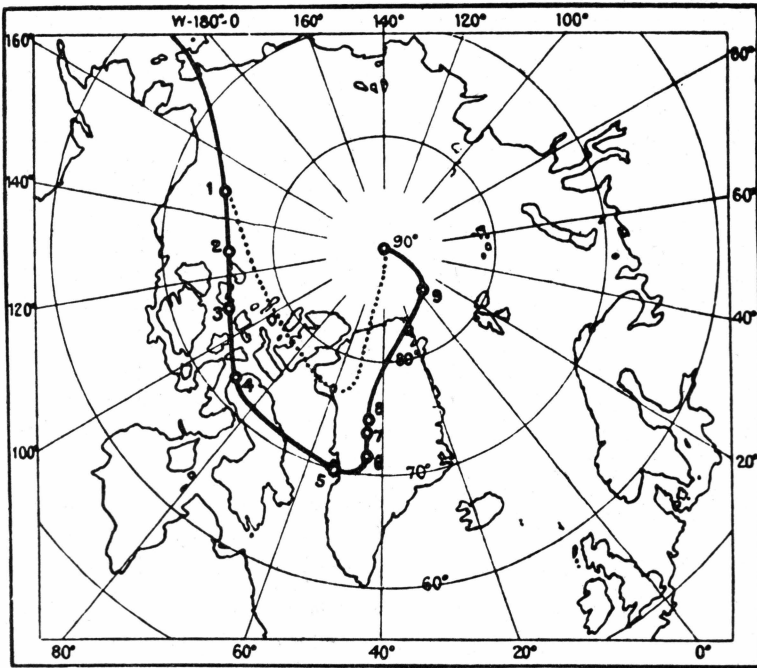


Fig. 49. The route of the Pole in relation to Europe. 1 Miocene, 2—4 Pliocene (4 Kansan), 5 Günz, 6 Mindel, 7 Riss, 8 Würm, 9 Baltic advance (KÖPPEN u. WEGENER 1924 and 1940).

It may be taken for granted that the area nearest the Pole is always sterile. Consequently the Polar area, by means of its situation west of Greenland, has prevented any immigration from west almost throughout the Quaternary period. On its route through the Canadian archipelago and across Northwest Greenland, the Pole extinguished all life in a belt of about 15 degrees of latitude. As it is not known how quickly the displacement of Greenland has taken place, it is possible that the North Pole proper has never been situated in a Greenland area, but also in the Würm-period lay west of the Thule district. The sterile Polar area must, however, at least have extended over the greater part of Northwest and North Greenland. Close upon the wandering sterile Polar area follows an arid arctic fauna element, which at the earliest can have begun to immigrate to North Greenland towards the end of the period of the Baltic advance, that is about 20.000 years ago.

Already in 1928 AD. S. JENSEN maintained that the route across Smith Sund was the most natural one for the postglacial immigration of nearctic species into Greenland. On general principles he is right in this supposition, but as far as the spiders are concerned, only five (13 %) of the species have come by this route. The remainder have come by

Table X. Summary of the geographical distribution of the East Greenland species.

	Other nearctic distribution	West Greenland	East Greenland species	Palaeartic distribution
holartic species	Alaska	69°	1. <i>Microerigone spitsbergensis</i>	Spitzb., N. Zemlya, New Sib. Isl., n. Sib.
	Akpatok, Baffin Ld.	65°-73°	2. <i>Coryphaeolana holmgreni</i>	J. M., B. Isl., Spitzb., N. Zemlya, n. Sib., Kamtsch., n. Norway, Icel., Far., Scot
	Alaska, Ellesmere Ld.	75°-81°	3. <i>Erigone psychrophila</i>	Spitzb., N. Zemlya, Fr. J. Ld. New Sib. Isl., n. Sib. Kamtsch., n. Norway, Far.
	Akpatok	69°	4. <i>Typhochraestus borealis</i>	Spitzb., Swed.
	Akpatok	62°-75°	5. <i>Cornicularia karpinskii</i>	Spitzb., Sib., n. Scand., Gr. Brit., Alp.
	(Akpatok)	67°-69°	6. <i>Micryphantes nigripes</i>	J. M., Spitzb., N. Zemlya, Swed., Far., Scotl., Alp.
	U.S.A., Canada	60°-65°	7. <i>Pardosa saltuaria</i>	(Fennosc., n. Russ., Pol.), Ricseng., Alp., Pyr., Balkan I.
	U.S.A.	60°-67°	8. <i>Drassodes signifer</i>	Icel., Far., Brit. Isl., Azor Europe, w. Sib., Mong.
	Mexico, Canada, Alaska, Labrador	60°-69°	9. <i>Tetragnatha extensa</i>	Whole Palaeartica, N. Zealand
	Akpatok	60°-69°	10. <i>Oreonetides vaginatus</i>	n. Scand., Murm.—Kamtsch. Far., Brit. Isl., Pyr., Alp. Carp.
		60°-69°	11. <i>Dictyna major</i>	Scotl., Denm., Central Eu. Kamtsch.
	Akpatok, Baffin Ld.	60°-70°	12. <i>Hilaira frigida</i>	J. M., Icel., Murm., Far., Brit. Isl., Scand.
	Akpatok	60°-70°	13. <i>Lepthyphantes audax</i>	Icel., Spitzb., Lapl., Scotl. Switz.
	U.S.A., Canada	÷	14. <i>Arctosa alpigena</i>	Icel., Brit. Isl., Scand., Denm. Central Eu., Murm., v. Sib.
	Akpatok	÷	15. <i>Erigone tirolensis</i>	J. M., Brit. Isl., Spitzb., N. Zemlya, n. Sib., Murm. Icel., Swed., Scotl., Alp. Carp.
	Alaska? Ellesmere Ld.?	73°-77°	16. <i>Hilaira glacialis?</i>	Spitzb.
palaeartic species			17. <i>Coryphaeolana thulensis</i>	Spitzb.
			18. <i>Gnaphosa islandica</i>	Icel., Lapl., Finl., Kola P.
			19. <i>Bolyphantes index</i>	Icel., Far., Scand., n. Russ. Sib.
			20. <i>Tiso aestivus</i>	Icel., Scand., Gr. Brit., Tyro. Carp., Kamtsch.
			21. <i>Rhaebothorax morulus</i>	Icel., Brit. Isl.
			22. <i>Caledonia evansi</i>	Icel., Scand., Brit. Isl.

(continued)

Table X (continued).

	Other nearctic distribution	West Greenland	East Greenland species	palaeartic distribution
nearctic species	Labrador	60°-67°	23. <i>Pardosa jurcifera</i>	Icel.
	Canada, Labrador, Baffin Id.	60°-67°	24. <i>Enoplognatha intrepida</i>	
		60°-69°	25. <i>Arctosa insignita</i>	
	Akpatok	60°-70°	26. <i>Lepthyphantes turbatrix</i>	
		61°-70°	27. <i>Coryphaecolana lapidicola</i>	
	Akpatok, Ellesmere Id.	60°-70°	28. <i>Erigone whymperi</i>	
	U.S.A., Labrador	60°-70°	29. <i>Pardosa groenlandica</i>	Icel.
		60°-69°	30. <i>Hahnia glacialis</i>	
	Alasca, U.S.A., Canada		31. <i>Islandiana princeps</i>	Icel.
	Akpatok	60°-64°	32. <i>Micryphantes n. jacksoni</i>	
	U.S.A., Canada	60°-67°	33. <i>Xysticus durus</i>	
	Canada, Baffin Id., Ellesmere Id.	64°-75°	34. <i>Pardosa glacialis</i>	
	Akpatok, Baffin Id.	69°-70°	35. <i>Hilaira curvitaris</i>	
	arc. Canada, Akpatok	60°-74°	36. <i>Dictyna borealis</i>	
U.S.A., Alasca, Canada (Alasca)		37. <i>Xysticus labradorensis</i>		
		38. <i>Erigone s. orientalis</i>	(n. Sib.)	

In Table X the following abbreviations of geographical names are used: n = northern, w = western, Alp. = the Alps, Azor. = the Azores, Balkan P. = the Balkan Peninsula, B. Isl. = Bear Island, Brit. Isl. = British Isles, Carp. = the Carpathian mountains, Central Eu. = Central Europe, Denm. = Denmark, Far. = the Faroes, Fennosc. = Fennoscandia, Finl. = Finland, Fr. J. Id. = Franz Joseph Land, Gr. Brit. = Great Britain, Icel. = Iceland, J. M. = Jan Mayen, Kamtsch. = Kamtschatka, Kola P. = Kola Peninsula, Lap. = Swedish Lapland, Mong. = Mongolia, Murm. = the Murman coast, N. Zealand = New Zealand, Norw. = Norway, N. Zemlya = Novaja Zemlya, New Sib. Isl. = New Siberian Islands, Pol. = Poland, Pyr. = the Pyrenees, Rieseng. = Riesengebirge, Russ. = Russia, Sib. = Siberia, Scand. = Scandinavia, Scot. = Scotland, S. W. As. = Southwest Asia, Spitz. = Spitzbergen, Swed. = Sweden, () around a name means that another race belonging to the same species lives here.

other routes, and several of them have immigrated in interglacial times. Add to this that the nearctic species in East Greenland only amount to 16 (42%), whereas the remainder are holarctic or palaeartic. AD. S. JENSEN was of opinion that the nearctic species were in the majority in Greenland, but as far as the spiders are concerned, this is not the case in East Greenland, and in that respect it will undoubtedly prove that the same holds good of the insects.

Pardosa glacialis, *Hilaira curvitaris* and *Dictyna borealis* also have a rather considerable distribution in West Greenland (table X, nos. 34-36). It is nearly inconceivable that these species in postglacial times should have been able to wander from the Thule district and south along the coast of Melville Bugt. This stretch of coast is, as is well known, nearly devoid of ice-free land, and in a straight line there are more than 500 km from Thule to Upernavik.

The distance across Davis Stræde from Baffin Land and to the region between Holsteinsborg and Egedesminde is a good deal shorter, so that wind-spreading may more easily have taken place along that

route. Besides, the arid nearctic immigration element must have reached Baffin Land at an earlier period than the area at Smith Sund, and the immigration to West Greenland may consequently have taken place at an earlier period from here.

Off the coast between Holsteinsborg and Egedesminde lies, as is well known, "Store Hellefiskebanke", the eastern part of a submarine ridge, which extends right across Davis Stræde to the Cumberland peninsula on Baffin Land. This ridge shows that this is the last place, where the continental connection between Greenland and Baffin Land has been broken off. If we only go as far back as the period between the Würm glacial period proper and the Baltic advance, about 40.000 years ago, Davis Stræde, at least in this place, must have been considerably narrower than it is now, and this has greatly facilitated the immigration. It is therefore probable that the immigration of this fauna element into West Greenland has taken place from Baffin Land at an earlier period than into North and East Greenland.

10. The West Greenland Immigration Element.

As far as East Greenland is concerned, there may still be a question of an immigration element. This element comprises the three species: *Pardosa saltuaria*, *Pardosa furcifera* and *Erigone whymperi*. Each of these species is only represented by a few specimens, found on Milne Land in the interior of the Scoresbysund fjord (p. 73, table VII, nos. 1, 2 and 10). The only find of *Pardosa furcifera* can, as already mentioned (p. 13), not be identified in the collections of the Zoological Museum, but as the species has been found in Iceland, it is very possible that WILL. SØRENSEN'S record is correct.

It has already been mentioned that, owing to climatic conditions, the species cannot live on the southern part of the east coast (p. 72). An immigration to the Scoresbysund area can, therefore, not have taken place from the south. If the immigration had taken place by this route, traces of the immigration, if nothing else, must have been found in the interiors of the comparatively long fjords at Angmagssalik, where great collections have been made, but this is not the case.

It has been mentioned above that the Inlandice proved an almost unsurmountable barrier for the air plankton (p. 72). However, it appears from HELGE PETERSEN'S publication "Extrem hohe Temperaturen und Föhn in Grönland" (1934, p. 289) that air currents may pass across the Inlandice. With these the three species of spiders must have arrived in the Scoresbysund area, and here, in the interior of the fjords, there must thus be such high summer temperatures that these termophilous species are able to survive.

Immigration Conditions of Spiders in Relation to the Immigration of Other Groups of Animals.

It is naturally a problem of some interest, whether the result arrived at by this faunistic and climatic-ecological investigation regarding the immigration of the Greenland spiders also holds good of other groups of animals.

Before entering into the details of this problem we must apprehend clearly that the spiders are all carnivorous, and consequently must have immigrated at the same time as, or later than the animals which have served as food for them. The most likely supposition is that the immigration of the spiders has taken place at a later period than that of the animals, which constitute their food. Furthermore, it must be borne in mind that there is not a single primitive species of spiders in Greenland (p. 61). This also applies to West Greenland, as well as to all other countries with a pronouncedly arctic climate. The Greenland spiders must thus phylogenetically originate from primitive types, which have previously lived in countries with a warmer climate. If they descended from more primitive species, which had lived in the Greenland area at the end of the Tertiary period, we might at least expect to meet with traces of these more primitive types among the Greenland spider fauna, but such traces are entirely lacking. The spider species have thus immigrated into Greenland and, with their ecology also taken into consideration, one inevitably arrives at the result that this immigration must have taken place at a comparatively late period.

The Riss glacial period evidently shows the greatest depression of temperature during the whole of the Quaternary period. It appears from the curve which, on the initiative of KÖPPEN and WEGENER (1924), was prepared by M. MILANKOVITCH, Professor of Applied Mathematics at Belgrad University, that in the Riss glacial period 230,000 years ago a locality situated in 65° lat. N. had so slight an insolation of sunlight as to correspond with what at present prevails in 75°30' lat. N. It is hardly probable that many of the species now populating Greenland can have survived such a deterioration of the climate. One must, therefore, surely take it for granted that most of the species of the Greenland fauna have immigrated after the Riss glacial period, that is, in the later interglacial period or postglacially.

As far as the spiders are concerned, the oldest fauna element undoubtedly consists of the euryoeqous species (p. 86), which live on the herbivorous microfauna (*Collembola* and *Oribatidae*). This is the pre-

vailing opinion among arachnologists as to the food of the *Micro-Araneina*, and I have myself frequently caught a small spider with a *Collembola* in its mouth. It is therefore probable that the primitive *Collembola* and *Oribatids* have immigrated before the euryoecous holarctic immigration element, and so it is not improbable that they were in Greenland before the Riss glacial period. MARIE HAMMER (1944, p. 135) maintains that this fauna in Greenland in the main consists of primitive species, which are very hardy and must consequently have survived the whole of the Quaternary period in Greenland. When she puts forward the opinion that most *Collembola* and *Oribatids* now living in Greenland are preglacial, I do however doubt her being in the right. In these Greenland species nothing in the line of race-formation worth mentioning has been identified, and yet it is a question of species which, according to MARIE HAMMER's view, have lived for nearly a million years in Greenland areas.

As to the *Collembola* 29 of the 41 East Greenland species are known from other nearctic areas. With the exception of one species they are all known from Europe, or in other words, the greater part, viz. 71 per cent of the species are holarctic. Why all of these holarctic species should be of European origin, as MARIE HAMMER maintains, it is difficult to understand. Holarctic species have, however, the possibility of immigrating from more than one quarter, particularly in the earlier part of the Quaternary period, for at that time the sterile polar area was not situated immediately west of Greenland so as to block immigration from that quarter.

As to the *Oribatids* the position is the following (Hammer 1944, p. 58, table 8): of 42 species of *Oribatids* found in East Greenland only 10 are known from any other nearctic area. These ten (24 per cent) are, however, all known from Europe and are thus holarctic species. The remainder with the exception of one n. sp. are only known from Europe. As appears from table IX (p. 93) this is in almost complete contradistinction to the East Greenland spiders. Of these, 44 per cent are nearctic, 41 per cent holarctic and only 15 per cent palaeartic. On the other hand, there are no nearctic species of *Oribatids* in East Greenland, though it is quite unthinkable that the *Oribatid* fauna in Ellesmere Land, Baffin Land or Labrador should not be more or less related to that of Greenland. When this cannot be statistically proved, it seems to be due to lack of knowledge, or only a very slight knowledge of the *Oribatid* fauna of these countries. An examination of MARIE HAMMER's list of literature points in this direction. Naturally attention should be paid to this defective knowledge, and if this is done, the result seems to be that the Greenland *Oribatids*, like the *Collembola*, mainly consist of holarctic species.

The oldest of the immigration elements of the spiders is the euryoecous holarctic immigration element. Nothing can be said as to its origin, and it would perhaps have been more correct, if MARIE HAMMER had also refrained from expressing an opinion on the origin of the Collemboles and the primitive Oribatids, instead of letting them undertake a "Wegnerian passage" from Europe to the present geographical position of Greenland.

There are, however, in the Godthaab—Julianehaab area nine species of Oribatids, which have not been found elsewhere in Greenland (HAMMER 1944, pp. 52—53, table 6). These species clearly have a distribution in Greenland, which corresponds with the arid boreal and the arid boreo-arctic fauna element among the spiders (pp. 72 and 74). Most of these Oribatids are only known from West Greenland and Europe. Their known distribution corresponds, for the greater part, with the distribution of the 19 species of Chironomids, which are mentioned on p. 89, and which must be supposed to have immigrated into Greenland from a nearctic area, together with the boreal holarctic immigration element among the spiders (p. 87). It is therefore most natural to suppose that these Oribatids for the greater part have also immigrated together with this element of immigration. One of the species, *Notaspis coleoptratus*, is furthermore known from North America. These species of Oribatids, which are only known from South and Southwest Greenland are also more highly specialized forms (HAMMER 1944, p. 172). This is presumably a further reason to suppose a later immigration than in the case of the other Oribatids. Two of the species, viz. *Hermannia scabra* and *Notaspis punctatus*, which are also known from Iceland can, however, have been carried to Greenland by the old Norsemen in medieval times.

Still, there are not many points of similarity between the immigration conditions of the Collemboles and Oribatids and those of the spiders, but as already shown (pp. 89, 92 and 94) it is possible to find a fairly accurate correspondence between the immigration routes of the spiders and those of the Chironomids. This seems to suggest that the spiders must be compared with the phylogenetically most highly specialized groups of animals, if one wants to find zoogeographical points of similarity.

Table XI A (p. 106) gives a summary of the Greenland distribution of five arid arctic spiders. The arid arctic fauna element (pp. 74—76) otherwise consists of seven species, but the two species, *Hilaira glacialis* and *Coryphaeolana thulensis*, which belong to an entirely different immigration element (p. 92) are not included in this table. When these species, with the exception of *Pardosa glacialis*, are not known from the Thule district and none of them from the north coast of Greenland, this is

Table XI. The distribution of three arid arctic groups of animals in Greenland.

Names of species	West Greenland	The Thule district	North coast of Greenland	East Greenland
A. Arid arctic spiders.				
<i>Xysticus labradorensis</i> ...	÷	(+)	(+)	76°50'–70°15'
<i>Erigone sibirica orientalis</i>	÷	(+)	(+)	76°50'–70°15'
<i>Hilaira curvitaris</i>	68°45'–70°35'	(+)	(+)	76°50'–70°25'
<i>Pardosa glacialis</i>	64°10'–74°44'	78°20'	(+)	76°50'–68°
<i>Dictyna borealis</i>	59°55'–74°	(+)	(+)	76°50'–68°05'
B. Arid arctic land mammals.				
<i>Ovibos moschatus wardi</i> ..	÷	extinct	+	87°30'–70°30'
<i>Canis lupus tundrarum</i> ..	÷	÷	+	87°30'–70°30'
<i>Mustela arctica</i>	÷	÷	+	87°30'–69°40'
<i>Dicrostonyx groenlandicus</i>	÷	÷	+	87°30'–69°
<i>Lepus arcticus</i>	+	+	+	87°30'–68°45'
<i>Rangifer tarandus</i>	+	+	÷	extinct
C. Arid arctic Lepidoptera.				
<i>Plebeius aquilo</i>	+	(+)	(+)	76°50'–70°40'
<i>Sympistis zetterstedti</i>	67° –72°45'	77°50'	(+)	76°50'–68°30'
<i>Pyrausta torvalis</i>	62°40'–c. 73°	76°46'–77°50'	(+)	76°50'–69°10'
<i>Byrdia groenlandica</i>	61°13'–c. 73°	76°30'–78°20'	83°10'	76°50'–70°30'
<i>Brenthis chariclea</i>	60°49'–c. 73°	77°50'–78°20'	(+)	76°50'–65°35'
<i>Colias hecla</i>	60°30'–c. 73°	77°50'	81°30'	76°50'–68°42'

(+): The species not yet identified, but must be supposed to live here.

due to the fact that collections of spiders have practically not (the Thule district) or never (the north coast) been made in these regions. It may, however, almost be taken for granted that they live on the north coast, seeing that they must have immigrated into East Greenland from the west (pp. 97–101), and then the north coast with its large ice-free areas is the most natural route of passage.

The three species, *Hilaira curvitaris*, *Pardosa glacialis* and *Dictyna borealis* also live in West Greenland, but these species have hardly come from the Thule district to West Greenland along the inhospitable coast of Melville Bugt. They must be supposed to have crossed Davis Stræde from Baffin Land at the end of the Würm-glacial period (pp. 101–102).

Table XI B is a summary of all Greenland mammals, with the exception of the polar fox (*Alopex lagopus* L.) and the polar bear (*Ursus maritimus* PHIPPS). HERLUF WINGE (1902, p. 357) says of the land

mammals of Greenland that they belong to the most highly specialized among the related animals. Furthermore, as they belong to a highly specialized class of animals, one must be justified in calling them species which from a phylogenetical point of view have even reached a very high degree of specialization. When the polar bear is not included in table XI, this is due to the fact that it is not in the proper sense of the word a land mammal, but is rather connected with the drift ice.

When comparing the tables XI A and B one cannot help being struck by the great similarity existing in the conditions of distribution of the two groups in Greenland. This similarity must be explained by the fact that the six species of mammals, as also the five species of spiders, from a climatic-ecological point of view belong to the arid arctic fauna element (pp. 74—76).

Like the arid arctic spiders the land mammals in East Greenland have not been distributed much farther south than Scoresbysund. It is true that a few foot prints of musk ox (*Ovibos moschatus wardi* LYD.) have been found along the stretch between Kap Brewster and Kap Dalton (DEGERBØL 1937, p. 13), but these clearly originate from some roaming steers. Breeding flocks have never crossed the Scoresbysund fjord. The polar wolf (*Canis lupus tundrarum* MILLER) has the same distribution as the musk ox, seeing that the latter constitutes its chief food (JENSEN 1928, p. 38). Its foot prints, like those of the musk ox, have also been seen as far south as Kap Dalton (DEGERBØL 1937, p. 14).

The ermine (*Mustela arctica* MERR.) is dependent upon the collared lemming (*Dicrostonyx groenlandicus* TRAILL), in the same manner as the polar wolf is dependent upon the musk ox. Burrows and excrements of the collared lemming have been met with as far south as d'Aunay Bugt (DEGERBØL 1937, p. 13). It must evidently live rather constantly a little south of Scoresbysund, and this also applies to the ermine. On Turner Ø several ermines have been observed both by SØREN JENSEN and by ALVIN PEDERSEN (DEGERBØL 1937, p. 14).

Traces have been found of the snow hare (*Lepus arcticus groenlandicus* RHOADS) in the shape of excrements as far south as at Søkongens Bugt, but of this, as of all the arid arctic animals, it holds good that they are rare south of the Scoresbysund fjord. AD. S. JENSEN (1928, p. 40) mentions as a peculiar feature of the snow hare that upon the whole it becomes more numerous the further north one gets. This is correct and not at all peculiar when once it has been realized that the snow hare is an arid arctic species. This i. a. means that it is a heliophilous animal, which thrives badly in the more southerly, rainy regions with a clouded sky, nor is it probable that it is able to live in regions, where its fur is frequently made wet through and through. In continuation of JENSEN's statements, which have been quoted above, it is said

to have been met with on the rocks right down to the outer coast, but in the main it keeps to the interior of the country. This latter statement has clearly a bearing upon West Greenland, where the snow hare prefers the arid hinterland, and it is evidently the presence of the latter in West Greenland which has made it possible for the snow hare to live as far down as the very southernmost regions of West Greenland. Its distribution corresponds rather closely with that of the spider *Dictyna borealis*, and the cause is evidently the same, viz. the special climatic-ecological conditions in the West Greenland hinterland.

It is true that the polar hare living in West Greenland belongs to a different race (*Lepus arcticus porsildi* NELSON) which, like all other hares, has orthodont front teeth, whereas the North Greenland hare (*L. a. groenlandicus* RHOADS) has proodont front teeth, (BRÆSTRUP and DEGERBØL 1934). BRÆSTRUP and DEGERBØL are, however, of the opinion that the West Greenland hare descends from the North Greenland one. It must thus have immigrated to West Greenland along the inhospitable coasts of Melville Bugt and not across Davis Stræde from Baffin Land. The two authors are presumably right in this supposition. Along the Melville coast the reindeer (*Rangifer tarandus* L.) must also have come to West Greenland. The immigration of these two animals must be supposed to have taken place in the postglacial warm period, which AD. S. JENSEN and POUL HARDER (1910) proved to have existed in Greenland, and which is possibly contemporaneous with the Scandinavian Tabes- or Litorina-period. The polar hare and the reindeer have thus arrived in West Greenland at a later period and by another route than the three arid arctic species of spiders, which must be supposed to have immigrated from Baffin Land (pp. 101—102).

Thus it is only the polar hare and the reindeer which have managed to cover the stretch along the coast of Melville Bugt. The collared lemming and the musk ox were not able to do it, and so the ermine and the polar wolf did not come to West Greenland either. For that matter there is no doubt that both the collared lemming and the musk ox would be able to live under the climatic-ecological conditions found in the West Greenland hinterland.

Of the six arid arctic land mammals found in Greenland the reindeer evidently is best able to bear living under humid conditions. It has thus formerly lived at Angmagssalik, but is now exterminated there (JENSEN 1928, p. 36).

The musk ox is beyond doubt the most pronouncedly arid arctic species of all the Greenland land mammals, as was clearly proved when an attempt was made in 1929 to transfer it to Iceland. An expedition was fitted out at great cost, and it succeeded in bringing back eight calves, but in order to achieve this result it had been necessary to shoot

thirty-four adult oxen (JENSEN 1929). The fate of the eight calves in the humid Icelandic climate was unfortunately deplorable. They could not bear going about with their fur nearly always wet through. Their power of resistance was gradually weakened, and in the course of a few years they all died from an infectuous disease, which also attacks the Icelandic sheep.

The polar fox is the only one of the Greenland land mammals proper, which does not belong to the arid arctic fauna element, as it lives all along the coast, both on the pronouncedly oceanic coast of Southeast Greenland, in the arid area north of Scoresbysund and on the north coast as well as along the whole of the west coast. In contradistinction to the other land mammals the polar fox belongs to the euryoecous fauna element. When it has obtained such a wide distribution in Greenland, this is not only due to the fact that it is able to live under the most different climatic-ecological conditions, as long as there is sufficient food in the place, but also that it is distinctly given to roam about without allowing itself to be checked even by apparently insurmountable obstacles. Thus traces have been found of several animals on the ice far out in the Polar Sea in 85° lat. N. (NANSEN 1897, II, pp. 69—73), and J. P. KOCH (1913, p. 237) found fresh traces of foxes right in the middle of the Inlandice. BRÆSTRUP (1941, p. 31) mentions the latter record and many others from the ice along the coasts of Greenland, one of them dating from Baffin Bugt, about 200 km west of Upernavik. The occurrence of the polar fox in Iceland is beyond doubt due to the fact that it has arrived with the drift ice from Greenland (DEGERBØL 1937, p. 26).

It must be regarded as a fact that all the arid arctic land mammals, with the exception of the reindeer, have immigrated from the Canadian archipelago across Smith Sund and the Kennedy and Robeson Kanal. As to this both HERLUF WINGE (1902), AD. S. JENSEN (1928) and M. DEGERBØL (1937) are agreed, and it further corresponds with what has been mentioned (pp. 97—101) as to the arid nearctic immigration element. The polar fox has surely in the main followed this route, although it must be admitted that it also can enter by other routes, as for instance across Davis Stræde. According to A. JACOBI (1931) the reindeer must be supposed to have immigrated from the east via Spitzbergen.

When looking at another phylogenetically highly specialized order, viz. *Lepidoptera*, it is also possible among its Greenland species to find a number which may, with some justice, be called the arid arctic *Lepidoptera* (p. 106, table XI C). A comparison between tables XI A, B and C clearly show the striking agreement.

To the arid arctic *Lepidoptera* belong three of the four butterflies of Greenland: *Brenthis chariclea* SCHNEID., *Colias hecla* LEF. and *Plebeius aquilo* Bdv.

The arctic Yellow (*Colias hecla*) is known from Kap Daussy in East Greenland and from here along the east and north coasts as far as West Greenland, where it has been met with as far south as the Lichtenau fjord (60°30').

Brenthis chariclea is met with on the east coast, as far south as in the Angmagssalik area, where there is a comparatively broad hinterland, into which the Sermilik fjord extends. Here it has been taken in several specimens and in several localities. It is evidently rare in the neighbourhood of the coast, where the mission and trading station is situated, for as DEGERBØL (1937, p. 10) reports: "Pastor ROSING of Angmagssalik, when directly questioned by me, said that he had never, or perhaps only once, seen *Argynnis* (*Brenthis*) butterflies in the Angmagssalik district." Besides it has been found in the very interior of the fjord of Kangerdlugssuatsiaq, in Kangerdlugssuaq and in the fjords on the Blossville coast. North of Scoresbysund it is the most commonly occurring butterfly. As it has been found in the Thule district, it presumably also lives along the north coast of Greenland. On the west coast it is found as far south as the Julianehaab district.

Plebeius aquilo is only known from the northernmost part of the west coast. It must be supposed to live in the Thule district and along the north coast of Greenland, but it has never been found here. In East Greenland it is the only butterfly exclusively known from the region north of Scoresbysund. It is presumably the most pronouncedly arid arctic butterfly in Greenland.

JENSEN (1928, p. 74) states that *Colias hecla* and *Brenthis chariclea* are rare on the west coast south of 68°30'. This is surely owing to the fact that comparatively few collections have been made in the arid hinterland, which is their natural resort as well as that of the other arid arctic animals.

Besides from Greenland *Byrdia groenlandica* is only known from Grinnell Land. HENRIKSEN and LUNDBECK (1917, p. 676) are, however, not quite certain that it lives in Grinnell Land, as there is a possibility of its having been mistaken for the closely allied species *Byrdia* (*Dasychira*) *rossii* CURT. The others have either an arctic circumpolar distribution, or are known from arctic North America and northern Europe. They have, however, surely all in the postglacial period immigrated by the same route as the arid arctic spiders and mammals, which supposition is proved by the wandering of the Pole (pp. 98—99). It is, however, very likely that the immigration to West Greenland has taken place across Davis Stræde from Baffin Land. As far as the spiders are concerned, an account has already been rendered of an immigration of this kind (pp. 101—102).

This summary (p. 106, table XI C) does not claim to comprise all the arid arctic *Lepidoptera* of Greenland, seeing that such species as are only known from a few finds have been left out, and this also applies to all the subsequent attempts to group the species from other groups of animals into the different fauna elements. To do this in the same manner as has been done for the spiders, is the work of a lepidopterologist entirely familiar both with the details of the distribution of the species and their ecology. Perhaps it can only be done with full certainty, when the collection outlined on p. 78 has been made. A similar reservation it is naturally also necessary to make within the other orders, which will be mentioned in the following.

The beautiful lady bird (*Coccinella transversoguttata* FALDERM.) is found both on the west coast (60°—70°25') and on the east coast (60°25'—63°26', 65°30'—65°50' and 70°30'—73°40'), besides having a holarctic distribution, extending in western America as far south as California and Mexico; it must be a comparatively arid species which in Greenland lives both in boreo-arctic and in arctic areas, and it is the most likely supposition that it has partly spread actively from the west coast to the southern east coast and from there farther north, where it is only known from the least humid areas. Thus, it is not known from the Blossville coast, but has been found most frequently in the Angmagsalik area, where also other not too pronouncedly arid animals (*Rangifer tarandus*, *Brenthis chariclea*) have lived until lately or are still living. The lady bird surely belongs to the arid nearctic immigration element and has not immigrated into Greenland by the most northerly route, but as is more probable, it has come to West Greenland from Baffin Land (pp. 101—102).

The arid arctic fauna also comprises the two species of bumble bees living in Greenland, where their distribution is typical of this fauna element. *Alpinibombus hyperboreus* SCHÖNH. has been found in the whole of West Greenland, from Julianehaab (60°43') in the south and as far as the Thule district (78°17') in the north. On the north coast; where it was taken in Vildtland (81°30'), it also lives, and on the east coast its most southerly occurrence is Søkongens Bugt (68°42'). *Alpinibombus arcticus* KBY. has nearly the same distribution. In West Greenland it has, however, been found still farther south (59°55') and on the north coast still farther north, viz. at J. P. Kochs Fjord (82°50'), whereas its known distribution in East Greenland is exactly the same as that of the preceding species. They are both arctic circumpolar species, but it is probable that they have immigrated into Greenland together with and in the same manner as the arid nearctic immigration element among the spiders (pp. 97—101).

As the sterile Polar area in the Würm glacial period has hardly had a diameter of more than at most 15 degrees of latitude, there is a possibility that all animal life has not been extinguished in those parts of North Greenland, which are farthest from the route of the Pole (fig. 49, p. 99), that is, in the regions round Scoresbysund. Here one would thus expect to meet an older fauna element, which in postglacial times can have spread farther north. It was to be expected that this fauna element more particularly consisted of palaeartic or holartic species, which now are to be found at Spitzbergen, Novaja Zemlya and in the tundra regions of Eurasia. Among the spiders there was one (*Coryphaeolana thulensis*), perhaps two species which might be explained as belonging to such a fauna element (p. 92). Among the Chironomids in East Greenland the corresponding element would consist of twelve species (SPÄRCK 1943, p. 436).

The arid arctic fauna element (pp. 74—76) is, as might be expected, only sparsely represented by the Greenland beetles. *Gnypeta cavicollis* J. SAHLB. which is only known from East Greenland (70°40'—74°40') and Siberia must, it is true, presumably belong to this climatic-ecological fauna element but, judging by the distribution, it must belong to the arid arctic Spitzbergen element (p. 92) and not to the arid nearctic immigration element (pp. 97—101) dating from a somewhat later period.

Table XII. *Lepidoptera*, which in Greenland are only known from Northeast Greenland.

Names of species	Distribution	
	In East Greenland	Outside Greenland
<i>Brenthis polaris</i> BSD.	69° —c. 82°	Circumpolar
<i>Argyroploce groenlandicana</i> BANG HAAS. ...	70°27'—76°50'	÷
<i>Argyroploce boreana</i> REB.	70°27'—76°50'	Arctic America

The three species of *Lepidoptera* which are mentioned in the summary (table XII) seem to correspond with the arid arctic Spitzbergen element i. a. the butterfly *Brenthis polaris*. As to the two species of *Argyroploce* the distribution outside Greenland is presumably not sufficiently well known to give any support of importance from a zoogeographical point of view.

From Greenland not a single *Lepidoptera* species is known which can with certainty be referred to the humid fauna element.

As to the beetles (*Coleoptera*) the zoologists, who have occupied themselves with the zoogeography of Greenland, are all very interested in the weevil *Otiorrhynchus arcticus* O. FABR. JENSEN (1928, p. 15) is

apt to think that together with *Otiorrhynchus (dubius) nodosus* O. FABR. and five other species it has been carried from Iceland by the Norsemen in medieval times, because it more particularly occurs in south-western Greenland and by preference beneath the stones of old ruins. It is probable that JENSEN is right, when he says that the Norsemen have brought in these and other species from Iceland, but as far as the two species of *Otiorrhynchus* are concerned, it is practically certain that they have lived in Greenland long before the Norsemen settled there, so that the bringing in was of no zoogeographical importance. DEGERBØL (1937, p. 35) is of the opinion that *Otiorrhynchus arcticus* has immigrated from Europe in interglacial times.

Now it is known (HENRICHSEN 1939, p. 47) that *Otiorrhynchus arcticus* was much more widely distributed in Greenland, than was the prevailing opinion at the time when JENSEN and DEGERBØL wrote their treatises. In East Greenland it has been identified from Ravns Fjord (68°30') as far as Igdlut near Kap Farvel (59°50') and in West Greenland from Ilua (59°55') as far as Agpat at Ũmánaq (70°55'). As *Otiorrhynchus arcticus* is wingless, it cannot have spread actively through the air, and it is far too heavy to occur as air plankton; therefore, it is quite impossible that it can have spread from the old eastern and western settlement (60°40' and 64°10'), as far as Ũmánaq and the Blossville coast, within the comparatively short time elapsed since the immigration of the Norsemen in the Middle Ages.

In actual fact it lives along the whole of the humid part of the coast of Greenland, and its distribution nearly coincides with that of the spider *Hilaira frigida* (table VII, p. 73). When regarding the distribution of *Otiorrhynchus arcticus* outside Greenland one becomes entirely persuaded that, like *Hilaira frigida*, it must belong to the humid fauna element (p. 76). LARS BRUNDIN (1934, p. 186) describes the distribution of *Otiorrhynchus arcticus* in the following manner: "Greenland, Iceland, the Faroes, the Shetland Isles, the northern part of the British Isles, Fennoscandia, the northern coast of Russia from Kola to Kanin, the Pyrenees, Auvergne, the Sudetes and the northern and eastern Carpathian mountains. In Fennoscandia and northern Russia *Otiorrhynchus arcticus* is a pronounced coast species." Thus it is a definitely oceanic species in northern and western Europe, but it is also of alpine occurrence in Central Europe. What is known of *Otiorrhynchus arcticus* points in the direction that, as far as Greenland is concerned, it also must belong to the humid holarctic immigration element (pp. 89—91 and fig. 47). The only thing lacking is that there is as yet no record of it from the Canadian archipelago and the north-eastern American continent. It is almost unthinkable that it should not be found in these areas which are situated so close to Greenland. When we do not know

that it is to be found here, this must be due to the fact that the land Arthropods of these areas are still so little known. It is most probable that in nearctic areas it lives as far south as New Foundland.

If one takes it for granted that *Otiorrhynchus arcticus* belongs to the humid holartic immigration element, it must have had a holartic distribution early in the Quaternary period, and its immigration to Greenland must have taken place as described above (p. 90). Thus *Otiorrhynchus arcticus* has not immigrated from Europe to Greenland across an interglacial land bridge, but when the land connection was broken off, it was on the bridge. It is, therefore, natural that it lives in Iceland, the Faroes and the Shetland Isles, which are the last remainders of this land connection.

To the humid fauna element undoubtedly also belong the two beetles: *Micralymma brevilingue* SCHIØDTE (West Greenland: 59°55'—73°05', East Greenland 65°59'—73°40') and *Byrrhus fasciatus* FORST. (West Greenland: 59°55'—69°13', East Greenland: 65°32'—68°05'). The former is, however, only known from Greenland; but *Byrrhus fasciatus* is holartic, and as it is known from Iceland, the Faroes, New York, New Foundland and Labrador, it must be taken for granted that it belongs to the humid holartic immigration element.

Table XIII. Boreal and boreo-arctic Lepidoptera from West Greenland.

Names of species	Distribution	
	In West Greenland	Outside Greenland
<i>Eupithecia? altenaris</i> STAUD.	60° —61°13'	holartic
<i>Acella maccana</i> TR.	60°49'	holartic
<i>Amphitrota unicolor</i> WALK.	61°	holartic
<i>Rhyacia occulta</i> L.	60°30'—67°	holartic
<i>Syngrapha diasema</i> BSD.	60°43'—68°37'	holartic
<i>Rhyacia quadrangula</i> ZETT.	60°43'—70°40'	Iceland, Labrador, Nova Scotia

Among the insects it is also possible to demonstrate some groups, which belong to south-western Greenland and correspond with the arid boreal and the arid boreo-arctic fauna element among the spiders (pp. 72—74).

As appears from table VII (p. 73), the first ten spiders belong to these two fauna elements, and here it also appears that they are all known from the very southernmost part of East Greenland (p. 72). The six *Lepidoptera* mentioned in table XIII evidently belong to the same fauna elements. Of those only one, *Rhyacia occulta*, is also known

from East Greenland (60°15'—61°30'), but when more thorough collections have been made, it may appear that the other five species also occur in the very southernmost part of the east coast. Of the species mentioned in table XIII the first five must be boreal and only the last one boreo-arctic.

Table XIV. Boreal and boreo-arctic *Coleoptera* from West Greenland.

Names of species	Distribution		
	In West Greenland	In East Greenland	Outside Greenland
<i>Acrotona jungi</i> GRAV.	60°59'—61°13'	÷	holarctic
<i>Atheta islandica</i> KRAATZ.	60°—61°35'	÷	palaeartic
<i>Quedius boops</i> GRAV.	60°—62°	÷	palaeartic
<i>Nebria gyllenhali</i> SCHÖNH.	60°—64°05'	÷	holarctic
<i>Patrobis septentrionis</i> DEJ.	59°55'—64°45'	60°05'—63°25'	holarctic
<i>Trichocellus cognatus</i> GYLL.	59°55'—64°45'	60°15'—60°25'	holarctic
<i>Otiorrhynchus nodosus</i> O. FABR. ..	59°55'—67°	60°05'—60°35'	palaeartic
<i>Gyrinus opacus</i> SAHLB.	60°—67°	÷	holarctic
<i>Simplocaria metallica</i> STURM.	60°—68°49'	÷	palaeartic

Whereas, as was to be expected, there were few *Coleoptera* in Greenland which could be referred to the arid arctic fauna element, there are in contrast many boreal or boreo-arctic beetles, which in Greenland have a distribution closely corresponding with that of the arid boreal and the arid boreo-arctic spiders (pp. 72—74 and table VII, nos. 1—10); but while these spiders may be defined as a group of thermophilous or heliophilous species, which are indigenous to the more continental and arid hinterland of West Greenland (p. 72), and most of them may with justice be said to be both heliophilous and thermophilous, conditions are entirely different in the case of the beetles. Among them there is only one species which is heliophilous, and that is the whirligig, *Gyrinus opacus*, which lives on the surface of the water. All the others are afraid of light and lead a hidden life beneath stones or vegetation, only emerging freely at dusk or in the night. There can, however, be no doubt that they are thermophilous animals, which particularly in West Greenland are mostly thrown back upon the arid hinterland in the southern part. They may, therefore, justly be referred to the arid boreal or the arid boreo-arctic fauna element (table XIV). As they are all holarctic or palaeartic species, they must be classed with the boreal holarctic immigration element (pp. 87—89 and fig. 46).

As no high arctic species proper are known among the *Coleoptera*, there is not a single euryoecous species among the Greenland beetles.

Among the *Lepidoptera* there is, on the other hand, one species, *Anarta richardsoni* CURT., which can with certainty be referred to the euryocean fauna element (p. 77). This species is in actual fact known from all the ice-free areas of Greenland (West Greenland: $61^{\circ}35'$ —c. 73° , the Thule district: $77^{\circ}50'$, the north coast: $81^{\circ}30'$ — $81^{\circ}50'$ and East Greenland: $76^{\circ}50'$ — $61^{\circ}45'$).

As to the *Diptera* R. SPÄRCK (1943) has dealt with the Chironomids from a zoogeographical point of view. A comparison between SPÄRCK's results and the zoogeographical conditions of the spiders has been undertaken earlier in this treatise (pp. 79, 89, 92, 94). In the case of the other *Diptera* most of the species occurring in Greenland have been found in so few localities that it is impossible with certainty to refer them to any definite Greenland climatic-ecological fauna element. A number of them (32) are only known from Greenland, and for most of the others the distribution outside Greenland is so imperfectly known that it is difficult, with a fair degree of certainty, to pronounce any opinion as to their routes of immigration.

East Greenland and Iceland.

In conclusion it will be natural to make a comparison with the fauna of Iceland, the nearest neighbour of East Greenland towards east.

CARL H. LINDROTH (1931, pp. 504—505) makes the following statement: "Schon an dieser Stelle kann jedoch festgestellt werden, . . . dass die isländische Insektenfauna europäisch ist. Dies gilt prinzipiell für die isländische Landfauna als Ganzes, so dass jeder Versuch, in dieser Beziehung Island zu den arktischen Inseln zu rechnen, als unnatürlich betrachtet werden muss." It appears from table IX (p. 93) that the spider fauna of Iceland is also in the main of European origin, 40 (67 per cent) of the species of spiders of Iceland being of palaeartic origin, and 17 (28 per cent) holarctic. Only 3 nearctic species of spiders (5 per cent) have been found in Iceland. As a number of the holarctic species have probably also immigrated to Iceland from the east, LINDROTH is surely in general right in his supposition that the Icelandic fauna is mainly European and boreal.

LINDROTH (1931, pp. 567—570) is however mistaken when, relying upon HENRIKSEN and LUNDBECK (1917), he takes it for granted that the land Arthropod fauna of Greenland is of European origin. As appears from table IX (p. 93), this cannot apply to the spiders of East Greenland, for of those only 6 species (15 per cent) are of palaeartic, whereas 17 species (44 per cent) are of nearctic origin. It is true that there are nearly as many holarctic species of spiders, viz. 16 (41 per cent) in East

Greenland, but as has already been elucidated in this treatise under conditions of immigration, it is not possible in the case of Greenland, as in that of Iceland, to take it for granted that the holarctic species practically all have immigrated from Europe.

There is no reason to doubt that LINDROTH is right in maintaining that the Islandic land Arthropod fauna has in the main immigrated from Europe in an interglacial period; but when he elaborates this thought further and says (1931, p. 569): "Dies muss den Gedanken auf die Möglichkeit richten, dass diese selben Arten interglazial ihre Wanderung aus Europa über Island noch weiter bis Grönland fortgesetzt haben," then he cannot be right, for if this was so, there would be far more than the 6 palaeartic species of spiders actually found in East Greenland. Nor can the idea be correct, though for quite other reasons, that an essential part of the fauna of Greenland should have wandered from Europe across Iceland to Greenland in interglacial times.

In the middle and last part of the Quaternary period (Mindel, Riss and Würm) the situation of the North Pole was west of or above Northwest Greenland (fig. 49, p. 99). A straight line from the Thule district across Iceland will strike the British Isles. On this stretch such a line at present cuts the meridians from 60° long. W. to 0°, but at that time it nearly coincided with a meridian. This means that the western part of Central Europe in that period was situated due south of Iceland, whereas Greenland, which is now situated west of Iceland, was at the same time due north of it.

In the last interglacial period (Riss-Würm) the North Pole must have been situated slightly west of or above the Thule district proper. The result is that north-western, northern and north-eastern Greenland has been dominated by the sterile Polar area (p. 99), whereas the Scoresbysund area and the Blossville coast must have been situated south of this area, but with an arctic climate very nearly corresponding with what is now found in the Thule district and along the north and north-east coast of Greenland. It is therefore easily understood that boreal and boreo-arctic species of European origin during their advance towards north in the interglacial period have not been able to spread farther than to Iceland, even though, as late as the end of the last interglacial period, there has been a continental connection between Iceland and the Blossville coast.

In postglacial times all continental connection between Greenland and the palaeartic area has been entirely broken off (cf. p. 96), and therefore the nearctic immigration which only reached East Greenland and Northeast Greenland in late-glacial and postglacial times (pp. 96 and 99) was checked in its distribution towards east by Danmark Stræde and Grønlandshavet. Only some few nearctic species have, in

postglacial times, crossed Danmark Stræde to Iceland in the shape of air plankton (p. 96).

It is therefore easily understood that there are so few nearctic species in Iceland. Of the Icelandic *Coleoptera* fauna, which according to LINDROTH (1931, pp. 165—237) consists of 144 species, only one is nearctic, viz. the species *Phymaphora pulchella* NEWM. It is, however, doubtful whether this species has been found in Iceland (LINDROTH 1931, pp. 219—220), but if so, it must at least be a species which has come there by chance; at any rate it has not, for climatic and ecological reasons, been able to become a native of Iceland, and so it will be most correct to say that there is not a single nearctic beetle living in Iceland. Among the *Lepidoptera* fauna there is, however, one nearctic species (*Rhyacia quadrangula* ZETT.) which is indigenous to Iceland. As there are in all 50 species of *Lepidoptera* in Iceland, this consequently corresponds with 2 per cent of all Icelandic *Lepidoptera*. On the other hand, the nearctic element of *Araneina* amounts to 3 species (table IX and p. 93), which corresponds with 5 per cent of the entire spider fauna.

That the beetles in this respect occupy a special position as compared with *Lepidoptera*, and more particularly with *Araneina* is easily understood, when one realizes that, as contrasted with *Lepidoptera* and more particularly with *Araneina*, only a few species of *Coleoptera* can have immigrated through the air as plankton.

LITERATURE

- BISHOP, S. C. and CROSBY, C. R.: Revision of the Spider Genera *Erigone*, *Eperigone* and *Catabrithorax*.—New York State Mus. Bull. No. 278, Albany, N. Y. 1928.
- Aeronautic Spiders with a Description of a New Species.—*Jour. New York Ent. Soc.*, vol. XLIV, 1936.
- A New Genus of Spiders in the *Erigoneae*.—*Proc. Biol. Soc.* vol. 49, Washington 1936.
- BLACKWALL, JOHN: Observations and Experiments, made with a view to ascertain the Means by which the Spiders effect their aerial Excursions.—*Trans. Linn. Soc. London*, vol. XV, 1827.
- BRISTOWE, W. S.: The Fauna of the Arctic Island of Jan Mayen.—*Ann. Mag. Nat. Hist.* ser. 9, vol. XV, London 1925.
- The Distribution and Dispersal of Spiders.—*Proc. Zool. Soc.*, London 1929.
- The Spiders of the Orkney and Shetland Islands.—*Proc. Zool. Soc.*, London 1931.
- A Preliminary Note on the Spiders of Krakatau—*Ibid.*
- The Spiders of Bear Island.—*Norsk Ent. Tidssk.* III, Oslo 1933.
- The Comity of Spiders, vol. I.—*The Ray Soc.*, London 1939.
- BRUNDIN, LARS: Die Coleopteren des Torneträskgebietes, Lund 1934.
- BRENDEGAARD, JENS: Fortegnelse over Danmarks Edderkopper.—E. NIELSEN: De danske Edderkoppers Biologi, København 1928.
- *Araneina*.—*Zool. of the Faroes*, Copenhagen 1928.
- Isländische Spinnentiere 3, *Araneae*.—*Kungl. Vetenskaps- och Vitterhets-Samhälles Handl.* ser. B, Bd. 2 No. 7, Göteborg 1932.
- Preliminary Statement of the Synonymy of Certain Greenland Spiders.—*Vidensk. Medd. Dansk naturh. Foren.* Bd. 98, København 1934.
- , HENRIKSEN, KAI L. and SPÄRCK, R.: Insect and Arachnids.—*Medd. om Grønland*, Bd. 104 Nr. 16, København 1935.
- Revisal of Spiders from Ellesmere Land collected by the Second Arctic Expedition of the "Fram".—*Norsk Ent. Tidssk.* IV, Oslo 1936.
- Spiders from Southeast Greenland.—*Medd. om Grønland*, Bd. 108 Nr. 4, København 1937.
- Observations on Spiders Starting off on Ballooning Excursions.—*Vidensk. Medd. Dansk naturh. Foren.* Bd. 101, København 1937.
- Aeronautic Spiders in the Arctic.—*Medd. om Grønland.* Bd. 119 Nr. 5, København 1938.
- Om »Flyvende Sommer« i arktiske Egne.—*Naturens Verden*, p. 444, København 1938.
- Supplementary List to "Spiders from Southeast Greenland".—*Medd. om Grønland*, Bd. 108 Nr. 7, København 1939.
- *Arctosa alpigena* Dol. and *A. insignita* Th.—*Ibid.*
- Spiders from Northeast Greenland between Lats. 70°25' and 76°50' N.—*Ibid.* Bd. 125 Nr. 8, København 1940.

- BRÆNDEGAARD, JENS: On the Possibility of a Reliable Determination of Species of the Females of the Genus *Erigone*.—*Ibid.*
- BRÆSTRUP F. W. and DEGERBØL, M.: The Geographical Variation of the Greenland Hares. — *Vidensk. Medd. Dansk naturh. Foren. Bd. 98, København 1934.*
- A Study on the Arctic Fox in Greenland. — *Medd. om Grønland, Bd. 131 Nr. 4, København 1941.*
- CAMBRIDGE, O. P.: On new and rare British Spiders (1872).—*Trans. Linn. Soc. vol. XXVIII, London 1873.*
- On some New Species of Araneidea, chiefly from Oriental Siberia.—*Proc. Zool. Soc., London 1873.*
- On some new and little-known Spiders from the Arctic Regions.—*Ann. Mag. Nat. Hist. ser. 4, vol. XX, London 1877.*
- On some new and rare Scotch Spiders.—*Ann. Scott. N. H. 1894.*
- CAMBRIDGE, F. O. P.: Descriptive Notes on some obscure British Spiders.—*Ann. Mag. Nat. Hist. ser. 6, vol. VII, London 1891.*
- CHARITONOV, D.: Katalog der russischen Spinnen.—*Beilage z. Ann. Musée Zool. vol. XXXII, Leningrad 1932.*
- CHYZER et KULCZYNSKI: Araneae Hungariae I, II₁, II₂. *Budapestini 1891, 1894, 1897.*
- COAD, B. R.: Insects Captured by Airplane. Are Found at Surprising Heights.—*Yearbook of Agriculture 1931.*
- CROSBY, C. R.: Some Arachnida from Southampton Island.—*Memoire Carnegie Mus. vol. XII part II, sec. 4, 1934.*
- See BISHOP, S. C.
- DAHL, FR.: Die Lycosiden oder Wolfspinnen Deutschlands.—*Nova Acta LXXXVIII, Halle 1908.*
- DAHL, MARIA: Spinnen.—The Norwegian North Polar Expedition with the "Maud" 1918—1925, *Scient. Results, vol. V, No. 16d, Bergen 1933.*
- DEGERBØL, M.: A Contribution to the Investigation of the Fauna of the Blossesville Coast.—*Medd. om Grønland, Bd. 104 Nr. 19, København 1937.*
- See BRÆSTRUP, F. W.
- DOLESCHAL, L.: Systematisches Verzeichniss der im Kaiserthum Österreich vorkommenden Spinnen.—*Sitzungsberichte kaiserl. Akad. Wissensch. Mat.-naturw. Clas. Bd. 9, Wien 1852.*
- ELTON, C. S.: The Dispersal of Insects to Spitsbergen.—*Trans. Ent. Soc., London 1925.*
- EMERTON, J. H.: Canadian Spiders.—*Trans. Connecticut Acad. Arts Sci. vol. IX, New Haven 1892—95.*
- Notes on the Spiders collected by FRITS JOHANSEN of the "Danmark Expedition" 1906—8 to Northeastern Greenland, Lat. $76\frac{1}{2}^{\circ}$ to 77° North. (1918). — *Vidensk. Medd. Dansk naturh. Foren. København. Bd. 70, Odense 1919.*
- Spiders.—*Report Can. Arctic Exp. 1913—18, vol. III part H (1919), Ottawa 1922.*
- Notes on Canadian and Arctic Spiders.—*Psyche, vol. 28, 1921.*
- FELT, E. P.: Dispersal of Insects by Air Currents.—*New York State Mus. Bull. No. 274, Albany 1928.*
- GERTSCH, W. J.: New Genera and Species of North American Spiders.—*Amer. Mus. Novit. No. 636, New York 1933.*
- Notes on American Lycosidae.—*Ibid. No. 693, New York 1934.*
- A Revision of the Typical Crab-Spiders of America North of Mexico.—*Bull. Amer. Mus. Nat. Hist. vol. LXXVI, New York 1939.*

- Grønland i Tohundreaaret for Hans Egedes Landing I og II.—Medd. om Grønland, Bd. 60 og 61, København 1921.
- HAARLØV, NIELS: A Morphologic-Systematic-Ecological Investigation of Acarina.—Medd. om Grønland, Bd. 128, Nr. 1, København 1942.
- HAMMER, MARIE: Studies on the Oribatids and Collembles of Greenland.—Medd. om Grønland, Bd. 141, Nr. 3, København 1944.
- HARDER, POUL, see JENSEN, AD. S.
- HENRIKSEN, KAI L. og LUNDBECK, WILL.: Conspectus Faunæ Groenlandicæ, Pars sec. Insecta et Arachnida (1917).—Medd. om Grønland, Bd. 22, København 1918.
— A Revised Index of the Insects of Grønland. — Medd. om Grønland, Bd. 119 Nr. 10, København 1939.
- HOLM, ÅKE: Spindelfaunan inom Abisko Nationalpark.—Kgl. Sv. Vetenskapsak. Skr. i Naturskyddsärenden, No. 19, Stockholm 1931.
— Notes on the Spider Fauna of East Greenland.—Ark. Zool. Kgl. Sv. Vetenskapsak. Bd. 29B No. 12, Stockholm 1937.
— Zur Kenntnis der Spinnenfauna Spitzbergens und der Bären Insel.—Ibid. Bd. 29A No. 18, Stockholm 1937.
— Neue Spinnen aus Schweden.—Ibid. Bd. 31A No. 8, Stockholm 1939.
— and CARPENTER, G. D. HALE: Insecta and Araneæ coll. in the Kangerdlugsuak Reg. of East Greenland 1935—36.—Ann. Mag. Nat. Hist. ser. 11, vol. III, London 1939.
- JACKSON, A. RANDELL: A Contribution to the Spider Fauna of Scotland.—Proc. Royal Physic. Soc. vol. XIX No. 5, Edinburgh 1914.
— Results of the Oxford University Expedition to Greenland 1928, Araneæ and Opiliones.—Ann. Mag. Nat. Hist. ser. 10, vol. VI, London 1930.
— Results of the Oxford University Expedition to Akpatok in 1931, Araneæ.—Proc. Zool. Soc., London 1933.
— Notes on Arctic Spiders obtained in 1933.—Ann. Mag. Nat. Hist. ser. 10, vol. XIV, London 1934.
— On a Collection of Spiders made by SIG. THOR in Spitsbergen.—Norsk Ent. Tidssk., Oslo 1934.
— Notes on Arctic Spiders obtained in 1933—36.—Proc. Zool. Soc. ser. B, vol. 107 (1938), London 1937.
- JACOBI, ARNOLD: Das Rentier.—Zool. Anz. Ergänzungsbd. zu Bd. 96, Leipzig 1931.
- JENSEN, AD. S.: Grønlands Fauna.—Festskrift udg. af Københ. Univ. i Anledning af Hans Majestæt Kongens Fødselsdag, København 1928.
— Moskusoksen paa Grønland og dens Fremtid. — Dansk Jagttidende, 46. Aarg. Nr. 16, København 1929.
— and HARDER, POUL: Post-Glacial Changes of Climate in Arctic Regions as Revealed by Investigations on Marine Deposits. — Postglaciale Klimaveränderungen, Stockholm 1910.
- KOCH, J. P.: Gennem den hvide Ørken, København 1913.
- KOCH, L.: Arachniden.—Die zweite deutsche Nordpolarfahrt 1869—70, II. Bd. 2, Leipzig 1874.
— Arachniden aus Sibirien und Novaja Semlja.—Kgl. Sv. Vetenskaps-Akad. Handl. Ny Följd, Bd. 16 No. 5, Stockholm 1878.
- KULCZYŃSKI, L.: See CHYZER.
— Erigonæ Europææ.—Bull. intern. Acad. Sci. Clas. Mat. et Nat. Cracovie 1902.
— Araneæ et Oribatidæ Expeditionum Rossicarum in Insulas Novo-Sibiricas annis 1885—86 et 1900—03.—Mém. Acad. Imp. Sci. ser. 8, vol. 18 No. 7 (1908), St. Petersburg 1910.

- KULCZYŃSKI, L.: Arachnoidea camtschadalica.—Annu. Mus. Zool. Bd. XXVII, Leningrad 1926.
- KÖPPEN, W. und WEGENER, A.: Die Klimate der geologischen Vorzeit, Berlin 1924.
- KÖPPEN † und WEGENER †: Ibid. Ergänzungen und Berichtigungen, Berlin 1940.
- LENZ, H.: Grönländische Spinnen.—Biblioth. Zool. Bd. 8, Stuttgart 1897.
- LESSERT, R. DE: Arachniden Graubündens.—Revue Suisse Zool., Genève 1905.
— Catalogue des Invertébrés de la Suisse, Araignées, Genève 1910.
- LINDROTH, CARL H.: Die Insektenfauna Islands und ihre Probleme, Uppsala 1931.
- LUNDBECK, WILL.: See HENRIKSEN, KAI L.
- MENGE, A.: Preussische Spinnen, Danzig 1866—78.
- NANSEN, F.: "Fram" over polhavet II. Kristiania 1897.
- NARES, G. S.: Narrative of a Voyage to the Polar Sea during 1875—6 in H.M. Ships "Alert" and "Discovery", London 1878.
- NIELSEN, E.: De danske Edderkoppers Biologi.—København 1928.
— The Biology of Spiders.—Copenhagen 1932.
- PALMGREN, P.: Die Spinnenfauna Finnlands I.—Acta Zool. Fennica 25, Helsingforsiae 1939.
— Ibid. II.—Ibid. 36, Ibid. 1943.
- PETERSEN, HELGE: Extrem hohe Temperaturen und Föhn in Grönland.—Meteorol. Zeitschr. 1934.
— Das Klima der Küsten von Grönland.—Handbuch der Klimatologie (KÖPPEN u. GEIGER) Bd. II, Berlin 1938.
- PETRUNKEVITCH, ALEX.: A Synonymic Index-Catalogue of Spiders of America.—Bull. Amer. Mus. Nat. Hist. vol. XXIX, New York 1911.
— Systema Araneorum. — Trans. Connecticut Acad. Arts Sci., New Haven 1928.
- PETRUSEWICZ, K.: Katalog der echten Spinnen Polens.—Festschrift v. E. STRAND, Vol. III, Riga 1937.
- REIMOSER, E.: Katalog der echten Spinnen des paläarktischen Gebietes.—Abh. Zool.-Bot. Gesells. Bd. X, Wien 1919.
- RENSCH, BERNH.: Über die Bedeutung des Prinzips geographischer Rassenkreise.—Geogr. Zeitschr. 38, H. 3, 1932.
- SCHENKEL, E. Beitrag zur Spinnenkunde: .—Verhandl. Naturforsch. Gesellsch. Bd. XXXIV, Basel 1923.
— Fauna Færøensis, Araneina.—Ent. Medd. Bd. XIV, København 1925.
— Beitrag zur Kenntnis der Schweizerischen Spinnenfauna.—Revue Suisse Zool. vol. 32 No. 19, Genève 1925.
— Beitrag zur Kenntnis der Schweizerischen Spinnenfauna.—Revue Suisse Zool. Genève 1927.
— Arachniden aus dem Sarekgebirge.—Naturwissensch. Untersuch. Sarekgeb. in Schwedisch-Lappland, Stockholm 1931.
- SEELEY, RALPH M.: Revision of the Spider Genus Tetragnatha.—New York State Mus. Bull. No. 278, Albany 1928.
- SEIDENFADEN, G.: Notes on a Map of East Greenland from 73° to 74°50' N. Lat.—Medd. om Grønland, Bd. 87 Nr. 3, København 1931.
- SIMON, E.: Les Arachnides de France, Tome V, Paris 1884.
— Ibid. Tome VI 1. 2. 3. 4. Partie, Paris 1914, 1926, 1929, 1932.
- SFÄRCK, R.: Zoogeographical Remarks on the Chironomid Fauna of Greenland.—Ent. Medd. Bd. XXIII, København 1943.
- STRAND, EMB.: Die arktischen Araneae.—Fauna Arctica IV, Jena 1906.
— Araneae.—Report Sec. Norweg. Arctic Exped. in "Fram", vol. I, Kristiania 1907.

- SØRENSEN, WILL.: Arachnida Groenlandica.—Vidensk. Medd. Dansk naturh. Foren. København 1898.
- Danmarks, Færøernes og Islands Edderkopper (1904).—Ent. Medd. II. Række Bd. 1, København 1897—1904.
- TAMBS-LYCHE, HANS: Die norvegischen Spinnen der Gattung Pardosa Koch.—Avhandl. Norske Videnskaps-Akad. (Mat.-Naturv. Kl. 1939 No. 6), Oslo 1940.
- THORELL, T.: Recensio critica Araneorum Suecicarum quas descr. Clerckius, Linnaeus, De Geerus. Upsaliae 1856.
- Arachnider från Spetsbergen och Beeren-Eiland.—Översigt Kgl. Vetensk.-Akad. Förhandl. (28. Årg. 1871), Stockholm 1872.
- Om några Arachnider från Grönland.—Ibid. (29. Årg. No. 2, 1872), Stockholm 1873.
- Notice of some Spiders from Labrador.—Proc. Boston Soc. Nat. Hist. vol. XVII, Boston 1875.
- Notice of the Spiders of the "Polaris" Expedition.—Amer. Naturalist XII, Philadelphia 1878.
- WARMING, EUG.: The Vegetation of Greenland.—Greenland, vol. I, Copenhagen and London 1928.
- WEGENER, A.: See KÖPPEN.
- WINGE, HERLUF: Grønlands Pattedyr (1902). — Medd. om Grønland, Bd. 21. København 1898—1902.
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DANSK RESUMÉ

Der kendes nu i alt 38 edderkoppearter fra Østgrønland. En af arterne, *Micryphantes nigripes*, består af to geografiske racer, der begge forekommer i Østgrønland (nr. 15 og 16, pp. 32—34).

Ligesom i det øvrige arktiske område, er der i Østgrønland kun fundet edderkoppearter, der i fylogenetisk henseende står meget højt (p. 61).

Deres livscyklus synes for alle arternes vedkommende at være flerårig. For nogle arters vedkommende (*Pardosa glacialis* pp. 16—19 og *Dictyna borealis* pp. 26—27) viser materialet dette helt tydeligt. Arter fra tempererede egne, tilhørende de samme familier, er derimod som regel eenårige. Alle grønlandske arters æglægning synes at finde sted så tidligt på sommeren, at udklækningen er fuldbyrdet før vinterens komme, og den første overvintring finder sted, medens dyrene er på et tidligt udviklingsstadium.

Der er i alt beskrevet 35 nye arter fra Grønland, og så sent som 1930 antog man disse arter for endemiske. Dette har vist sig at være en næsten fuldstændig misforståelse (tabel V, pp. 64—65). Der findes næppe en eneste endemisk edderkoppeart i Grønland. De 14 arter, der endnu kun kendes fra Grønland, er enten så ufuldstændigt beskrevet, at det ikke har været muligt at identificere dem igen, eller også må man antage, at de også lever på de nærliggende øer i det Canadiske Arkipelag, hvis landarthropodfauna man endnu har meget ringe kendskab til.

Østgrønlands klima er meget forskelligt i nord og syd. Længst mod nord er klimaet udpræget kontinentalt med ringe nedbør (fig. 39, 40 og tabel VI, pp. 67—69), medens det længst mod syd er udpræget oceanisk med meget stor nedbør (over 1000 mm årlig) og langt mere skydække end i de nordligste områder. Grænsen mellem de to klimaområder synes at ligge lidt syd for Scoresbysund. Den nordlige del af Blossville Kyst og kyststrækningen indtil den sydligste del af Franz Joseph Fjord området må betragtes som et klimatisk grænseområde. De brede isfrie landområder nord for Scoresbysund kan stort set betegnes som aride, medens det forholdsvis smalle kystland syd for

Scoresbysund kan betegnes som udpræget humide områder. I Vestgrønlands sydligste del indtil Egedesminde er det isfri kystland derimod bredt, så der her findes en humid yderkyst og et forholdsvist aridt bagland (fig. 41, 42, 43 og tabel VI, pp. 68—71).

De klimatiske modsætninger er skyld i, at Østgrønlands fauna består af forskellige klimatisk-økologiske elementer, der kun i grænseområderne er blandet med hinanden.

1. Det arid boreale og (2.) det arid boreo-arktiske faunaelement findes paa østkysten faktisk kun i det sydligste grænseområde (60° — 61° n. br.). Her er der ingen udtalt grænse mellem Vest- og Østgrønland, og de fleste af de arter, der hører hjemme i Vestgrønlands aride bagland forekommer derfor ogsaa her (tabel VII, nr. 1—10, p. 73).

3. Det arid arktiske faunaelement træffes paa østkysten næsten kun nord for Scoresbysund (tabel VII, nr. 11—17), medens nogle af disse arter også er hjemmehørende i det aride bagland paa vestkysten. En enkelt art, *Dictyna borealis*, der paa østkysten ikke lever syd for 68° n. br., træffes paa vestkysten helt ned til 60° n. br.

4. Det humide faunaelement er i Østgrønland væsentlig indskrænket til de humide områder syd for Scoresbysund (tabel VII, nr. 18—31 og fig. 44, pp. 73, 75). I Vestgrønland er flere af disse arter (nr. 18—24) også hjemmehørende i det humide kystland.

5. Det euryøke faunaelement (tabel VII, nr. 32—38) er uafhængig af klimaets aride eller humide karakter og kan derfor træffes overalt, hvor jordbunden ikke er steril.

Af de 38 østgrønlandske arter er der kun 11, der ikke kendes fra Vestgrønland. Til gengæld er der 12 vestgrønlandske arter, der aldrig er fundet i Østgrønland. Denne forskel mellem de to kystlandes edderkoppefauna kan ikke forklares ud fra forståelsen af de klimatisk-økologiske forhold alene. Det er også nødvendigt at tage hensyn til indvandringen, der må have fundet sted til forskellige tider og ad flere veje.

Om alle de østgrønlandske edderkopper undtagen tre arter (*Hahnia glacialis*, *Drassodes signifer* og *Gnaphosa islandica*) gælder det, at de må antages at kunne spredes ved vindens hjælp. Selv om man kan gå ud fra, at vindspredning også må være den betydeligste spredningsfaktor, er det dog nødvendigt at ty til andre spredningsfaktorer for at kunne forklare hele edderkoppefaunaens indvandring. Muligheden af indslæbning fra Island i middelalderen, da nordboerne bosatte sig i Øster- og Vesterbygden, kan ikke helt afvises; men denne indslæbning har næppe haft nogen videre betydning i zoogeografisk henseende, da de arter, der kan tænkes at være indslæbt paa denne måde, må have

levet i Grønland længe før den historiske middelalder. Indslæbning siden HANS EGEDES tid (1721) synes ikke at have fået nogen praktisk betydning i Vestgrønland, hvor man ikke engang endnu har påvist *Tegenaria derhami* (Husedderkoppen), der ellers er en udpræget kosmopolit. Heller ikke de arter, der lever både i Østgrønland og Danmark (tabel VIII, p. 83) er indslæbt. *Arctosa alpigena* og *Dictyna major* er så sjældne i Danmark, at indslæbning herfra er utænkelig. *Tetragnatha extensa* og *Drassodes signifer* blev påvist på østkysten af GUSTAV HOLMS konebådsekspedition, før den regelmæssige forbindelse kom i gang mellem Danmark og Angmagssalik.

Transport af edderkopper med fugle og drivtømmer har heller ikke fundet sted (p. 83). Det er derfor nødvendigt at antage en landforbindelse, ad hvilken de tre førnævnte arter kan være indvandret, og over samme kontinentalforbindelse er de fleste af de andre arter formodentlig også indvandret, selv om det alligevel er sket som luftplankton.

Vort kendskab til landarthropodfaunaen paa det Canadiske Arkipelag, Labrador og New Foundland er kun ringe. Derigennem kommer der et usikkerhedsmoment ind i beregningen. Dette formindskes dog betydeligt, fordi vi har sikre oplysninger om edderkoppefaunaen paa øen Akpatok nord for Labrador.

1. Det euryøk holarktiske indvandringselement består af seks af de syv euryøke arter (tabel X, nr. 1—6, p. 100). På grund af sin store udbredelse (fig. 45, p. 86) må dette element antages at være meget gammelt, antagelig det ældste i Grønland. Da der ikke kan antages at have eksisteret nogen postglacial landforbindelse med Grønland, må hovedparten af de yngre elementer også være indvandret i interglacial tid.

2. Det boreal holarktiske indvandringselement består af fire arter (tabel X, nr. 7—10, p. 100) med en meget stor udbredelse (fig. 46, p. 87) og må derfor også være et gammelt element, der må antages at være indvandret i førstningen af den sidste interglacialtid. De tre boreale hjulspindere (*Araneus cornutus*, *A. patagiatus* og *A. quadratus*) fra Vestgrønlands allersydligste del og *Dictyna major* (tabel X, nr. 11, p. 100) må også høre til dette indvandringselement.

3. Det humid holarktiske indvandringselement består af fire arter (tabel X, nr. 12—15, p. 100), der har et mere begrænset udbredelsesområde (fig. 47, p. 90). Oprindelsen til denne udbredelse må føres tilbage til en tid, da Europa og Amerika var forenede. De nuværende udbredelsesforhold kan forklares ved Atlanterhavets fremtrængen mod nord, hvorved området blev delt. Da alle arterne er humide, har ingen af dem hjemme langs Grønlandshavets vestlige bredder.

4. Det boreo-arktisk palæarktiske indvandringselement består kun af een edderkoppeart, *Gnaphosa islandica*. Udbredelsen må have fundet sted, medens Grønland og Nordeuropa endnu var i kontinental forbindelse med hinanden. Da forbindelsen bristede, blev artens udbredelsesområde delt i tre dele (Scoresbysund, Island og Nordeuropa).

5. Det arid arktiske spitsbergenelement, der bestaar af to arter (tabel X, nr. 16 og 17, p. 100) er sikkert et gammelt element i Grønland. Det er blevet til i de områder, hvor de nu lever. Spitsbergen og Nordgrønland må antages at have været i kontinental forbindelse med hinanden indtil henimod slutningen af istiden og lå uden for det isdækkede område.

6. Det boreal palæarktiske indvandringselement består af fire edderkoppearter (tabel X, nr. 19—22, p. 100). Det er et af de alleryngste grønlandske faunaelementer, der først er indvandret til Grønland i postglacial tid som luftplankton over Danmark Stræde (fig. 48, p. 94).

7. Det boreal og boreo-arktisk nearktiske indvandringselement består af seks arter (tabel X, nr. 23—28, p. 101), der må antages at være indvandret til Vestgrønland i sidste interglaciertid. Til det egentlige Østgrønland har dette faunaelement ikke udbredt sig (tabel VII, nr. 2, 3, 6, 7, 9 og 10, p. 73).

8. Det humid nearktiske indvandringselement (tabel X, nr. 29—33, p. 101) må antages at være indvandret til Grønland imod slutningen af Würm-Istiden. Da det baltiske fremstød ikke berørte Nordamerika, kan denne vandring mod nord være begyndt for c. 60.000 år siden. De nearktiske indvandringselementer til det egentlige Østgrønland omfatter kun dette og de følgende to indvandringselementer. De har kun i meget ringe grad formået at udbrede sig til Island (tabel IX, p. 93). Det må skyldes, at de er kommet så sent til egnene ved Danmark Stræde, at al landforbindelse med Island paa dette tidspunkt var afbrudt.

9. Det arid nearktiske indvandringselement består af 5 arter (tabel X, nr. 34—38, p. 101). Ikke en eneste af disse arter har formået at udbrede sig længere mod øst end til Grønlandshavets vestlige bred, fordi denne indvandring først har fundet sted i postglacial tid, da al landforbindelse med Spitsbergen var afbrudt. Dette indvandringselement er kommet vestfra over Smith Sund—Robson Kanal til Nordgrønland og har herfra udbredt sig til Østgrønland. Nogle af dette elements arter lever også i det sydlige Vestgrønland. Disse må dog antages at være kommet hertil over Davis Stræde fra Baffin Land som luftplankton.

10. Endelig findes der tre arter (*Pardosa saltuaria*, *Pardosa furcitera* og *Erigone whymeri*), der er almindelige i Vestgrønland, men også er fundet i det indre af Scoresbysund området. De må være ført hertil over indlandsisen som luftplankton fra Vestgrønland.

Hvis man betragter andre Dyregrupper, især sådanne, der ligesom de grønlandske edderkopper står højt i fylogenetisk henseende (landpattedyr, sommerfugle, biller, dansemyg o. s. v.), saa viser det sig, at man også hos dem kan påvise tilsvarende klimatisk-økologiske faunaelementer som hos edderkopperne og naturligst forklare deres indvandring paa samme maade som for edderkoppernes vedkommende.

LINDROTH har påvist, at Islands insektfauna hovedsagelig er boreal og af europæisk oprindelse. Det gælder også Islands edderkoppefauna (tabel IX, p. 93) og formodentlig hele landarthropodfaunaen. Således kan forholdene slet ikke være for Grønlands vedkommende. I Østgrønland findes således kun seks palæarktiske edderkoppearter (15 pCt.). Noget lignende må forholdet være for de øvrige landarthropoders vedkommende. På grund af Nordpolens beliggenhed under istiden (fig. 49, p. 99) er det let forståeligt, at boreale og boreoarktiske arter af europæisk oprindelse under deres fremtrængen mod nord i interglacial tid ikke har formaaet at trænge længere nordpå end til Island, selv om der også endnu i slutningen af sidste interglaciertid har eksisteret en kontinental forbindelse mellem Island og Østgrønland.



Misprint

p. 49 line 25: 99 — read 900 km.