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THE ZOOLOGY OF EAST GREENLAND

FRESHWATER ENTOMOSTRACA

BY

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WITH 24 FIGURES IN THE TEXT

KØBENHAVN

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INTRODUCTION

The freshwater entomostraceans of East Greenland have until recent years been little investigated only. The first papers dealing with this fauna were published by C. WESENBERG-LUND in 1895 and 96. The paper from 1895 deals mainly with the fauna of West Greenland, but the material collected by Ryder's Expedition (1891—92) on Danmarksø in Scoresby Sund, East Greenland is dealt with also. The paper from 1896 concerns the East Greenlandic fauna only. In these papers the following species are recorded from Danmarksø and Jameson Land, 70°26' N. Lat., (see the map, fig. 1):

- Lepidurus glacialis* (KRØYER).
- Daphnia groenlandica* n. sp.
- Scapholeberis mucronata* (O. F. M.).
- Simocephalus expinosus* (KOCH)?
- Bosmina obtusirostris* G. O. SARS.
- Macrothrix arctica* G. O. SARS.
- Eurycercus lamellatus* (O. F. M.).
- Acroperus leucocephalus* SCHOEDLER.
- Chydorus sphaericus* O. F. M.
- Polyphemus pediculus* (L.).

Of these 10 species *Daphnia groenlandica* cannot be maintained as a separate species, it must be referred to *D. pulex* (see p. 13), and there are strong reasons to suppose that *Eurycercus lamellatus* (see pp. 30—31) is identical with *E. glacialis* and that *Simocephalus expinosus* must be referred to *S. vetulus* (see pp. 19—20). Finally *Acroperus leucocephalus* is a synonym for *A. harpae*.

In the years 1906—08 the Danmark Expedition collected entomostraceans from the region of East Greenland between 76°—77° N. Lat. This material was treated systematically by V. BREHM 1912, and biologically by FR. JOHANSEN 1912. In the first mentioned paper the following 15 species were recorded:

Lepidurus arcticus PALLAS.
Daphnia pulex DE GEER.
Macrothrix hirsuticornis NORM. & BR.
Lynceus rectangulus G. O. SARS.
Chydorus sphaericus O. F. M.
Limnocalanus macrurus G. O. SARS.
Diaptomus minutus LILLJ.
Cyclops strenuus FISCHER.
Canthocamptus cuspidatus SCHMEIL.
— *duthiei* SCOTT??
Epactophanus richardi MRAZEK.
Maraenobiotus brucei RICH.?
— *danmarki* n. sp.
Candona groenlandica n. sp.
Herpetocypris glacialis G. O. SARS.

Apart from the two species recorded with a ? the list comprises 13 spec. According to EKMAN, 1913, *Limnocalanus macrurus* must be referred to *L. grimaldi* DE GUERNE. P. HABERBOSCH, 1920, is of the opinion that *Canthocamptus* (*Moraria*) *duthiei* should be *M. schmeili*.

The present investigation deals with a material of freshwater entomostraceans from East Greenland (see the map fig. 1) collected by various expeditions for the Zoological Museum of the University of Copenhagen. By far the largest part of the material has been collected during "Treaars Expeditionen til Christian d. X's Land" 1932—34 under the leadership of Dr. phil. LAUGE KOCH. A smaller part was collected by the "Amdrup Expedition" 1901—02, the "Godthaab Expedition" 1930, and an English expedition to Scoresby Sund (C. C. BERTRAM) 1933. Further a small material from the "Danmark" Expedition 1906—08, which was not dealt with by V. BREHM has been included in the investigation.

In the above mentioned material at hand for the present investigation the following species were found.

Euphyllopoda.

1. *Lepidurus arcticus* (PALLAS).

Cladocera.

2. *Daphnia pulex* (DE GEER).
3. *Scapholeberis mucronata* (O. F. M.).
4. *Simocephalus vetulus* (O. F. M.).

5. *Bosmina longirostris* (O. F. M.).
6. *Macrothrix hirsuticornis* NORMAN & BRADY.
7. *Eurycercus glacialis* LILLJEBORG.
8. *Acroperus harpae* BAIRD.
9. *Alona affinis* (LEYDIG).
10. *Alonella excisa* (FISCHER).
11. *Chydorus sphaericus* O. F. M.
12. *Polyphemus pediculus* (L.)

Copepoda.

13. *Cyclops strenuus* (FISCHER).
14. *Canthocamptus cuspidatus* SCHMEI.
15. *Maraenobiotus danmarki* V. BREHM.

Ostracoda.

16. *Prionocypris glacialis* G. O. SARS.
17. *Heterocypris incongruens* (RAMD.).
18. *Candona candida* O. F. M.—VAVRA.

Thus of the various orders the following numbers of species were recorded:

Euphyllopoda	1
Cladocera	11
Copepoda	3
Ostracoda	3
	in all ... 18

Of these 18 species the following 5 are new to East Greenland:

- Bosmina longirostris.*
Alona affinis.
Alonella excisa.
Heterocypris incongruens.
Candona candida.

These 5 species have all been recorded from West Greenland.

Further 6 species (8?), which are not found in the above mentioned material, have previously been published from East Greenland. Thus till now 24 (26?) species of Freshwater Entomostraca are known from this area. They will all be dealt with in the Synopsis.

I. Synopsis of the Species.

A. Euphyllopoda.

1. *Lepidurus arcticus* PALLAS.

Apus glacialis, KRØYER 1847.

Lepidurus glacialis G. O. SARS 1896, pl. XI, XII, XIII.

East Greenland records:

Lepidurus glacialis C. WESENBERG-LUND 1896.

Lepidurus arcticus V. BREHM 1912.

Apus glacialis F. JOHANSEN 1912.

Apus glacialis K. STEPHENSEN 1913.

Lepidurus arcticus SVEN SØMME 1934.

Occurrence in East Greenland: *Scoresbysund Area*: Danmarksø and Jameson Land (C. WESENBERG-LUND), various ponds in the neighbourhood of Hurry Fjord, 4.—14. Aug. 1933. *Franz Joseph Fjord Area*: Geographical Society Island (SVEN SØMME), Myggbukta (SVEN SØMME), near Knudshoved (SVEN SØMME), between Tyroler Fjord and Grant's Fjord (SVEN SØMME), Crater Lake near Cape Herschel (SVEN SØMME). Lake near Knudshoved $\frac{5}{8}$ 1930, small lake at Moskusoksefjord $\frac{15}{8}$ 1930, small lake near Kap Stosch $\frac{1}{8}$ 1930, Langsø on Ellaø $\frac{24}{8}$ 1933 and $\frac{29}{8}$ 1934, Bjørnesø on Ellaø $\frac{1}{7}$ 1934. *Nordøstkyst Area*: Various localities in the area of the Danmarks-*expedition*, ca. 77° N. Lat. (V. BREHM, F. JOHANSEN), lake near Danmarkshavn July 1907 and June 1908.

Occurrence in West Greenland: Recorded from several localities between ca. 67° and ca. 78° N. Lat. GRUBE (1853), WESENBERG-LUND (1894), G. O. SARS (1909), K. STEPHENSEN (1913), P. HABERBOSCH (1920).

Distribution: In the arctic and semiarctic regions: Scandinavian Highland, Bear Island, Spitzbergen, Iceland, Greenland, Northern Canada, Alaska, North Japan, Sibiria, Russia.

Remarks: SV. SØMME (1934) has drawn attention to the fact that specimens from the arctic Bear Island differ from specimens from the Norwegian Highland by the smaller spines on the posterior segments

of their bodies. In the East Greenlandic specimens the spines (see fig. 2) are as small as, or even smaller, than in specimens from the Bear Island and sometimes also fewer in number. According to OLOFSSON (1918) specimens from Spitzbergen differ from Norwegian specimens by their shorter caudal lamella. Also the East Greenlandic specimens have a shorter caudal lamella than those from Norway. It is, however, not only the length of the caudal lamella but its form too which are different in the two regions. As it is seen from fig. 3 A and B the caudal lamella is triangular in the East Greenlandic *L. arcticus* as well in larger as

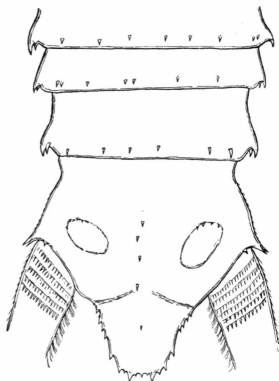


Fig. 2. *Lepidurus arcticus*, ♀, 27 mm, Pond C. Hurry Fjord, $\frac{9}{8}$ 1933. Posterior part of body with caudal lamella and base of caudal filaments; seen from above.

in smaller individuals although comparatively longer in the former, whereas in Norwegian specimens according to SARS (l. c. Tab. XII, figs. 23—27) and SV. SØMME (l. c. fig. 3 c) it is “linguiform, scarcely constricted at the base” (SARS). The triangular caudal lamella is also according to SØMME (1934), OLOFSSON (1918), and FR. JOHANSEN (1920) found in *L. arcticus* from Bear Island, Spitzbergen and Canada. Thus there seems to be morphological differences between the various stocks of *L. arcticus*, and there is reason to assume that there exist at any rate two races of this species, one from the true arctic regions, characterized by a triangular caudal lamella, and another from the Scandinavian Highland, characterized by a linguiform caudal lamella. It is of interest to observe that regarding the form of the caudal lamella the Scandinavian individuals come nearer to the Central European *L. productus* (with a pear-shaped caudal lamella) than the true arctic individuals. The first pair of legs of the Greenlandic specimens (fig. 3 C) resembles that of the Norwegian form very closely.

The East Greenlandic specimens attain a large size, the total length of the largest specimens being 29 mm. In table 1 is given the measurements of specimens (all females) from Langsø (Ellaø) and from ponds at

Hurry Fjord (Aug. 1933). The carapace length is measured from the front margin of the carapace to the middle of the sinus of its hind margin; the total length from the front margin of the carapace to the tip of the caudal lamella. The carapace length varies between 6 and 21 mm, the total length between 8 and 29 mm. The specimens from Langsø (Aug. 24th, 1933) are considerably smaller (in mean 14.2 mm) than those

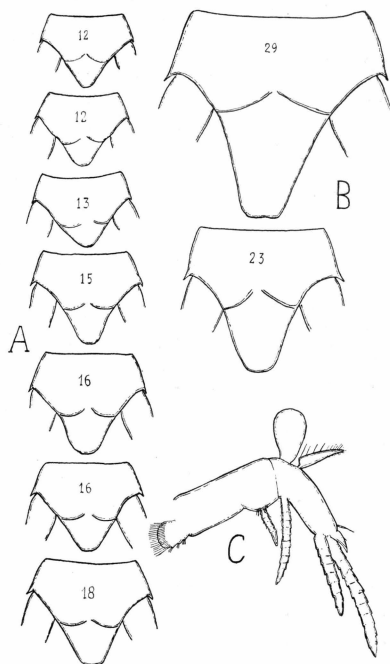


Fig. 3. *Lepidurus arcticus*, A — Langsø, 24/8 1933; B — Pond A, Hurry Fjord, 6/8 1933; last segment with caudal lamella of specimens of varying sizes, the figures denote the total length in mm. C — leg of the 1st pair of an individual (tot. 1. 27 mm) from Hurry Fjord, Pond A, 6/8 1933.

from Hurry Fjord (Aug. 4th—14th, 1933) (17.0 mm). This difference in size may perhaps be due to a beginning dying away of the oldest and largest specimens during the month of August. The smallest mature specimens (i. e. females with eggs in the capsule of the 11th pair of legs) measure a total length of 11 mm. The number of eggs in each capsule is generally one, in a few cases two and in one case only, three. The number of eggs seems to be higher in the larger individuals than in the smaller ones. No males were found in the material¹⁾.

L. arcticus is very common in the area investigated; it is found both in lakes along the beach and in small ponds. The fact that it is

¹⁾ Further particulars concerning the development and descriptions of the larvae found are given separately (ERIK M. POULSEN, 1940).

Table 1. Measurements of *Lepidurus arcticus* from North-East Greenland.

Locality	Ponds round Hurry Fjord		Langsø Ellø		Both localities		
Date	4.—14. Aug. 1933		24. Aug. 1933		4.—24. Aug. 1933		
Length	Carapace	Tot. l.	Carapace	Tot. l.	Carapace	Tot. l.	Mean no. of eggs ¹⁾
mm							
6.....	2	..	2	..	4	..	..
7.....	..	..	3	..	3	..	..
8.....	..	1	12	..	12	1	0
9.....	6	1	22	1	28	2	0
10.....	10	..	16	1	26	1	0
11.....	8	..	12	3	20	3	1
12.....	2	..	3	9	5	9	0.7
13.....	2	2	1	12	3	14	1.3
14.....	2	3	..	16	2	19	0.8
15.....	1	10	..	10	1	20	0.7
16.....	1	5	..	9	1	14	0.6
17.....	..	4	..	6	..	10	1.2
18.....	1	1	..	2	1	3	0.7
19.....	..	1	..	1	..	2	2.0
20.....	1	3	..	1	1	4	1.0
21.....	1	2	..	..	1	2	0.5
22.....	..	..	..	..	..	..	..
23.....	..	..	..	..	..	..	..
24.....	..	1	..	..	..	1	0
25.....	..	..	..	..	..	..	..
26.....	..	..	..	..	..	..	..
27.....	..	1	..	..	..	1	1.0
28.....	..	1	..	..	..	1	2.0
29.....	..	1	..	..	..	1	2.5
Tot. number	37	37	71	71	..	..	..
Mean length.....	11.4	17.0	9.4	14.2	..	..	..

¹⁾ the no. of eggs refer to the tot. l.

found in Langsø during the summer, but not in autumn, winter or spring, seems to show that the species does not hibernate, the observation of larvae but not of grown-up specimens in June and the beginning of July gives evidence to the same effect. The dispersion of the length of the individuals in Tab. 1 is quite uniform with one maximum only and tends to show that one generation only is present; thus the life cycle is the following: In early summer the larvae are hatched from the wintering eggs, in the course of the summer the larvae grow up to mature specimens, which in the course of August produce wintering eggs and then die. The life cycle is just the same as in Spitzbergen (OLOFSSON l. c.).

B. Cladocera.

2. *Daphnia pulex* DE GEER.

Daphnia pulex W. LILLJEBORG 1900, Tab. IX, fig. 8 and Tab. X, figs. 1—9.

East Greenland records:

Daphnia groenlandica C. WESENBERG-LUND 1895.

Daphnia groenlandica C. WESENBERG-LUND 1896.

Daphnia pulex V. BREHM 1912.

Daphnia pulex F. JOHANSEN 1912.

Occurrence in East Greenland: *Scoresbysund Area*: Danmarkshavn and Jameson Land (C. WESENBERG-LUND). Pond on Jameson Land, various ponds near Hurry Fjord, pond on Storø. *Franz Joseph Fjord Area*: Various lakes and ponds on Ellæ, Uglesø on Ymers Ø, ponds and small lakes near Nordfjord, lakes at Moskusoksefjord, lake at Knudshoved, lakes and ponds at Kap Stosch, Sandøen Tyrolerfjorden. *Nordøstkyst Area*: Pond on Maroussia Island, lake near Storm-Kap, lakes near Danmarkshavn, various localities in the area of the "Danmark"-Expedition (V. BREHM and F. JOHANSEN).

Occurrence in West Greenland: Common and numerous in West Greenland from Kap Farvel in the South to 77°30' N. Lat. (North West Point of Greenland).

Distribution: Widely distributed: Europe, Northern- and Central Asia, North Africa and North America.

Systematical remarks: The principal character by which *Daphnia pulex* differs from the closely related *D. longispina* is the comb of strong thorns on the tail claws. This comb is present in all the *Daphnia*

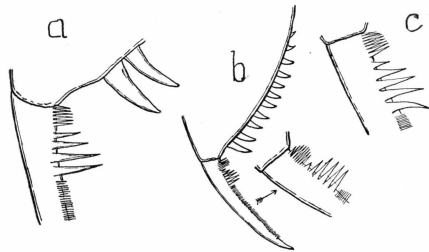


Fig. 4. *Daphnia pulex*, a — the end of the cauda and the base of the caudal claw of an ehippial female from a pond at Kap Stosch, $\frac{3}{8}$ 1930. b — the cauda and the base of the caudal claw of an ehippial female from a lake at Moskusoksefjorden, $\frac{17}{8}$ 1930. c — the base of the caudal claw of an empty (subitaneous) female from Langsø, $\frac{10}{7}$ 1934.

specimens observed in the material from East Greenland. The comb (see fig. 4) is divided in two parts: a proximal one consisting of 5—8 slender and comparatively short spines placed very closely to each

other, and another part distally to the first one and composed of 4—6 long and strong spines set a little apart from one another; in some cases a small but stout spine is placed between the two sections of the comb. Distally to the comb is a fringe of fine hairs; this fringe continues almost to the end of the claw. The rostrum is short but pointed; the pigment spot is always present. The spine of the carapace varies very much in length, in some cases it is almost lacking, in other cases (grown-up individuals) it attains nearly $\frac{1}{3}$ of the total length (\div the spine). In most cases the spine is straight, but some specimens were observed having a slightly upwards curved spine. The length of the head is about $\frac{1}{4}$ — $\frac{1}{3}$ of the carapace-length.

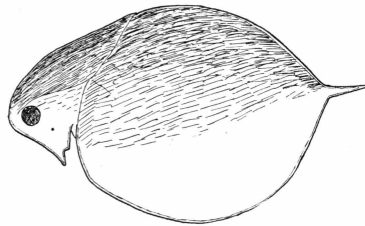


Fig. 5. Empty (subitaneous) female from Langsø, Ellasø, $\frac{10}{7}$ 1934; Tot. l. \div the spine 2.00 mm.

On Danmarksø WESENBERG-LUND (1895) has found specimens which he described as a new species *D. groenlandica*. As the most characteristic features of *D. g.* he mentions its almost spherical form, the dark, nearly black, colour of the dorsal part of the carapace and the head, and the short, stout, slightly curved spina arising from the central (not the dorsal) part of the posterior margin of the shell; further the comb of the caudal claws is somewhat stronger than in *D. p.* Of *D. g.* he found empty specimens only. In the collections of the "Danmark" expedition V. BREHM (1911) did not find specimens corresponding with *D. g.*, and P. HABERBOSCH (1920) is of the opinion that *D. g.* is identical with *Daphnia pulex*. In the present material specimens closely resembling *D. g.* are found in the early summer ($\frac{10}{7}$) in the colonies propagating by means of sub. eggs. Here both empty ♀ and ♀ carrying sub. eggs (or young) have — laterally viewed — a rather spherical form, and the spine is placed very near the central part of the hind margin of the shell (see fig. 5); the animals are dark-coloured especially in the dorsal part of the cephalothorax, but also the dorsal part of the carapace and — to a lesser degree — the ventral parts are dark. According to the figure of *D. g.* given by WESENBERG-LUND the margin of the head in front of the eye is straight; this holds good also for the said specimens in the present material. Regarding the pigment spot WESENBERG-LUND writes: "macula cerebialis deest (?)". In my material,

however, the pigment spot is present without doubt, but it is hardly visible through the microscope by transparent light, no doubt due to the comparatively dark colour of the head; however, on a white background it is clearly seen. The cauda resembles that of other *D. p.*; the number of thorns on its dorsal margin is about 14. The comb of the caudal claws (fig. 4 c) consists as in other *D. p.* of a proximal part with 7—8 slender spines and a distal part with 5 long and stout spines.

In think there can be no doubt that *D. g.* must be regarded as an early summer form of *D. p.*¹⁾ (WESENBERG-LUND has found it in July too) representing ex-ephippia females which are propagating by means of subitaneous eggs (or have just ceased from this mode of reproduction). The spherical form and the strong vaulting of the carapace (on account of which the spine seems to spring from the middle of the hind margin) is no doubt caused by the strong development of the brood pouch. That WESENBERG-LUND has not found his *D. g.* with subitaneous eggs may be caused either by a too small material or by the fact that the sampling has taken place at a time when the colonies in question have ceased from the subitaneous propagation without having yet begun to produce ephippia.

Specimens with dark coloured cephalothorax and carapace are, however, very common in most of the arctic localities where *D. p.* has been found. P. HABERBOSCH mentions that he in shallow waters (often together with *Lepidurus arcticus*) has found "eine merkwürdige, an den dorsalen Schalen- und Antennenteilen stark pigmentierte Form von *Daphnia pulex*". The same dark coloured form I have found often in the highlands of Iceland²⁾. In Spitzbergen O. OLOFSSON (1918) has found the dark coloured form too. In more southern regions this dark coloured form has not been observed, and there is any reason to suppose that the dark coloured form is characteristic for the arctic and semiarctic regions. In the material from East Greenland it is very common; sometimes the colony consists of dark coloured specimens only, but in many cases dark coloured and light coloured specimens are found together, in still other cases light coloured specimens are present only. During the fortnightly investigations of Langsø the following observations were made as to the occurrence of light coloured and dark coloured specimens:

Date	29/6	10/7	23/7	8/8	12/8	22/8	5/9	19/9	3/10	19/10	31/10
Dark spec.....	(+) ³⁾	+	+	+	+	+	+	+	+	(+)	+
Light spec.....	+	+	(+)	(+)	(+)	..	(+)	(+)	+	+	+
Date	14/11	30/11	13/12	27/12	12/1	23/1	7/2	24/2	5/3	20/3	4/4
Light spec.....	+	+	+	+	+	+	+	+	+	+	+

1) Cfr. ERIK M. POULSEN 1940.

2) ERIK M. POULSEN, 1924.

3) A () means comparatively few individuals.

These observations tend to show that dark coloured specimens are dominating during the summer and totally lacking in the winter. During the winter light coloured specimens are found only; in the beginning of the summer and during the autumn both dark and light specimens are present in the samples. It could be supposed that the dark colouring was connected either with certain size groups or generations or with a certain mode of reproduction; further the possibility cannot be denied on beforehand that the dark and the light specimens constitute two races of *D. p.*: one, the dark, which ends its life cyclus in autumn and another, the light which lives through the whole of the winter. In order to elucidate these questions we shall go in details as to the occurrence of dark coloured specimens (= d) and light coloured specimens (= l) especially in the Langsø-material. On June the 29th *D. p.* is observed for the first time since the disappearance of the wintering animals in the beginning of April. The colony consists of young partly newly hatched and partly older, all of course hatched from the ephippia. Among the newly hatched mainly l. occur, there are, however, some few with a slight dark colouring of the shell; the older young are, however, truly dark coloured. The measurements (in mm) of the young are as follows:

	l. young (6 sp.)	slight d. young (12 sp.)	older d. young (5 sp.)
Total length.....	0.83	0.83	1.87
Length of spina	0.29 (35 %)	0.31 (38 %)	0.30 (16 %)
Length of head.....	0.19	0.17	0.40

Both l. and d. are thus of the same total length; also the length of the spine and the head is about the same; the few older but still immature specimens had the same actual length of S. as the young ones. On July the 10th both d. and l. specimens occur, they have now grown considerably and subitaneous females as well as young are found in both forms. The following table gives the results of some measurements (in mm) carried out on specimens from this sample:

	Young		Subitaneous ♀♀	
	d. (7 spec.)	l. (7 spec.)	d. (16 spec.)	l. (41 spec.)
Tot. length	0.83	0.91	2.35	2.42
length of spine ..	0.51 (61 %)	0.35 (38 %)	0.21 (8.9 %)	0.37 (15.2 %)
length of head ..	..	..	0.44 (17.8 %)	0.44 (17.8 %)

Concerning the sub. ♀ it is clear that there is little difference only as to the total length of the two forms and the length of the head is about the same. As to the length of the spine there is, however, a clearly pronounced difference between the two forms, the l. spec. having a spine nearly twice as large as that of the d. spec. As to the young ones the case is just the opposite, here the spine of the d. spec. is nearly

twice as large as that of the l. spec. The number of eggs or young in the brood pouch is about the same in the two forms; in the l. spec. in main 6.5 (4—11) in the d. spec. 6.2 (2—11).

On July the 23rd by far the largest number of the individuals belong to the dark form, whereas only few are light coloured; empty and sub. ♀ are found among both forms. The young found in the sample all belong to the dark form. The measurements (in mm) are as follows:

	Young d. spec. (9 sp.)	empty and sub. d. (25 sp.)	empty and sub. l. (16 sp.)
Total length	0.93	2.18	2.43
Length of spine	0.43 (44 %)	0.17 (7.8 %)	0.21 (8.7 %)

Considering the grown-up individuals it is seen that the l. spec. are somewhat larger than the d. spec. The spine has about the same length in the two forms; this is rather astonishing as on July the 10th the spine was nearly twice as large in the l. as in the d. spec. The alterations in the spine length is clearly seen from the following figures:

	d.	l.
July 10th	8.9 %	15.2 %
July 23rd	7.8 %	8.7 %

Whereas the length of the spine in the l. spec. is reduced with 43 %, the reduction in the d. spec. is only 12 %; the result of this varying degree of reduction is that the two forms now have nearly the same percentic spine length. Another remarkable feature is that whereas on July the 10th the l. spec. were only 0.07 mm longer than the d. spec., they were on July 23rd no less than 0.25 mm longer than the d. spec. That young of the light coloured form was not observed at all on the 23rd, whereas d. young were fairly numerous makes it evident that the l. form now is disappearing and therefore now only composed of older and larger individuals, the cause of this disappearance may either be that the l. females now have ceased to produce young or that they now produce dark young; the last explanation is obviously the right one as at any rate a few light coloured ♀ with sub. eggs were observed. On August the 12th we have still a not inconsiderable number of light coloured ♀ with sub. eggs but no light coloured young. This also tends to show that the light coloured ♀ during the summer produce dark young. The results of measurements (in mm) of specimens from Aug. the 12th were as follows:

	young d. (11 sp.)	empty and sub. d. (13 sp.)	empty and sub. l. (5 sp.)
Total length	1.47	2.39	2.50
Length of spine	0.23 (15.6 %)	0.13 (5.8 %)	0.13 (5.2 %)

The length of the spine is now still more reduced both in young and in grown-up spec. and about the same in the d. and l. spec.

In 1934 the sampling was stopped on Aug. 12th but in order to follow the fate of the two forms during late summer and onwards we can go back to 1933 when the fortnightly sampling began on Aug. the 8th. On Aug. the 8th the colony consisted of empty ♀ and young only, there were many dark coloured ones grown-up as well as young but only 2 light coloured spec. were observed. The measurements were as follows:

	young d. (36 spec.)	empty d. (14 spec.)	empty l. (2 spec.)
Total length	1.18	2.40	2.83
Length of spine	0.30 (26 %)	0.15 (6.0 %)	0.17 (6.0 %)

The l. spec. observed were thus large (old) individuals. On Aug. 22nd only d. spec. were found. On Sept. the 5th rather many d. young and grown-up spec. (♀ with eph.) were observed and one single light young. On Sept. 19th many d. eph. ♀ and empty ♀ and some few light empty and eph. ♀ were present, the d. and l. specimens were of about the same size and their spine were of the same length. On Oct. the 3rd, the 19th and the 31st the number of d. spec. is steady decreasing and the number of l. spec. increasing; both d. and l. eph. ♀ are found; the measurements (in mm) are as follows:

	d. empty and eph. ♀ (13 spec.)	l. empty and eph. ♀ (14 spec.)
Total length	2.03	1.98
Length of spine	0.16 (8 %)	0.17 (7.6 %)

The size and the spine length of the two forms are thus nearly the same. From Nov. and onwards until the colony dies away in the end of March l. spec. are found only.

How are we to explain the relation between dark- and light-coloured specimens? are there in East Greenland two varieties of *D. p.* or two different species of *D.* one dark with a short life cyclus lasting to October only and another light one with a long life cyclus lasting until March. As in most of the samples there is no other difference to be found between the two forms than the difference in colour, there is no reason to regard the two forms as different species or varieties. This view is supported by the fact that light coloured spec. are very common in the beginning of July and then nearly disappear towards August without having produced ephippia and in spite of an intense production of sub. eggs in the first half of July. When on July the 23rd we find dark young only, although the sample contains rather many light sub. ♀ this must undoubtedly show that the light coloured ♀ produce dark young. Thus the d. and l. specimens cannot be regarded as belonging

to various species or varieties; the varying colouration must be regarded as a mode of seasonal variation.

The course of this variation is the following: In the early summer when the colony only consists of young or immature larger individuals (June 29th) the young are light or only slightly coloured, whereas the larger individuals are truly dark coloured. A little later in the season (July 10th) both l. and d. young and l. and d. subitaneous ♀ are found. Thus we may draw the conclusion that the young hatched from the ephippia are lightcoloured or slightly dark coloured. As the first sub. ♀ observed are partly dark coloured and partly lightcoloured, we must conclude that the exephippiao young partly maintain the light colour and partly become dark coloured during their further growth. All the young hatched from both light coloured and dark coloured ♀ are dark coloured. As the temperature rises during July the l. ♀ disappear; it is not clear from the material if this disappearance of the light specimens is caused by their dying away or by the fact that they become dark during their further development. At any rate in the high summer dark specimens occur only, in the autumn, however, light spec. appear again and the number of dark spec. decreases; finally in the winter light spec. are found only. Although the relation between the dark and the light specimens has not been fully explained by the observations made, I think we are right in assuming that the variation in colour is a seasonal variation; the dark colour prevailing during the summer and the light colour in the winter, whilst dark and light colouration is found together during spring and autumn.

Biological remarks. Although a very large material from several localities and from various seasons of the year has been investigated males have never been observed. Neither have any of the previous investigators of East Greenlandic *D. p.* colonies (C. WESENBERG-LUND and V. BREHM) mentioned the occurrence of males. It is thus evident that the *D. p.* of East Greenland propagate exclusively without males producing as well subitaneous eggs as resting eggs parthenogenetically. The case is thus the same as in Svalbard, where O. OLOFSSON did not find males in his large material.

By means of the fortnightly investigation of Langsø (on Ellaø) it has been possible to state the mode of the life cyclus of the North-East Greenlandic *D. p.* The propagation is monocyclic. The young are hatched from the ephippia in the course of June, in July and August the propagation by means of subitaneous eggs is in full swing and many young individuals are present in the samples. In September no more females with sub. eggs neither any young are found, but a number of ephippial females are now observed (in samples from other localities ephippial females were found as early as in the latter half of July). In all the

samples from the autumn and the winter ehippial females were found; the last sample in which ehippial females were present was from the 1st half of March; in samples from the latter half of March and from the 1st half of April a few empty females were found; from the end of April to the beginning of June no specimens were present in the samples. It is of interest to note that the production of resting eggs is continued through the long arctic winter.

The mature specimens of *D. p.* from East Greenland generally have a size of ca. 2.0 mm (without the spine); the largest spec. found had a total length of 3.00 mm (including the spine 3.27 mm). On the whole the growth is through the summer about the same as in more southern localities (f. i. Denmark), however, the wintering specimens do not grow in the latter half of the winter as it is the case in southern waters (K. BERG, 1931).

In the colonies of *D. p.* from East Greenland a seasonal variation has been found regarding the spine length; the following observations have been made: Within one and the same individual the length of the spine does not increase at all. In spec. which grow up in early summer (when the temperature is rising) the spine length does not decrease during the individual growth, later, however, when the temperature is falling the length of the spine decreases. In specimens hatched in the middle of the summer when the temperature begins to fall the spine length decreases steadily from the newly hatched stage and onwards through the life of the individual. The length of the spine of the newly hatched young varies accordingly to the temperature as it appears from the following survey:

1934	June	July		August
	17 ex-eph. young	7 ex. eph. y.	16 ex-sub. egg-y.	8 ex-sub. egg-y.
Total length	0.81 mm	0.93 mm	0.87 mm	1.10 mm
Spine length	0.27 mm	0.35 mm	0.46 mm	0.33 mm
Sp. l. in % of tot. l.	33.3	37.6	53.0	31.8

The spine length — both actual and percentic is thus somewhat larger in July than in June and August.

It has not been possible to state any conspicuous local variation between colonies from various East Greenlandic waters neither concerning the mode of propagation nor concerning seasonal variation. As to the spine length there seems to be some local variations, some colonies having in the main a longer spine than others.

As it is not within the scope of the present paper to go into details as to the biology of the species treated further observations and remarks concerning the biology of *Daphnia pulex* in East Greenland have been published separately (ERIK M. POULSEN 1940).

3. *Scapholeberis mucronata* (O. F. MÜLLER).

Scapholeberis mucronata W. LILLJEBORG 1900, Tab. XXII, fig. 15.

East Greenland records:

Scapholeberis mucronata C. WESENBERG-LUND 1895.

Scapholeberis mucronata C. WESENBERG-LUND 1896.

Occurrence in East Greenland: *Scoresby Sund Area*: Danmarksø 70°27' N. Lat. (C. WESENBERG-LUND 1895), lake, Nordostbugten, 71°30' N. Lat. ¹⁴/₈ 1900.

Occurrence in West Greenland: Rather commonly found along the coast from Umanak in the north to Breddefjord in the south.

Distribution: Widely distributed: Asia, Africa, Europe, North America; not so common in the Arctic as in more southern latitudes.

Remarks: In the sample only one specimen, a young female without a frontal horn was found; it measured: Tot. l. (÷ mucro) 0.5 mm, height 0.3 mm, mucro 0.08 mm. The scarce occurrence in East Greenland is in good accordance with the fact that the species is rare also elsewhere in the Arctic. WESENBERG-LUND writes that the species never is found in Greenland in considerable numbers.

4. *Simocephalus vetulus* O. F. MÜLLER.

Simocephalus vetulus LILLJEBORG 1900, Tab. XXIV, figs. 8 and 17.

East Greenland records:

Simocephalus exspinosus? C. WESENBERG-LUND 1895.

Simocephalus exspinosus? C. WESENBERG-LUND 1896.

Occurrence in East Greenland: *Sydøstkyst Area*: Pond near Puisortok, ¹⁶/₈ 1932. *Scoresby Sund Area*: Pond near Hurry Fjord, 2 samples ⁷/₈ 1933, empty and ephippial females. *Franz Joseph Fjord Area*: Bjørnesø, Ellaø, ¹⁸/₈ 1933, ephippial females and males; ¹/₇ 1934, many young females and a single one with ephippia. Langsø, Ellaø, ¹²/₆ 1934, cast ephippia. Lake at Ellaø, ²⁵/₈ 1932. Lake at Knudshoved, ⁵/₈ 1933, young, females with subitaneous eggs, cast ephippia.

Occurrence in West Greenland: Found in various localities (C. WESENBERG-LUND 1895, P. HABERBOSCH 1920).

Distribution: Widely distributed, especially in the northern hemisphere.

Remarks: The specimens from East Greenland correspond well with former descriptions (f. i. W. LILLJEBORG 1900). The front of the head (see fig. 6) is rounded and the rostrum is quite smooth; the hind margin of the shell is rounded; the caudal claw is furnished with a

dense fringe of fine hairs but completely devoid of spines or stronger hairs. The pigment spot is rhomboidal or oval in form with a long ascending stripe; thus it has not quite the longstretched form which is generally found in *Simocephalus vetulus*, but as the form of the pigment spot may vary rather considerably (according to LILLJEBORG, 1900) I do not think that there is any reason — on account of the form of the pigment spot — to doubt the identity of the Greenlandic specimens with *Sim. vetulus*. WESENBERG-LUND (1895) has described some specimens of *Simocephalus* from East Greenland (Danmarksø) as *S. ex-*

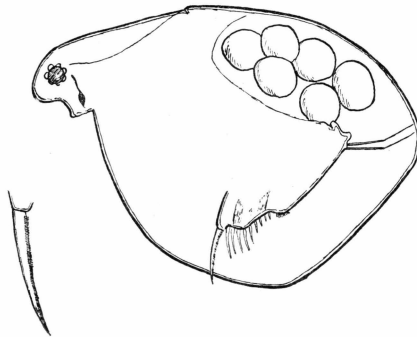


Fig. 6. *Simocephalus vetulus*, Knudshoved, $\frac{5}{8}$ 1934; female with subitaneous eggs, total length 1.93 mm; the claw of the cauda drawn to a larger scale.

spinosus?, but on account of the “small and badly conserved” material he has added the ? to the name. As *S. vetulus* now is known both from West- and East Greenland whereas *S. exspinosus* not has been recorded from Greenland at all, I think there is reason to assume that these “badly conserved” specimens from Danmarksø belong to *S. vetulus*.

As to the mode of reproduction the following details can be given. Bjørnesø Aug. 18th (1933): many females with ephippia and a few males found, no females with subitaneous eggs. The ephippial females were of the following sizes (total length):

Units.....	18	19	20	21	22	23	24	25	26	27
No.	1	..	1	3	9	4	4	2	..	1

Mean total length: 1.50 mm (1.20—1.80), 25 spec. The males measured 1.07 and 1.33 mm; the males are thus considerably smaller than the ephippial females. In the same locality on October 25th (1933), when the lake was ice-bound, no specimens were observed at all. On July the 1st of the following year some few young immature females and two ephippial females were found; no males were observed. The mean total length of the young females was 1.14 mm (0.80—1.53), 42 spec. As no larger, parthenogenetic females were found it is obvious that the spec-

imens are still immature and that they must have been hatched from the hibernating ephippia. The two ephippial females had a length of 1.33 and 1.40 mm, thus falling within the range of the young, immature females; this in connection with the fact that no signs of a parthenogenetic propagation was observed, makes it probable that these ephippia-carrying females belong to the first ex-ephippio-generation.

Near Knudshoved on August the 5th a number of young females with a mean total length of 1.07 mm, and very few (3) parthenogenetic females, total length: 1.80, 1.93 and 2.13 mm, were found. The parthenogenetic females were thus considerably larger than the ephippial females found in Bjørnesø on Aug. 18th. The number of eggs in the brood pouch is ca. 5—6.

In a pond, Hurry Fjord, Aug. 7th ephippial and empty females were found.

From the preceding statements it is evident that *S. vetulus* in East Greenland is monocyclic. In the course of June (?) the ephippia hatch and in the beginning of July the young ones become mature. The ex-ephippio specimens propagate by means of partly subitaneous eggs and partly ephippial eggs. The propagation by means of subitaneous eggs is still going on in the beginning of August, but in the latter half of August only ephippial females are found. After the period of sexual propagation has come to an end the colony disappears and the wintering takes place by means of ephippia.

It is interesting to observe that males are exceedingly rare; this tends to show that the males are not necessary for reproduction by means of winter eggs and ephippia. The case is thus to some degree the same as in *Daphnia pulex*, only the males can still be found however in very limited numbers.

As well WESENBERG-LUND as HABERBOSCH have found that the "sexual" period begins very late in the year, later than for the other Greenlandic Cladocera. As it appears from the above mentioned observations this does not always hold true for the colonies in North-East Greenland, ephippial females have been found as early as July 1st. *S. vetulus* does not in this respect behave otherwise than other Greenlandic Cladocera, but the fact that parthenogenetic females have been found as late as August 5th (by P. HABERBOSCH as late as Aug. 19th) seems to indicate that although the propagation by means of resting eggs begins early, the propagation by means of subitaneous eggs lasts for a long time, the two modes of reproduction taking place simultaneously for a rather long period.

5. *Bosmina longirostris* (O. F. MÜLLER).

Bosmina longirostris F. E. RÜHE 1912, Tab. I, fig. 3.

Bosmina longirostris var. *similis* W. LILLJEBORG 1900, Tab. XXXI, fig. 15.

Bosmina longirostris var. *cornuta* JURINE, W. LILLJEBORG 1900, Tab. XXXII, fig. 3.

Occurrence in East Greenland: *Franz Joseph Fjord Area*: Rundsø, Ellaø, 72°50' N. Lat., during the fortnightly investigations it

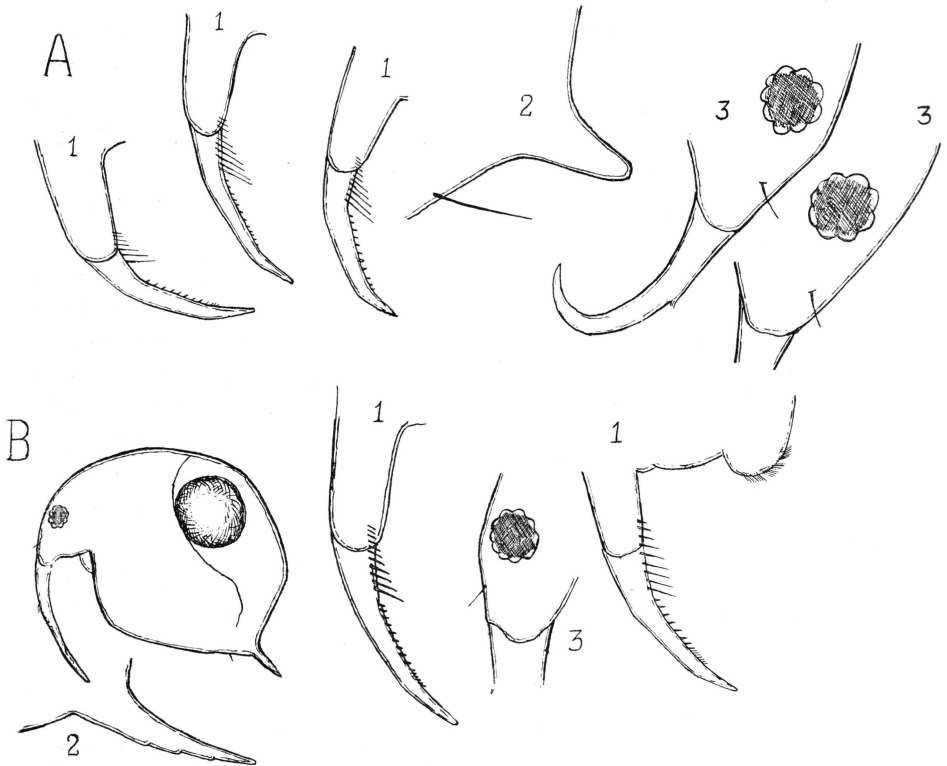


Fig. 7. *Bosmina longirostris*, A — Rundsø, $\frac{9}{8}$ 1933, 1 — end of cauda with claw of 3 different ind., 2 — posterior-inferior angle of carapace, 3 — head of 2 ind. B — Ulvesø, $\frac{14}{9}$ 1933, 1—3 as in A.

is caught in all the samples taken from $\frac{9}{8}$ - $\frac{31}{10}$ 1933 and $\frac{11}{7}$ - $\frac{12}{8}$ 1934. Uglesø, Ymerø, 73°15' N. Lat., $\frac{11}{8}$ 1932 and $\frac{10}{8}$ 1933. Ulvesø, Ellaø, 72°50' N. Lat., $\frac{15}{8}$ 1933 and $\frac{14}{9}$ 1933.

New to East Greenland.

Occurrence in West Greenland: Known from a few localities (P. HABERBOSCH 1920).

Distribution: Widely distributed: Europe, Africa, Asia, America; from the tropical zones and into the Arctic.

Systematical remarks: It is rather astonishing that it is *B. longirostris* and not *B. coregoni* that is found in the present material,

as *B. coregoni* in the var. *obtusirostris* G. O. Sars is most commonly met with in arctic waters, whereas *B. longirostris*, although it is recorded from several localities in the Arctic, has its main distribution in more temperate regions. There is, however, no doubt as to the identity of the specimens in question with *B. longirostris* as it is defined by F. E. RÜHE (1912): The caudal claw (fig. 7 A and B 1) has always two flexures by which it is divided in three parts. The proximal part is on its dorsal margin furnished with a comb of long slender hairs or spines increasing in length distally; distally of the comb is a row of 7—10 short spines or teeth set apart from one another, outside of this row may be found a narrow fringe of hairs. The frontal seta (fig. 7 A and B 3) is inserted halfway between the eye and the end of the rostrum.

Of *B. longirostris* two varieties are found, one in Rundsø (fig. 7 A) corresponding with var. *cornuta* (JURINE) and another in Ulvesø (fig. 7 B) corresponding with var. *similis* LILLJEBORG. In the specimens from Rundsø, var. *cornuta*, the 1st antennae are rather short and in the adult always curved backwards towards the end and hookformed, in the young the 1st antennae are comparatively longer, backwards curved but not hookformed. The height of the carapace of the sub. ♀ in ‰ of the total l. is 725 varying between 565 and 867 ‰ (59 spec.). The horn on the inferior posterior angle of the carapace has a mean length of 60 ‰ of the total l. varying between 40 and 100 ‰ (59 spec.).

From Ulvesø, where the other variety var. *similis* LILLJEBORG was found only very few spec. were recorded. The 1st antennae are rather long, in 5 spec. measured the following lengths in ‰ of the tot. l. were found: 407, 448, 452, 484, 500. The horn on the inferior-posterior angle of the carapace had the following lengths in ‰ of the tot. l.: 129, 129, 138, 157, 167.

In both varieties the reticulation and striation of the shell is hardly visible.

Biological remarks: The occurrence of the species in Rundsø, where fortnightly investigations have been carried out was as follows:

	9/s	24/s	5/9	14/9	(the lake ice covered)					11/7	23/7	12/8
					5/10	17/10	31/10	14/11 1933—	30/6 1934			
Young	c	c	+	r	rr	..	..	no	+	c	c
♀ w. sub. eggs	c	c	+	r	r	rr	..	specimens	+	c	c	
Eph. ♀ . . . . .	..	+	+	+	..	..	..	observed	..	..	+
empty ♀	r	r	+	c	c	r	rrr		+	+	+	

B. long. is present in the samples from summer and early autumn only. It makes its first appearance on July the 11th after the lake has been ice-free a week or two. During July and the 1st week of August it propagates by means of sub. eggs only; in the last half of August

by means of resting eggs also. The number of eggs in the brood pouch of the sub. females is rather small: in July in mean 2.6, in August 1.7, in September 1.0. Thus the number of eggs is highest in the beginning of the season. Males were not present in any of the samples. In the sparse material of *B. longirostris* from West Greenland P. HABERBOSCH (1920) found eph. females only and no males. Thus males of *B. longirostris* have not been recorded from Greenland, although ehippial females have been found both in West and East Greenland.

6. *Bosmina coregoni-obtusirostris* G. O. SARS.

Occurrence in East Greenland: WESENBERG-LUND (1895 and 1896) records *Bosmina obtusirostris* G. O. SARS from Danmarksø (70°27' N. Lat.), and *Bosmina arctica* W. LILLJEBORG from Greenland (no locality and date).

Occurrence in West Greenland: Found in many localities from Umanak in the north to Bredefjord in the south.

Distribution: Mainly arctic and subarctic, found in Asia, Europe and America.

Remarks: Although WESENBERG-LUND does not give any description of the hairs or spines on the caudal claws (the specific value of this character not being recognised at that time), his figures and descriptions make it probable that the species in his material is *B. coregoni-obtusirostris* and not *B. longirostris*. In his Greenlandic material (both from the west and the east) of *B. obt. arctica* he did not find any males; of *B. obt. s. str.* he only found 2 males. As it appears from P. HABERBOSCH'S records (although he does not draw attention to this fact in his text) males are very rare in his material. $^{29}/_7$: more than 100 sub. ♀, 15 eph. ♀, 4 ♂; $^{20}/_8$: many sub. ♀, ca. 1000 eph. ♀, 5 ♂; $^{25}/_7$: hundreds of sub. ♀, 3 eph. ♀, no ♂; $^{1}/_8$: of 1000 ♀ at the most $^{1}/_{10}$ only with eph. 20 ♂; $^{11}/_8$: 50 eph. ♀, 1 ♂. The number of males is thus very small in comparison with the number of ehippial females (abt. 1200 eph. ♀ against 30 ♂). The scarcity of the males in proportion to the ehippial females (both regarding *B. longirostris* and *B. obtusirostris*) seems to indicate that the propagation by means of resting eggs in the Greenlandic *Bosmina* is at any rate not purely sexual.

7. *Macrothrix hirsuticornis* NORMAN & BRADY.

Macrothrix arctica G. O. SARS 1890.

Macrothrix hirsuticornis var. *groenlandica* W. LILLJEBORG 1901, Tab. LV, figs. 6—14.

East Greenland records:

Macrothrix arctica C. WESENBERG-LUND 1895.

Macrothrix arctica C. WESENBERG-LUND 1896.

Macrothrix hirsuticornis V. BREHM 1912.

Occurrence in East Greenland: *Scoresby Sund Area*: Danmarksø (WESENBERG-LUND 1895). Pond at Hurry Fjord, $7/8$ 1933, empty females and females with subitaneous eggs and with resting eggs, a few males. Another Pond at Hurry Fjord, $4/8$ 1933, males and empty females. *Franz Joseph Fjord Area*: Pond on Sandøen Tyrolerfjorden, $24/7$ 1930, females with subitaneous eggs. *Nordøstkyst Area*: Lake on Maroussia (V. BREHM 1912).

Occurrence in West Greenland: Various localities between Holstensborg and Umanak (P. HABERBOSCH 1920). WESENBERG-LUND 1895, has mentioned *Macrothrix rosea* JURINE from West Greenland; P. HABERBOSCH is of the opinion that WESENBERG-LUND's species is not *Macr. rosea* but *Streblocerus serricaudatus* (which HABERBOSCH has found in various localities in West Greenland), as WESENBERG-LUND's figure shows 4 sensory setae on the distal margin of the 1st antenna. The said figure shows, however, clearly 3 such setae only. According to LILLJEBORG the number of sensory setae is both in *Macrothrix (rosea)* as well as *hirsuticornis*) and in *Streblocerus* ca. 6. Thus even if the specimen figured by WESENBERG-LUND had 4 sensory setae, this does not show that the specimen belong to *Streblocerus* rather than to *Macrothrix*. The specimen figured by WESENBERG-LUND can, however, not — as stated by WESENBERG-LUND — belong to *Macr. rosea*. In *Macr. rosea* the first antenna is not widened distally and not backwards curved (cfr. LILLJEBORG's fig. 17, Tab. LIV). WESENBERG-LUND's figure shows, however, both the distally widening and the backwards curve of the 1st antenna, both features being characteristic for *Macr. hirsuticornis*. I therefore hold that the specimens described by WESENBERG-LUND must be referred to this species and neither to *Macr. rosea* nor to *Streblocerus serricaudatus*. The occurrence of *Macr. rosea* in Greenland should be rather astonishing also as it is not found elsewhere in the Arctic.

Distribution: *Macr. hirsuticornis* is widely distributed, recorded from South- and North America, with the Arctic, from Africa, total Europe (with Iceland and Spitzbergen) and from Northern Asia.

Remarks: The arctic *Macr. hirsuticornis* is often described as a special species, *M. arctica*, G. O. SARS 1890 (Northern Norway), OLOFSSON 1918 (Spitzbergen) and C. WESENBERG-LUND 1895 (N. E. Greenland). W. LILLJEBORG 1900, mentions the East Greenlandic form as a special variety, *M. hirs. groenlandica* and looks upon the two forms as luxuriating varieties only of *M. hirsuticornis*; KAJ BERG (1933—34) supports this view. The variety *arctica* has in later years been found in temperate countries too, by KAJ BERG (l. c.) who writes that "the large, well developed Danish individuals seem to resemble var. *arctica* most", and by P. PARENZAN (1931) who has described *M. arctica* G. O. SARS from the Italian Alps. According to G. O. SARS *M. arctica* differs

from *M. hirsuticornis* by the lesser curving of and the broader distal part of the 1st antenna, and LILLJEBORG states that the distal part of the tail bristles are longer in *M. arctica* than in *M. hirsuticornis*. OLOFSSON and KAJ BERG hold that the difference in the length of the distal part of the tail bristles is the best distinguishing character between the two forms. P. PARENZAN states that the two forms (he regards them as distinct species) are to be distinguished from one another by a notch in the dorsal margin just at the border between the head and the carapace being present in *M. arctica* but not in *M. hirsuticornis*. This is quite opposite to G. O. SARS' original description of *M. arctica*, who writes: *linea dorsali testae et capitis arcum aequum formata*". It is evident that none of the characters by which *M. arct.* has been distinguished from *M. hirs.* are very distinct and there is reason to suppose that KAJ BERG is right in assuming that "the appellation var. *arctica* covers luxuriating individuals which appear when certain unknown conditions of life exist".

The specimens found in the present material are very like those from Denmark. The size (total length) of the East Greenlandic specimens is as follows (Maroussia, end of July, Hurry Fjord, beginning of August).

Mature ¹⁾ females	0.80 mm (0.49—1.08)	43 spec.
Ephippial females.....	0.69, 0.71, 0.72 mm	3 spec.
Males	0.40 mm (0.28—0.46)	14 spec.

Thus on a whole the East Greenlandic specimens of the present material are rather small and by far not as large as WESENBERG-LUND'S specimens from Danmarksø from July (up to 2 mm). They coincide in size with primiparous females from Denmark (0.80 mm) from January (KAJ BERG); the males are somewhat smaller than the Danish males (0.60 mm). According to LILLJEBORG *M. arct.* differs from *M. hirs.* s. str. by its size, the former being 0.80—1.20 mm, the latter only 0.60—0.98 mm. At Spitzbergen the size varies according to OLOFSSON from 0.6—1.0 mm; the Spitzbergen specimens is thus of about the same size as the East Greenlandic. In size the East Greenlandic and Spitzbergen specimens come nearer to *M. hirs.* s. str. than to *M. arctica* which shows that it is not at any rate the size that distinguish the arctic specimens from those of the more southern distribution.

On a whole the East Greenlandic specimens (see figs. 8, 9 and 10) resemble those from Denmark fairly well, only the nape-organ is very inconspicuous and by far not so protruding as in the specimen figured by KAJ BERG, sometimes it is not to be seen at all. However, I shall,

¹⁾ By mature females I understand all females larger than the smallest egg-carrying females (0.49 mm).

not lay much stress on this difference as the indistinctness of the nape-organ in the East Greenlandic specimens may be caused by the state of preservation, these specimens having been conserved in alcohol or formalin for several years, whereas BERG's figure obviously is made from living specimens. The shell is oval, more or less according to the number of eggs in the brood-pouch. There is no dorsal incision behind

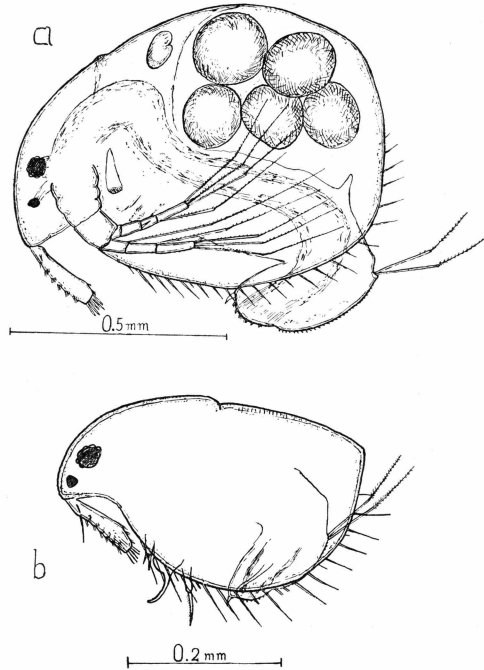


Fig. 8. *Macrothrix hirsuticornis*, A — subitaneous female from Sandøen, Tyrolerfjorden, ²⁴/₇, 1930. b — a male from pond A, Hurry Fjord, ⁴/₈, 1933.

the head. The first antennae (fig. 9) are always backwards curved and distally widened. On the front margin there is 6, in some cases 7, incisions furnished with a comb of bristles; on the outside and near the basis a small bristle is present. The distal end carries ca. 6 strong sensory setae and behind these, on the distal part of the hind margin, two or three groups of bristles. The form of the 2nd antenna appears from fig. 10 b; it corresponds into details with the descriptions and figures given by W. LILLJEBORG 1900; only I have observed 2 joints in the large bristles; it seems, however, as if the second distal joint is a false one — without flexibility. The cauda (fig. 10 a) is furnished with a small but stout end claw; on both sides of the anus 6 or 7 small combs of bristles are present. The margin of the cauda is furnished with a fringe of short tiny spines; on the sides of the cauda especially near

the dorsal margin small hairs or groups of hairs are scattered rather densely. The male (fig. 8) is as already mentioned much smaller than the female. The back is less rounded than in the female and often nearly

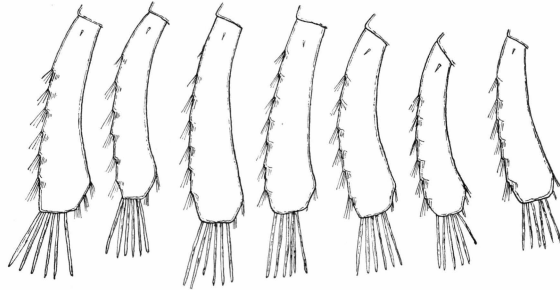


Fig. 9. *Macrothrix hirsuticornis*, pond at Hurry Fjord, 7/8 1933; 1st antenna of 7 females.

straight; the head is comparatively large and set off from the carapace by a small incision. The superior-posterior angle of the carapace is prominent. The lower margin of the carapace is, as in the females, furnished with long, stout hairs, these being comparatively longer than in the females. The 1st antenna is longer than that of the female and hardly curved at all; it has the same furnishing of hairs and setae as

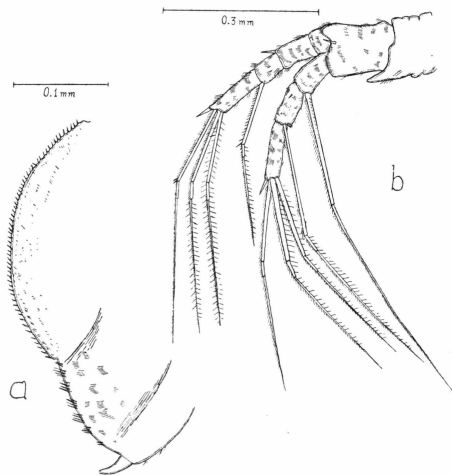


Fig. 10. *Macrothrix hirsuticornis*, female from a pond at Hurry Fjord, 7/8 1933; a — cauda, b — 2nd antenna.

that of the female but besides it carries a long bristle proximally on the front margin. Further the male is easily recognised from the female by the strong hook on the first pair of legs.

The ephippium consists of the hind part of the shell and carries 2 eggs. Concerning the ephippia OLOFSSON has observed that the newly cast ephippium consists of the whole hind part of the shell with both dorsal and ventral margin, but later on the ventral part breaks off and the ephippium consists of the upper part of the shell only. Observations on the present material confirm this statement; I have found in August (Pond at Hurry Fjord) as well newly cast ephippia (with eggs) and consisting of the whole posterior part of the shell as old, empty ephippia (from the preceding season) without the ventral shell part.

Regarding the mode of propagation the following observations have been made. On July 27th (Tyrolerfjorden, Sandøen) females with subitaneous eggs were observed only; the number of eggs in the brood pouch varied between 8 and 12. On July the 30th (Maroussia) the colony consisted of both subitaneous and ephippial females; whereas the subitaneous females were present in rather large numbers, there were very few ephippial females only; also males were present. On August the 4th—7th also both subitaneous and ephippial females as well as males were found; the majority of the females were still subitaneous, the ephippial females were, however, more numerous than in the end of July. The number of eggs in the brood pouch of the subitaneous females was smaller than in the sample from the end of July, 3—7 in mean 5 (10 spec.). A number of young immature specimens were present too. Thus it is evident that the propagation by means of subitaneous eggs lasts at any rate until the beginning of August and that the production of winter eggs begins in the end of July. P. HABERBOSCH, 1920 has not found ephippial females in his material and of males some shell-fragments only. Neither WESENBERG-LUND (1895) nor V. BREHM (1912) have given any information as to the mode of reproduction.

8. *Eurycercus glacialis* LILLJEBORG.

Eurycercus glacialis LILLJEBORG 1900, Tab. LXI, figs. 1—8.

East Greenland records:

Eurycercus lamellatus (?) C. WESENBERG-LUND 1895.

Eurycercus lamellatus (?) C. WESENBERG-LUND 1896.

Occurrence in East Greenland: *Sydøstkyst Area*: Pond with shallow water near Angmagssalik, ¹⁵/₈ 1902. *Scoresby Sund Area*: Danmarkso (C. WESENBERG-LUND 1895 and 1896)¹.

¹) It is not quite evident from W. L.'s paper (1895) if *Eur.* has been found in East Greenland (Danmarkso) or only in West Greenland. In his list of localities for *Eurycercus* (l. c. p. 123) no locality from East Greenland is mentioned. In his table showing the distribution of the cladocera in Greenland the species is, however, marked down under the heading "Danmarkso". In the paper from 1896 it is mentioned from the locality "Danmarkso" too.

Occurrence in West Greenland: KRØYER (1838), WESENBERG LUND (1895), VANHÖFFEN (1897), and K. STEPHENSEN (1916) mention *Eurycerus lamellatus* from various localities, whereas DE GUERNE and J. RICHARD (1889) and P. HABERBOSCH (1920) give records of *Eurycerus glacialis* from many localities. P. HABERBOSCH is of the opinion that *Eur. glacialis* is the only *Eurycerus* species in Greenland, and that all former records of *Eur. lamellatus* in reality must be referred to *Eur.*

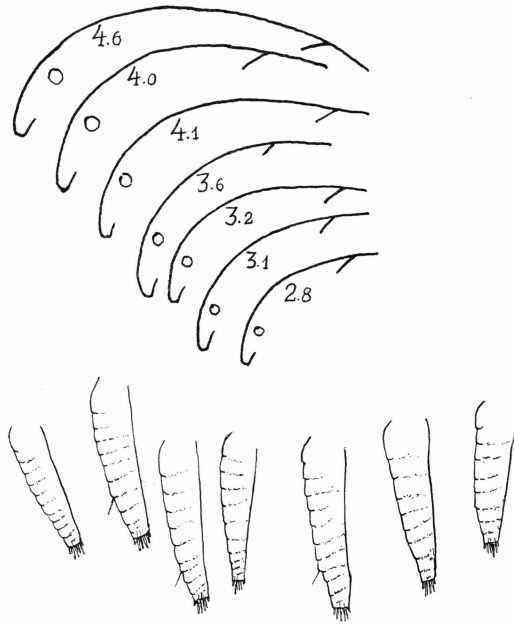


Fig. 11. *Eurycerus glacialis*, pond near Angmassalik, $\frac{15}{8}$ 1902. Head and anterior part of carapace of 7 females of varying sizes (the figures denote the total length of the spec. in mm). 1st antenna of 7 females.

glacialis. He gives, however, no reasons for this opinion. The fact that HABERBOSCH himself has not been able to find in his large material from West Greenland *Eur. lamellatus*, may perhaps justify his opinion, but it must be borne in mind that the existence of *Eur. lam.* in Greenland cannot be denied on beforehand. The species occurs under similar arctic conditions both in the highlands of Sweden, in the northernmost part of Siberia (Yamal peninsula, Jana territory) and in the arctic Canada.

Distribution: Siberia, Arctic North America, North Europe and a single record from Holland.

Remarks: C. WESENBERG-LUND has from Greenland on the whole (both West- and East Greenland) recorded specimens of *Eurycerus* corresponding closely with the description W. LILLJEBORG has given of his *Eurycerus glacialis*, but he says that among his very large material,

both of young and of older stages, there are found as well specimens corresponding with *Eur. lamellatus* as specimens corresponding with *Eur. glacialis* and that it is completely impossible always to state with certainty which specimens belong to *Eur. glac.* and which to *Eur. lam.*; especially the smaller forms occurring in early summer resemble *Eur. lam.*, whereas those from the autumn seem to be identical with *Eur. glac.* He therefore finds it most natural to class all the Greenlandic specimens of *Eurycercus* among the old species *Eurycercus lamellatus*.

The specimens found in the material at disposal for the present investigations are true *Eurycercus glacialis* (see fig. 11). There is no constriction of the dorsal margin behind the head; fig. 11 shows some contour-drawings of the head and the anterior part of the carapace of specimens of varying sizes; both in the smaller and in the larger individuals the said margin is quite smooth and no trace of the constriction so characteristic for *Eur. lamellatus* can be observed. The figure also shows the 1st antenna of seven specimens of varying sizes; the 1st antenna is more slender than that of *Eur. lamellatus* and corresponds quite well with W. LILLJEBORG's figure of the 1st antenna of *Eur. glacialis*. The sensory seta is placed, when present, (in some of the specimens it could not be seen, obviously due to the state of conservation) near the end of the antenna and not as in *Eur. lamellatus* in the middle of the antenna. The number of teeth on the dorsal margin of the cauda varies between 65 and 89 (see the table below). Also this shows that the specimens in question belong to *Eur. glacialis*. According to W. LILLJEBORG the number of teeth by *Eur. glacialis* varies between 80—90, rarely exceeding 100; in *Eur. lamellatus*, however, between 100 and 120. The table below gives some further details regarding the specimens (all females) found near Angmagssalik on Aug. 15th, 1902:

Tot. l. mm	height of carapace, mm	No. of eggs	No. of teeth on cauda
69.....	46	12	88
67.....	42	11	79
65.....	44	9	67
64.....	43	9	89
61.....	39	12	?
59.....	34	7	79
59.....	35	8	74
54.....	33	14	74
50.....	32	8	63
49.....	34	4	?
48.....	30	7	77
48.....	28	15	85
47.....	30	9	73
46.....	32	2 young	79
45.....	27	9	81
42.....	26	2 young	65

The carapace of the two specimens with young in the brood-pouch had a light yellow colour, whereas in all the other specimens the upper and especially the hindmost part of the carapace was of a dark yellow or brownish colour; obviously these specimens are ehippial females with resting eggs in the brood-pouch and the primitiv ehippium is about being formed. The fact that all the eggs in these specimens were of the same nearly spherical form, and dark coloured, shows that they are in the same state of development, and therefore makes it evident that these eggs are resting eggs. The number of young in the brood-pouch was only two; also WESENBERG-LUND has observed that the parthenogenetic females carry only few eggs or young in the brood pouch. In most of his samples he observed ehippial females only; in one sample a few parthenogenetic females were found. It seems thus as if the parthenogenetic propagation is of little importance in comparison with the sexual propagation. P. HABERBOSCH (1920), however, holds another view as to the numerical proportion of the parthenogenetic and ehippial females; he writes: "Die Mehrzahl der reifen *Eurycercus glacialis*-Weibchen, die ich in meinem Material ganz vereinzelt antraf, halte ich für Sub. ♀, und nur wenige — — — betrachte ich mit Sicherheit als Lat. ♀, da nur bei diesen der Dorsalteil der Rumpfschale die für das Primitiv ehippium typische Dunkelfärbung zeigt". As P. HABERBOSCH uses the word "regard" (betrachte) it is obvious that he is not quite sure if he has distinguished rightly between subitaneous females and ehippial females. Unfortunately enough he does not give any informations as to the state of development of the eggs in his assumed sub. females. However, if the eggs had been developing he would not have had the slightest doubt as to whether his females were sub. females really, so I think we are right in assuming that his sub. females are ehippial females; that their carapaces had not yet got the typical dark colouring of the primitiv ehippium does not matter much, as it is a well known fact that the winter eggs are transferred to the brood-pouch before the ehippium is fully developed.

That P. HABERBOSCH's subitaneous females — or at any rate the larger part of them — must have been ehippial females is also indicated by the relative frequency of the two modes of reproduction as it is stated in his tables; according to HABERBOSCH the number of samples with sub. females only and eph. females only are as follows: In July: 34 samples with sub. females only and 2 samples with eph. females only; in August 22 samples with sub. females only and no samples at all with eph. females. That ehippial females should be so extremely rare during July and August in arctic Greenland is quite unnatural and can only be explained by a wrong determination of the mode of reproduction in the specimens concerned.

In the sample from Angmagssalik no males were present. P. HARBOSCH has not found males at all and in the 6 localities where WESENBERG-LUND found ehippial females, males were only present in one. It is thus clear that males are very rarely found and they are by far outnumbered by the ehippial females.

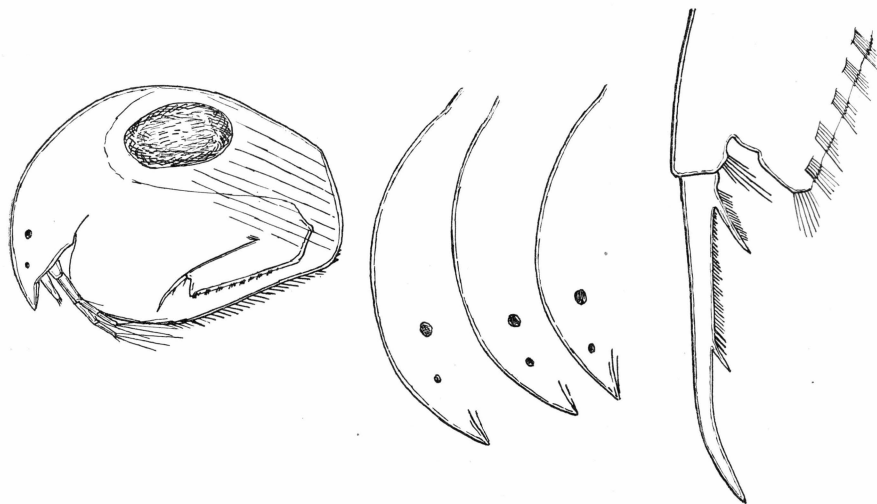


Fig. 12. *Acroperus harpae*, pond near Puisartok, $16/8$ 1932; ehippial female, 0.71 mm; head of 3 ehippial females, end of cauda of an ehippial female.

9. *Acroperus harpae* BAIRD.

Acroperus harpae W. LILLJEBORG 1900, Tab. LXIII, fig. 14.

Acroperus harpae KEILHACK 1909.

East Greenland records:

Acroperus leucocephalus C. WESENBERG-LUND 1895.

Acroperus leucocephalus C. WESENBERG-LUND 1896.

Occurrence in East Greenland: *Sydøstkyst Area*: Pond on a little island off Puisartok, $16/8$ 1932. *Scoresby Sund Area*: Danmarkø (C. WESENBERG-LUND (1895)).

Occurrence in West Greenland: Found from Bredefjord in the south to Umanak in the north.

Remarks: The specimens (see fig. 12) found in the sample from $16/8$ were all ehippial females; in some of them an egg (only one) was found in the ehippium, others were empty but characterized as ehippial females by the brownish colour of the upper part of the shell. No males were present in the sample. The total length of the specimens was in mean 0.66 mm, varying from 0.62—0.71 mm (11 spec.). The height of the carapace was in mean 68 % of the total length, varying from 65—75 %. The height of the crista, measured from the eye to the margin

of the crista, was 0.06 mm or about 80 % of the distance from the eye to the pigment spot. The specimens are thus of about the same size as those from more southern localities. The considerable height of the carapace makes it evident that the species is *A. harpae* and not *A. angustatus*. The crista is much lower than in the summer-specimens from more southern localities and has about the same height as in the autumnal individuals from the Faroes (ERIK M. POULSEN 1929 l. c.). The var. *frigida* EKMAN was not found in the material.

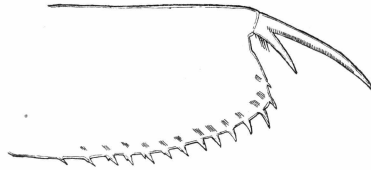


Fig. 13. *Alona affinis*, Fuglesøen, Ymerø, 11/8 1932, cauda of an empty female.

10. *Alona affinis* LEYDIG.

Lynceus affinis LILLJEBORG 1900, Tab. LXVII, figs. 1—14.

Alona quadrangularis var. *affinis* KEILHACK 1909.

Occurrence in East Greenland: This species is only found once in the present material, a single empty female being found in the lake Fuglesøen on Ymerø (Franz Joseph Fjord Area) on Aug. 11th, 1932. New to East Greenland.

Occurrence in West Greenland: The species is rather common along the coast from Umanak in the north to Julianehaab in the south.

Distribution: Europe, especially the northern part, Northern Asia, North America.

Remarks: The cauda (see fig. 13) with the straight, not outwards curved dorsal margin and the series of short hairs on the base of the basal spine of the caudal claws clearly shows that the specimen belongs to the species *A. affinis* and not to the nearly related *A. quadrangularis*. The single specimen found — an empty female — had a length of 1.00 mm and a height of 0.52 mm.

11. *Alona rectangula* G. O. SARS.

Lynceus rectangulus W. LILLJEBORG 1900, Tab. LXIX, figs. 1—3.

Lynceus rectangulus V. BREHM 1912.

East Greenland records:

Occurrence in East Greenland: *Nordøstkyst Area:* 2 specimens found by V. BREHM (1912) in a lake at Danmarkshavn in the end of July 1907.

Occurrence in West Greenland: Found between Holstensborg and Disco, HABERBOSCH 1920.

Distribution: Widely distributed: Europe, Northern Asia, South and North America.

Remarks: One of the specimens found was an ephippial female.

12. *Alonella excisa* FISCHER.

Alonella excisa W. LILLJEBORG 1900, Tab. LXXII, figs. 9—16.

Occurrence in East Greenland: *Scoresby Sund Area*: Pond at Hurry Fjord, $7/8$ 1933; empty females, ephippial females, parthenogenetic females and males. Another Pond at Hurry Fjord, $14/8$ 1933; empty females, ephippial females and males.

New to East Greenland.

Occurrence in West Greenland: Between Julianehaab and Jacobshavn (DE GUERNE et J. RICHARD 1889). Godthaab $12/7$ - $20/9$ 1891 (C. WESENBERG-LUND 1895), Umanak (VANHÖFFEN 1897), *Pleuroxus exiguus*. Godhavn and Holstensborg (P. HABERBOSCH 1920). WESENBERG-LUND names the species found by him *Pleuroxus exiguus* LILLJB., and writes: "I am not able to distinguish *Pl. exiguus* Lilljb. from *Pl. exisus* Fischer". He mentions, however, that his specimens differ from *Al. exigua* by the small height of their carapace. As, however, the small height of the carapace is just one of the features by which *Al. excisa* is distinguished from *Al. exigua* and as further, as pointed out by P. HABERBOSCH, the figure given by WESENBERG-LUND resembles the former and not the latter, there is any reason to suppose that the specimens described by WESENBERG-LUND belong to *Al. excisa* and not to *Al. exigua*. A further evidence to this effect is that other authors (DE GUERNE et J. RICHARD and P. HABERBOSCH) have found *Al. excisa* as common in West Greenland, whereas they have not at all found *Al. exigua* there.

Distribution: Europe, Siberia, Central Asia, East India, North America, North Africa and Australia. Is nearly cosmopolitan but only rarely found under extreme arctic conditions; it is f. i. not recorded neither from Spitzbergen nor from the arctic Canada, and in the northernmost part of Siberia (peninsula Yamal) it is only rarely met with.

Remarks: As the Greenlandic *Alonella* has been described, as it is seen from the preceding, sometimes as *Al. excisa* and sometimes as *Al. exigua*, I have found it necessary to give the following closer description of the East Greenlandic specimens. The general appearance of the East Greenlandic specimens of *Alonella excisa* is seen from fig. 14 a and b showing an ephippial female and a male from a Pond at Hurry Fjord, $7/8$ 1933. I have not found any difference between the parthen-

ogenetic and ehippial females apart from the dark yellowish colour of the dorsal and posterior part of the carapace in the latter ones. The cauda (of the female) fig. 14 a 1 is on its dorsal margin furnished with two rows of about 9 teeth, at the base of each tooth is a minute tooth or a couple of hairs. The margin of the anus is furnished with two combs

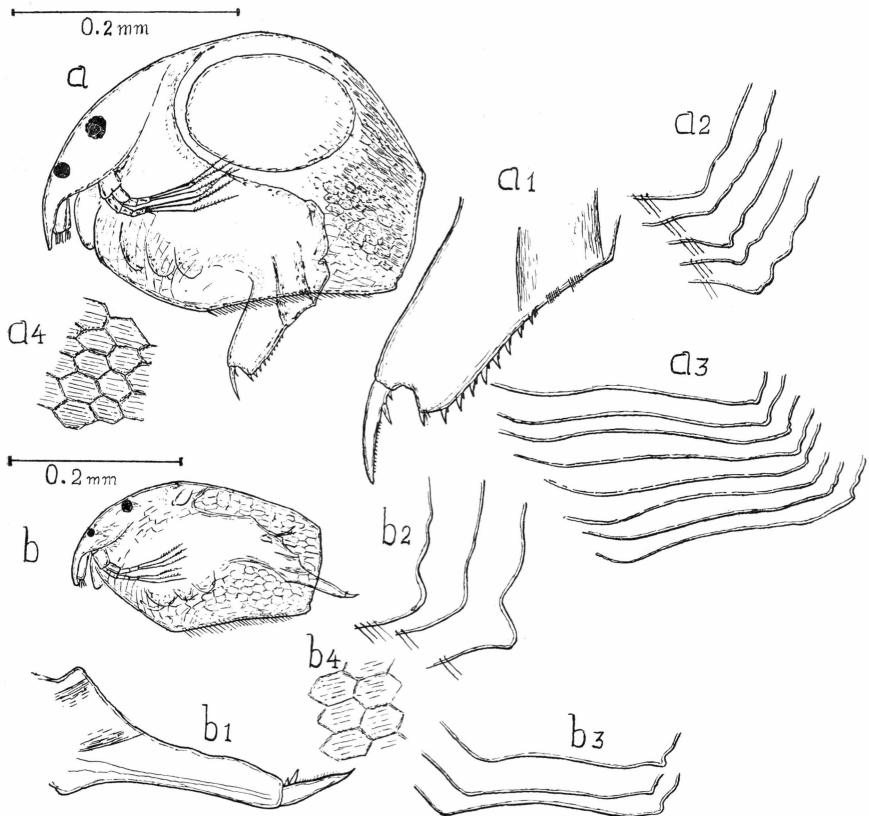


Fig. 14. *Alonella excisa*, Pond at Hurry Fjord $7/8$ 1933. a — ehippial female, b — male; 1 — cauda, 2 — posterior-inferior angle of carapace, 3 — ventral margin of carapace, 4 — the sculpture of the hind part of the shell.

of small hairs not, as figured by LILLJEBORG for Swedish specimens with one (continuous) fringe of hairs. The tail claw carries two basal spines a larger one and a smaller one; the small one is sometimes placed just at the base (proximally) of the larger one, sometimes it is set a little apart from it (as in figure 14 a 1). Distally of the basal spine is a series of minute teeth (not hairs). These teeth are neither mentioned nor figured by W. LILLJEBORG; STINGELIN'S (1895—96) figure shows a series of minute hairs in this place, in his text, however, he writes "Endkrallen glatt". The lower part of the posterior margin of the carapace

is more or less undulated, the inferior-posterior angle of the carapace sometimes forming almost a tooth (see fig. 14 a 2). The ventral margin of the carapace is always concave but the concavity may be more or less pronounced (fig. 14 a 3). The carapace is especially in its posterior and superior part reticulated, the meshes forming more or less regular striated hexagons (fig. 14 a 4), not rhombs as figured by LILLJEBORG. The males are (as in other chydorids) characterised by their long narrow cauda (fig. 14 b 1); the dorsal margin of the cauda is (as stated by LILLJEBORG) quite smooth without teeth or hairs. The tail claw is s-shaped but not so much as in the specimens figured by LILLJEBORG (Tab. LXXII, fig. 19). The tail claw is furnished proximally with two basal spines and distally with a series of small hairs (not teeth as in the female). The form of the inferior and posterior margin of the carapace is the same as in the female (see fig. 14 b 2 and 3). The striation of the meshes of the carapace is less pronounced than in the female. The dorsal part of the carapace is by far not so arched as in the female. The form of the male, seen in side view, is therefore more oblong than that of the female. This is seen from the following figures giving the height of the carapace in percent of the total length.

	height-percent	no. of spec. measured
Empty females.....	70.0	23
Ephippial females.....	67.8	23
Males.....	61.6	13

The vaulting of the dorsal part of the carapace of the females is, however, more pronounced than these figures show because the prominent ventral angle of the males augments the height of the carapace considerably. The point of the rostrum of the males is not blunt only, as recorded by LILLJEBORG, but also curved backwards against the distal end of the first antennae.

On 139 specimens from a pond at Hurry Fjord, 7/8 1933, the following measurements of the total length have been taken:

												Tot.	
Units of scale (mm)	16	17	18	19	20	21	22	23	24	25	26	27	
	(0.25)		(0.28)		(0.31)		(0.34)		(0.37)		(0.42)		
Empty females ..	1	..	..	1	1	7	11	17	15	12	3	1	69
Parth. fem. ....	..	..	..	..	..	1	1	1	..	1	..	..	4
Ephip. fem. ....	..	..	..	..	..	1	7	4	4	4	..	..	20
Males.....	..	3	20	21	1	..	1	..	..	..	..	..	46

The largest specimen found is 0.42 mm. The mean length of the parthenogenetic and ephippial females is 0.35 mm (0.32—0.38 mm). The males are much smaller, mean length 0.29 mm (0.26—0.34). The sizes correspond very closely with those of Swedish specimens, which ac-

According to LILLJEBORG attain a length of 0.40—0.44 mm for the females, against 0.28 mm in the males only, and with those from Finland where the following lengths have been recorded (H. JÄRNEFELT 1915): females 0.33—0.37 mm, males 0.25—0.27 mm. The number of eggs or young in the parthenogenetic females from East Greenland are 2. The number of eggs in the ephippium is one only.

In a pond (Hurry Fjord) ($^{14}/_8$) ephippial (and empty) females and males were found only, and in another pond here ($^7/_8$) the ephippial females by far outweigh in number the parthenogenetic females (20 eph. females against 4 parth.); in both samples males were found abundantly. Therefore it is obvious that in the beginning of August the parthenogenetic propagation is nearly finished, whereas the sexual propagation now is in full swing. As the Greenlandic localities where *Al. excisa* is found only have been investigated during the first half of August, the life cycle of this species in East Greenland cannot be further elucidated. The fact that the material does not show more than one size-group is rather astonishing and the more so, as *Chydorus sphaericus* in the same localities shows clearly several size-groups; this could indicate that the ephippia of *Al. excisa* only hatch late in the season and that the first (and then probably also the last) parthenogenetic brood only just has been hatched or is about being hatched. The larger number of mature males (which as far as our knowledge of Greenlandic Cladocera must belong to the first parthenogenetic brood) is, however, against this explanation as it shows that the first parthenogenetic brood must have been hatched some time ago. This first brood must then either have consisted mainly of males only or its females must by now have grown up to the same size as the ex-ephippial females. The third possibility, that the exephippial females should already have died away is not in accordance with other observations as to the propagation of the Greenlandic Cladocera.

13. *Chydorus sphaericus* O. F. MÜLLER.

Chydorus sphaericus LILLJEBORG 1900, Tab. LXVII, figs. 8—14.

East Greenland records:

Chydorus sphaericus C. WESENBERG-LUND 1895.

Chydorus sphaericus C. WESENBERG-LUND 1896.

Chydorus sphaericus V. BREHM 1912.

Chydorus sphaericus F. JOHANSEN 1912.

Occurrence in East Greenland: *Scoresby Sund Area*: Danmarkssø, $^{16}/_8$ 1891 (C. WESENBERG-LUND 1895); Lake at NO. Bugten, $^{14}/_8$ 1900; Jameson Land, $^{17}/_8$ 1900; various ponds near Hurry Fjord, $^{414}/_8$ 1933. *Franz Joseph Fjord Area*: Lake near Knudshoved, $^5/_8$ 1930; Uglesø, Ymerø, $^{10}/_8$ 1932; pond near Uglesø, $^{21}/_8$ 1932; pond at Nord-

fjord, $\frac{2}{8}$ 1932; small lake at Nordfjord, $\frac{2}{8}$ 1932; Langsø, Ellaø, $\frac{8}{8}$ and $\frac{22}{8}$ 1933, $\frac{10}{7}$ 1934; Bjørnesø, Ellaø, $\frac{18}{8}$ 1932, $\frac{1}{7}$ 1934; Ulvesø, Ellaø, $\frac{15}{8}$ 1932, $\frac{1}{11}$ 1933 and $\frac{17}{7}$ 1934. *Nordøstkyst Area*: Pond on Maroussia (V. BREHM and F. JOHANSEN 1912).

Occurrence in West Greenland: Common along the coast from 60° — 71° N. Lat. (DE GUERNE and J. RICHARD 1889; C. WESENBERG-LUND 1895; E. VANHÖFFEN 1893—97; K. STEPHENSEN 1913 and 1916; P. HABERBOSCH 1920).

Distribution: *Chydorus sphaericus* is regarded as a typical ubiquitous and found all over the world from the tropical zones and far into the arctic regions.

Remarks: By the present investigations *Ch. sphaericus* has been found throughout the whole of the area investigated both in the small ponds and in larger lakes. Although it has been observed in nearly all the waters examined it never occurs in the samples in large quantities, and it is easily outnumbered by such species as *Daphnia pulex*, *Bosmina longirostris* and *Cyclops strenuus*. The species, obviously, is by far not so abundant in North-East Greenland as in West Greenland, where it according to C. WESENBERG-LUND and P. HABERBOSCH is very numerous. In North-East Greenland it is never found in such large quantities as is often the case in more southern countries (f. i. Denmark). It seems as if the extreme arctic conditions prevailing in North-East Greenland do not suit *Chydorus sphaericus*. The case is obviously just the same as in Spitzbergen, where according to O. OLOFSSON *Ch. sphaericus* is not found "auf extrem hocharktischen Lokalen"; also in Highsweden (S. EKMAN 1904) the species is more common in the milder lower regions than under the true arctic conditions in the upper regions:

	Frequency per cent	No. of localities investigated
350—600 m	83	48
600—1000 m	61	89
1000—1350 m	51	43

The general outer appearance of the *Chydorus sphaericus* from East Greenland is seen from figs. 15 and 16. The form of the shell of the grown up females, subitaneous as well as ephippial, is — seen in profile — nearly spherical, the longitudinal axis being only little longer than the vertical. The cauda fig. 15 a is, as in specimens from other regions, short and broad; its dorsal margin being furnished with about 10 short spines. The caudal claw is nearly straight; a small, pointed tooth is situated near its base in the median line, another still smaller spine laterally at the base. Generally the shell is in its lower parts hexagonal reticulated, in its upper part this reticulation gradually becomes more

and more irregular and this part of the shell can be termed as granular. The form *coelatus* (HELLICH), with small hollowings in the meshes has

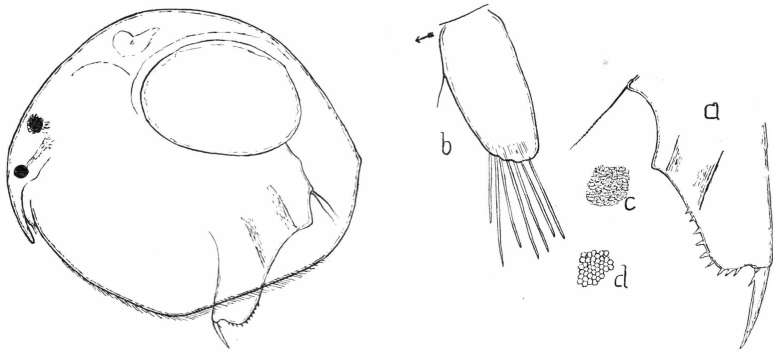


Fig. 15. *Chydorus sphaericus*, Ulvesø, 17/7 1934, female with sub. eggs, a — cauda, b — 1st antenna, c — structure of the dorsal part of the shell, d — structure of the ventral part of the shell.

not been found in the material (neither was it found by OLOFSSON in his Spitzbergen-material). The shape of the male (fig. 16) is not so

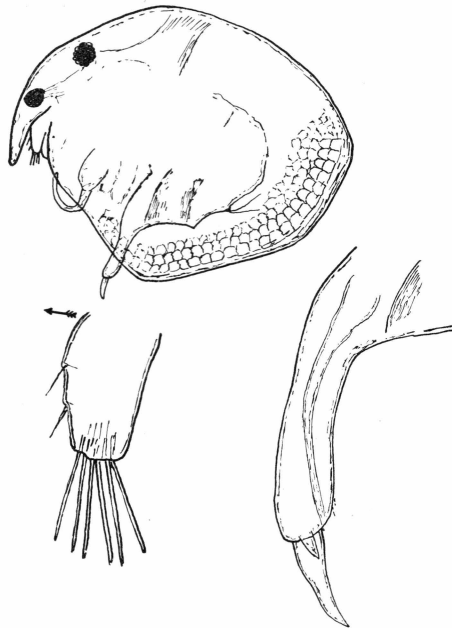


Fig. 16. *Chydorus sphaericus*, pond D. Hurry Fjord, 7/8 1933, male with cauda and 1st antenna.

regular spherical as that of the female; there is a small depression in the margin of the head in the region above the eye, and the ventral angle of the carapace is far more prominent than in the female. The

whole outline of the carapace is more like an irregular pentagon than like a circle. Along the posterior-inferior margin — at any rate — the meshes are arranged in concentric rings. The cauda has the usual slender form; the tail claw is rather stout with only one basal claw laterally.

On the basis of the varying form of the shell, laterally viewed, OLOFSSON has for the Spitzbergen specimens described 2 forms, in the first (type A) the height is nearly as large as or even larger than the length, in the second (type B) the height is considerably smaller than the length; between the two types — the spherical and the oval — he has found transitional forms, however. According to OLOFSSON the two types can be found in any water and in any size-group of individuals as well among ephippial as among subitaneous females, and he writes that the variation in type is so irregular that no theory explaining it can be established. The reason why no such theory can be established is, as far as I can see, that no such types exist. It is sure that the proportion height — length varies very much in the Spitzbergen material from 76—106 %. In the following table is given the height in per cent of the length calculated from OLOFSSON'S measurements of empty, subitaneous, and ephippial females from 4 localities:

%	76	—	80	81	82	83	84	85	86	87	88	89	90	91	92
1. loc.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2. loc.	..	..	..	1	..	3	1	1	..	..	..	..	..	..	..
3. loc.	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1
4. loc.	1	..	1	..	2	1	2	..	..	3	1	1	1	2	..
Total	1	0	1	1	2	4	3	1	0	4	1	1	1	2	1
%	93	94	95	96	97	98	99	100	101	102	103	104	105	106	
1. loc.	1	1	..	1	1	..	1	3	..	..	2	..	..	..
2. loc.	1	..	..	..	2	..	..	..	..	1	1	..	1	..	
3. loc.	..	1	2	..	..	1	1	1	..	..	..	..	..	2	
4. loc.	2	..	..	..	1	2	..	1	..	..	1	..	..	..
Total	4	2	2	1	4	3	2	5	0	1	4	0	1	2	

It is quite right that there is as well spherical as oval individuals but in order to establish two types it must be obligatory that the specimens are spread along the line of percentages in such a way that two maxima occur. This is, however, by far not the case; in the second locality there can be said perhaps to be an indication of two maxima; in the 4th locality there are, however, 3 maxima; and all 4 localities taken together show 4 or 5 maxima. Thus on the material at hand 4 types as well as 2 types could be established. The material is at any rate too small to show different types. In order to investigate this question more closely I have measured a larger number of specimens

from East Greenland. The following survey gives the percentic height of all grown up females (i. e. females larger than 0.32 mm):

%	77	82	83	84	85	86	87	88	89	90
No.	1	2	2	4	2	8	12	5	10	8
%	91	92	93	94	95	96	97	98	99	100
No.	3	4	14	0	0	9	2	0	0	1 = 87

This line of figures is rather irregular too with about 4—5 maxima, but this irregularity is due to the method of measurement giving only 3 units of height to each unit of length which makes certain percentages f. i. 94 and 95 impossible. When the numbers, however, are drawn together for each three percentages this irregularity disappears; the following table gives the material from East Greenland and Spitzbergen in this form:

%	76—78	79—81	82—84	85—87	88—90	91—93
East Greenland	1	0	8	22	23	21
Spitzbergen	1	2	7	5	3	7
%	94—96	97—99	100—102	103—105	106—108	Total
East Greenland	9	2	1	..	..	87
Spitzbergen	5	9	6	5	2	49

The Spitzbergen material still shows an irregular dispersion of the figures, a dispersion which perhaps could be explained by the occurrence of two types; the two maxima at 82—87 and at 91—102 are, however, not so distinct that they can be regarded as an evidence of the existence of two types of specimens. The curve of the larger material from East Greenland does only show one top and thus only one type of specimens with a mean percentic height of about 89 % and a dispersion from 77 % to 100 %.

Although no different types of *Chydorus sphaericus* can be established based on the varying percentic height, the height varies regularly otherwise. The percentic height of the males is generally lower than that of the females. The percentic height of the males compared with that of the females of the same size is as follows; number of spec. in ():

Length mm	males	females
0.31	80 (3)	84 (4)
0.32	84 (5)	86 (3)
0.34	84 (13)	86 (9)
0.35	84 (3)	87 (9)
Total	83.7	87.7

The height of the males are thus somewhat smaller than that of the females. This is of course due to the lacking of a brood pouch in

the males. That the difference is not larger is caused partly by the ventral prominence of the margin in the males increasing the height and partly by the fact that the females of the sizes 0.31—0.35 mm have not yet produced eggs; in females with subitaneous eggs the height percent is 90.3. On a whole the height is larger in grown up females than in young ones as is seen from the following figures:

empty females:	
0.25—0.28 mm.....	84.8 % (12 spec.)
0.29—0.32 mm.....	85.0 % (9 —)
0.34—0.37 mm.....	88.9 % (18 —)
0.39—0.42 mm.....	89.4 % (5 —)
0.43—0.46 mm.....	89.1 % (9 —)
subitaneous females:	
0.39—0.51 mm.....	90.3 % (27 spec.)
ephippial females:	
0.37—0.54 mm.....	90.0 % (23 spec.)

Further the figures show, that the percentic height is highest in the subitaneous females.

The life cyclus of *Chydorus sphaericus* in East Greenland is very short lasting from the end of June to the beginning of November or, in most cases, to the beginning of September only. In July the parthenogenetic propagation is prevailing; in August, however, the sexual propagation dominates, males and ephippial females being very common. The number of subitaneous eggs in the brood pouch is 2 (or 1).

The size of the East Greenlandic *Ch. sph.* is seen from the following figures (in mm) referring to specimens caught in ponds near Hurry Fjord during the period Aug. the 4th to the 14th 1933:

	Mean	Variation	No. of Spec.
Parthenogenetic females.....	0.44	0.26—0.55	56
Ephippial females.....	0.42	0.37—0.54	18
Males.....	0.33	0.31—0.35	31

The largest specimen found (a parthenogenetic female from Ulvesø July the 17th) measured 0.56 mm¹).

14. *Polyphemus pediculus* LINNÉ.

Polyphemus pediculus W. LILLJEBORG 1900, Tab. LXXIX, figs. 22—31.

East Greenland records:

Polyphemus pediculus C. WESENBERG-LUND 1895.

Polyphemus pediculus C. WESENBERG-LUND 1896.

Occurrence in East Greenland: *Scoresby Sund Area*: Danmarkso (C. WESENBERG-LUND 1895 and 1896). *Franz Joseph Fjord*

¹) Further remarks on the propagation of *Chydorus sphaericus* are given in another paper (ERIK M. POULSEN 1940).

Area: Ulvesø, Ellaø, 7/6 1934, 1 specimen, a female without eggs in the brood pouch.

Occurrence in West Greenland: Orpigsuit, 19/7 1890, Ritenbek, 10/8 1890, Godthaab, 12/7-20/9 1891 (C. WESENBERG-LUND 1895). West Greenland (DE GUERNE and RICHARD 1889). Southwest Greenland (K. STEPHENSEN 1916), Holstensborg (P. HABERBOSCH 1920).

Distribution: Europe, North America, Siberia.

Remarks: Although the material at hand for the present investigation is large and includes samples from various regions of East Greenland, from ponds as well as from lakes, only one individual in all of this species has been observed. The species is thus obvious very rare in East Greenland. The scarcity of this species appears also from WESENBERG-LUND's investigations; WESENBERG-LUND writes that he has found few specimens only in the samples from Danmarksø; in West Greenland, however, he has found it to be common. The scarce occurrence of *Polyphemus pediculus* in Northeast Greenland is no doubt due to the extreme arctic conditions of this region. Generally *P. pediculus* is regarded as a true arctic species. P. HABERBOSCH 1920 thus mentions *P. pediculus* among the species which have their "main distribution in the Arctic". It is true that *P. pediculus* is common in some parts of the arctic region, f. i. in West Greenland, yet only in the southern part of the area investigated, S. of Holstensborg; in the high Arctic, however, the species is either very rare or not found at all. Thus it was not found by O. OLOFSSON (l. c.) during his extensive investigations of the fresh-waters of Spitzbergen, neither has it been recorded from the arctic North-America (although it occurs to the south of this region) nor from the Novaya Zemlya or the Bear Island. In the peninsula Yamal, the northernmost part of Siberia, it is recorded from 4 localities only, whereas f. i. *Chydorus sphaericus* was found in 32 localities. In the Swedish highland (S. EKMAN 1905) its frequency percent in the various regions was as follows:

350— 600 m	79 % (48 localities investigated)
600—1000 m	49 % (89 — —)
1000—1350 m	7 % (43 — —)

in the most arctic part of this region it is thus very rare.

Its distribution throughout the arctic and temperate regions will appear from the following survey giving the frequency percents for the various regions:

Region:	Bel- gium	Den- mark	Ice- land	Swe- dish High- land	The Fa- roes	W. Green- land	E. Green- land	Yamal	Spitz- bergen
Frequency %/o	2	25	22	45	6	71	4	4	0

It is evident from this survey that *P. pediculus* does not thrive well under extreme arctic conditions, whereas it is very common in more temperate regions as well as in the lower Arctic. Its high frequency percent in West Greenland could appear to contradict this statement; but it must here be borne in mind that the climate of West Greenland is rather mild in comparison with other arctic regions. Further — as mentioned — it is not found in the northern part of the area of West Greenland investigated by HABERBOSCH.

Thus the fact that *P. pediculus* is so very scarce in Northeast Greenland is in good accordance with its range of distribution. Its main distribution area is the northern part of the temperate regions and the milder part of the Arctic. Thus *Polyphemus pediculus* cannot be regarded as a true arctic species.

C. Copepoda.

15. *Diaptomus minutus* LILLJEBORG.

East Greenland records:

Diaptomus minutus V. BREHM 1912.

Diaptomus minutus F. JOHANSEN 1912.

Occurrence in East Greenland: *Nordøstkyst Area*: In a large lake, Sælsøen, at Hvalrosodden, 24/5 1908 (V. BREHM 1912).

Occurrence in West Greenland: Recorded from various localities at the westcoast of Greenland between 60° and 71° N. Lat.

Distribution: Northern and Arctic America, Greenland and Iceland.

16. *Limnocalanus grimaldi* (DE GUERNE).

East Greenland records:

Limnocalanus macrurus V. BREHM 1912.

Limnocalanus macrurus F. JOHANSEN 1912.

Occurrence in East Greenland: V. BREHM 1912 has recorded *L. macrurus* G. O. SARS from the lake Sælsøen, 77° N. Lat., 28/6 1908. S. EKMAN 1913 has, however, shown that the East Greenlandic *Limnocalanus* species as to its systematic characters falls within the range of variation of *L. grimaldi*.

Not found in West Greenland.

Distribution: Greenland, Northern Asia.

17. *Cyclops strenuus* FISCHER.

Cyclops strenuus SCHMEIL 1892, pl. II, figs. 12—15.

East Greenland records:

Cyclops strenuus V. BREHM 1912.

Cyclops strenuus F. JOHANSEN 1912.

Occurrence in East Greenland: *Scoresby Sund Area*: Ponds near Hurry Fjord, $14/8$ 1933, ♀ without eggsacs. *Franz Joseph Fjord Area*: Langsø, Ellaø, $72^{\circ}50'$ N. Lat. $8/8$ 1933; ♀ without eggsacs, nauplia and young¹⁾. $22/8$ 1933; ♀ without eggsacs, nauplia and young, ♂. $5/9$ 1933; ♀ without eggsacs, young, ♂. $19/9$ 1933; decreasing number of ♀ (without eggsacs), young, ♂. $3/10$ 1933; few ♀ (without eggsacs), nauplia and young, ♂. $19/10$ 1933; many ♀ without and with eggsacs, ♂, young. $31/10$ 1933; many ♀ without eggsacs, young, ♂. $14/11$ 1933; ♀ without eggsacs, few ♂, young. $30/11$ 1933; decreasing number of ♀ (without eggsacs), ♂, young. $13/12$ 1933; decreasing numbers of ♀ (without eggsacs), ♂, young. $27/12$ 1933; decreasing numbers of ♀ (without eggsacs), few ♂, no young. $12/1$ 1934; a few ♀ (without eggsacs), few ♂, young. $23/1$ 1934; ♀ without eggsacs, ♂. $7/2$ 1934, few ♀ without eggsacs, ♂. $24/2$, $5/3$ and $20/3$, few ♀, ♂. $4/4$ 1934; few ♀, no ♂. $17/4$ 1934 increasing numbers of ♀ without eggsacs. $3/5$ 1934; many ♀ without eggsacs (no ♂, nor young). $14/5$ 1934; many ♀ without eggsacs, few ♂. $29/5$ 1934; ♀ without eggsacs and few ♀ with eggsacs, few ♂. $12/6$ 1934; the sample was taken in more shallow water than usually, no *Cyclops str.* were present. $29/6$ 1934; ♀ with and without eggsacs, nauplia. $10/7$ 1934; ♀ with and without eggsacs, nauplia, young. $23/7$ 1934, a few ♀ (without eggsacs). $12/8$ 1934; ♀ without eggsacs, ♂. Rundsø, Ellaø: $9/8$ 1933, few ♀ without eggsacs. $5/10$ 1933; ♀ without eggsacs, ♂. Bjørnesø, Ellaø: $18/8$ 1933; ♀ without eggsacs. $25/10$ 1933; ♀ without eggsacs, ♂. $1/7$ 1934; ♀ with and without eggsacs, ♂, young. Ulvesø, Ellaø $15/8$ 1933; ♀ without eggsacs, ♂. $14/9$ 1933; ♀ without eggsacs, ♂. $1/11$ 1933; ♀ without eggsacs, ♂. $21/11$ 1933; ♀ without eggsacs, ♂. $22/3$ 1934; ♀ with eggsacs (no ♂). $18/4$ 1934; ♀ with eggsacs (no ♂). $15/5$ 1934; ♀ with eggsacs (decreasing number), nauplia, (no ♂). $7/6$ 1934; few ♀ with eggsacs, (no ♂), nauplia. $17/7$ 1934; few ♀ with eggsacs (no ♂), nauplia, young. Uglesø, Ymerø, $73^{\circ}20'$ N. Lat.: $11/8$ 1933; ♀ without eggsacs. $10/8$ 1932, ♀, ♂, young. Lake at Nordfjord, $73^{\circ}40'$ N. Lat.: $2/8$ 1932; ♀ with eggsacs. Noa lake Ymerø, $73^{\circ}20'$ N. Lat.: $10/8$ 1932. Small lake at Nordfjord: $2/8$ 1932; a few spec. Lake at Ellaø: $25/8$ 1932; ♀ and ♂. Little Noa lake, Ymerø: $10/8$ 1932; a few spec. *Nordostkyst Area*: At Danmarkshavn (V. Brehm 1912).

¹⁾ "young" indicate all specimens between the nauplia stage and the grown-up stage.

Occurrence in West Greenland: At Umanak, 71° N. Lat., VANHÖFFEN 1897. At Strømfjord, 68° N. Lat. K. STEPHENSEN 1913 and 1916.

Distribution: Europe, North America, Spitzbergen and other arctic regions.

Remarks: The East Greenlandic specimens have the true character of the species as defined by SCHMEIL (1892). The branches of the furca diverge considerably and the inner bristle of each branch is long and

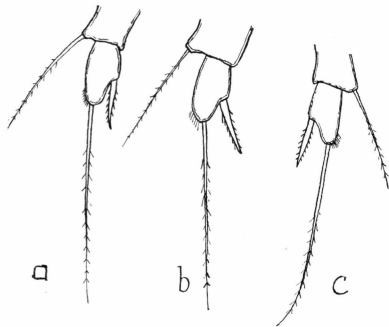


Fig. 17. *Cyclops strenuus*, leg of the 5th pair; a — Ulvesø, 18/8 1934, b — Langsø, 1/7, 1933, c — Bjørnesø, 1-7-1934.

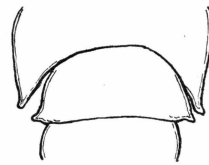


Fig. 18. *Cyclops strenuus*, Langsø, 8/8 1933, last thoracic segments of female.

fringed with hairs. The form of the 5th pair of legs is shown in fig. 17. The distal joints of the 1st antennae are only finely spinulated. The form of the last thoracic segments is seen from fig. 18. Both the thoracic segments and the 5th pair of legs have the same form as in the specimens from Spitzbergen figured by O. OLOFSSON (1918).

In Langsø the species has been found through the whole year as it appears from the following table:

	Empty ♀	♀ with eggsacs	Males	Nauplia	Young
June	+	+	r	+	..
July	++	+	r	+	+
Aug.	+	+	r	+	+
Sept.	+	..	+	+	+
Oct.	++	r	++	..	++
Nov.	++	..	r	..	+
Dec.	r	..	r	..	..
Jan. ....	+	..	+	..	..
Febr.	r	..	r	..	..
March	r	..	r	..	..
April .....	+	..	..	..	..
May	++	r	r	..	..

According to the observations females with eggsacs have been found in the period May—October only, and in considerable numbers

only in June, July and August; therefore it is obvious that the propagation takes place in the summer season only. The fact that nauplia were found in June—September only corroborates with this. Copepodid-stages and older young were observed from July to December. Males were found through the whole of the year, but in considerable numbers in September—October only, i. e. at a time when females with egg sacs were found in small numbers. It is obvious from the observation that the *C. strenuus* colony in Langsø hibernates as young, which towards the spring reach the adult stage, beginning to propagate in May.

The life cyclus of the colony in Ulvesø is illustrated by the following table:

	Empty ♀	♀ with eggsacs	Males	Nauplia	Young
March	+	+
April	+	+
May	+	+
June	+	..	+	..
July	+	+	+	+
August	+	..	+
Sept.	+	..	+
Nov.	+	..	+	..	+

In this lake females with eggsacs are found already in the end of March ($22/3$). Nauplia are found in May and July. As no females with eggsacs are found during the autumn and winter it is obvious that also this colony hibernates mainly as young. In this case the propagation begins rather early (in March) when the lake is still ice-bound.

From the above cited observations it is evident that the mode of reproduction of the East Greenlandic *C. strenuus* is the following: The hibernating individuals produce the eggs in early spring or in the beginning of the summer; the first brood of nauplia appears in May or June; until September several broods of nauplia are hatched; during the autumn the grown up individuals which have produced these broods die away; the young live through the winter and produce the new broods during the following spring.

The following tables give the size (without the bristles of the furca) of the East Greenlandic *C. strenuus*:

	Units	11	12	13	14	15	16	17	18	19	20	21	22	23	24	mean		
	mm	0.73	0.87	1.00	1.13	1.27	1.40	1.53										
Langsø	$\left\{ \begin{array}{l} 3/10 \\ 3/5 \end{array} \right.$	empty ♀	1	..	..	..	1	1	2	1	2	..	1	2	2	..	1.25
		♂	1	..	3	2	2	2	1.00
		empty ♀ .....	..	..	..	..	..	..	1	2	3	9	10	19	6	1	1.41
Ulvesø	$\left\{ \begin{array}{l} 22/3 \\ 18/4 \end{array} \right.$	♀ with eggsacs ..	..	..	..	..	..	1	1	4	1	6	5	..	..	..	1.29
		empty ♀	1	3	1	1	1.49
		♀ with egg sacs ..	..	..	..	..	..	..	..	2	1	2	..	1	..	..	1.29

The mean size of the females carrying eggsacs is thus 1.30 mm; the smallest eggsac-carrying ♀ is 1.07; the largest ♀ measured is 1.60 mm. According to O. OLOFSSON the size of the Spitzbergen specimens is 1.48—1.90 mm; thus the East Greenlandic *C. strenuus* is somewhat smaller than those from Spitzbergen.

The above stated mode of reproduction is very much the same as that found on Spitzbergen by OLOFSSON. OLOFSSON is, however, of the opinion that the eggs produced during the autumn are not hatched until next spring, he bases this opinion on the fact that in the beginning of July he has found nauplia only and not other young stages which should have been the case if the eggs produced in autumn had been hatched in the autumn too. The present investigation shows, however, that egg-carrying females does not occur during the winter and consequently the eggs produced in the autumn are hatched before the winter.

I think there is any reason to suppose that the case is the same in Spitzbergen, only OLOFSSON has not been able to state this as he had no observations from the end of September and until the beginning of July.

The number of eggs in each eggsac varies between 4 and 12.

18. *Canthocamptus cuspidatus* SCHMEIL.

Canthocamptus cuspidatus SCHMEIL 1893—95, pl. IV.

East Greenland record:

Canthocamptus cuspidatus V. BREHM 1912.

Occurrence in East Greenland: *Scoresby Sund Area*: Pond at Hurry Fjord, 14/8 1933. *Nordøstkyst Area*: Lake at Danmarkshavn, end of July 1907. Two localities at Danmarkshavn, one of them the same as the above mentioned locality (V. BREHM 1912).

Occurrence in West Greenland: Godhavn and Holstensborg (P. HABERBOSCH 1920).

Distribution: Europe, including the regions bordering the Polar Sea, Greenland.

Remarks: Fig. 19 shows the form of the furca in the male and the female; the longer of the apical bristles is abt. twice as long as the short, both are fringed with thin hairs. V. BREHM writes that the East Greenlandic specimens have not the typical knee-bending of the short inner apical bristle. In the present material, however, this bristle has the knee-bended form characteristic for the females of this species; the bristle has about the same length as the furca. Females with eggsacs

were not present in the very scarce material. The size of the two specimens measured was 0.40 and 0.56 mm.

Canthocamptus duthiei SCOTT??

Occurrence in East Greenland: V. BREHM (1912) has found in a lake at Hvalrosodden (Nordøstkyst Area) on $31/8$ 1906 a male which he records as *C. duthiei*?? P. HABERBOSCH (1920) is of the opinion that this male is the male of *Moraria schmeili*. He bases, however, this sup-

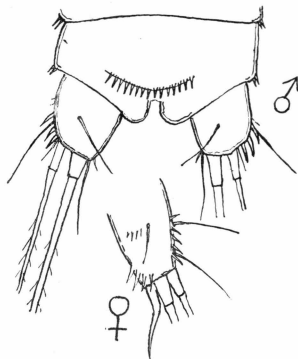


Fig. 19. *Canthocamptus cuspidatus*, pond at Hurry Fjord, $14/8$ 1933, hind part of body of the male and a branch of the furca of the female.

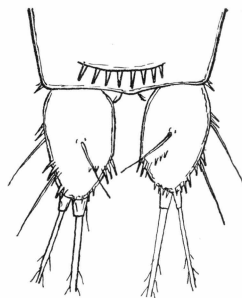


Fig. 20. *Maraenobiotus danmarki*, Rundsø, $9/8$ 1933, hind part of body of female with furca.

position on the fact only that in West Greenland he has found *M. schmeili* and not *C. duthiei*. None of these two species were observed in the material at hand for the present investigation.

19. *Maraenobiotus danmarki* V. BREHM.

Maraenobiotus danmarki V. BREHM 1912, Tab. XVIII, figs. 4—6 and Tab. XIX, figs. 10—13.

East Greenland record:

Maraenobiotus danmarki V. BREHM 1912.

Occurrence in East Greenland: *Scoresby Sund Area*: Pond at Hurry Fjord, $7/8$ 1933. *Franz Joseph Fjord Area*: Rundsø, Ellaø, $9/8$ 1933. *Nordøstkyst Area*: Lake at Danmarkshavn, end of July 1907; Danmarkshavn, end of July 1907 (V. BREHM 1912). Obviously the two last mentioned records refer to on and the same sampling.

Remarks: As my material consists of very few specimens only I shall not try to discuss whether *M. danmarki* must only be regarded as a variety of *M. brucei*. The form of the furca and the anal segment of the female is shown in fig. 20. The number of spines on the anal

plate is in the female 6—8; in the males the spines are fewer and more slender than in the female. The length of the shorter apical bristle amounts to 32 % of the longer. Only males and females without eggsacs were found.

Maraenobiotus brucei RICHARD?

V. BREHM (1912) records this species with a ? from a lake at Hvalrosodden, 76°55' N. Lat. (Nordøstkyst Area), ²²/₅ 1908. The species has been recorded from West Greenland by P. HABERBOSCH (1920).

20. *Epactophanes richardi* MRAZEK.

Occurrence in East Greenland: This rare Copepod was found by V. BREHM (1912) in a sample from a small brook at Stormkap, 76°49' N. Lat. (Nordøstkyst Area), on ²⁴/₆ 1907. It has not been observed in the material at hand for the present investigation.

D. Ostracoda.

21. *Prionocypris glacialis* G. O. SARS.

Prionocypris glacialis G. O. SARS 1925, Tab. LXI, fig. 1.

Eucypris glacialis G. ALM 1916, fig. 34.

East Greenland record:

Herpetocypris glacialis V. BREHM 1912.

Occurrence in East Greenland: *Scoresby Sund Area*: Pond on Jameson Land, ²/₈ 1933; Freshwater on Storø, ²/₈ 1933; pond at Hurry Fjord, ⁴/₈ 1933; lake at Nordøstbugten, ¹⁴/₈ 1900. *Franz Joseph Fjord Area*: Pond with water from snow-melting at Kap Oswald, Ellaø, ¹⁴/₆ 1934; Ulvesø, Ellaø, ¹⁵/₈ 1933; the small lake Fuglesø on Ymerø, ¹¹/₈ 1932. *Nordøstkyst Area*: Lake at Hvalrosodden, Aug. 1906 (V. BREHM 1912); lake at Danmarkshavn, July 1907 (V. BREHM 1912).

Occurrence in West Greenland: Various localities between 67°—71° N. L. (VANHÖFFEN 1893; G. ALM 1914; HABERBOSCH 1920).

Distribution: Greenland, Spitzbergen, Bear Island, Northern Scandinavia.

Remarks: The specimens found coincide well with the descriptions given by G. ALM (1916) and G. O. SARS (1925). The shell (fig. 21) is oblong oval with a nearly straight ventral margin, its greatest height is somewhat in front of the middle. The height of the shell is a little more than half its length; the height in % of the length was in 26 spec. measured as follows:

height % ₀	50	51	52	53	54	55	56	57	58
No. of ind.	2	1	1	4	8	3	5	1	1
In mean the height % ₀ is 54.1									

The anterior end of the shell is more broadly rounded than the posterior. The shell is rather densely clothed with hairs especially on the posterior and anterior parts. The natatory setae of the second antennae (see fig. 21 A₂) are rather short reaching little beyond the

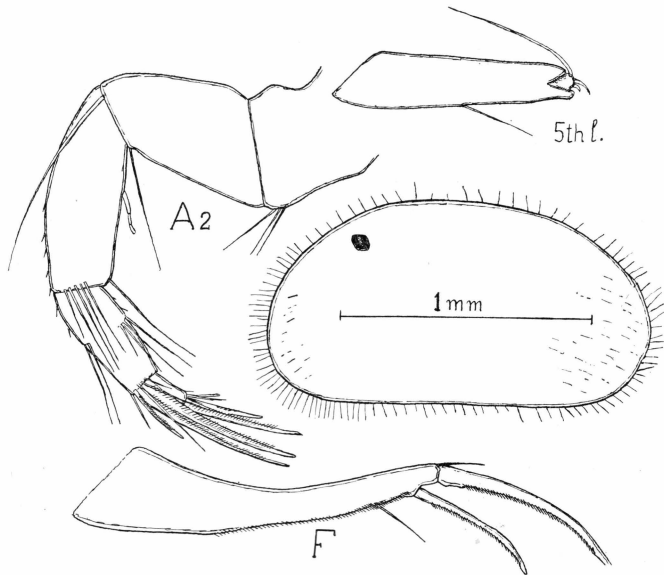


Fig. 21. *Prionocypris glacialis*, Fuglesøen, Ymerø, ¹¹/₈ 1932. The shell of the female the 2nd antenna, the 5th post-oral limb, and the furca drawn to a large scale.

middle of the following joint only. The form of the furca and of the 5th post-oral limb is seen from fig. 21.

The length of the 59 specimens measured (all females) was as follows:

mm	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	Tot.
No. of ind. ¹⁴ / ₆	2	1	1	6	1	..	1	..	12
— - — ¹¹⁻¹⁵ / ₈ .....	..	..	..	3	5	20	15	4	47

The mean length of the individuals which may be regarded as adult is 1.44 mm and the range of variation from 1.20—1.58 mm. According to G. O. SARS and G. ALM the length of the adult females is 1.60 mm; thus it seems as if the East Greenlandic specimens scarcely attain the size of those from the Northern Scandinavia. In Spitzbergen OLOFSSON has found the length to vary between 1.5 and 1.8 mm. The colour is grey and tinted with brown or yellow.

As it appears from the measurements there is in the samples from August one size group represented only, and therefore it must be assumed that only one generation is present. This generation then must be composed of the individuals hatched in the spring from the hibernating eggs. The specimens in the sample were for the most part egg-carrying. The mode of reproduction is obviously the same as in Spitzbergen: Only one generation is produced every year; this generation is hatched from the hibernating eggs and produces towards the end of the summer a new set of hibernating eggs. FR. JOHANSEN (1911) has found on the basis of the "Danmark" material the same mode of reproduction in the East Greenlandic Ostracoda.

Prionocypris glacialis G. O. SARS var. *albida* G. ALM.

Herpetocypris glacialis EKMAN 1908.

Eucypris glacialis var. *albida* G. ALM 1914 and 1916.

Occurrence in East Greenland: *Franz Joseph Fjord Area*: Bjørnesø, Ellaø, $1/7$ 1934; Sandøen, Tyrolerfjord, $24/7$ 1930. *Nordostkyst Area*: Pond near Danmarkshavn, $30/7$ 1907.

New to East Greenland.

Occurrence in West Greenland: Found near Godhavn (ALM and HABERBOSCH).

Distribution: Greenland, Northern Scandinavia.

Remarks: The var. *albida* from East Greenland is (conserved specimens) of a more whitish colour than the species s. str., the surface of the shell is white and shining. Regarding the form of the appendages no difference was found between the two forms. According to G. ALM (1920) the only difference — apart from the colouration — is the following: in var. *albida* the dorsal bristle of the furca is longer than $\frac{1}{2}$ of the proximal claw, in the species s. str. it is shorter than $\frac{1}{2}$ of the proximal claw. According to O. OLOFSSON (1916) the length of the dorsal bristle varies between 37 and more than 50 % of the proximal claw in the Spitzbergen specimens of *P. glacialis*, and thus the var. *albida* cannot be distinguished from the species s. str. by the length of the dorsal bristle. In East Greenland specimens I have found the following length of the dorsal bristle in % of the length of the proximal claw:

<i>P. glacialis</i> s. str.	42	42	44	50	50	50	52	56	58	58	mean	50.2 %
— var. <i>albida</i>	51	54	54	54	56	57	57	58	58	59	mean	55.9 %

Thus in the mean there is a small difference between the two forms in the percentic length of the dorsal bristle, such as stated by G. ALM; but the single percentages overlap considerably and the character is

therefore of little value only as a distinguishing mark between single specimens of the two forms.

The length of the var. *albida* appears of specimens from $1/7$ 1934, $24/7$ 1930 and $30/7$ 1907:

mm	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	Tot.
No. of spec. $1/7$	1	1	1	..	..	..	..	..	..	..	..	..	3
— - — $24/7$.....	..	1	2	4	..	..	1	..	..	..	..	..	8
— - — $30/7$.....	..	..	1	..	..	3	1	4	11	12	4	1	37

The mean total length of the adult individuals from $30/7$ is 1.53 mm (1.2—1.8). The size is thus little larger than that of the species s. str. According to the series of measurements (one size group only in each sample) it must be assumed that only one generation is raised in the course of the summer.

22. *Heterocypris incongruens* (RAMDOHR).

Eucypris incongruens v. DADAY 1900.

Cyprinotus incongruens G. ALM 1916, fig. 39.

Heterocypris incongruens G. O. SARS 1925, pl. LVII.

Occurrence in East Greenland: *Scoresby Sund Area*: Pond on Stewart Land, 70° N. Lat., ca. $1/8$ 1900. *Franz Joseph Fjord Area*: Freshwater at Knudshoved, Karlshavn, $5/8$ 1930.

New to East Greenland.

Occurrence in West Greenland: Found once at Strømfjord (G. ALM).

Distribution: Europe, North Africa, Northern and Central Asia, South and North America.

Remarks: The individuals found show the character of the species according to the description given by G. ALM and G. O. SARS. The valves of the shell are unequal in size, the left one overlapping the right one considerably. The edges of the shell, especially those of the right valve, are finely crenulated, the shell is covered with small tubercles (appearing under the microscope as clear dots), each tubercle carries a fine hair (see fig. 32). The greatest height falls a little behind the middle. The height of the shell in % of the length was as follows:

height %	54	55	56	57	58	59	60	61	62	63	mean	59.4 %
No. of spec.....	1	2	2	..	4	10	8	3	6	3		39

The height is according to SARS not fully attaining $2/3$ of the length, and ALM writes "grösste Höhe mehr als $1/2$ der Länge". The appendages

(fig. 22 c, d, e) coincide fairly well with the description and figures given by Sars, only the bristle on the posterior inner angle of the 1st joint of the endopodit of A_2 is much larger than figured by Sars and fringed with minute hairs. The furca (fig. 22) is long and slender, the dorsal edge is very finely spinulated (this character is not mentioned by Sars). As the comparative length of the bristles and the claws of the furca

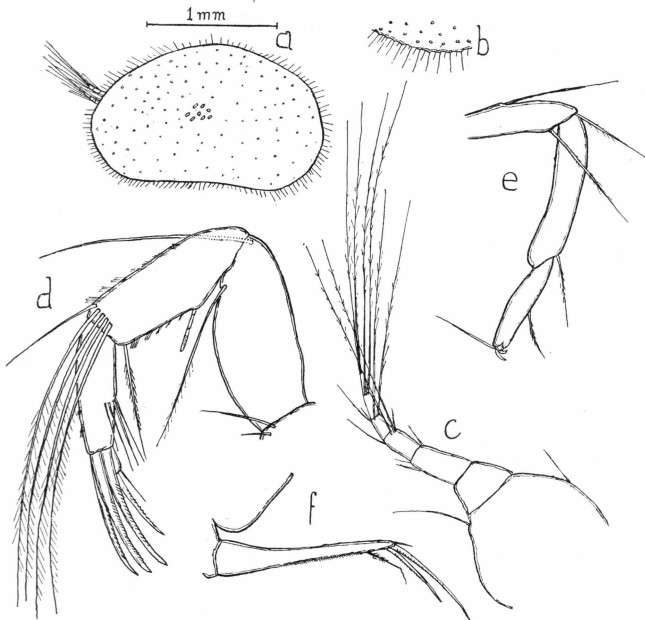


Fig. 22. *Heterocypris incongruens*, Knudshoved, $\frac{5}{8}$ 1930. a — female, b — the margin of the shell, c — 1st antenna, d — 2nd antenna, e — 5th post-oral limb, f — furca.

are of some worth as specific characters the following measurements (in units) are given.

dorsal bristle	proximal claw	distal claw	apical bristle
29	33	46	21
31	38	54	25
26	33	43	22
30	36	44	22
31	38	52	25
29	38	52	20
28	34	53	23

According to ALM the dorsal bristle is $\frac{2}{3}$ of the proximal claw (against “nearly as long as” in the allied species *Cyprinotus salina*); according to the above cited measurements its length is ca. 80% of that of the proximal claw; this disagreement is perhaps due to the fact

that the end part of this bristle is exceedingly fine and curved and therefore not easily observed.

The size (length) of the specimens measured was as follows:

mm	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
No. of spec.	1	2	1	..	1	2	..	2	8	..	..	8	8	8	5 = 46

The size of the grown up specimens (all females, partly with eggs) is thus 1.5—1.8 mm, or nearly the same as stated by G. ALM (1.4—1.8 mm); according to SARS the length of the adult females amounts to 1.6 mm.

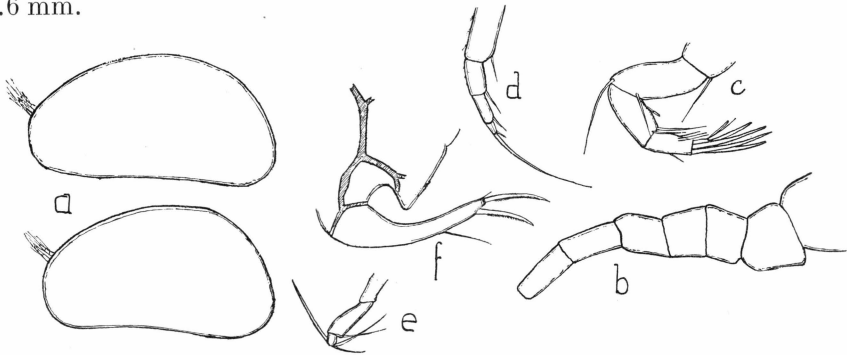


Fig. 23. *Candona candida*, Langsø, Ellaø, ²⁸/₉ 1933. a — the contour of the shell of two females, b — 1st antenna (the hairs omitted), c — 2nd antenna, d — 4th post-oral limb, e — 5th post-oral limb, f — furca with genital lobes.

23. *Candona candida* (O. F. MÜLLER) — VAVRA.

Candona candida G. ALM 1916, fig. 60.

Candona candida G. O. SARS 1925, pl. XXXII & XXXIII.

Occurrence in East Greenland: *Scoresby Sund Area*: Lake at Nordøstbugten, ¹⁴/₈ 1900 (a few adult spec.). *Franz Joseph Fjord Area*: Langsø, Ellaø, 72°50' N. Lat. ⁷/₂ 1934 (empty shell), ¹¹/₆ 1934 (ca. 20 empty shells), ¹⁵/₆ 1934 (9 empty shells), ¹⁹/₆ 1934 (one adult spec.), ²³/₆ 1934 (one adult spec.), ⁶/₉ and ⁷/₉ 1933 (one adult spec.), ²⁸/₉ 1933 (3 adult spec.), ¹/₁₀ 1933 (one adult spec.), ¹²/₁₀ 1933 (one adult spec.). "Lake A", Ellaø, ²⁵/₈ 1932 (one adult spec.). Rundsø, Ellaø, ²³/₅ 1935 (one juv. spec.), ¹/₆ 1934 (one empty shell), ⁵/₆ 1934 (one adult spec.).

New to East Greenland.

Occurrence in West Greenland: Various localities (G. ALM and P. HABERBOSCH).

Distribution: Northern, Central and Eastern Europe, North America, Siberia, Central Asia. The distribution of this species is mainly arctic and subarctic.

Remarks: The East Greenlandic specimens (see fig. 23) coincide well with former description of this species. The form of the shell is rather variable, however, the greatest height falls always behind the middle, and the ventral margin is more or less concave; the shell is white, smooth and shining, only very sparsely haired, the hairs being most conspicuous along the margin of the shell. The fig. 23 b-e shows the form of some of the appendages, and the furca with the sub-triangular genital lobe. In 13 spec. measured the percentic height was as follows:

height %	48	49	50	51	52	53	54	in mean	51.8 %
No. of spec.....	1	1	1	2	3	2	3	=	13 spec.

Regarding the height G. O. SARS writes "greatest height considerably exceeding half the length". In the East Greenlandic specimens the height exceeds half the length very little only, according to the above stated figures; SARS' figure of a femal shows, however, a height % of 54 only, thus falling within the range of variation of the East Greenlandic specimens.

The young specimens found on May the 23rd had a total length of 0.8 mm; the measurements of the (13) adult specimens were as follows (in mm): 0.90, 0.99, 1.00, 1.03, 1.05, 1.05, 1.05, 1.05, 1.06, 1.08, 1.08, 1.08, 1.12; mean 1.04 mm. According to G. ALM the length is 0.9—1.2 mm, according to G. O. SARS 1.1 mm.

As the species has not been found during the winter in Langso there is reason to suppose that it hibernates as resting eggs; the young were firstly observed towards the end of May; the species was found as late in the autumn as October the 12th.

24. *Candona groenlandica* V. BREHM.

Candona groenlandica V. BREHM 1912, Tab. XIX, figs. 18 and 19.

Candona groenlandica G. ALM 1914, fig. 4.

East Greenland record:

Candona groenlandica V. BREHM 1912.

Occurrence in East Greenland: *Nordøstkyst Area*: Two lakes at Stormkap, 12th and 14th June 1907; lake at Danmarkshavn, end of July 1907 (V. BREHM 1912).

Occurrence in West Greenland: Sarpusat, ca. 67° N. Lat., G. ALM, and Godhavn ca. 70° N. Lat., P. HABERBOSCH.

Distribution: Greenland, the northernmost part of Europe.

Remarks: V. BREHM writes that *C. gr.* is very common in the area investigated by the "Danmark" Expedition. Therefore it is rather

astonishing that it has not at all been observed in the material at hand for the present investigation; in this material *C. candida* was observed only. There is, however, no possibility of a confusion of the two species; the form of the genital lobes in the specimens of the present material differs very clearly from as well BREHM's as ALM's figures of the genital lobe of *C. groenlandica*.

Zoogeographical Remarks.

As it appears from the preceding Synopsis of the Species the following number of species¹⁾ of the various orders of freshwater entomostreaceans²⁾ have been recorded from East Greenland either during the present investigation or by former investigators:

Euphyllopoda	1
Cladocera	13
Copepoda	6 (8)
Ostracoda	4
Total...	24 (26)

The number of species found in East Greenland (excluding the two copepods whose occurrence are doubtful) is in the following table compared with the number of species found in other regions round the Northern Atlantic:

	East Greenland	West Greenland WESENBERG- LUND, 1895, P. HABERBOSCH 1920).	Spitzbergen (O. OLOFSSON 1918)	Bear Island (O. OLOFSSON 1918)	Yamal (VERESCAGIN 1913)
Euphyllopoda	1	3	1	1	..
Cladocera	13	24	4	3	34
Copepoda	6	11	6	4	..
Ostracoda	4	9	4	2	..
Total...	24	47	15	10	(34)

	High Sweden (SVEN EKMAN 1904)	Iceland (ERIK M. POUL- SEN 1939)	The Faroes (ERIK M. POUL- SEN 1929)	Denmark (S. JENSEN 1904, 1905; ERIK M. POULSEN 1928; KAI BERG 1929; C. WESEN- BERG-LUND 1937)
Euphyllopoda	3	1	0	5
Cladocera	28	27	24	69
Copepoda	16	18	12	32
Ostracoda .....	..	14	3	47
Total...	(47)	60	39	153

¹⁾ Parasitic or hemiparasitic species have not been considered.

²⁾ No freshwater malacostraceans were observed in the material. The amphipod *Gammarus duebeni* has, however, been recorded from West Greenland (K. STEPHEN-SEN 1913).

As it appears from the table the East Greenlandic fauna is rather poor, poorer than that of the other larger arctic regions, but naturally not so poor as that of the smaller arctic islands or groups of islands.

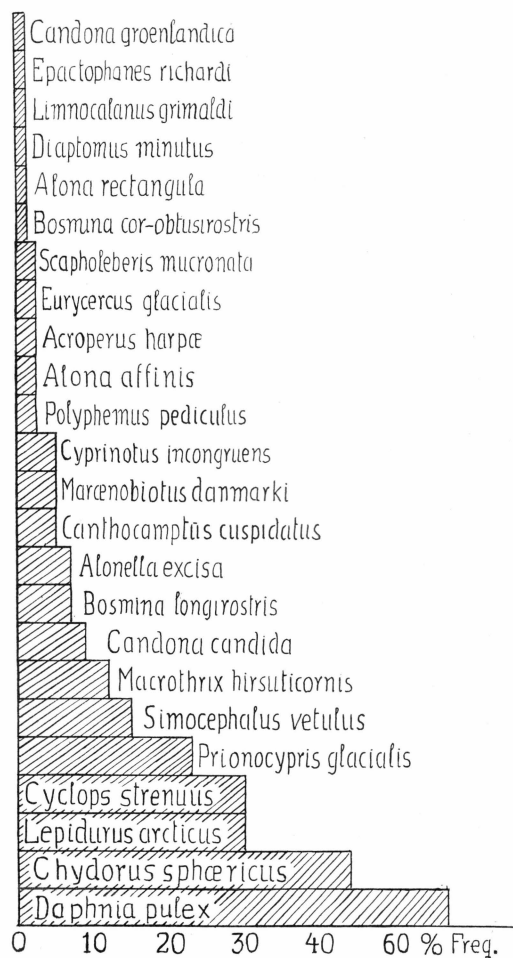


Fig. 24. The East Greenlandic Entomostraca species arranged according to their frequency-percents.

That the East Greenlandic entomostracean-fauna is poor qualitatively seen appears from the fact also that the number of species per locality is small, 2.7 only against 7.5 in West Greenland and 5.0 in Iceland (for Iceland Harpacticids and Ostracods not considered).

The occurrence of the different species in East Greenland is seen from table 2 which for the material of the present investigation gives a list of the localities investigated and the species found on each locality.

Table 2. List of localities where samplings of Freshwater-Entomostraca

Locality Nr. (see the map fig. 1)	1	2	3	4	5	6	7	8	9
Locality	Pond on Stewart Land	Lake at NØ.-Bugten	Jameson Land	Pond near Angmagssalik	Lake at Danmarkshavn	Lake near Danmarkshavn	Lake at Danmarkshavn	Lake at Stormkap	Pond at Maroussia.
Date	1900	14/8 1900	17/8 1900	15/8 1902	July 1907	20/8 1906	13/6 1908	3/9 1906	30/7 1907
<i>Lepidurus arcticus</i>	+	..	+
<i>Daphnia pulex</i>	+	..	+	+	..	+	+
<i>Scapholeberis mucronata</i>	+
<i>Simocephalus vetulus</i>
<i>Bosmina longirostris</i>
<i>Macrothrix hirsuticornis</i>	+
<i>Eurycerus glacialis</i>	+
<i>Acroperus harpae</i>
<i>Alona affinis</i>
<i>Alonella excisa</i>
<i>Chydorus sphaericus</i>	+	+	+
<i>Polyphemus pediculus</i>
<i>Cyclops strenuus</i>
<i>Canthocamptus cuspidatus</i>	+
<i>Maraenobiotus danmarki</i>
<i>Prionocypris glacialis</i>	+ ¹⁾	+ ¹⁾	+ ²⁾
<i>Heterocypris incongruens</i>	+
<i>Candona candida</i>	+
No. of species.....	1	4	3	1	3	1	1	1	4

¹⁾ *Pr. glac. s. str.* ²⁾ *Pr. glac. var. albida.*

Further the table gives the frequency percent of each species, i. e. the number of localities wherefrom the species has been recorded in percent of the total number of localities.

In fig. 24 the frequency-percents of the species occurring in East Greenland are shown; the species not found during the present investigations are set up in the figure as having a frequency-percent of 1 as they must be supposed to be rare only. *Daphnia pulex* is the most common species, next to this comes *Chydorus sphaericus* and then *Lepidurus arcticus* and *Cyclops strenuus*. These species are either (*Ch. sphaericus*) ubiquitous or (the three others) species that have their whole distribution within the arctic and subarctic regions (*L. arcticus*) or whose distribution falls mainly within these regions. *Prionocypris glacialis* (25 %) which comes next is a true arctic species. Among the species with a considerably lower frequency percent are *B. longirostris*, *P. pediculus*, *A. harpae*

Table 2.

Locality Nr. (see the map fig.1)	23	24	25	26	27	28	29	30	31
Locality	Pond G Hurry Fjord	Pond H Hurry Fjord	Pond I Hurry Fjord	Pond J Hurry Fjord	Pond near Puisortok	Little Noa lake Ymerø	Uglesø Ymerø	Noa lake Ymerø	Fuglesø Ymerø
Date	14/s 1933	14/s 1933	14/s 1933	14/s 1933	16/s 1932	10/s 1932	10/s 1932	10/s 1932	11/s 1932
<i>Lepidurus arcticus</i>.....	..	..	..	+	..	..	..	..	..
<i>Daphnia pulex</i>.....	..	+	+	+	..	..	+	..	..
<i>Scapholeberis mucronata</i>.....	..	..	..	..	..	..	..	..	..
<i>Simocephalus vetulus</i>.....	..	..	..	..	+	..	..	..	..
<i>Bosmina longirostris</i>.....	..	..	..	..	..	..	+	..	..
<i>Macrothrix hirsuticornis</i>.....	..	..	..	..	..	..	..	..	..
<i>Eurycercus glacialis</i>.....	..	..	..	..	..	..	..	..	..
<i>Acroperus harpae</i>.....	..	..	..	..	+	..	..	..	..
<i>Alona affinis</i>.....	..	..	..	..	..	..	..	..	+
<i>Alonella excisa</i>.....	..	..	..	..	..	..	..	..	..
<i>Chydorus sphaericus</i>.....	+	+	+	+	..	..	+	..	..
<i>Polyphemus pediculus</i>.....	..	..	..	..	..	..	..	..	..
<i>Cyclops strenuus</i>.....	+	+	..	..	..	+	+	+	..
<i>Canthocamptus cuspidatus</i>...	..	..	..	..	..	..	..	..	..
<i>Maraenobiotus danmarki</i>.....	..	+	..	..	..	..	..	..	..
<i>Prionocypris glacialis</i>.....	..	..	..	..	..	..	..	..	+
<i>Heterocypris incongruens</i>.....	..	..	..	..	..	..	..	..	..
<i>Candona candida</i>.....	..	..	..	..	..	..	..	..	..
No. of species.....	2	4	2	3	2	1	4	1	2

¹⁾ *Pr. glac. s. str.* ²⁾ *Pr. glac. var. albida.*

viously with various gears it seems hardly possible from these figures to draw any definite zoogeographical conclusions. The following species have been found through all the regions (except the Sydøstkyst area, where one sample has been taken only): *Lepidurus arcticus*, *Daphnia pulex*, *Chydorus sphaericus*, *Cyclops strenuus*, *Maraenobiotus danmarki*, and *Prionocypris glacialis*. Of these *L. arcticus*, *M. danmarki*, and *P. glacialis* are true arctic or subarctic species, whereas *D. pulex* and *Ch. sphaericus* must be regarded as ubiquitous, the former, however, having its main distribution in northern regions, just as it is the case with *Cyclops strenuus*. It seems as if a gradual reduction in the number of species of Cladocera takes place from the south to the north; the number of species for the 3 northern areas are the following: 10—6—5. The fauna of the northernmost region (round Danmarkshavn) is very much like that of Spitzbergen (compare

(continued).

32	33	34	35	36	37	38	39	40	41	42	43	No. of localities Total	Frequency — percent
Pond near Uglesø, Ymero	Pond Nordfjord	Pond Nordfjord	Small lake Nordfjord	Lake A Ellao	Pond Ellao	Langsø Ellao	Rundsø Ellao	Bjørnesø Ellao	Ulvesø Ellao	Pond Kap Oswald Ellao	Freshwater on Storø		
²¹ / ₈ 1932	²⁸ / ₇ 1932	² / ₈ 1932	² / ₈ 1932	²⁵ / ₈ 1932	²⁵ / ₈ 1932	⁸ / ₈ -33 ¹² / ₈ -34	²⁴ / ₈ -33 ¹² / ₈ -34	¹⁸ / ₈ -33 ¹ / ₇ -34	¹⁵ / ₈ -33 ¹⁷ / ₇ -34	¹⁴ / ₆ 1934	² / ₈ 1933	43	
..	+	..	+	13	30
..	..	+	+	+	+	+	..	+	+	..	+	29	67
..	1	2
..	+	..	+	..	+	7	15
..	+	..	+	3	7
..	5	12
..	1	2
..	1	2
..	1	2
..	3	7
+	+	+	+	+	..	+	+	19	44
..	+	1	2
..	..	+	+	+	+	+	+	+	+	13	30
..	2	5
..	+	2	5
..	+2)	+1)	+1)	+1)	10	23
..	2	5
..	+	+	4	9
1	1	3	3	3	2	5	4	6	6	1	2	..	..

Table 4). Of the 7 species found at Danmarkshavn 5 have been recorded from Spitzbergen too.

A comparison between the fauna of West Greenland and that of East Greenland has been made by WESENBERG-LUND (1895). He arrived to the result that of the 9 Cladocera species of East Greenland no less than 3 were not known from West Greenland, and that therefore East Greenland has its own Cladocera fauna different from that of West Greenland and showing stronger relationship to eastern faunas. The 3 East Greenlandic Cladocera at that time not recorded from West Greenland are *Macrothrix arctica*, *Simocephalus exspinosus* and *Daphnia groenlandica*. P. HABERBOSGH has, however, (1920) found *M. arctica* = *M. hirsuticornis* in West Greenland. As it further seems evident (see p. 20 and 13) that *S. exspinosus* is = *S. vetulus* and *D. groenlandica* = *D. pulex*, there is no evidence showing that the East Greenlandic fauna must be

Table 3. The distribution of the freshwater Entomostraca within East Greenland.

	Recorded by: P. = the present in- vestigation W.-L. = Wesenberg-Lund B. = V. Brehm	Sydøstkyst Area	Scoresby Sund Area	Franz Joseph Fjord Area	Nordøstkyst Area
1. <i>Lepidurus arcticus</i>	P. W.-L. B.	..	+	+	+
2. <i>Daphnia pulex</i>	P. W.-L. B.	..	+	+	+
3. <i>Scapholeberis mucronata</i>	P. W.-L.	..	+	..	..
4. <i>Simocephalus vetulus</i>	P. W.-L.	+	+	+	..
5. <i>Bosmina longirostris</i>	P.	..	..	+	..
6. — <i>cor.-obtusirostris</i> ..	W.-L.	..	+	..	..
7. <i>Macrothrix hirsuticornis</i>	P. W.-L. B.	..	+	..	+
8. <i>Eurycerus glacialis</i>	P. W.-L.	+	+	..	..
9. <i>Acroperus harpae</i>	P. W.-L.	+	+	..	..
10. <i>Alona affinis</i>	P.	..	..	+	..
11. — <i>rectangula</i>	B.	..	..	..	+
12. <i>Alonella excisa</i>	P.	..	+	..	..
13. <i>Chydorus sphaericus</i>	P. W.-L. B.	..	+	+	+
14. <i>Polyphemus pediculus</i>	P. W.-L.	..	+	+	..
15. <i>Diaptomus minutus</i>	B.	..	..	..	+
16. <i>Limnocalanus grimaldi</i>	B.	..	..	..	+
17. <i>Cyclops strenuus</i>	P. B.	..	+	+	+
18. <i>Canthocamptus cuspidatus</i> ...	P. B.	..	+	..	+
— <i>duthiei</i> ?? ..	B.	..	..	..	(+)
20. <i>Epactophanes richardi</i>	B.	..	..	..	+
<i>Maraenobiotus brucei</i> ?	B.	..	..	..	(+)
19. — <i>danmarki</i>	P. B.	..	+	+	+
23. <i>Candona candida</i>	P.	..	+	+	..
24. — <i>groenlandica</i>	B.	..	..	..	+
21. <i>Prionocypris glacialis</i>	P. B.	..	+	+	+
22. <i>Heterocypris incongruens</i> ...	P.	..	+	+	..
No. of species .....	..	3	17	12	13 (15)
No. of species of Cladocera only.	..	3	10	6	5

regarded as different from that of West Greenland. According to the present knowledge there are two species of Entomostraca only, which are recorded from East Greenland and not from West Greenland, viz. the marine relict *Limnocalanus grimaldi* and the Harpacticid *Canthocamptus duthiei*, whose occurrence in East Greenland is rather doubtful only. Otherwise the East Greenlandic fauna differs from the fauna of West Greenland by its small number of species only. The species occurring in West Greenland but not known from East Greenland are:

<i>Artemia salina</i>	<i>Branchinecta paludosa</i>
<i>Latona setifera</i>	<i>Holopedium gibberum</i>
<i>Ceriodaphnia quadrangula</i>	<i>Alona quadrangularis</i>
<i>Alona guttata</i>	<i>Alona intermedia</i>
<i>Graptoleberis testudinaria</i>	<i>Alonella nana</i>
<i>Cyclops vernalis</i>	<i>Canthocamptus arcticus</i>
<i>Moraria schmeili</i>	<i>Maraenobiotus insignipes</i>
<i>Nannopus palustris</i>	<i>Cypris pubera</i>
<i>Eucypris affinis-hirsuta</i>	<i>Cypridonus viduæ</i>
<i>Candona lapponica</i>	<i>Candona rectangula</i>

Thus the number of species is 20 higher in West Greenland than in East Greenland, as, however, until the present investigation the difference in number of species was 26, there is some reason to suppose that further investigations will make the difference at any rate somewhat smaller. That the East Greenlandic fauna is in reality poorer qualitatively seen than that of West Greenland is, however, shown beyond doubt by the fact that the mean number of species per locality is in East Greenland 2.7 only against 7.5 in West Greenland. No doubt the poverty of the East Greenlandic fauna is due partly to the isolated position of the region and partly to the extreme arctic conditions prevailing here.

The occurrence in East Greenland of *Diaptomus minutus*, which is a true nearctic species found only in Northern America, Greenland and Iceland, shows that the East Greenlandic fauna at any rate partly has immigrated from West Greenland. The fact that *D. minutus* has been found in the northernmost part of East Greenland only indicates that it has immigrated to East Greenland round the northern coast of Greenland and not along the south-eastern coast or across the Denmarkstrait from Iceland. *D. minutus* has thus immigrated by the same way as the mammals of East Greenland. However, the gradual reduction in the number of species from south to north tends to show that an immigration has occurred from the south also, either along the coast or across the sea.

In table 4 is shown the frequency and distribution of the East Greenlandic species in some other parts of the holoarctic region. The following species: *Lepidurus arcticus*, *Eurycerus glacialis* (found, however, in Holland), *Diaptomus minutus*, *Candona groenlandica*, *Herpetocypris glacialis* have only been found in the arctic or subarctic regions. Another group of species have their main distribution and the highest frequency percents in the Arctic although they occur in the temperate countries too; these species are *Daphnia pulex*, *Bosmina cor.-obtusirostris*, *Macrothrix hirsuticornis*, *Cyclops strenuus* (cfr. the table). Other species — *Scapholeberis mucronata*, *Bosmina longirostris*, *Acroperus harpae*, and

Table 4. Frequency-percents of the species of freshwater Entomostraca of East Greenland in other holo-arctic regions.

	East Greenland	West Greenland	Iceland	Swedish Highland	Faroes	Spitzbergen	Northern Siberia	Denmark
<i>Lepidurus arcticus</i>	30	2	4	3	..	+	..	..
<i>Daphnia pulex</i>	67	57	11	7	1	+	+	7
<i>Scapholeberis mucronata</i> ...	2	20	5	9	..	..	+	18
<i>Simocephalus vetulus</i>	15	19	18	3	1	..	+	20
<i>Bosmina longirostris</i>	7	3	..	..	1	..	+	33
— <i>cor.-obtusirostris</i> ..	r	62	27	63	13	..	+	20
<i>Macrothrix hirsuticornis</i>	12	5	9	..	..	+	..	+
<i>Eurycerus glacialis</i>	2	58	9	..	..	..	..	..
<i>Acroperus harpae</i>	2	41	31	38	8	..	+	25
<i>Alona affinis</i>	2	21	28	13	34	..	+	8
— <i>rectangula</i>	r	7	+	..	..	..	+	5
<i>Alonella excisa</i>	7	36	9	21	4	..	+	14
<i>Chydorus sphaericus</i>	44	82	50	65	34	+	+	64
<i>Polyphemus pediculus</i>	2	71	16	47	6	..	+	25
<i>Diaptomus minutus</i>	r	82	14	..	..	..	..	..
<i>Limnocalanus grimaldi</i>	r	..	..	..	..	..	..	..
<i>Cyclops strenuus</i>	30	22	11	9	13	+	..	+
<i>Canthocamptus cuspidatus</i> ..	5	2	0.6	3	6	..	..	..
— <i>duthiei</i> ??.	r	..	..	..	..	..	..	..
<i>Epactophanes richardi</i>	r	+	+	..	..	..	..	..
<i>Maraenobiotus brucei</i> ?.....	r	}	..	..	..	..	..	..
— <i>danmarki</i> ...	5		..	..	..	..	..	..
<i>Candona candida</i>	9	+	2	+	+	..	..	+
— <i>groenlandica</i>	r	+	..	..	..	..	..	..
<i>Herpetocypris glacialis</i>	23	+	0.6	+	..	+	..	..
<i>Heterocypris incongruens</i> ..	5	+	2.5	+	..	..	..	+

Polyphemus pediculus — are met with only rarely in East Greenland (and other arctic regions) but more commonly in the temperate regions; these species have their main distribution in the more temperate countries and live in East Greenland at the northern limit of their distribution; thus none of these species have been recorded by OLOFSSON from Spitzbergen or from any other of the islands in the Arctic Sea.

The two species *Daphnia pulex* and *Lepidurus arcticus* are by far the most predominating in the East Greenlandic Entomostracean-fauna. They occur in respectively $\frac{1}{3}$ and $\frac{2}{3}$ of the localities, and in the samples from these localities they are — especially *D. pulex* — present in large numbers, and there is no doubt that these two species play a predominating role as food for other animals f. i. fish and birds living in or at the East Greenlandic freshwaters.

The East Greenlandic Entomostracean-fauna is a true arctic fauna. Its most common species have an either purely or mainly arctic distribution and only among the rarely occurring species the species with a more temperate distribution are found. Only the two nearly ubiquitous species *Simocephalus vetulus* and *Chydorus sphaericus* are exceptions from this rule; they occur with large frequency percents both in East Greenland and in temperate countries f. i. Denmark.

On the Propagation of the Greenlandic Cladocera.

The propagation of the Greenlandic Cladocera was studied firstly by C. WESENBERG-LUND (1895). On the basis of his investigations he arrived to the following conclusions:

1. The Greenlandic Cladocera seem to have one sexual period only. They are monocyclic.
2. There seems to be a tendency to restrict the parthenogenetic reproduction both in number of broods and in number of eggs. "On a whole it may be said that in Greenland and probably everywhere in the Arctic the sexual generations are the most predominating, and it is on these that the propagation of the species is based".

These conclusions in the main still hold true, only the term "sexual generations" should be altered to "generations propagating by means of resting eggs".

Not until 25 years afterwards the biology of the Greenlandic Cladocera was studied again. P. HABERBOSCH (1920) states that the principal scope of his investigations regarding the propagation of the Greenlandic Cladocera was, firstly to find out the mode of the seasonal variation in the occurrence of parthenogenetically produced, subitaneous eggs and sexually produced resting eggs, and secondly to ascertain whether the Greenlandic colonies are polyyclic, monocyclic or acyclic. As he defines his scope thus it is obvious that he adheres to the opinion, prevailing at that time, that the mode of reproduction, monocyclic or dicyclic etc. is a definite character for each colony or even for each species within a certain climatic region. It is, however, very doubtful if we are right in terming certain colonies of Cladocera as monocyclic, dicyclic etc. I have found in Denmark a colony of *Daphnia pulex* which in one year was monocyclic, in the next year, however, dicyclic, and

K. BERG (1931) has observed the same regarding another colony of the same species, and he has further showed "that *D. pulex* generations which would propagate parthenogenetically in nature can be forced to propagate gamogenetically in cultures". It is thus evident that the certain colonies themselves cannot be termed monocyclic, dicyclic etc. The mode in which the propagation varies is not a definite character of the colony in question, it is only the way in which the colony meets the external conditions and it may be and is altered according to variation in these external conditions. Thus we cannot term a certain colony f. i. monocyclic, we can only state that the external conditions prevailing during the investigation has forced the colony for the present to propagate monocyclic; during the next year it may possibly propagate dicyclic. In certain cases, of course, the external conditions may be so special and so constant that one mode of reproduction may be possible only, but still this mode cannot be regarded as a definite character of the colony in question.

In his two papers P. HABERBOSCH (1916 and 1920) states that the Greenlandic Cladocera propagate monocyclic and he further discusses whether it is the spring period or the autumn period of sexual propagation of these Cladocera (being di- or polycyclic in Central Europe) which has been left out. He arrives to the conclusion that it is the spring period which has been left out, but he adds that this question cannot be answered definitely before a more extensive material is at hand. It is clear from this that P. HABERBOSCH in accordance with the view prevailing at that time, is of the opinion that the "dicyclic species" of Central Europe have two fixed sexual periods so characteristic for the species even, that when finding the species monocyclic in Greenland, we can discuss which of the two periods it is that has disappeared. I shall not on the material now at hand try to decide which of the two periods it is that has disappeared as no such fixed periods exist in the life of the Cladocera. The case is obviously thus: In more southern localities the "dicyclic species" live under such external conditions that — as a rule, but not always — they are forced to produce resting eggs and able to produce subitaneous eggs twice in the year due to certain external conditions (f. i. exciccation of the locality, cold). In the Arctic, however, the period favourable for the production of subitaneous eggs is so restricted due to the very short summer that it leaves no time for a resting period followed by a new period favourable for propagation by means of sub. eggs. The result is that we have in the Arctic one period only of propagation by means of resting eggs. The propagation of the colonies, therefore, happens to be monocyclic, not on account of any internal factors in the individuals themselves but due to the conditions of the environment.

As already mentioned WESENBERG-LUND has shown that the reproduction by means of resting eggs is far more important for the survival of the Greenlandic Cladocera species than the reproduction by means of subitaneous eggs. This is right as far as the resting egg-propagation lasts for a considerably longer time than the propagation by means of sub. eggs, but during the period with subitaneous propagation the number of females producing sub. eggs is large and the number of eggs is rather high at any rate during the first part of the period.

A striking feature regarding the propagation of the East Greenlandic Cladocera is the scarcity of the males. It is already shown by OLOFSSON that the *Daphnia pulex* from Spitzbergen never produces males, and that the resting eggs thus are produced parthenogenetically; the same holds good for East Greenland. But there is in the present material some evidence at hand that other Cladocera-species also propagate purely parthenogenetically:

Bosmina longirostris; no males observed, ehippial females observed in 4 samples.

Eurycerus glacialis; only found in one sample containing 14 eph. ♀ but no males.

Acroperus harpae; only found in one sample containing 11 eph. ♀ but no males.

In the material of *Macrothrix hirsuticornis*, *Simocephalus vetulus*, and *Alonella excisa* rather many males were found. Of *Chydorus sphaericus* males were not rare although they were easily outnumbered by the ehippial females; in a certain sample 60 eph. ♀ were recorded against 32 males only.

The material dealt with by WESENBERG-LUND also shows for certain species an astonishing scarcity of males: *Eurycerus lamellatus* = *E. glacialis*; 6 samples with eph. ♀, 1 only with males. *Bosmina coregoni* many ♀ with resting eggs, only two ♂. *Acroperus harpae* and *Polyphemus pediculus* 2 samples with resting eggs, no males.

From the material described by P. HABERBOSCH 1920, from West Greenland the following observations concerning the lacking or the scarcity of the males can be given (only the samples in which either eph. ♀ or males were observed are considered):

	Samples with eph. fem.	Samples with males
<i>Daphnia pulex</i>	38	1
<i>Scapholeberis mucronata</i>	8	0
<i>Simocephalus vetulus</i>	2	0
<i>Ceriodaphnia quadrangula</i>	30	1
<i>Bosmina longirostris</i>	1	0
<i>Bosmina coregoni obtusirostris</i>	28	18

	Samples with eph. fem.	Samples with males
<i>Eurycercus glacialis</i>	2	0
<i>Acroperus harpae</i>	0	1
<i>Alona affinis</i>	0	4
<i>Alona rectangula</i>	2	0
<i>Alonella excisa</i>	10	13
<i>Chydorus sphaericus</i>	11	6
<i>Polyphemus pediculus</i>	39	0

From these figures it is clear that males are rare among the Greenlandic Cladocera. Only of *Bosmina cor. obtusirostris*, *Alona affinis*, *Alonella excisa* and to a minor degree *Chydorus sphaericus* males are found rather often. Regarding *B. cor. obt.* males are, however, few only in comparison with the number of ephippial females (see p. 24).

Of the following species males have not been observed at all in Greenland although ephippial females were found: *Bosmina longirostris*, *Alona rectangula*, *Polyphemus pediculus*. Further in *Daphnia pulex*, *Scapholeberis mucronata*, *Ceriodaphnia quadrangula*, *Eurycercus glacialis*, *Acroperus harpae* and *Bosmina cor. obtusirostris* males are exceedingly rare.

These observations makes it evident that the production of resting eggs without fertilization is rather common among the arctic colonies of Cladocera. A pure parthenogenetic production of resting eggs is stated for *Daphnia pulex* in East Greenland and obviously also for *Polyphemus pediculus* and *Bosmina longirostris* for the whole of Greenland. For a number of other species males are so rarely met with that there can be no doubt that the production of resting eggs in these species is at any rate partly parthenogenetic.

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