

Es ist ein Organ, das beim Kauprocess der Cyprinoiden eine große Rolle spielt, morphologisch aber ist es dem Hornzahn homolog. Daß es eine Hornbildung ist, habe ich mich auch durch die Verdauungsmethode überzeugt; auch war bei dem Verbrennen der Kauplatte der Geruch so ähnlich dem bei Haarverbrennen erhaltenen, daß a priori kein Zweifel über ihre Hornnatur war.

Meine Arbeit ist noch nicht vollendet. Diese Mittheilung ist nur eine vorläufige. Sie hat den Zweck, nur darauf hinzuweisen, mit welchem interessanten Organ wir hier zu thun haben.

4. On the Nauplius stage of *Penaeus*.

By K. Kishinouye,
Imperial Fisheries Bureau, Tokyo.

(With 3 figs.)

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Since F. Müller¹ had published in 1863, the remarkable fact that the larva of *Penaeus* comes out of the egg in the *Nauplius* stage, no other naturalists yet corroborated his observation, though Claus², Brooks³ and Willemoes-Suhm⁴ observed the *Zoea* of the genus.

This summer I was able to collect the different stages of the larva of *Penaeus* in the Tokyo Bay and the Inland Sea. Among the collection there were many *Nauplii*.

The youngest *Nauplius* (fig. 1) in my collection, seems to be shortly after the animal had left the egg. It is very small, being only $\frac{1}{4}$ mm in length. The body is ellipsoidal, the longer diameter of which is nearly double the shorter one in length. The ventral side of the body is a little flattened. On this side we find a simple eye near the anterior end, a wide rectangular lip in the middle, and a pair of bristles at the posterior end. Behind the lip, there is a median longitudinal groove. The cells which compose the body are very large. Some of them contain yolk granules and many of them are in the process of



fig. 1.

¹ F. Müller, Die Verwandlung der Garneelen. Arch. f. Naturgesch. 29. Bd.

² C. Claus, Untersuchungen zur Erforschung der genealogischen Grundlage des Crustaceen-Systems. Wien. 1876.

³ W. K. Brooks, The Metamorphosis of *Penaeus*. Johns Hopkins Univ. Circ. vol. 2. 1882.

⁴ Spence Bate, Report on the Crustacea Macrura. Challenger Report. vol. 24. 1888.

segmentation. Muscle-fibres are scarcely found. There are only three pairs of appendages. They are short unsegmented, blunt at the distal end and are rather club-shaped. The second pair is the longest, the first pair is next in length, and the third pair is the shortest. The first pair (bristles excluded) is about $\frac{1}{2}$ so long as the body, and is uniramous, while the others are biramous. Each appendage has some bristles near the distal end. The appendage of the first pair has 1 short and 3 long bristles, that of the second pair 1 short and 2 long bristles on the inner branch, 5 or 6 long bristles on the outer branch, and that of the third pair 3 long bristles on each branch of it. I could not find the cilia on these bristles and also on the paired bristles at the posterior end of the body.

In the next stage which I had observed, all the appendages were much elongated and became gradually narrow towards the distal end. This stage, however, was not minutely examined, so I can not give more detailed description.

In a little older larva (fig. 2), the appendages are divided into numerous, minute segments. Bristles on the first two pairs of appendages have increased in number. The posterior end of the body is

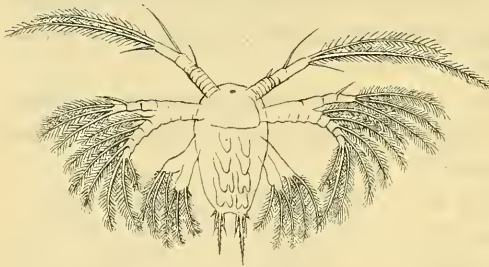


fig. 2.

faintly bilobed. On each lobe, there is a very long bristle which was already found in the youngest *Nauplius*. On either side of this long bristle, there is a short bristle and outermost to these three bristles, we find a rudiment of another bristle as a pointed protuberance. All

the bristles, except small ones, are ciliated. Muscles in appendages and their adductor muscles are now well developed. Behind the third pair of appendages, four pairs of appendages newly appear as short protuberances.

In this stage, the body is developed posteriorly. It is now about $\frac{1}{3}$ mm in length. Behind the third pair of appendages and the upper lip, the ventral side of the body is concave. This is due to the incurvation of the body towards the ventral side, as it elongates at the posterior end.

In a little older stage, the animal undergoes a remarkable change. The body is divided into two different parts. The division takes place near the posterior end of the dorsal side by a transverse fold of the

skin. The dorsal surface of the anterior portion is the rudiment of the future carapace. This and the following stage may be grouped as *Metanauplii*.

Subsequently, the body is faintly segmented. Such segments are found behind the third pair of appendages (fig. 3). There are four segments, corresponding to the fourth—seventh pairs of appendages. These appendages have developed much; but they perform no definite function yet.

The portion of the body, not-covered by the rudimentary carapace has become long, but it is still bent much towards the ventral side. The accompanying figure shows an animal, the tail portion of

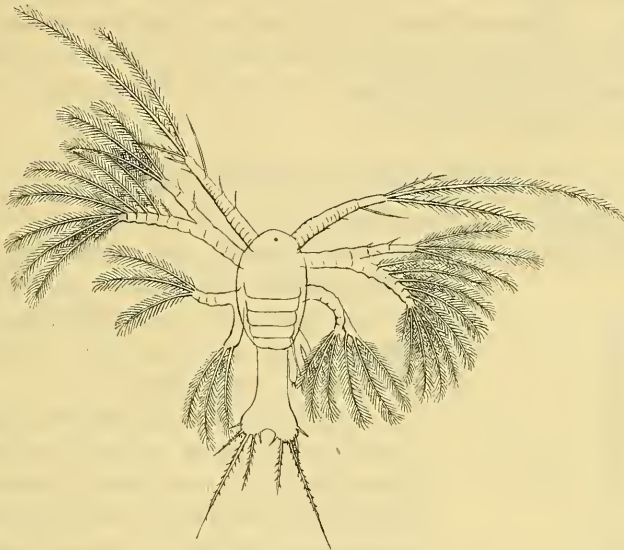


fig. 3.

which was straightened by the pressure of a cover-glass. The upper lip is comparatively large. Bristles on the first two pairs of appendages have increased in number as well as in length. The masticating portion of the third pair of appendages, which becomes the chief portion of the future mandible, is developed as a short cylindrical knob at the base of the appendage.

In certain species, the posterior margin of the carapace was found in this stage a little thickened and elevated.

When such a *Metanauplius* undergoes a moulting, the incurvated tail portion becomes straight and moreover it is greatly elongated near the end. In this way a *Metanauplius* is transformed to a *Protozoeca*.

Tokyo, Nov. 4, 1899.

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Autor(en)/Author(s): Kishinouye Kamakichi

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