

M.S.119. VIJAYAN, K.K.—Studies on the Physiology of moulting in the penaeid prawn, *Penaeus indicus*

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Penaeid prawns form the most economically significant group in the marine and brackishwater fishery resources of India. This particular group contributes about 62% of the total prawn landings of the country. At present prawns have assumed an important place especially as a commodity supporting an export trade of sizable magnitude. Considerable interest has been shown in the last decade to increase prawn production through various culture practices, mainly due to the high demand for good quality prawns for export coupled with the stagnant and even depleting nature of marine catches.

Available informations suggest that among the 15 species of shrimps and prawns occurring in Indian waters, which are deemed suitable for aquaculture, the Indian white prawn *P. indicus* is identified as one of the most important commercial species. Considering the increasing importance as an accepted species for prawn culture, *P. indicus* was selected for the present study. In the life history of prawns, moulting is an important event, which enables the animal to achieve growth. This dynamic physiological event continues through out the life span of the prawn, linking almost all biological activities with this process. Hence, a good knowledge pertaining to the physiology of moulting is imperative to understand the growth process of prawns.

Pioneer workers like Drach in 1939 and Sheer in 1960 initiated the classic studies on crustacean moulting physiology. In subsequent years a great deal of information has been added to this particular field by a number of workers viz., Passano, Aiken, Cooke and Sullivan, Stevenson, Skinner, and Fingerman. In spite of these great contributions, only limited attention was received to the moulting physiology of natantians especially of penaeids. In this context an effort is made, through the present work, to study some aspects of the moulting physiology of *P. indicus*.

The main objectives of the present study are:

1. To draw a scheme for the moult cycle classification, and identification of sequential stages of the moulting process.
2. To understand the physiology of moulting in relation to following aspects:
 - a) The structure and function of endocrine systems in relation to moulting process
 - b) Studies on the behaviour of important metabolites during the moulting cycle
 - c) The structure of the cuticle and mapping of some of the important minerals viz., Calcium, Magnesium and Phosphorus and investigation on the mobilization of these minerals during moulting process.
 - d) The effect of some environmental and other factors on moulting process

The thesis consists of five chapters, with preface, general introduction and the objectives of study in the beginning. Each chapter has an introduction, followed by materials & methods, results and discussion. Introduction of each chapter highlights the importance of the particular aspects of study covering a review of literature. Under materials and methods the methodology used, and in the results the data obtained are presented. Each chapter is concluded with a discussion followed by a short summary.

The first chapter deals with the characterization and classification of complete moul cycle on the basis of setal development (setagenesis) and cuticle histology. Duration of each moul stage, effect of body size on moul cycle duration, and moulting behaviour are also investigated on the basis of moul experiments.

The second chapter deals with the structures of endocrine systems and their mechanisms of control on moulting process of the animal. Investigations on the structure and changes of endocrine centres, such as X-organ Sinus Gland complex (Eye), Brain & thoracic ganglia are made using standard staining techniques. Y-organ or the moulting gland and mandibular gland have been found out and their positions were confirmed with histological studies. Alterations in the size and tinctorial affinity of Y-organ cells were noted between the moul stages. Eyestalk ablation and Y-organoctomy experiments revealed the production of moul controlling factors in X-organ during the moulting cycle of the prawn.

The third chapter is on role and involvement of some important metabolites like protein, DNA, RNA, Lipid, glycogen, glucose, glucosamine, chitin, and water content during the moulting cycle of the prawn. Metabolites were estimated in selected tissues such as muscle, hepatopancreas, cuticle and haemolymph of the animal. Profound changes in the concentration of metabolites were observed during the different stages of moul cycle, especially between early premoul and postmoul stages.

The fourth chapter is on the structure of cuticle, and distribution and mobilization of some important minerals of the exoskeleton viz, calcium, magnesium and phosphorus. Cuticle structure is studied using histological and histochemical techniques. The bio concentration of calcium, magnesium and phosphorous was estimated in different tissues such as exoskeleton, muscle, hepatopancreas and haemolymph with changing stages of the moul. Among minerals calcium was found to have a major share and showed significant changes between the moul stages. The mapping of calcium, magnesium and phosphorus in different parts of the exoskeleton was carried out to understand the distribution pattern of these minerals in the exoskeleton.

In the fifth chapter, observations on the effect of some important environmental factors like temperature, salinity, pH, light, and the effect of other factors like starvation and autotomy on moulting cycle of the prawn are included. In the experimental set up, along with the moulting cycle, growth pattern of the prawns was also monitored to find out the effect of environmental factors on growth. Temperature was observed to have prime and direct control over the process of moulting. The moulting cycle of the prawn was severely affected due to starvation while autotomy has not produced any significant effect on moulting.

A summary of the work, and bibliography are given at the end.