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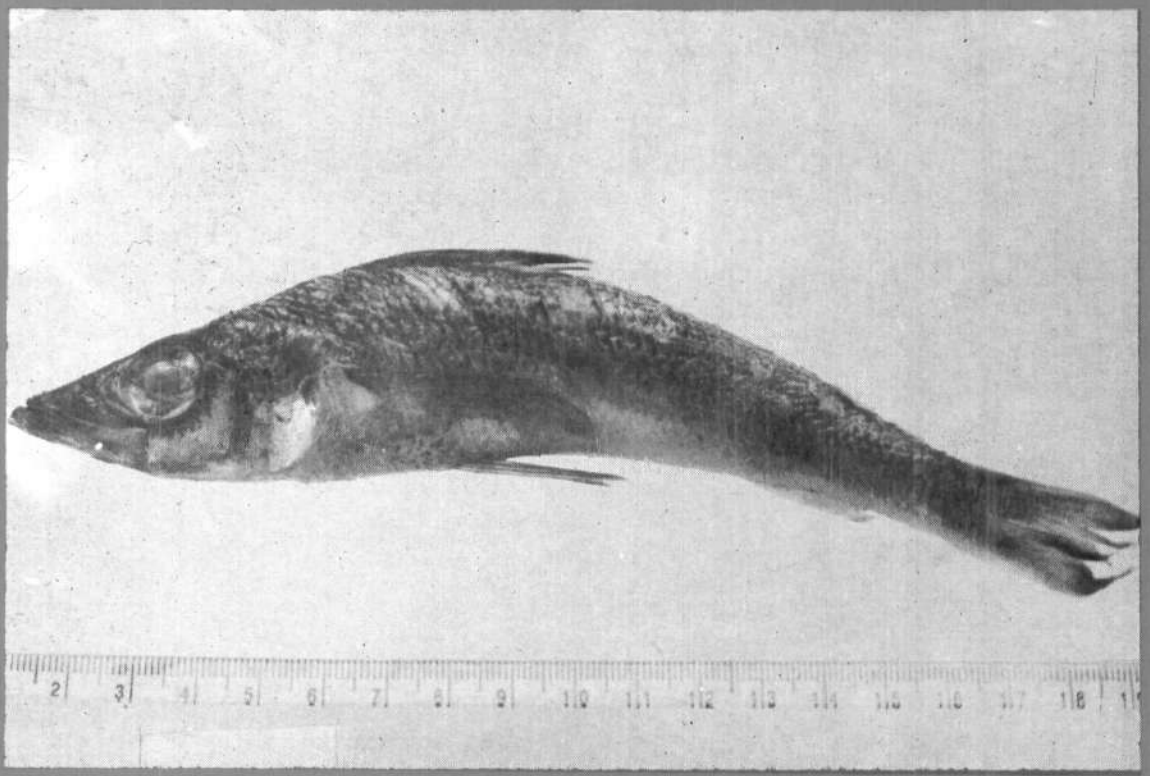

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NEUROENDOCRINE FACTORS INFLUENCING MATURATION IN SHRIMPS

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Introduction

The females in the crustacean species have to cope up in the adult stage, with two highly energy demanding processes namely body growth and reproduction. Body growth and moulting are periodic events in the life cycle of prawns. In prawns reproduction and growth are programmed as antagonistic events. Apparently moulting is induced when the levels of moult inhibiting hormone (MIH) and gonad stimulating hormone (GSH) are low and gonad inhibiting hormone (GIH) and moulting hormone (MH) are high. To induce gonadal maturation and spawning, unilateral eyestalk ablation is the technique widely used nowdays. The technique no doubt achieved its objective of spawning but casts aspersions on the quality of the progeny as it interferes with not only the titres of the gonad inhibiting hormone but also reduces the effective levels of metabolic hormones that are secreted from the eyestalk. Moreover in eye stalk ablation the hatching rate and fecundity decline with repeated spawning. Hence it is imperative to explore the available methods for inducing maturation in shrimps. As a prelude to this it is essential study to protein and catecholamine secretory pattern from extracts of the neuroendocrine centres viz., eyestalk, brain and thoracic ganglia of female shrimps that may play a role directly or indirectly in bringing about maturation in females. The shrimp species chosen were *Parapenaeopsis stylifera*, *Metapenaeus dobsoni* and *Penaeus indicus*.

Protein secretory pattern

M. dobsoni

The protein concentration in the eyestalk extracts of different stages of maturation in female specimens and mature male specimens was studied. The protein concentration in mature and late mature female specimens of *M. dobsoni* was six times higher when compared with the values obtained from immature females and mature males of the species (Table 1).

TABLE 1. *Concentration of protein in the female and male specimens*

Sample	Total wt. of sample taken (mgu)	Qty. of protein (gu)	% of protein
1. Mature female eyestalk extract	413	722	0.17
2. Immature female eyestalk extract	413	134.12	0.03
3. Late mature female eyestalk extract	253	476.00	0.188
4. Mature male *M.dobsoni* eyestalk extract	425	145.83	0.03

Electrophoretic studies revealed four bands in both the maturing and late maturing eyestalk extract samples (Rm 0.75, 0.80, 0.90, 0.96) whereas only one band (Rm 0.96) was observed in the eyestalk extracts of immature female and mature male specimens revealing that the secretory activity of the eye stalks of immature female and mature male is the same. As the females mature the secretory activity of their eyestalks also seems to increase and these bands (Rm 0.75, 0.80 and 0.90) may be specific only to mature female specimens.

P. stylifera

Later, electrophoretic studies were repeated on the eyestalks, thoracic ganglion and brain of mature female specimens of *P.stylifera* to understand and compare the secretory pattern of different neurosecretory centres.

The protein concentration was observed to be higher in the extracts from mature specimens than in the immature specimens . It was found to be 2.5 folds higher in the thoracic ganglia extracts from mature female specimens when compared to the values of eyestalk extracts. This observation is highly significant in view of the weight of sample taken in each case to prepare the extracts.

When 1.254 g of thoracic ganglia of mature female specimens yielded about 3.19% of protein eyestalks of 4.540 g weight could yield only 1.272%. The electrophoretic pattern observed in the eyestalk extracts of mature specimens was similar to that of *M. dobsoni*. But the thoracic ganglia extracts from mature *P.stylifera* revealed a single band which was absent in immature specimens.

No band pattern could be observed in immature as well as mature brain extracts. This suggests the possibilities of existence of low molecular weight peptides in very low concentration though protein was detected in the extracts.

P. indicus

To increase the resolution of band pattern the extracts prepared from the neurosecretory centres of mature female specimen of *P. indicus* were concentrated through ultra filtration procedure using a membrane of molecular weight cut off in the range of 500 and the volume of extracts reduced to 1.5–2 ml. The protein pattern obtained through horizontal slab gel electrophoresis showed prominent bands both in eyestalk and thoracic ganglia extracts. Though protein was detected in the extracts of brain, no band pattern was observed in both the cases.

Catecholamines in gonadal maturation

Biogenic amines such as Dopa, Dopamine, Epinephrine and 5-hydroxy tryptamine in crustaceans function mainly as neurotransmitters and neuromodulators. In addition, some biogenic amines serve as neurohormones in the haemolymph. In this study the main catecholamine identified in the haemolymph as well as the neurosecretory centres of mature shrimps was Dopamine. The enzyme phenol oxidase in the circulating haemolymph is known to use epinephrine for maintaining the hardness of the cuticle. Hence epinephrine could not be detected. Another biogenic amine by name 5HT is known to play a crucial role in moulting and reproduction of crustaceans. The eyestalk extracts that may contain the moult inhibiting hormone (MIH) in greater quantities is being influenced by the biogenic amine 5HT. This stimulates the release of MIH. 5HT also stimulates the release of gonad stimulating hormone. Hence further study in this area will bring out the physiological role of biogenic amines that co-exist with peptide neurotransmitters that are detected in the extracts of eyestalk, thoracic ganglion and brain. This also needs further experimentation particularly with regard to how the biogenic amines share roles with the peptides with which they colocetized. This is an important area of research where the relationship of amines and peptides that co-exist in neurons in invertebrates can be understood.