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**Zoogeographical Remarks
on the Chironomid Fauna of Greenland.**

By
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Some years ago I had the opportunity of delivering a lecture in which I compared the dipterous faunas of East Greenland, Iceland, and the Faroes. A very brief review was published in 1936 in *Opuscula Entomologica*, Lund, Vol. 1. In this lecture I pointed out the peculiar zoogeographical relations which exist between East Greenland and the arctic and boreoarctic regions east of East Greenland (e. g. Spitsbergen, Iceland, Scandinavia), while there is a marked difference between the East and the West Greenland dipterous faunas. Since then several papers have been published which are of importance to the problems discussed in the above-mentioned lecture. In the first place mention should be made of a paper by Søggaard Andersen on Northeast Greenland Chironomids, and, above all, the great work of Thienemann on the Chironomids of the Scandinavian mountains, in which this family for the first time are treated from a zoogeographical point of view. On this background I have found it natural to revert to my quite preliminary contemplations from 1936 and again to subject the Chironomid fauna of Greenland to a zoogeographical examination.

Altogether 83 specifically determined Chironomids are known from Greenland, a number which will, no

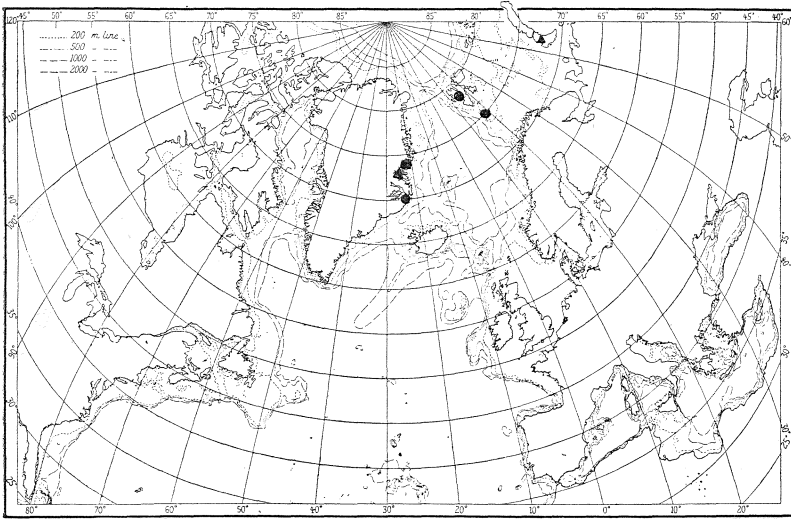


Fig. 1. The distribution of *Orthocladius decoratus* (●) and *Metriocnemus similis* (▲).

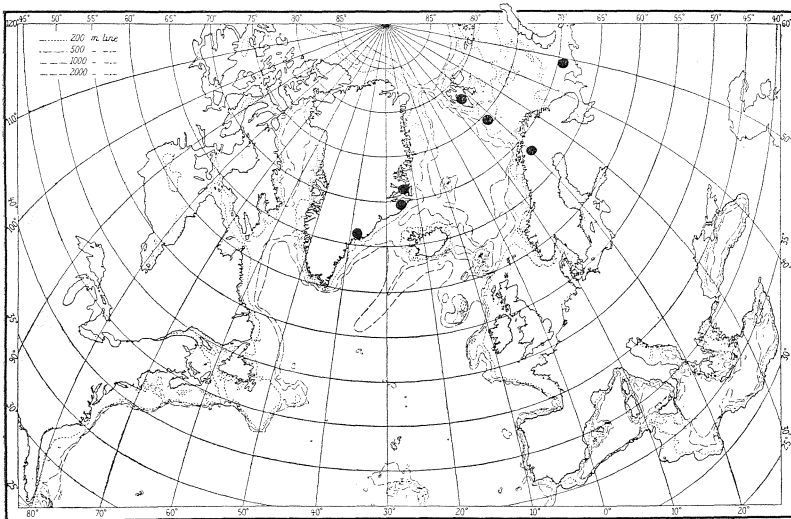


Fig. 2. The distribution of *Eudactylocladius mixtus*.

doubt, be increased. Of these 83 species, only 11 are common to East and West Greenland, and thus confirm the slight conformity between East and West Greenland which I have previously pointed out. Thirty-two species have been found in West Greenland, but not in East Greenland, and 40 have been found in East Greenland, but not in West Greenland. If we consider these 40 species of Chironomids from East Greenland more closely, it will be seen that they can be divided into two categories, viz. endemic species (14), and species which are common to East Greenland, Spitsbergen, Europe, etc. Altogether 26 species belong to the last-mentioned category, and it might be expected that further investigations would show that a number, perhaps all the species of the endemic category, also belong to the group common to East Greenland and Europe.

The Chironomids common to East Greenland and various parts of Europe are in some cases true arctic forms only known from arctic regions. No less than 12 of these arctic species, besides in East Greenland, are found in Spitsbergen, on Bear Island, Nowaya Zemlya, or in Siberia, while only 6 are found in East Greenland and Scandinavia. As examples of the former type of distribution I may mention *Metriocnemus similis*, found in East Greenland and on Nowaya Zemlya, *Eudactylocladius spitsbergensis*, found in East Greenland and Spitsbergen, *Orthocladius decoratus*, found in East Greenland, Spitsbergen, and on Bear Island, *Limnophyes globifer*, found in East Greenland, Spitsbergen, and Siberia. Examples of the latter category are *Endochironomus oldenbergi*, found in East Greenland and Lappland, *Ditanytarsus setosimanus*, likewise known from East Greenland and Lappland, *Heterotrissocladius subpilosus*, known from East Greenland, Bear Island, and Lappland, and *Eudactylocladius mixtus*, known from East Greenland, Spitsbergen, Bear Island, Waigatsch, and Lappland (Fig. 1—2).

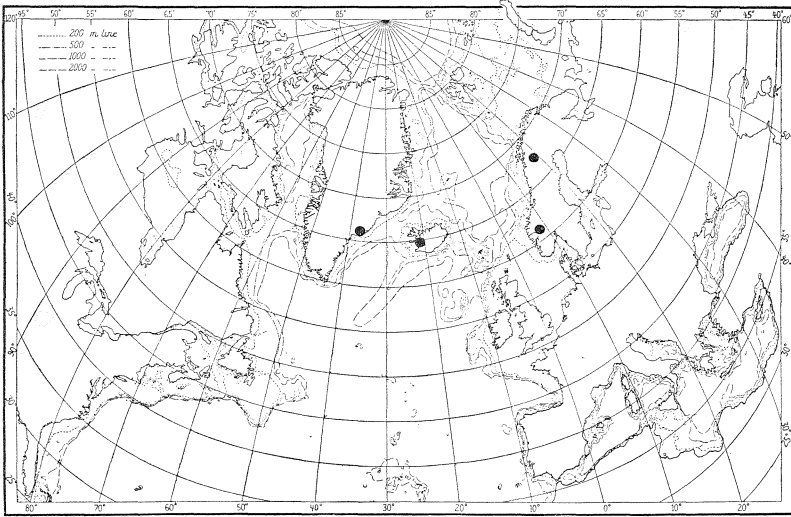


Fig. 3. The distribution of *Diamesa lindrothi*.

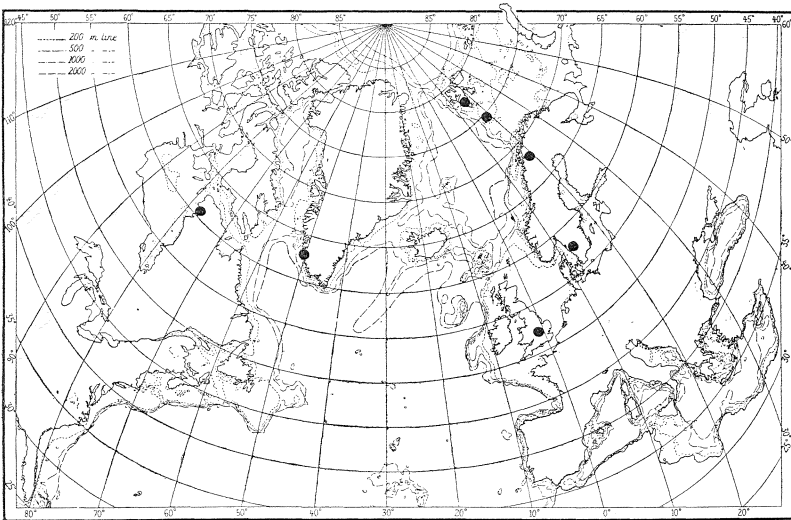


Fig. 4. The distribution of *Procladius crassinervis*.

Another group of the Chironomids common to East Greenland and Europe are not confined to the arctic regions proper, but are more or less widely distributed in the palaeartic region. This category includes seven species, e. g. *Procladius choreus*, *Sergentia coracina*. Several of these seven species are also found in Iceland or the Faroes, e. g. *Metriocnemus hygroptericus*, *Psectrocladius barbimanus*, *Diamesa lindrothi*, and *Syndiamesa branickii* (Fig. 3). Finally it may be pointed out that the East Greenland Chironomids exhibit one of the rare examples of bipolarity, viz. *Podonomus kiefferi*. This species is the only Chironomid found in East Greenland but not in West Greenland which is also recorded from North America; however, very likely further investigations will show that it is also to be found in West Greenland.

In contrast to the East Greenland Chironomids, the West Greenland species in a very few cases are pure arctic forms. Altogether 32 Chironomids are found in West Greenland but not in East Greenland. Of these 32 species twelve are not found outside West Greenland and are consequently for the present to be regarded as endemic. Of the remaining 20 species only one is restricted to arctic regions, viz. *Trichotanyppus posticalis*, since, besides in West Greenland, it is only found in Lappland. The other 19 species have a very wide distribution, in several cases occurring throughout Europe as far as the Mediterranean; many are also found in America, e. g. *Procladius crassinervis*, *Smittia byssina* (Fig. 4).

As regards their distribution, the Greenland Chironomids may consequently be divided into five categories. 1) Widely distributed arctic boreal species, in most cases circumpolar (Fig. 5—6). This category comprises the eleven species common to West and East Greenland and probably the bipolar species *Podonomus kiefferi*. 2) North-Eastern arctic species, comprising the twelve

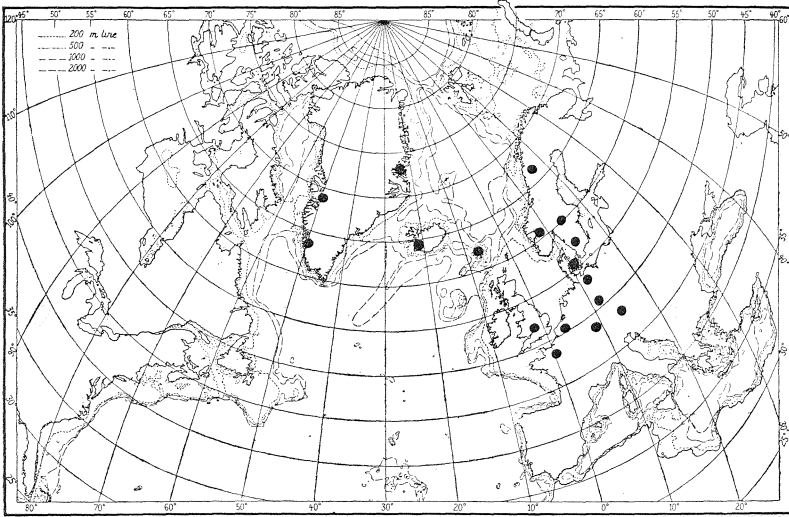


Fig. 5. The distribution of *Cricetopus vitripennis*.

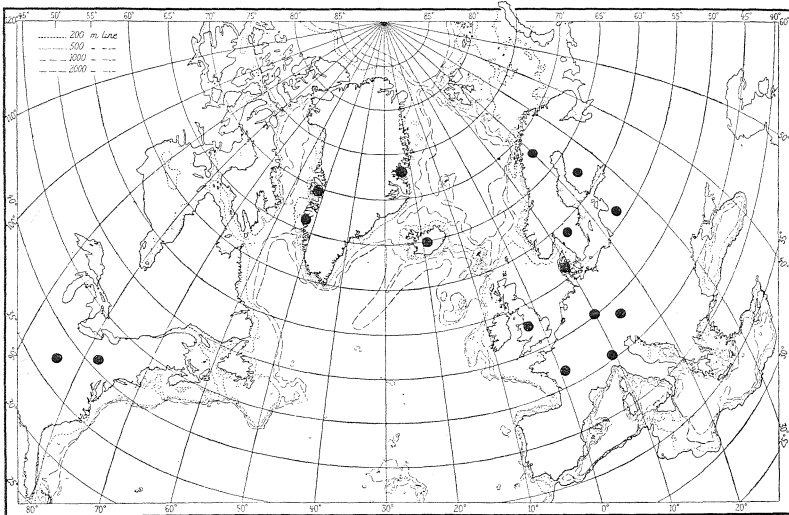


Fig. 6. The distribution of *Metriocnemus fuscipes*.

East Greenland species which, besides in East Greenland, occur in Spitsbergen, on Nowaya Zemlya, or in other extreme arctic regions east of the Atlantic, but are not found in Scandinavia. 3) Eastern arctic species, comprising the six species found in East Greenland, in the Scandinavian mountains, and in some cases also in Spitsbergen, on Bear Island, and in Siberia. 4) Boreo-arctic and boreal species, occurring only in West Greenland and having a wide palaeartic and in several cases nearctic distribution. Finally 5) Eastern arctic-boreal species found in East Greenland but not in West Greenland, and further in Iceland, the Faroes, Scandinavia or boreal Europe. To these should be added the endemic species which may probably in the future be distributed over the above-mentioned five categories.

These five rather well defined types of distribution can to a certain degree be ascribed to climatic conditions but may in my opinion also lend support to the hypothesis that the recent Greenland fauna comprises elements of different zoogeographical origin which have immigrated into Greenland in different periods. The conformity between the Chironomid fauna of North East Greenland and the high-arctic islands north of Eurasia is in all probability due to a rather late immigration from Siberia via Spitsbergen into East Greenland. The twelve species with an extreme north-eastern arctic distribution may consequently be considered as the youngest element in the dipterous fauna of Greenland. In this connection it should be borne in mind that there seems to be a peculiar similarity between the Greenland reindeer and that of Siberia; among other Diptera than the Chironomids, also, examples may be found of such a distribution, e. g. the fly *Limnophora almquisti*. It should further be pointed out that according to Seidenfaden and Sørensen (1937, p. 186) several plants are supposed to have immigrated from the North-East arctic

islands via Spitsbergen. The immigration of this element may have taken place rather late, perhaps in post-glacial time. On the other hand, there is a possibility that these species may have survived the latest period of glaciation in East Greenland.

The species which occur in East Greenland, Iceland, the Faroes, Scotland, etc., may be supposed to have immigrated into East Greenland from Iceland. In a paper from 1937 Degerbøl has called attention to the possibility of an immigration into East Greenland from Iceland, and the six species of Chironomids belonging to this group may present another example of the existence of such an element in the Greenland fauna. In all probability immigration has taken place prior to the latest period of glaciation, and this element is consequently older than the North-Eastern arctic element.

The widely distributed arctic boreal species, in most cases holarctic, in contrast to the two last-mentioned categories constitute an ancient element in the Greenland fauna and are no doubt survivors at any rate from the last interglacial period.

The 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. Their occurrence in Europe might be explained by the theory that these species were an ancient element common to the arctic and the nearctic regions.

Finally, there is the category occurring in East Greenland, Scandinavia, and in some cases also in Spitsbergen, Siberia, etc. It might be supposed that zoogeographically these species should be regarded from the same point of view as the first-mentioned North-Eastern arctic element. They only differ in having a wider distribution in Europe, where they have spread as far as Northern Scandinavia.

For the zoogeographical theories the Diptera, especially the Chironomids, have hitherto played a minor rôle. The reason is, quite naturally, that our knowledge of the dipterous faunas of the different regions has been rather sparse. Furthermore, the systematics and synonymics are in several cases rather difficult. On the other hand, the Diptera, especially in arctic regions, represent such a large percentage of the total land fauna that they can hardly be disregarded. Even if various difficulties and sources of error must be taken into consideration, I am of opinion that the distribution of the Greenland Chironomids clearly shows not only the great difference that exists between the faunas of West Greenland and East Greenland, especially the fauna north of Blosseville Coast, but also that this difference must be ascribed — besides to ecological factors — to different origins of the faunas.

If we compare the Greenland Chironomids with e. g. the Chironomids of Lappland, the paucity of the Greenland fauna will be obvious. In the large area of the whole of Greenland only 83 species have been found, whereas 233 species were found by Thienemann in the relatively small Abisko region in Lappland. This may in some degree be due to ecological factors, but in my opinion the isolated position of Greenland must be regarded as the actual cause. In other respects there is a distinct accordance between the Greenland and the Lappland Chironomid faunas, viz. in the distribution of the species over the systematic groups. In Greenland as well as in Lappland the Orthocladiinae represent about 60 per cent of the total number of species.

It must be considered beyond doubt that the Chironomid fauna of Greenland, and especially the 40 species only found in Eastern and North-Eastern Greenland, has not been introduced by man; consequently it must have immigrated into Greenland in a natural way. Fur-

thermore, the immigration of such forms as small Orthocladiinae can hardly have taken place in any other way than across a land bridge. If we suppose that the Chironomids have been introduced into Greenland in different passive ways, e. g. by the wind, driftwood, etc., the distribution of the Greenland Chironomids would present a more confused aspect, since in such case the immigration would depend on mere accident. The fact that the Chironomids of Greenland can be divided into several distinct types of distribution in my opinion lends great support to the theory that the Greenland fauna has immigrated across land connections. The composition of the Greenland Chironomid fauna also supports the view that parts of the Greenland fauna have survived the latest period of glaciation. The conclusion of these zoogeographical considerations on the Greenland Chironomids is, then, that the Greenland fauna is to be regarded as a poor outpost of the holarctic region, which at different times received immigrations from different adjacent regions.

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Dansk Oversigt.

Af de 83 grønlandske chironomider er kun 11 fælles for øst- og vestkysten. Bortset fra et ikke ubetydeligt antal arter, der ikke er fundet uden for Grønland, falder de grønlandske chironomider i fire eventuelt fem udbredelsestyper. 1. nordøstlig-arktiske arter (Østgrønland, Spitsbergen, Novaja Zemlja etc.), 2. østlig-arktiske (Østgrønland, Spitsbergen, nordlige Skandinavien), 3. østlige boreal-arktiske (Østgrønland, Island, Skandinavien, event. Mellemeuropa), 4. boreo-arktiske og boreale arter (Vestgrønland, Nord-europa, event. Nordamerika), 5. vidt udbredte holarktiske arter (baade Vest- og Østgrønland, Nordeuropa, Amerika etc.). Selv om økologiske faktorer til en vis grad er årsag til chironomidernes særlige grønlandske udbredelse, maa den utvivlsomt hovedsagelig tilskrives indvandring til forskellige tider, dels fra nord-øst, dels fra syd-øst, samt endelig fra vest.
