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## REPRODUCTIVE BEHAVIOUR OF MUD CRABS IN THE DEVELOPMENT OF CAPTIVE BROODSTOCK

### Introduction

Two species of portunid crabs, namely, *Scylla tranquebarica* (larger species) and *Scylla serrata* (smaller species) known as mud crabs, are marine in origin. They migrate into the brackishwater environment during their postlarval (megalopal) stage. The mud crabs are euryhaline. They are found in considerable numbers in the lower, middle and upper reaches of estuarine systems, where they grow and attain maturity. The ovigerous females are common among the catches from the brackishwater region. Since the larval development requires a saline medium above 26 ppt, these females migrate to the adjoining sea for release of larvae, thus completing the life cycle.

In recent times, attempts are being made in India to take up mud crab culture. It is a lucrative venture, since live mud crab

export trade is a good source for earning foreign exchange. The present mud crab culture practices depend on the collection of stocking material from wild. As the availability of stocking material from the wild is limited, the only alternative is seed production through the hatcheries, which in turn are dependent on the availability of ovigerous females at appropriate time. In this context, a review of knowledge on the reproductive behaviour of crabs in general and mud crabs in particular is attempted here, which would help to develop suitable strategies for the production of ovigerous females through the development and management of captive broodstock of mud crabs.

### Reproductive system in brachyuran crabs

The male reproductive system consists of a pair of testes, vas deferentia



Paired mud crabs (*Scylla tranquebarica*)

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and ejaculatory ducts internally and a pair of accessory reproductive organs, namely, pleopods externally. The ejaculatory ducts open in a small genital papilla. The ejaculate consists of non-motile sperms and seminal plasma. Sperms are enclosed in numerous small spermatophores and stored in the anterior vas deferens, while the seminal plasma is produced and stored in the posterior vas deferens. The first pleopod is made up of two segments, the basal one being broad, rectangular and flattened and positioned close to the sternal wall. The terminal segment of first pleopod is long tube-like and tapering towards the tip, which is actually inserted into the seminal receptacle of female during the copulation. The second pleopod helps in passing the spermatophores from the ejaculatory ducts into the funnel portion of the first pleopod.

The female reproductive system consists of a pair of ovaries, seminal receptacles and oviducts internally and four pairs of pleopods externally as accessory reproductive organs, present on the inner side of second to fifth segments of the abdominal flap. The seminal receptacles or spermathecae are an enlarged portion of the oviduct. The oviduct opens to the exterior on the sternite of sixth thoracic segment. Each pleopod consists of a basal propodite from which arise the medial endopodite and lateral exopodite. The exopodite bears a large number of pinnate setae. A cluster of long and very smooth setae are present in the endopodite, to which the ova are attached.



Freshly spawned eggs attached to the pleopods of the abdomen

### Reproductive behaviour

The size at first maturity for female mud crabs is above 120 mm in carapace width for larger species (*Scylla tranquebarica*) and above 83 mm for smaller species (*Scylla serrata*). Before the onset of first maturity, the female crab undergoes moulting which is called as 'first copulatory moult'. Two important morphological changes take place after the first copulatory moult, such as the change in the shape and colour of the abdominal flap from dull white triangular to green semi-circular and the appearance of clusters of long setae on the endopodite of four pairs of pleopods. For males, there is no external morphological character to identify

the matured crabs. In a breeding cycle, the copulation takes place between a moulted soft female and a hard male before the hardening of the female's exoskeleton. In some cases, a moulted female crab allows two different males to copulate one after another with an interval of 1 to 2 days. Thus, the sperms deposited by two males co-exist in the seminal receptacles of the female.

During insemination, the ejaculate is transferred sequentially, i.e. seminal plasma first, followed by spermatophores. Spermatophores and seminal plasma are stored in the oviduct till spawning takes place. During spawning, the stored sperms are liberated from spermatophore envelopes by a secretion from the glandular epithelium of seminal receptacles. The stored sperms are utilised for multiple spawnings. The duration of viability of stored sperms in portunid crabs is 9-12 months, while it is 2 years in majiid spider crabs. Spawning is related to environmental conditions. In laboratory-held mud crabs, it took 60 to 83 days to extrude eggs after mating. The number of eggs attached to the pleopods varied from 1 to 3 million in *Scylla tranquebaria* and 0.3 to 2 million in *Scylla serrata*. Between two copulatory moults, a female could extrude 3 to 4 batches of eggs, indicating the repetitive breeding habits. The water temperature appeared to be the controlling factor for the development of extruded eggs. The incubation period is 8-10 days at 20-27°C and 68 days at 18 °C.

### Physiology of reproduction

The process of ovarian maturation involves the mobilisation of biochemical



A : Developing eggs B : Pre-zeal larvae

reserves such as glycogen and lipid from hepatopancreas to ovary. This mobilisation serves to provide energy for developing ova. Oogenesis involves a series of cellular, physiological and biochemical events in germ cells leading to the production of mature ova, while the vitellogenesis relates to the growth of oocytes.

The crustacean X-organ-sinus gland complex plays an important role in the regulation of metabolism. The Hyperglycemic Hormone (HGH) present in the eye-stalk is responsible for metabolic regulation in Crustacea. The presence of HGH is measured by increased blood glucose levels in mud crabs.

Eye-stalk ablation not only removes the source of HGH, but also the Moulting Inhibiting Hormone (MIH), which may inhibit the secretion of Y-organ. Studies on the effect of the eye-stalk ablation in portunid and other brachyuran crabs have shown increased food intake, faster growth of ovary irrespective of developmental stage or season, significant increase in weight and size of oocytes and advancement of spawning. In the experimental studies, the eye-stalk ablated female mud crabs took an average of 16 days from immature to mature stage and 15 days from mature to ripe condition, while in the control (unablated) female crabs there was no change in the development of ovary. Studies on the effect of photo-period in the laboratory-held unablated female mud crabs have shown the existence of a photo-sensitive circalunadian rhythm for ovarian development.

### Preliminary trials on induced maturation

At Muttukadu Experimental Station of the Institute, experiments were initiated on the induction of maturity in the captive broodstock of females of *Scylla tranquebarica* by unilateral eye-stalk ablation, which yielded ovigerous females. It took an average of 58 days from eye-stalk ablation to the formation of berry. An eye-stalk ablated female crab spawned and became berried 3 times in 4 months, indicating the repetitive breeding habit in captivity, which will go in a long way to meet the requirements of ovigerous crabs for hatchery seed production trials.

This article was prepared by Shri M. Kathirvel, Shri S. Srinivasagam and Dr. S. Kulasekarapandian, Senior Scientists of the Institute.



Dr. S. A. Ali, Senior Scientist, explaining the importance of artificial feed for finfish and shellfish to Shri Balendu Shukla, Hon'ble Minister for Science & Technology, Govt. of Madhya Pradesh.

### RESEARCH HIGHLIGHTS

#### Grow-out culture of seabass (*Lates calcarifer*) in farmers' ponds

Monitoring of grow-out culture of hatchery-raised fry of seabass (*Lates calcarifer*) in private fish farmers' ponds at Nagapatnam was continued. At a stocking density of 5000/ha, fry grew from a initial size of 40 mm/1.25 g to 173 mm/238 g in 147 days. In another trial, at the same stocking density, fry of the same initial size grew to 150 mm/120 g in 101 days. In both

the trials, the reared fish were fed with trash fish @ 10% of stocked biomass.

### VISITORS

The following visited the Institute.

- Shri B. K. Chauhan, Secretary, ICAR, New Delhi, 16 January 1998.
- Shri M. Aslam, Director, DARE/ICAR, New Delhi, 17 February 1998.
- Shri Ujjal Dosanah, Cabinet Minister and Attorney General, Province of British Columbia, Canada, 21 February 1998.



Dr. G. R. M. Rao, Director, addressing the staff on the occasion of Republic Day Celebration.

- Shri Balendu Shukla, Hon'ble Minister for Science & Technology, Govt. of Madhya Pradesh, 31 March 1998.

## ENGAGEMENTS

Dr. G. R. M. Rao, Director, attended the following meetings:

- Fourth meeting of Aquaculture Authority, at MPEDA, Kochi, 4-7 January 1998.
- Fifth meeting of Aquaculture Authority, at Dept. of Agriculture and Cooperation, Ministry of Agriculture, New Delhi, 23 January 1998.
- ICAR Institutes Directors' Conference and Fisheries Divisional meeting, at ICAR, New Delhi, 3-6 March 1998.

Dr. S. Ahamad Ali, Senior Scientist, attended the Symposium on Advances and Priorities of Fisheries Technology, organised by Society of Fisheries Technologists (India) at CIFT, Cochin, during 11-13 February 1998 and presented a paper.

Dr. M. Krishnan, Senior Scientist, attended the National Seminar on Aquaculture in the Changing Environmental Perspectives, at Dept. of Aquatic Biology and Fisheries, University of Kerala, Thiruvananthapuram and presented a paper, 25-27 March 1998.

Dr. Mathew Abraham, Senior Scientist, attended the National Seminar on Management of Coastal Zone, organised by the International Centre, Goa, 28 March 1998.



Study area (Jagatjore, Orissa) for Environmental Monitoring Programme (EMP) under the Institute's Consultancy Service.

## MEETINGS

The fifteenth meeting of the Institute's Management Committee (IMC) was held at CIBA Headquarters, Chennai, on 21 January 1998.

The Staff Research Council (SRC) meeting of the Institute was held on 22 January 1998. Dr. R. Alfred Selvakumar, Assistant Director General (M.Fy), ICAR, presided, over the meeting.

The seventh meeting of the Institute's Joint Staff Council (IJSC) was held on 17 March 1998.

## LECTURE

Dr. K. K. Vijayan, Scientist (S.S), gave a lecture on the 'Indian white spot virus : morphological and molecular characterisation, DNA based diagnosis (PCR) and epizootiology', based on his training programme in biotechnology in USA, on 7 March 1998, at Muttukadu.

## REPUBLIC DAY CELEBRATION

The Indian National flag was hoisted at Muttukadu Experimental Station on 26-1-1998 by Dr. G. R. M. Rao, Director. The need for greater dedication of staff for up-lift of R & D programmes of the Institute was emphasised by the Director.

## TRAINING

Lectures and demonstrations in shrimp/fish/crab breeding, feed preparation, environmental monitoring and shellfish/finfish health management were held for the following at the Muttukadu Experimental Station:

- 39 trainees of Inland Fisheries Training Centre of CIFE, Barrackpore, West Bengal, 5 January 1998.
- 40 students from Dept. of Zoology, V. V. Vanniaperumal College for Women, Virudhunagar, Tamil Nadu, 7 January 1998.
- Students from MPR College, Visakhapatnam, Andhra Pradesh, 8 January 1998.
- 12 students from Sree Narayana College, Kannur, Kerala, 15 January 1998.
- 18 post-graduate students from Dept. of Environmental Science, A.N.College, Patna, Bihar, 15 January 1998.
- 59 students from Dept. of Zoology, K. K. College, Paramathy Velur, Namakkal district, Tamil Nadu, 27 January 1998.
- 8 post-graduate diploma (Aquaculture) students from Sri Venkateswara University, Tirupathi, Andhra Pradesh, 29 January 1998.

## NOMINATION

Dr. G. R. M. Rao, Director, has been nominated as Co-AED for National Agricultural Technology Project (NATP), for the management of the fishery component of the programme.

## INSTITUTIONAL CONSULTANCY PROGRAMME

The Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India, has approved the Institute's proposal to undertake consultancy for the Environmental Monitoring Programme (EMP) under the World Bank-assisted Shrimp and Fish Culture Project, in the states of West Bengal and Orissa. The total cost of consultancy is Rs 68.4 lakhs.

## INTERNET FACILITY

The Institute has set up the Internet facility under ARIS project of ICAR, from January 1998 onwards.

## STAFF NEWS

### Appointment Scientific Personnel

- Dr. R. K. Dey, Senior Scientist, from CIFA, Bhubaneswar, as Principal Scientist (Pathology), at Chennai, 3 February 1998.
- Shri J. Shyamdayal as Scientist (Animal Nutrition), at Chennai, 3 February 1998.
- Shri M. Kumaran as Scientist (Agricultural Extension), at Chennai, 26 February 1998.

