The Zoea of *Eurynome aspera.*

By

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With 2 Figures in the Text.

THE Zoea of *Eurynome aspera* has already been twice described—namely, by Kinahan (1857)* and Cano (1893),† but there is some discrepancy between the two accounts which an observation made at Plymouth in April, 1922, fully explains.

Kinahan observed the larva immediately on hatching and described it as having neither rostrum nor dorsal spine ; whereas Cano describes it as having both.

On April 18th, 1922, a female *E. aspera* bearing eggs was found in some material dredged from Plymouth Sound and was placed in a vessel under the circulation. At about 11 p.m. it was noticed that hatching of the eggs was in progress, and the vessel rapidly became full of actively-swimming Zoeas. Some of these were examined and found to be still enclosed in the embryonic cuticle. The following morning a large proportion of the very numerous larvæ were still in the same condition, the remainder having moulted and assumed the form shown in Cano's figure. It is evident that the larval cuticle is retained for several hours, in some cases for twelve hours or more, and that Kinahan observed the larva in this condition, a supposition already expressed by Cano.

The embryonic cuticle is usually moulted immediately after hatching, or is even cast off in the act of leaving the egg, but when it is retained for a short time, as in *Carcinus maenas*, the Zoea during that time is inactive. In the case of *E. aspera* the Zoea is almost as good a swimmer when first hatched as it is after the first moult, but its movements are, as might be expected, more erratic, and there are periods of quiescence.

The embryonic cuticle shows exceptionally well the "Protozoeal" setæ of the antennæ and telson which have been described by Faxon, Conn, and others in other species.

The telson has six very large ciliated setæ, a seventh which is short and not ciliated being placed between the third and fifth. This fourth seta contains the invaginated spine which forms the prolongation of the

* *Ann. Mag. Nat. Hist.* (3), I, 1858, p. 233.
† *Mitth. Zool. Stat. Neapel*, X, 1893.

fork of the telson in the Zoea, and is also distinguished in the Anomura by its large size and its not being jointed off from the telson.

The first antenna bears two large protozoeal setæ which are both ciliated, while the second antenna has a large exopodite with four large setæ all springing from the same point. The endopodite is only a small knob, but the future spine is enclosed in a rather large unciliated envelope (Fig. 1). The appendage very closely resembles that of Panopæus as figured by Conn.*

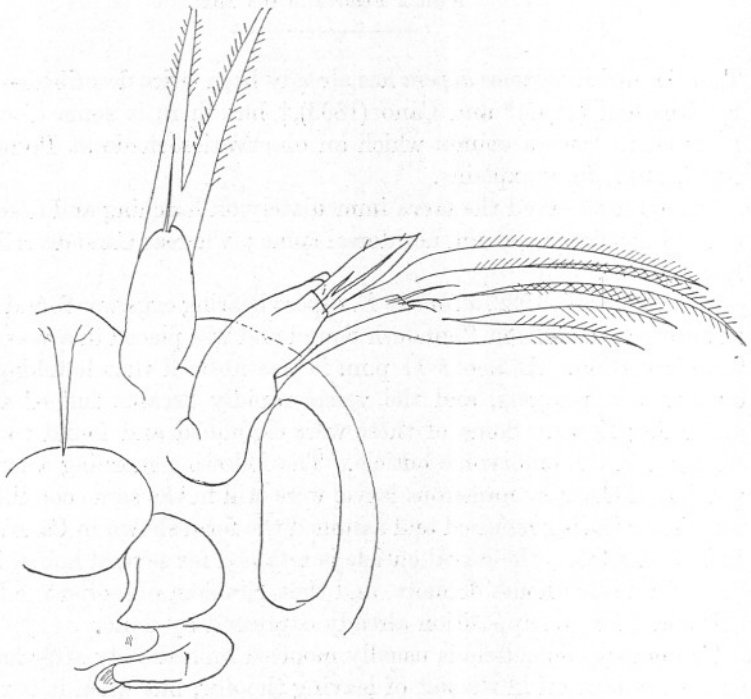

FIG. 1.—*Eurynome aspera.* Zoea before first moult. Ventral view of head.

I was not able to ascertain whether the antenna, armed with these large setæ, is used for swimming, but it seems very probable that it is so, since the swimming branches of the maxillipedes have no setæ, either embryonic or definitive.

It seems to me that the embryonic cuticle is, in fact, as Conn has suggested, a reminiscence of a Protozoea in which the second antenna was natatory, and I regard the Naupliosoma larva of Jasus which has been described by Gilchrist and by Archey as a special case of the retention in a functional condition of the appendages of this stage. In the

* *Stud. Biol. Lab.*, Johns Hopkins Univ., III, 1884.

Naupliosoma the second antenna alone bears these provisional setæ, and it has to a very remarkable extent retained the character of a biramous appendage with a scale armed with setæ along one edge. The first antenna has no setæ. It is true that Gilchrist states that the larva moults on leaving the egg, but the general appearance of the larva as figured by him leads one to believe that, if this moult occurs, it may only be partial, and that the great setæ of the antenna are actually homologous with those of the embryonic cuticle of Eurynome and other Brachyura.

It is curious that Jasus alone apparently should have this Naupliosoma stage. It may perhaps be found later to occur in other forms, but it certainly does not occur in *Palinurus vulgaris*, of which I have been able to study unhatched and newly hatched larvæ. In this species there is no trace whatever of the natatory exopodite of the antenna.

Apparently, although the telson has in most Decapoda retained the peculiar protozoeal covering, the antennæ have lost it in all except some Brachyura and in Jasus. If, then, it has been retained in the latter and lost in all its congeners, it seems that the Nephropsidea must have branched off from the Reptant stem at a time when the embryonic cuticle still was functional in early larval life, and that in Jasus alone that function has been retained. Bouvier has ably argued the origin of the Brachyura from the Homaridea, and the fact that it is only in the Brachyura and in this one among the Nephropsidea that the natatory antenna has been preserved may perhaps be allowed to be added as a further argument in favour of the origin of the Crabs from an ancestor closely allied to the Nephropsidea, but not actually from that group. At the same time it should be pointed out that the structure of the Zoea of the Brachyura in other respects points to an origin from a primitive form of Anomuran.

As regards the Zoea itself a detailed description is unnecessary since Cano's figure (Taf. 35, Fig. 57) is quite accurate. I may, however, add that the large lateral chromatophores of the carapace and abdomen are black, with delicate yellow branches. At the base of the dorsal spine and in the stem of the second antenna is a small yellow chromatophore, while that of the posterior end of the fifth abdominal somite is red. A line of blackish pigment lies internally over the stomach.

The Zoea is in a relatively advanced condition, having rudiments of the third maxillipedes and of all five pairs of legs. The third mxp. is biramous, and the third leg is pushed in and covered by the adjacent legs.

It is rather an unusual thing to find in the first Zoea, as is the case in Eurynome, traces of the gills (Fig. 2). These are confined to the rudimentary mxp. 3 and legs 1 and 2. Mxp. 3 bears three small rudiments which no doubt represent epipodite, and two arthrobranchs. There are

three quite distinct gill rudiments on legs 1 and 2, but their interpretation is a little difficult. The two rudiments on leg 1 should be by position an arthro branch and a pleurobranch; while the single rudiment of leg 2 has the position of a pleurobranch. On the other hand, a pleuro-

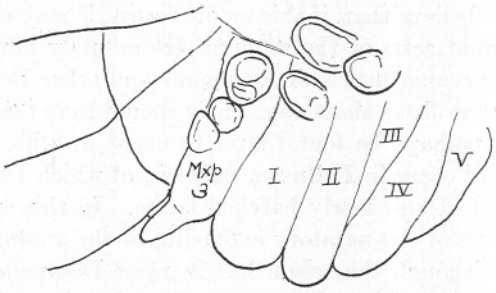

FIG. 2.—*Eurynome aspera*. First Zoea. Rudiments of thoracic appendages and gills.

branch is never found in the Brachyura above leg 1, the two pleurobranchs so generally found being on legs 2 and 3. The interpretation of larval gills is not an easy matter, as they are sometimes difficult to see and the limits of the appendages are ill-defined. It is therefore unsafe to attach importance to an apparent discrepancy such as this.