ON THE ENDOPHRAGMAL SKELETONS OF SPINY LOBSTERS

PANULIRUS HOMARUS AND P. ORNATUS

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ABSTRACT

Endophragmal skeletons of *P. homarus* and *P. ornatus* have been described in detail for the first time. "Subantennal apodeme", 'epistomal apodeme' and 'cephalic apodeme' revealed distinct differences between *P. homarus* and *P. ornatus*. "Subantennal apodeme" and "Interparaphragmal apodeme" have been tentatively named for the first time. The utility of endophragmal skeleton as a taxonomical tool in the lobsters has been indicated.

The endoskeleton in the thoracic region of crustaceans is made up of a number of ingrowths of the exoskeleton called the apodemes. Huxley (1906) and Calman (1909) referred to this system of pleurosternal invaginations or apodemes in decapods as the endophragmal system. Powell (1908) has made a mention of the presence of endophragmal system in lobsters.

Reddy and Ramachandran (1985) and Pearl and Reddy (1986) discussed the utility of endophragmal system in the taxonomy of prawns. Presently, an attempt is made to study in detail the endophragmal skeletons of two species of lobsters, *P. homarus* and *P. ornatus*, to know if the skeleton plays a role in the taxonomy of lobsters.

Specimens six each of *P. homarus* and *P. ornatus* measuring 20-30 cm in total length, preserved in 10% formalin for a week, were used for the study. The carapace and appendages were carefully removed. With the help of a fine needle and forceps the muscles were teased out without breaking the apodemal structure. The endophragmal skeletons thus prepared were dried till no moisture was left. The endophragmal skeletal terminology employed in the study is largely those of Patwardhan (1937), Reddy and Ramachandran (1985) and Pearl and Reddy (1986).

The endophragmal skeleton of lobsters is divided into two main regions, viz., (1) Anterior cephalic region, demarcated by the antennule, antenna and mandible, and (2) Posterior thoracic region, comprising the segments from 6th to 13th.
P. homarus (Fig. 1: 1-5)

**Anterior cephalic region:** When the antennular plate is removed, a narrow transversely placed rod, situated at the extreme anterior end of the body, is discernible. This is the 'ophthalmic sternum'. Immediately behind this, there is the antennal sternum referred to as the 'epistome'. The epistome is a more or less rectangular structure with lateral rod-shaped extensions. A triangular depression is present in the epistome along the median line. On either side of this depression the epistome is drawn into a laminated structure. Medially, the epistome bears an anteriorly directed wedge-shaped structure. These apodemes arising from the epistome are referred to as the 'epistomal apodemes'.

From the margin of the groove of antennular socket arises a short laminated apodeme referred to as the 'subophthalmic apodeme'. The margin of the groove of antennal socket bears dorsally a leaf-like apodeme referred to as the 'supra-antennal apodeme'. From the margin of the same groove arises ventro-anteriorly a pair of leaf-like, downwardly directed projections referred to as the 'preoral apodeme'. Ventromedially arises a laminated concave apodeme with anterior margin curved. This structure has been presently named as the 'subantenunal apodeme'. From the mandibular segment arises a pair of elongated rod-shaped structures bearing hair-like processes at the distal end. These are referred to as the 'mandibular apodemes'.

Between the mandibular and maxillular segments, the apodeme of each side is a well-developed plate-like structure running obliquely and remain connected at the distal end by transverse fibrous strands forming a 'H' shaped structure. This apodeme is referred to as the 'cephalic apodeme'. The anterior arms of the cephalic apodemes are slightly reduced and bear a tuft of hair-like processes at their tip. The posterior arms are expanded and serrated along their outer lateral margins.

**Posterior thoracic region:** In the thoracic region, the apodeme of each segment from 6 to 13 consists of (a) an endopleurite posterior, a projection from the anterolateral end of the epimeron of each segment which meets another projection, the endosternite posterior, from the sternal element of the same segment and (b) an endopleurite anterior from the posterolateral end of the epimeron belonging to the preceding segment, meeting another projection, the endosternite anterior from the sternal element of the same segment. These two pairs of ingrowths together constitute a rigid vertical double wall lying between the base of two consecutive appendages and serving for the attachment of appendicular muscles.

From the inner ends of adjacent endosternites of an apodeme arises a flattened 'Y' shaped plate. This is referred to as the 'endosternal apodeme'. The outer arm of the 'Y' is referred to as the 'paraphragm' and inner arm as the
FIG. 1. 1-5: Endophragmal skeleton of *P. homarus*. ACA - anterior view of cephalic apodeme; ANS - antennular socket; AS - antennal socket; CA - cephalic apodeme; D - dorsal view; EM - epimeron; ENS - endosternal plate; EP - epistome; EPA - epistomal apodeme; EPP - epimeral plate; IEP - inner view of epimeral plate; IPA - interparaphragmal apodeme; L - lateral view; MA - mandibular apodeme; Meso - mesophragm; OS - opthalmic sternum; POA - preoral apodeme; PP - paraphragm; S - sternum; SAA - supraantennal apodeme; SBAA - subantennal apodeme; SOA - subopthalmic apodeme; V - ventral view.

'mesophragm'. The mesophragm of each segment remains fused laterally to the mesophragm of the preceding segment and medially with the mesophragm of...
the other side. The paraphragm remains fused with the apodemal framework of the preceding segment. This typical structure of the endorternal plate is seen in segments 10 to 12. However, in the 7th and 8th segment, the mesophragm is not fused medially with the mesophragm of the other side. In the 9th segment, the mesophragm is not fused laterally with the mesophragm of the preceding segment. Mesophragm is absent in the 13th segment.

In each of the segments 8 to 11, a laminated triangular projection arises, which is basally fused partly to the epimeral plate and connects the paraphragm of a segment to that of the preceding segment. This structure has been presently named as the "interparaphragmal apodeme". From the base of the 13th segment, a rod shaped structure arises. This structure runs vertically and fuses with the apodemal framework of the preceding segment.

The apodemal structures in the thoracic region form in the middle line a tunnel or series of archways over the sternal sinus, the nervecord and sternal artery. Laterally they resemble the bulkheads of a ship and give attachment to the muscles (Powell 1908). The epimeron in the thoracic region is expanded into a vertical epimeral plate.

P. ornatus (Fig. 2: 1-5)

In P. ornatus, the 'subantennal apodeme' bears serrations along its anterior margin.

The anterior arms of the 'H' shaped structure of the cephalic apodeme are elongated and bear hair like processes along the outer lateral margins. The posterior arms are expanded and not serrated as in P. homarus.

The lateral epistomial apodeme is a laminated structure with a dent along the anterior margin.

In all other respects the endophragmal skeleton of P. ornatus is as in P. homarus.

There are thus basically similarities on one hand and dissimilarities on the other in the endophragmal skeletons of P. ornatus and P. homarus. In P. homarus, the anterior margin of the 'sub antennal apodeme' is not serrated, whereas in P. ornatus it is serrated. The anterior margin of the lateral projection of epistomial apodeme is entire in P. homarus, whereas in P. ornatus it bears a single dent. In P. homarus, the anterior arms of the 'H' shaped structure of the cephalic apodeme are slightly reduced and bear tuft of hair-like processes at the tip. The posterior arms are slightly expanded and not serrated along the outer lateral margins. However, in P. ornatus, the anterior arms are elongated and bear hair-like processes along the outer lateral margins. The posterior arms are slightly expanded, but not serrated along the outer lateral margins.
FIG. 2. 1-5: Endophragmal skeleton of *P. ornatus*. (see Fig. 1 for explanation)

REFERENCES