Endoskeleton of the Kuruma Prawn Penaeus japonicus

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Endoskeleton of the Kuruma Prawn *Penaeus japonicus*

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Abstract

The endoskeleton of the kuruma prawn *Penaeus japonicus* was grossly described with male exuviae. Its morphology was compared to that of crabs. The structure of cephalic and thoracic portions of the exuvial endoskeleton had large differences in the epistoma as well as the procephalic processes as concerns cephalic sternites, and in the median sternal elements as well as lateral pleurosternal arms as concerns thoracic sternites.

The exoskeleton of Crustacea is principally composed of tergite-sternite units which are connected segmentally with a pleural membrane. The cephalothoracic sternites of decapods invaginate into the body, becoming apodemes to which muscles attach or transforming to guard the nerve cord and visceral organs. Therefore, they are called an endoskeleton, and in some cases they are fused together to form a rigid endophragmal system. Regarding this endoskeleton, compared to that of crabs, crayfishes, and spiny lobsters in Reptantia[1-4], there are a few reports in Natantia species[5].

Present study was conducted to examine the endoskeleton of the kuruma prawn *Penaeus japonicus* with male exuviae, and to compare the results with those of previous studies in crabs[1,2].

Materials and Methods

Male exuviae were obtained from a rearing tank of kuruma prawns. The prawns were young with body weight of about 10 g . After sampling, exuviae were separated into the cephalothorax and abdomen. The cephalothorax fixed in 10% formaline was

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supplied to observation and description of the endoskeleton. In some cases, a weak solution of methylene blue was used to distinguish a pleural membrane and endoskeleton by coloration. The detailed morphology was examined by a dissecting microscope.

Results and Discussion

A segmental unit of the prawn endoskeleton is formed by a median sternite and its lateral derivative named a frame-like apodeme in which the basal portion of appendages is located. The prawn endoskeletons do not fuse segmentally[5], which differ from those of crayfishes and crabs[1,4]. In the latter cases, sternites and apodemes fuse rigidly one another to become a complex endoskeleton, and its median axis forms a keel structure of hard cuticulae.

From anterior to posterior, the endoskeleton of the kuruma prawn is composed as follows (Fig. 1). At the bottom of the brain, there is a transversal plate of highly sclerotized sternite (bs). This corresponds to a median plate and a part of the procephalic process of the crab endophragmal system[1,2]. The median plate of the prawn is small, differing from that of the crab which shows a widely transformed shape according to lateral expansion of the body.

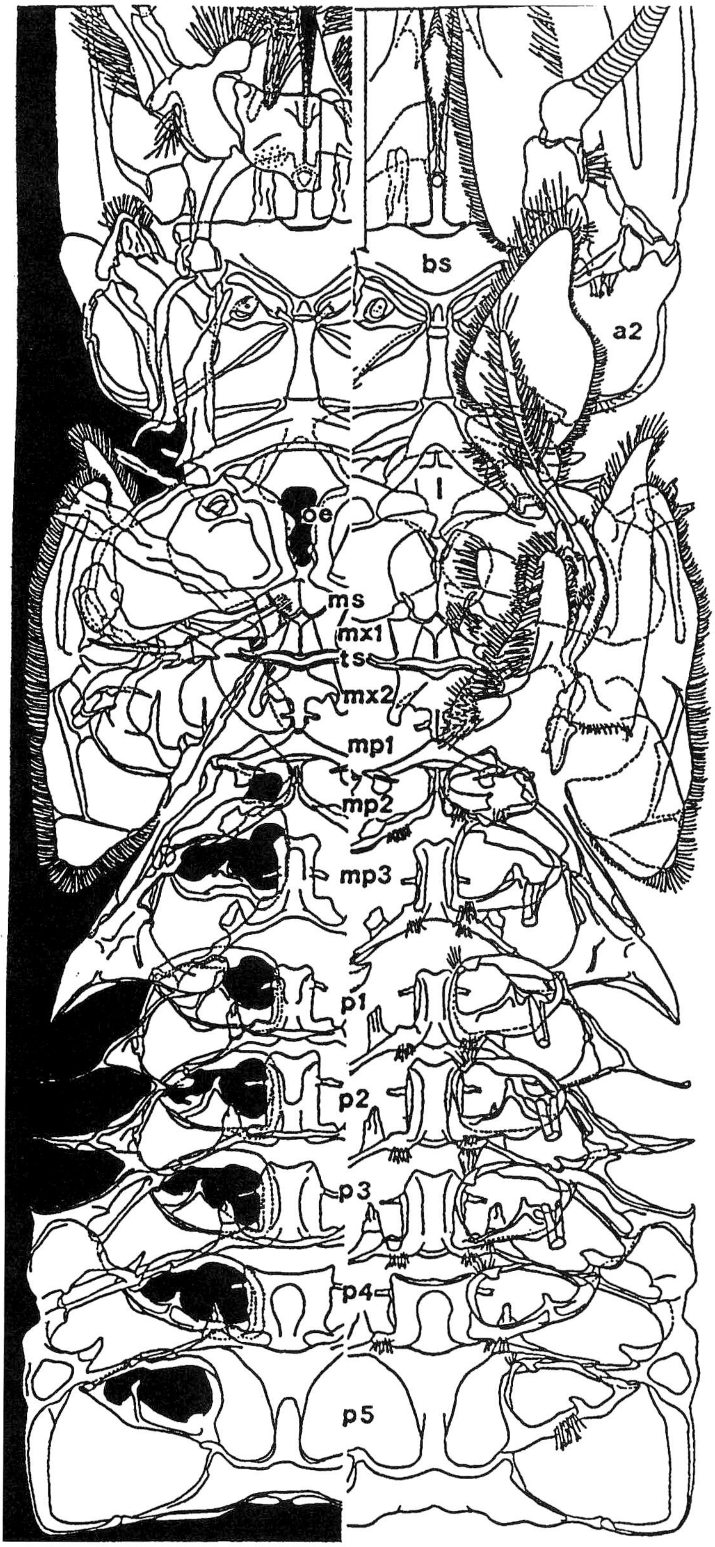
On the midline between the brain sternite and labrum (l), a sternite of hammer-headed shape is situated inside the coxopodite of the second antenna (a2). This is a median plate and named epistoma in crabs and crayfishes[1,4]. For the labrum, a membranous sternite forms a protuberance of the triangular shape.

Posterior to the oesophagus (oe), sternites of the mandible (ms) and two maxillae (mx1, mx2) are located medially. A transversal septum (ts) is present between the first and second maxillae.

The median sternite following the maxillae corresponds to that of the first maxilliped (mp1). Its structure consists of median and bilateral frames of apodemes. Two successive median sternites belong to the second and third maxillipeds (mp2, mp-3). Each of them is composed of median and lateral apodemes. The latter frame-like apodeme forms two overlapped loops of different size on each side.

Corresponding to each coxopodite position of five paired pereiopods (p1–p5), a foramen surrounded by a smaller and ventral loop of the apodeme is situated. This loop receives the coxopodite and articulates at two fulcra with the other dorsal

Fig. 1 Dorsal (left) and ventral (right) views of the endoskeleton of the kuruma prawn. The background of the dorsal view is darkened to show definite contours. Appendages as antennae, mandible and second maxilla are added. Abbrev., a2, second antenna; bs, brain sternite; l, labrum; mp1, first maxilliped; mp2, second maxilliped; mp3, third maxilliped; ms, mandibular sternite; mx1, first maxilla; mx2, second maxilla; oe, oesophagus; p1–p5, first pereiopod–fifth pereiopod; ts, transversal septum.


bs
a2
l
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mp1
mp2
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p1
p2
p3
p4
p5

loop, both being connected with the pleural membrane except the fulcra. This large loop encloses attaching areas of the foot-gill and epipodite of the pereiopod.

Lateral view of the thoracic sternite shows an arrangement of lateral pleurosternal arms whose segmental units tend to unite dorsally in the form of a reverse-curved arch[5]. Each arch corresponds to the above loop.

The median sternites of the pereiopods have a groove structure through which the nerve cord passes. Such structure is principally similar to that of crabs[1], except for their segmental separation.

By comparison with the above-mentioned result in the kuruma prawn, deformation of the cephalic endoskeleton in crabs[1] seems to be characterized by remarkable lateral expansion of the epistoma as well as procephalic processes which develop extremely and complicatedly, and by opposing shrinkage of the cephalic appendages as antennae and eyestalks. As for the endoskeleton posterior to the oesophagus, undeveloped median sternites lacking in the keel structure of rigidly fused segments are typical to the prawn. This characteristic seems to be reasonable to yield swimming and leaping habits of the prawn. On the contrary, lateral enlargement and intensely fused sternites whose median axis contributes to form the keel structure of the cephalothorax in the crab relate to development of walking behaviour.

Hitherto, such a structural divergence of the endoskeleton in decapods has been only treated as a material of phylogenic consideration. At some future time, it seems to become the subject of a genetic analysis which would answer their deformation mechanism.

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