

Fig. 1. Localities of *Artemiopsis stefanssoni* Johansen.

# STUDIES ON FRESHWATER ENTOMOSTRACA IN GREENLAND. I.

ARTEMIOPSIS STEFANSSONI JOHANSEN IN GREENLAND

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When investigating some ponds in the neighbourhood of Jakobshavn, West Greenland, I found in a sample of plankton some euphyllopods which seemed to differ from the fairy-shrimp common in West Greenland, the *Branchinecta paludosa* (O. F. Müller). The animals were smaller, more slender than the latter, and in the mature female the ovisac was short and wide, not, as in *Branchinecta*, long and narrow.

Examined in the laboratory the animals were identified as *Artemiopsis stefanssoni* Johansen 1922, a species known from northern Canada.

This species had not been found in Greenland hitherto, but the literature contains some notes regarding finds of *Artemia salina* (L.).

From the Zoological Museum, University of Copenhagen, I obtained some collections of Greenland entomostraca, so as to have material for comparison during my investigations. These collections comprise specimens from the material used by WESENBERG-LUND (1894) and by VANHÖFFEN (1897), plus 3 samples of *Artemiopsis stefanssoni*, taken in Greenland by Frits Johansen (1931), and so far not published. In the two old samples as well as in the unpublished ones the animals were determined by Frits Johansen as *Artemiopsis stefanssoni*; the tube containing the specimens from Vanhöffen's material also contained a note to the effect that the specimens were a gift from the Zoological Museum of Berlin to the Zoological Museum, University of Copenhagen.

Thus having at my disposal the whole of Wesenberg-Lund's material as well as part of Vanhöffen's, which is no doubt typical, I have no hesitation in maintaining that *Artemia salina* (L.) ought to be removed from the lists of the Greenland fauna, and replaced by *Artemiopsis stefanssoni* Johansen.

The previous records of *Artemiopsis* from Greenland, now to be considered synonymous, are:

*Artemia gracilis* Verrill, WESENBERG-LUND. 1894 p. 95

*Artemia gracilis* Verrill, VANHÖFFEN. 1897 p. 167

*Artemia gracilis* Verrill, STEPHENSEN. 1913 p. 286

*Artemia salina* (L.), HABERBOSCH. 1916 p. 137

*Artemia salina* (L.), HABERBOSCH. 1920 p. 31

It seems rather strange that the erroneous determination should not have been corrected at an earlier date, as apparently both Wesenberg-Lund and Vanhöffen, the only ones who have worked with material from Greenland, have their doubts as to the correctness of the determination. WESENBERG-LUND writes (1894 p. 98): "I have here dwelled in some detail on the description of this interesting species because there may be some doubt about the determination", and VANHÖFFEN (1897 pp. 167—168), comparing with the original description and that by Wesenberg-Lund: "Während bei diesen die Männchen 8—10, die Weibchen 10—12 mm lang waren, massen meine Exemplare nur 5 mm. Ausserdem ist bei ihnen das Abdomen kürzer im Verhältnis zum Vorderkörper, und die Bruttasche des Weibchens so breit, dass ich anfangs eine neue Art gefunden zu haben glaubte."

There is a 6th note on *Artemia* in connection with Greenland which should not be overlooked, as it might give the impression that the species after all does exist here. BÖCHER (1949 p. 56), writing on the zooplankton of Store Saltsø near the head of Søndre Strømfjord, states: "WESENBERG-LUND (1937) writes that *daphniae* (species of *Artemia*) play a very great part in salt lakes all over the world. They contribute to the red colouring of the water, "and it is stated that they may be found lying as red fringes along the shores". This statement thus may be corroborated by me." In September 1956 I had the opportunity, together with Professor Böcher, of paying a visit to Store Saltsø. A sample of plankton from the locality proved to consist almost exclusively of *Daphnia pulex* (de Geer). *Artemia* or *Artemiopsis* was not found.

The map (fig. 1) shows the localities of *Artemia stefanssoni* in Greenland. They are, from south to north: Claushavn (3/8 1890 Lundbeck leg.<sup>1</sup>)

<sup>1</sup>) WesenbergLund gives the locality and date for this specimen: "Claushavn, Will. Lundbeck 1889". Johansen's label in the collection of the Zoological Museum of Copenhagen has: 3/8 1890 W. Lundbeck leg. The original label has unfortunately been lost. VANHÖFFEN (1897) writes (p. 167): "Die Weibchen allein wurden 1891 von Lundbeck, dem dänischen Entomologen, bei Claushavn gesammelt, und von Wesenberg-Lund 1894 beschrieben". Having gone through the report on Lundbeck's journey I find that the date on the label is correct. On that date Lundbeck was in Claushavn and writes: "In a lake I collected a number of Crustacea". (LUNDBECK 1891 p. 135). The year 1889, given by Wesenberg-Lund, must be a mistake. In that year Lundbeck was travelling from Holsteinsborg to Julianehåb in South Greenland. Vanhöffen's mistake no doubt results from the publication of Lundbeck's report in 1891.

(WESENBERG-LUND 1894)), Jakobshavn (22/7 1956 and 24/8 1956 author leg.), Qarajaq Nunataq (23/7 1893 Vanhöffen leg. (VANHÖFFEN 1897)) and Tasiussaq (20/7 and 15/8 1931 F. Johansen leg.). Besides these there are two more samples, both collected by Frits Johansen and labelled: 1. Lake on the northern part of the island of Upernavik, West Greenland, 28/7 1931, and 2. Lake, about 3 feet deep, on the ridge on the northern part of the island of Upernavik, West Greenland. The two samples are probably from the same locality, as one contains only isolated *Artemiopsis stefanssoni*, and the other contains the species together with a great many other freshwater entomostraca. I have tried to locate the place, but have not definitely succeeded. Most likely it is on the northernmost part of the island where the town of Upernavik is situated. On the other hand I have never seen this island called "island of Upernavik" on any map. The nearest island correctly called by that name, is the "Island of Upernavik" situated in the north eastern part of Umanak Fjord. Of this island the northern part, however, is very inaccessible, and considering the means of transport available in Greenland, it would be very difficult to cover the distance from Tasiussaq to there in 7 days. For this reason the locality is not given on the map.

#### Comments on the material.

The following must be added to the original description given by JOHANSEN (1922 p. 26), and to the previous description of the Greenland species:

The male. The male specimens from Greenland are smaller than pointed out by JOHANSEN, who states: "The males measured from 7 to 10 mm, and in spite of their size they were fully mature, and continually copulating with the females."

I have measured the lengths of the males from the whole of the material. In the small samples all specimens were measured, and 25 individuals out of each of the large samples, giving the following result:

|                                | average<br>length | largest<br>specimen | smallest<br>specimen |
|--------------------------------|-------------------|---------------------|----------------------|
| Tasiussaq 20/7 1931 . . . . .  | 4.5 mm            | 5.6 mm              | 3.8 mm               |
| — 15/8 1931 . . . . .          | 3.4 mm            | 4.4 mm              | 3.1 mm               |
| Island of Upernavik 28/7 1931  | 4.5 mm            | 5.6 mm              | 3.9 mm               |
| Qarajaq Nunataq 23/7 1893.     | 3.8 mm            | 4.9 mm              | 3.0 mm               |
| Jakobshavn 22/7 1956 . . . . . | 5.7 mm            | 5.9 mm              | 5.5 mm               |
| — 24/8 1956 . . . . .          | 6.8 mm            | 7.5 mm              | 6.1 mm               |

It must be noted that the two collections from Tasiussaq are from two different localities, and that the great difference in size must be

due to biological conditions. Only one sample contains specimens of a size larger than the minimum given by Johansen.

Only mature individuals are taken into consideration in the present investigation, each specimen having been checked and found fully developed. VANHÖFFEN (1897 p. 167) gives the length as 5 mm, though the figures show that the males of his material, which I have gone through, are somewhat smaller.

In a single character the specimens from Greenland diverge from the original description. On the terminal joints of the claspers (fig. 2) on the dorsal side near the basis, is a small process furnished with spinules. This process does not appear in Johansen's drawing, nor is it mentioned in the text. He has probably overlooked it. In all other characters and in the proportions of the body, the specimens from Greenland agree well with the original description.

The female. The females from Greenland are also smaller than those of the original description. Johansen mentions 8 to 11 mm. Measurements of the present material give:

|                                | average<br>length | largest<br>specimen | smallest<br>specimen |
|--------------------------------|-------------------|---------------------|----------------------|
| Tasiussaq 20/7 1931 . . . . .  | 5.1 mm            | 6.8 mm              | 4.1 mm               |
| — 15/8 1931 . . . . .          | 5.2 mm            | 6.0 mm              | 4.0 mm               |
| Island of Upernavik 28/7 1931  | 5.1 mm            | 6.1 mm              | 4.3 mm               |
| Qarajaq Nunataq 23/7 1893.     | 4.4 mm            | 5.3 mm              | 2.9 mm               |
| Jakobshavn 22/7 1956 . . . . . | 5.1 mm            | 5.3 mm              | 4.9 mm               |
| — 24/8 1956 . . . . .          | 7.8 mm            | 8.8 mm              | 6.4 mm               |
| Claushavn 3/8 1891 . . . . .   | 4.6 mm            | 5.6 mm              | 3.4 mm               |

To make sure that all specimens measured were mature, only individuals with eggs in their ovisacs were taken into consideration. It will be seen that also here one sample only contains individuals of a size larger than the minimum size in the original description. The size mentioned by Vanhöffen is near enough correct. On the other hand it is very strange to read the note by WESENBERG-LUND (1894 p. 95): "*Artemia gracilis*, which is only 12 mm long — — —". Wesenberg-Lund's material originally comprised 16 specimens, all females. Of this material there are now left in the tube only 8 complete individuals and 3 defective ones (head or abdomen lacking). It seems a strange thing that the 5 missing specimens should have been so much larger than those remaining, more so as the bodies of the defective specimens are no larger than the bodies of those intact. It is possible that Wesenberg-Lund has not measured his specimens himself, but just given the length stated in the original description of *Artemia gracilis* Verrill. Unfortunately the present writer has not had the opportunity of seeing this paper.

On the number of eggs JOHANSEN just writes (1922 p. 28): "These females ---- had a great number of ripe, red-brown eggs ----". Wesenberg-Lund found 8 to 16 eggs, and Vanhöffen 5 to 9. In the material from Claushavn, used by Wesenberg-Lund, I only found 1 to 5 eggs, but as the animals were in a bad condition some of the eggs may have disappeared. The number in the Vanhöffen collection was as stated, and in the rest of the samples I have found every number from 1 to 25, the number increasing with the size of the animal.

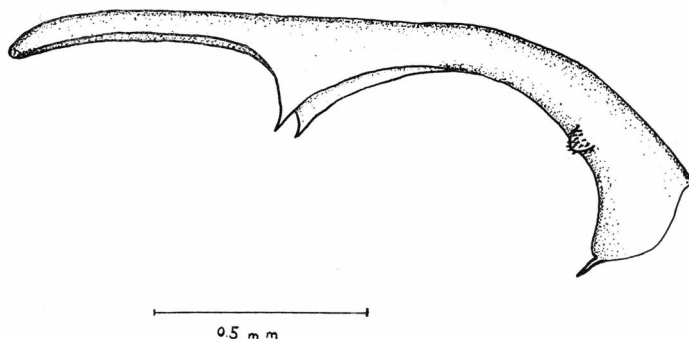


Fig. 2. Terminal joint of the claspers of *Artemiopsis stefanssoni* from Greenland.

The eggs were of a constant size of about 0.3 mm in diameter. I have measured eggs from all localities and from many specimens, but found no variation. It is not possible to find any character in which the Greenland specimens differ from the Canadian ones.

There is a single character I want to emphasise. JOHANSEN (1922 p. 28) writes: "The ovisac is very large and oval, its transversal diameter being longer than the longitudinal", and WESENBERG-LUND (1894 p. 98) says: "---- the ovisac, which is at least 3 times as broad as long." The specimens investigated by the present writer show quite plainly that with the increasing number of eggs the transversal diameter increases more than the longitudinal diameter:

| Number of eggs | longitudinal<br>diameter | transversal<br>diameter | length as % of<br>breadth |
|----------------|--------------------------|-------------------------|---------------------------|
| 2              | 0.80 mm                  | 1.00 mm                 | 80.0                      |
| 3              | 0.80 mm                  | 1.07 mm                 | 74.8                      |
| 4              | 1.07 mm                  | 1.40 mm                 | 76.4                      |
| 4              | 0.87 mm                  | 1.17 mm                 | 74.4                      |
| 5              | 0.87 mm                  | 1.23 mm                 | 70.7                      |
| 5              | 0.83 mm                  | 1.23 mm                 | 67.5                      |
| 6              | 1.00 mm                  | 1.47 mm                 | 68.0                      |
| 6              | 0.83 mm                  | 1.30 mm                 | 63.8                      |

(continued)

| Number of eggs | longitudinal<br>diameter | transversal<br>diameter | length as % of<br>breadth |
|----------------|--------------------------|-------------------------|---------------------------|
| 6              | 0.83 mm                  | 1.30 mm                 | 63.8                      |
| 7              | 0.83 mm                  | 1.10 mm                 | 75.5                      |
| 8              | 0.93 mm                  | 1.50 mm                 | 62.0                      |
| 9              | 0.93 mm                  | 1.40 mm                 | 66.4                      |
| 9              | 0.87 mm                  | 1.40 mm                 | 62.1                      |
| 9              | 1.07 mm                  | 1.77 mm                 | 60.5                      |
| 10             | 1.07 mm                  | 1.60 mm                 | 66.9                      |
| 11             | 1.07 mm                  | 1.73 mm                 | 61.8                      |
| 11             | 0.97 mm                  | 1.63 mm                 | 59.5                      |
| 13             | 1.00 mm                  | 1.90 mm                 | 52.6                      |
| 17             | 1.17 mm                  | 2.10 mm                 | 55.7                      |
| 18             | 1.20 mm                  | 2.13 mm                 | 56.3                      |
| 20             | 1.00 mm                  | 1.77 mm                 | 56.3                      |
| 20             | 1.00 mm                  | 1.97 mm                 | 50.8                      |
| 20             | 1.20 mm                  | 2.37 mm                 | 50.6                      |
| 22             | 1.07 mm                  | 2.17 mm                 | 49.3                      |
| 25             | 1.27 mm                  | 2.43 mm                 | 52.3                      |

This table confirms the fact that the transversal diameter is longer than the longitudinal diameter; the proportions, however, are in no case 3 : 1 as stated by Wesenberg-Lund. The Claushavn specimens were unfortunately in such bad condition that they could not be taken into consideration here; very likely Wesenberg-Lund has used the contents of the ovisacs and not the ovisacs themselves, the hindmost part of the latter being normally empty.

I wish to express my very sincere thanks to the Directors of the Arctic Station, University of Copenhagen, Professor Dr. T. W. Böcher Professor, Dr. R. Spæck, and Professor, Dr. M. Westergård for their never ceasing interest in the work at the station.

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