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The Hyperiid Amphipod, *Hyperia galba*, a True Ecto-parasite on Jelly-fish

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ABSTRACT

In the intestine of the amphipod *Hyperia galba* collected from the jelly-fish *Cyanea capillata* at the Marine Station at Espegrend, Norway, large quantities of nematocysts where found. A few of these could be definitely identified as belonging to *C. capillata*. It is suggested that *H. galba* is an ecto-parasite of jelly-fish during part of its life.

Various hyperiid amphipods are known to occur regularly under the bells of scyphozoan medusae. In Scandinavian waters this is the normal habitat of *Hyperia galba* (Montagu) and *H. medusarum* (O. F. Müller). *Hyperoche medusarum* (Krøyer) is also often found under similar circumstances although it will also very frequently be found in the open water or near the bottom.

The relationships between the amphipods in question and the jelly-fish with which they are normally associated has been the subject of diverging opinions. As far as concerns *H. galba*, which species was the object of the observations recorded in the present paper, some writers (e.g. Sars 1895, p. 7, Chevreux & Fage 1925, p. 12) refer to it as a parasite of jelly-fish without further qualification. Scheuring (1915, p. 182) refers to them as «parasitische Amphipoden, die sich in ihren Schirm einnagen» and Poulsen (1950, p. 207) makes a similar statement but refers to *H. galba* as a «semi-parasite» («halvvejs snyltende»). According to Orton (1922, p. 178) it is most likely that the amphipods are food-parasites, and this was the solution which Hardy (1956, pp. 128—129) was most inclined to accept. Stephensen (1928, p. 129) refers to the mode of life of *H. galba* in the large jelly-fish as »semi-parasitic» but also states (1929, p. 21) that among the amphipods there are probably no true parasites except the cyamids.

Recently I had the opportunity to examine the digestive tracts of about 25 specimens of *H. galba* collected from the jelly-fish *Cyanea capillata* in September 1958 at the Biological Station at Espegrend. I am greatly indebted to the Director of the station, Professor H. Brattström, for providing me with working facilities, to Dr. L. M. Passano, who collected specimens of *Hyperia* for me in the course of his own investigations of *C. capillata*, and to Dr. B. Åkesson for his skilful aid with the micrographs.

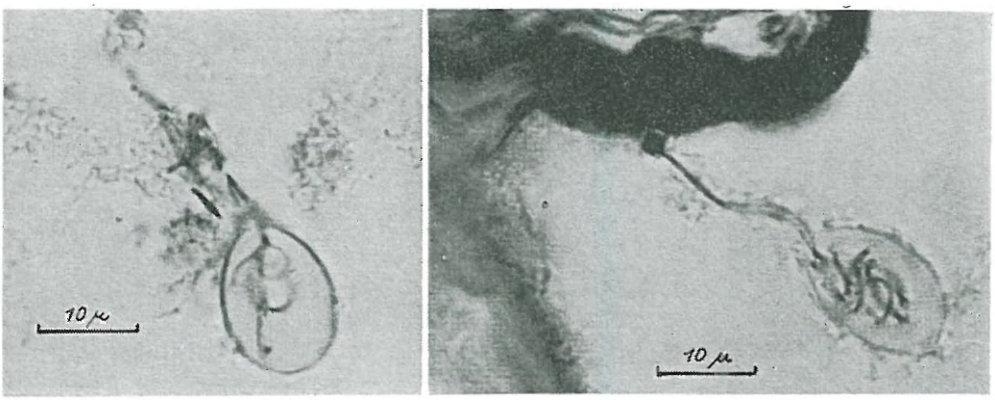

Fig. 1. (left). Discharged eurytele of *Cyanea capillata* in atrium oris of *Hyperia galba*.
Fig. 2. Discharged haploneme in atrium oris of same specimen. Note damage in body wall at the point where the thread has struck, and dark discolouration of part of body wall caused by increased affinity to azocarmine in area affected.

An examination of the intestine of *H. galba* soon revealed the presence of numerous empty nematocyst capsules. The lumen of the stomach and midgut of *H. galba* is wide and as a rule it is not nearly as crammed with food as that of most gammarid amphipods. Practically all food remains encountered in the gut of *H. galba*, however, contained large numbers of nematocyst capsules.

This constitutes in itself no proof of *H. galba* being an ecto-parasite. It is a well-known fact that *C. capillata* to a large extent preys upon other medusae, both hydromedusae and scyphomedusae. As far as known, however, it does not attack its own kind. The decision whether *H. galba* is an ecto-parasite or a food parasite therefore to a large extent depends upon the identification of the nematocysts found in its digestive tract.

With very few exceptions the nematocysts found in the intestine of *H. galba* are empty and the thread lost, but in practically every specimen there are a few nematocysts which were not discharged. In various instances they could be identified as euryteles of the type generally found among scyphozoan medusae, but in no instance could they be accurately measured for all of them gave evidence of distortion and shrinking. Concerning the empty capsules accurate measurements were also for obvious reasons impossible, but comparison was made with squash preparations of nematocysts from *C. capillata* and *Aurelia aurita*. The general impression obtained from the accumulations of empty nematocysts in the intestine agreed very well with that from the slides of C. *capillata* but not at all with that from the slides of *A. aurita*, the average size of the capsules in the latter case being distinctly smaller.

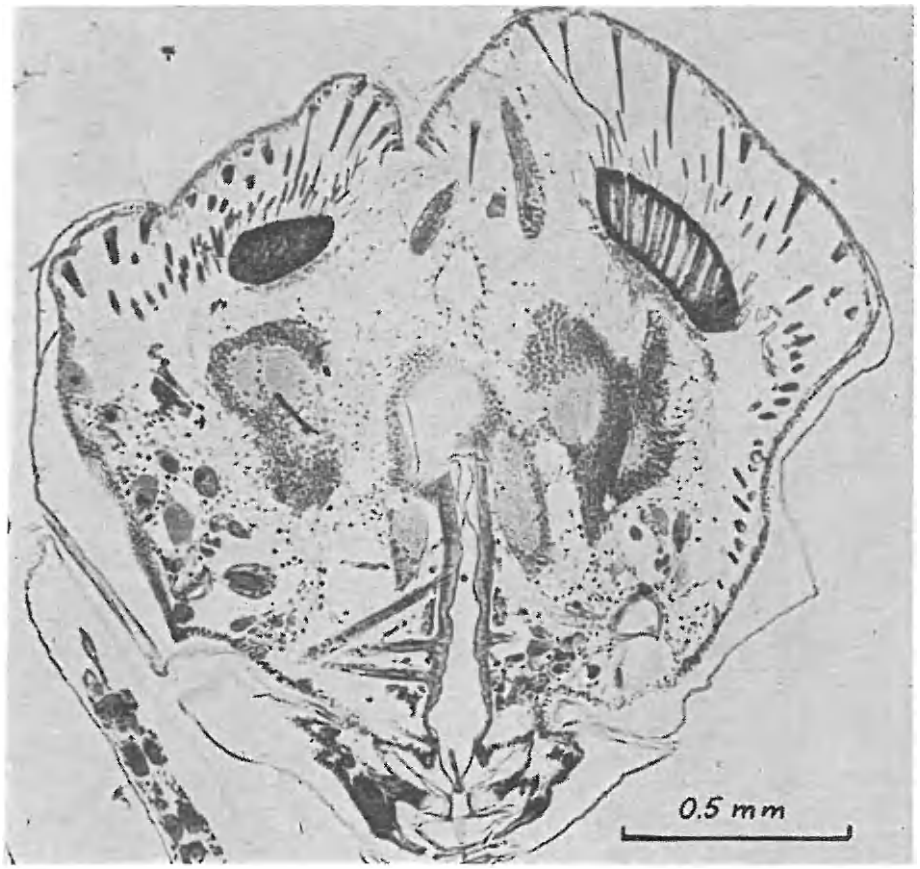

Fig. 3. Transversal section through head of *H. galba* showing mouth-parts (below), the straight oesophagus, part of the brain and part of the compound eyes.

One fortunate case provided more conclusive evidence. In one specimen of *H. galba* various discharged but otherwise well-preserved nematocysts were found in the atrium oris, and some of them could be accurately measured. Several of these nematocysts could be identified as heterotrichous microbasic euryteles of the type characteristic of scyphozoan medusae (fig. 1). Three of them were found to be 13.2, 13.4, and 14.1 μ long and 8.6, 8.6, and 9.4 μ wide respectively. PAPENFUSS (1936, pp. 5—6) gave the average of 50 discharged euryteles of Swedish specimens of *C. capillata* as 13.6×8.1 μ and the normal (length?) variation as $\pm$ 2 μ. Thus the three nematocysts in question fall well within the range of the euryteles of *C. capillata* but outside that of all other

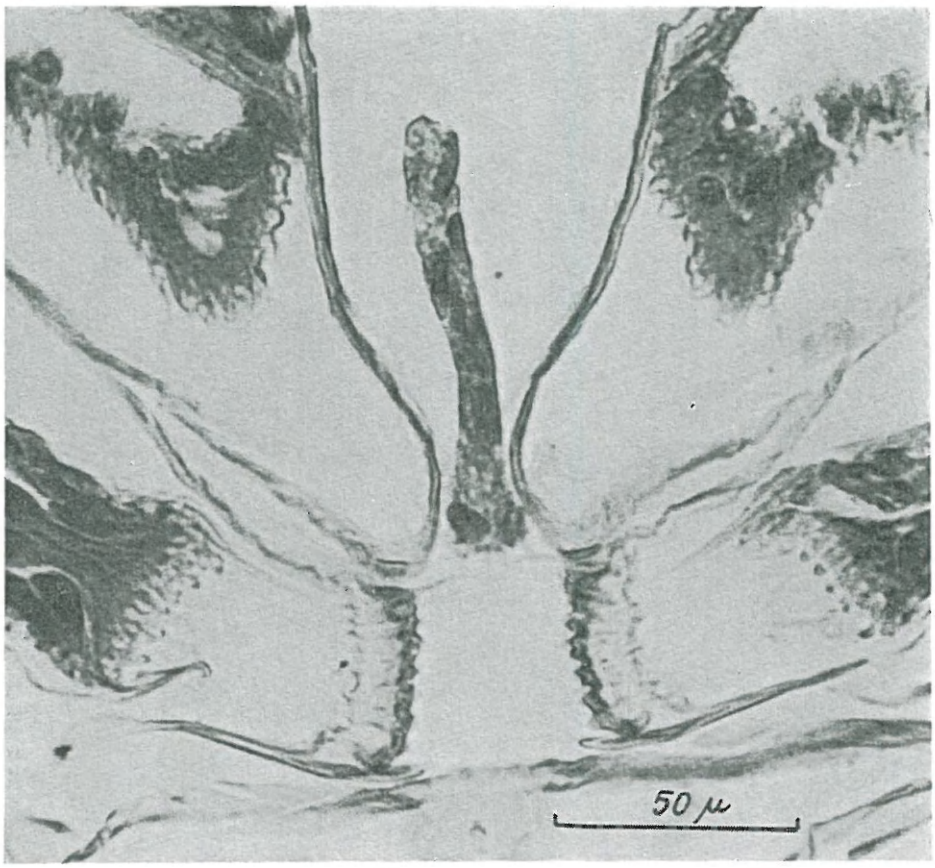

Fig. 4. Detail of fig. 3, showing mandibles and opening of oesophagus. Note strong armature on molars of mandibles. The sausage-shaped structure in the centre is a piece of jelly-fish tissue which has passed the mandibles and is being swallowed. The dark spots within it at least in some cases are crushed nematocysts.

scyphozoan medusae occurring in the area. One further discharged nematocyst could be identified as a haploneme measuring 17.0 μ in length $\times$ 11.2 μ in width (fig. 2). Nothing can be seen of any possible armature of the thread. The size agrees well with that of the atrichous haploneme '*A*' of *C. capillata* which averages 18.0 $\times$ 13.2 μ (PAPENFUSS, l.c.).

Among the mouth-parts of another specimen of *H. galba* I found a piece of tissue which could be identified as mesogloea of a scyphozoan medusa, and showed very good agreement with that of *C. capillata*.

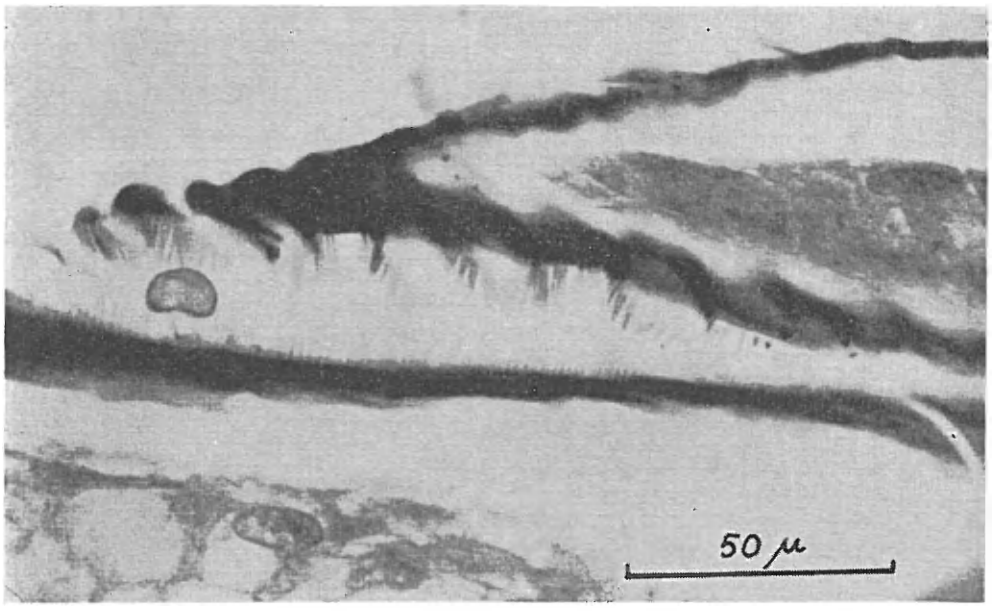

Fig. 5. Opening of oesophagus into the stomach (in lefthand middle part of figure). Note rows of spines in oesophagus and absence of armature in adjoining parts of stomach (upper part of figure). The section has struck a nematocyst on the point of entering the stomach

The sum of the evidence here seems to permit the conclusion that *H. galba* lives as a true ecto-parasite of the jelly-fish with which it is associated.

The mouth-parts of *H. galba* are admirably suited to such an ecto-parasitic life. The mandibles have a strong cutting edge and the molar, the edge of which is narrow in many other hyperiids (including *Hyperoche medusarum*) is here large, flat and provided with strong marginal spines (figs. 3 and 4). Moreover, its surface is richly beset with low conical projections, and the two molars rubbing against each other must form a pair of very effective grates.

The upper part of the oesophagus wall in *H. galba* is provided with numerous oblique rows of spines, on the other hand the stomodeal stomach is practically without armature and is certainly not designed to deal with food in need of further mechanical treatment (fig. 5).

In none of the specimens examined have any discharged nematocysts been found except among the mouth-parts. As indicated especially by the work of PANTIN (1942) various organic substances and especially certain surface-active lipoids seem to play an essential part in the normal discharging of nematocysts. In *Anemonia sulcata* PANTIN (l.c., pp. 299 ff.) found that in order to

produce discharge by means of mechanical stimuli alone, the latter have to be rather strong. As no discharged nematocysts were found outside the atrium oris of *H. galba* it seems to be the powerful masticatory activity especially of the molars which discharges or perhaps more often crushes the nematocysts.

Reference was already made to otherwise intact nematocysts discharged in the atrium oris, this discharge may have been brought about either by means of mechanical stimulation by the mouth parts or by chemical stimulation from the various large glands surrounding the atrium, or by a combination of both these stimuli.

Although no actual proof exists, it appears as if contact with the integument of *H. galba* does not as a rule produce discharge of nematocysts. As shown by fig. 2, however, a discharged nematocyst can do some mechanical damage to the body wall. Moreover, a fairly large area of the body wall (black in fig. 2) shows an increased affinity to azocarmine, indicating that the area has been to some extent affected. At the time of fixation, however, the specimen appeared to be in perfect health.

In summing up the evidence presented here, it would seem as if at least during part of its life-cycle *H. galba* lives as a true ecto-parasite of the jelly-fish with which it is associated. As far as can be judged from the 25 specimens which were examined histologically it takes during that time no other food than the tissues of its host. It also appears likely that contact with the integument of *H. galba* does not normally produce discharge of nematocysts in *C. capillata*.

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