

Contributions to the knowledge of larval development in Cyclops leuckarti Claus.

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Translated by W.J.P. Smyly.

In examining the plankton of the lake of Ghirla (Varesotto), I have sometimes observed numerous individuals of a species of Cyclops which in all characters resembles Cyclops leuckarti (Claus) except that the hyaline membrane of the last segment of the first antenna appears all finely serrated with two strong notches instead of one, as is figured in Schmeil (1892). Given the perfect identity of all other characters, this little difference does not seem to me sufficient reason for creating a new variety: it would be possible to treat this perhaps as a local variety but I reserve this for discussion in the work which I am in the course of doing on the plankton of the lake of Ghirla.

The purpose of this short note is to study the larval forms of C. leuckarti which have many characters in common with C. oithonoides var. hyalina, the larval development of which is described recently by Manfredi, (1925). Drawings of the two forms are so much alike that it seems to me interesting to find out what differences there may be, however small, which may permit the identification of the nauplius and metanauplius of these two Cyclops.

Taking account of the researches of Ziegelmayr (1925, Zeit.f.Wiss., B.126) I have tried to recognise the first stages of development but, though having followed some cultures, I have never had the fortune to examine newly hatched nauplii, nor to find the cast-skins in my culture vessels.

However, the morphological difference between naup I & II is small which I could not make out from material preserved in formalin.

Fig. 2 (title: I nauplius) refers then probably to that which according to Zieglmayer is the 2nd stage naup and which is indicated in the drawing of Manfredi as nauplius I. For clarity in naming, I will indicate with the name of orthonauplius ( following the nomenclature of Dietrich) the stage I nauplius and successively the other stages by name as I, II, III, IV, V nauplius: I, II, III, IV, V metanauplius. [metanauplius = copepodid].

#### Nauplius series

Nauplius I in C. leuckarti has an almost perfect oval-shape and, as observed in C. oithonoides the posterior extremity does not show any sign of bifurcation. On this extremity is inserted a single pair of feathered setae which differ from those of C. oithonoides var. hyalina in being much shorter and not curved at the tip. Near the insertion of this fine hair one sees a transverse series and two oblique series of very fine spines. Some setules (which increase in number in each successive stage) one observes on the ventral side of the nauplius. Their position is a little diverse as in C. oithonoides var. hyalina, as one can easily see in comparison between the figure given here and the corresponding figure in the work of Manfredi. Observing the drawings of the II, III, & IV nauplius of Cyclops oithonoides var. hyalina (which are not given in the work of Manfredi but which I was able to see as well) I have established that the II & III nauplius are not characterized by any particular difference. In the IV nauplius there is a difference in C. oithonoides of the body which is considerably elongated: there are well shown traces of a division into three segments. (fig. 3). This segmentation becomes much more evident in the successive stages. It is important to note that while in C. oithonoides, the longest seta of the maxilla

is that in the middle of the exopodite, in C. leuckarti the longest and least robust is that to the outside of the same exopodite. The caudal setae are three on the side and of them only the outside is hairy.

In the IV nauplius, Cyclops leuckarti (fig. 4) has a form less tapering than that of C. oithonoides var. hyalina. The distal segment of the exopodite of the II antenna carries three plumose setae; the endopodite carries three lateral setae of which only the median is plumose. (In Cyclops oithonoides the terminal setae of the exopodites are two and the lateral setae of the endopodite also two). In the IV stage the jaws are worth considering, indeed the spines have maintained the same relations in this respect to the length as to their positions. At the base of the maxilla on the inside is a plate less pointed than a spine and on the outside is scarcely pointed. The I & II pairs of swimming feet instead are well visible: so much so that one can clearly distinguish endopodite and exopodite one from the other. In the 1st pair, the endopodite is provided with three well-developed spines of which the median is the largest and the exopodite is provided with 4 spines of which the two inner ones are plumose. This pair of limbs is here much more developed than the corresponding one in Cyclops oithonoides var. hyalina. The outline of the furca is well marked and carries 3 pairs of rather long spines. One other character in which the two species differ one can observe in the cast skin of the nauplius. In that of Cyclops oithonoides, there is an oval hole situated dorsally through which the new nauplius escaped from its old shell. In Cyclops leuckarti however the empty shell appears torn at the anterior end.

Metanauplius (= copepodid) stages:

The first metanauplius of C. leuckarti (Fig. 5) has small dimensions with the first antenna of 6 segments provided with long plumose setae. The mouth parts are very similar to those of the adult, however the external margin of the maxilla (Fig. 5b), characteristic of the species, show small notches scarcely visible except under the highest power of the microscope. The furca is well developed: of the 4 terminal stetae that inside (innermost) is the longest. In the succeeding stages one observes nothing in particular however the notched margin of the maxilla becomes more evident still in the third metanauplius (Fig. 6). In this stage appears also well evident the hyaline membrane of the two last segments of the 1st antenna. In the following table is indicated the series of divisions of the segments of the 1st antenna during its development.

	♀ ♀																				
<i>Metanauplius</i> I	1						2						3	4	5	6					
(antenna di 6 art.)																					
<i>Metanauplius</i> II	1						2	3						4	5	6	7				
(antenna di 7 art.)																					
<i>Metanauplius</i> III	1 2							3	4	5						6	7	8	9		
(antenna di 9 art.)																					
<i>Metanauplius</i> IV	1	2	3	4 5		6						7	8		9	10	11				
(antenna di 11 art.)																					
<i>Metanauplius</i> V	1	2	3	4	5	6						7	8		9	10	11				
(antenna di 11 art.)																					
<i>Adulto</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17				
(antenna di 17 art.)																					

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	♂ ♂																				
<i>Metanauplius</i> III	1	2	3	4						5						6	7	8	9		
(antenna di 9 art.)																					
<i>Metanauplius</i> IV	1	2	3	4						5						6	7	8	9		
(antenna di 9 art.)																					
<i>Metanauplius</i> V	1	2	3	4	5	6	7						8	9	10	11					
<i>Adulto</i>	1	2	3	4	5	6	7	8	9	10						11	12	13	14	15	16
(antenna di 16 art.)																					

It is worth noting the fact that, in the ♀♀ the fourth copepodid has 11 segments in the antenna and this antenna passes unchanged to the 5th copepodid. In the ♂♂ instead the antenna of 9 segments in the 3rd copepodid remains the same in the 4th copepodid and only in the 5th copepodid divides into 11 segments.

\* \* \* \* \*

Summarizing, the fundamental differences between the larval forms of these two species are very small, but still sufficient to distinguish even the 1st nauplius stage. They consist principally:

- 1) in a shorter length and curvature of the terminal setae and a different arrangement of the fine setae of the ventral surface (1st 2nd and 3rd nauplius).
- 2) in the more slender form of the body which shows also a sketchy segmentation and in the distribution of the spines of the maxilla (4th or 5th nauplius).
- 3) in the inferior margin notched of the maxillary limb which one finds in all the copepodids. Also noteworthy is the developmental series of the segments of the 1st antenna, indeed in the fourth copepodid ♀ the antenna is composed of 11 segments, a condition noted also in C. bicuspidatus, C. serrulatus, C. prasinus, C. oithonoides var. hyalina, C. albidus, C. vernalis and C. strenuus.

The results of this short investigation confirm the hypothesis of Grandori that specific differences are recognisable even in the nauplius stages: and the fact is all the more noteworthy in the case which I have considered, in as much as one is dealing with nauplii belonging to species which are very much alike, namely C. leuckarti & C. oithonoides var. hyalina.

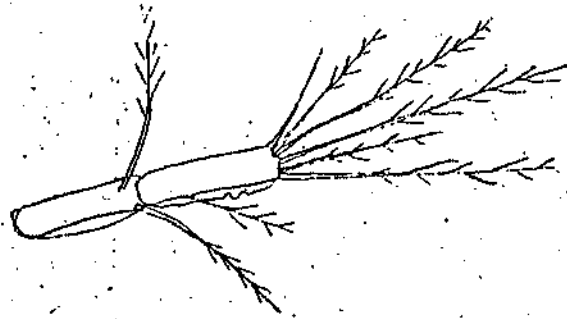


Fig. 1. — I duo ultimi artecoli dell'antenna.

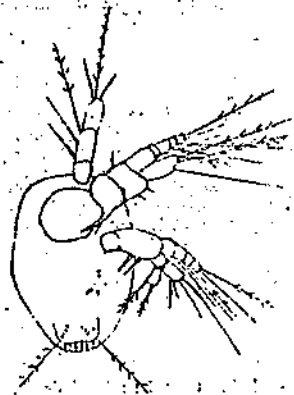


Fig. 2. — I nauplius.

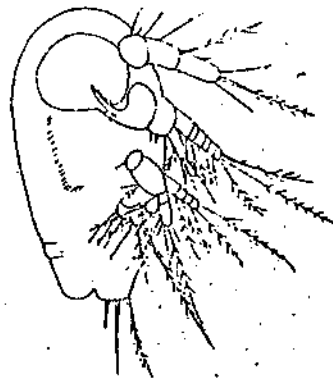


Fig. 3. — IV nauplius.

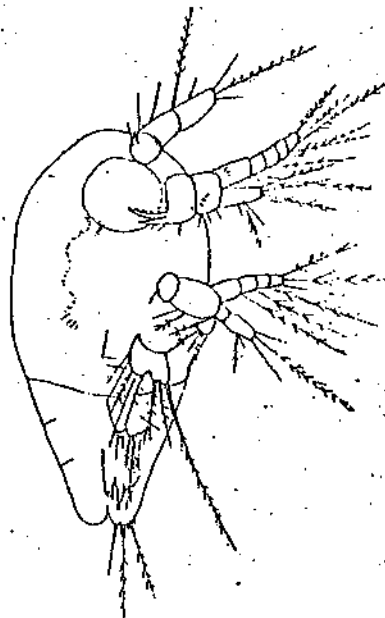


Fig. 4. — V nauplius.

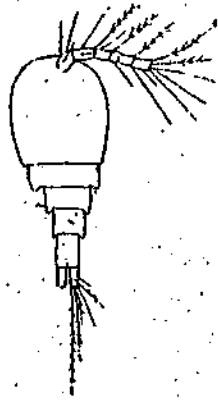


Fig. 5a - I metanauplius



Fig. 5b - piede mascellare esterno del I metan.

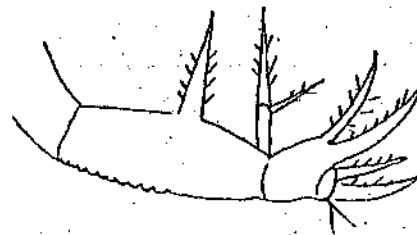


Fig. 6 - piede mascellare esterno del III metan.

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### **Notice**

Please note that these translations were produced to assist the scientific staff of the FBA (Freshwater Biological Association) in their research. These translations were done by scientific staff with relevant language skills and not by professional translators.