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Induced maturation and spawning of banana prawn, *Penaeus merguiensis* de Man, under captivity in the inshore waters of Karwar

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ABSTRACT

Investigations were made on the ovarian maturation of banana prawn *(Penaeus merguiensis)* held in a fixed hapa (2xlxlm) in inshore waters of Karwar bay. The shrimps collected (ablated females and males in the ratio 2:1) were subjected to experimental condition for a period of 10 days. The parameters such as salinity, temperature, pH and primary productivity of the seawater at the site were monitored regularly. Within 3-6 days after eyestalk ablation, 70% of the females matured in the cage and spawned successfully *in situ,* thereby indicating the possibility of induced ovarian maturation on commercial scale. Brood stock development on commercial scale for other important candidate species of aquaculture has been suggested.

Introduction

Shrimp culture is one of the major frontiers offish production in developing countries both for domestic consumption as well as for export, contributing substantially to the socio-economic conditions of the fishing community. Growth in the penaeid shrimp farming industry has increased the demand for shrimp post larvae and in the rapid expansion of hatchery sector to supply the growing requirements of seeds. The biggest constraint in the hatchery production is the non-availability of adequate number of spawners of the desired species as and when required. The current farming technology still depends for its seeds on wild broodstock or direct capture of wild post larvae and juveniles, all of which are highly unpredictable. Hence, highest priority in penaeid prawn research is given to reproduction of penaeid prawn in captivity (Conte, 1978). Captive maturation of various penaeid species has indeed been achieved and is routinely carried out in many countries, but the maturation technology and the closing of the life cycle has only been achieved on a consistent dependable basis for a handful of species and thus hatcheries still continue to be heavily dependent on wild stocks.

Economically viable culture methods such as cage and pen culture technologies have been recently introduced to India (Shanmugam *et al.,* 1998) and studies mainly on growth of penaeid shrimps have been undertaken in such units. So far no work has been recorded on the maturation of penaeid shrimps in similar units anywhere in aquaculture practices. *Penaeus merguiensis,* a candidate species for aquaculture with substantial reproductive capacity was selected for the present study. Several reports on reproduction of P. *merguiensis* in captivity exist (Alikunhi *et al.,* 1975; AQUACOP, 1975,1977,1983 ;Nurjana and Yang, 1976; Beard *et al.,* 1977; Alikunhi and Hameed Ali, 1978; Lichatowich et al., 1978; Primavera and Yap, 1979; Nair, 1987), but those related to estuarine, farm raised forms are scanty. Hence the present study was undertaken in Karwar bay to assess the effect of eyestalk ablation on estuarine, farm raised *P. merguiensis,* held in a net cage (hapa) suspended in the shallow bay waters.

Materials and methods

Live specimens of P. *merguiensis* were collected from the brackishwater ponds of Sunkeri area (latitude 14° 18' N and longitude 74° 97' E) using cast nets during the low tide. Healthy specimens of uniform size of 120-130 mm in total length and 20-25 gm in weight were selected and transported to the laboratory in polythene bags. Continuous aeration was provided during the transportation by battery-operated aerators. Upon their arrival to the laboratory, they were transferred to aerated plastic pools containing sea water (salinity 27±2 ppt; temperature 28 ± 2°C) and maintained at normal day-night illumination. They were fed with clams *ad libitum.* After an initial adaptation period of 6 hours, 16 numbers of immature females in the intermoult stage were ablated using an electrocautery apparatus in the evening hours and they were held overnight in separate glass aquaria filled with seawater of the same salinity. Ten ablated females along with five males were later transferred to the experimental unit and the remaining six females with three males were held in plastic pools as controls in the laboratory.

The experimental unit consisted of a velon-screen net cage (fish breeding hapa of 2x1x1 m; mesh size: 225 mesh /sq. inch) with a provision to open at the top. The unit was installed in Karwar bay about 500 m away from the shore line at a depth of about 1.5m. The net cage (hapa) was held in position by fastening to 6 casuarina poles driven to the bottom and it was provided with suitable anchors at each lower corner of the net. It was given an outer secondary covering of bigger mesh size (9 mesh per sq. inch) net to avoid damage by predators, especially crabs. The unit was set up during low tide so that it remained completely immersed even at the lowest low tide and was 1 foot off the bottom to avoid climbing of crabs. The hydrographical condition of the bay was monitored daily and it was as follows; Temperature: 30 ± 1°C; Salinity: 27-35 ppt; pH: 7.9 - 8.2; Dissolved oxygen: 4 .0-4.13 ml /l; Primary productivity: 849-889 mgC/ m^3/day.

In the experimental unit PVC tubes of 8" length and lW dia., with adequate anchoring weights, were introduced as possible hide-outs. The animals were fed daily with squids ad *libitum.* Observations were made on the third, fifth and eighth day after releasing the shrimps into the hapa. Stages of ovarian maturation were monitored by visual examination. Maturity stages were fixed as suggested by Rao (1966). Observation on the third day was made from a boat at the site itself while on the rest of the days, the net cage was untied and brought to the intertidal sandy shore zone for better observations. The net

was cleaned by scrubbing its surface with nylon brush at frequent intervals.

Results

The study was carried out for a period of 10 days and the results obtained were compared with the ablated controls maintained in the laboratory. On the third day of observation one female was found to reach the second stage of maturity while others did not show any sign of ovarian development. However, on the fifth day, advanced stages of ovarian development was observed in the ablated females (4 numbers in the second stage and one in third stage of development) while no change in the ovary was seen among the controls. On the eighth day, the five females formerly seen in the advanced stages of maturation were found to have spawned in their natural environment. Further, two more females attained third stage of maturation which were the late responders to the ablation technique. These prawns were removed to another hapa of finer mesh (mesh size of 300 microns) set out adjacent to the former hapa and they were found to be in spent condition on the 10^{th} day of observation. All the animals were healthy and their guts were full.

Discussion

The present study, made on ablated estuarine farm raised P. *merguiensis* held in net cage, has shown faster response in ovarian maturation within 3 days and complete spawning was observed in more than 50% of the ablated females within 6-8 days. Hundred percent survival was also observed during the experimental period. The faster response in the ovarian maturation compared to the controls may be due to the optimum conditions like natural environment and good water quality in terms of salinity, pH, dissolved oxygen and general elemental components in the open sea (Bray and Lawrence, 1992).

In land based confined systems, environmental and nutritional parameters of shrimp are often difficult to maintain. The circulation of water in the experimental unit during the tidal fluxes flushed away the accumulated waste in addition to bringing in nutrient and oxygen rich water, thereby reducing stress and benefitting the reproductive performances. The lipid and protein fractions in the diet provided (molluscs) also act as triggering factors for maturation (Kanazawa, 1990). The endocrine manipulation by eyestalk ablation resulting in enhanced ovarian maturation was first demonstrated by Panouse (1943) in *Palaemon serratus* making it a common practice for induced maturation of shrimps worldwide. Over 20 commercially important shrimp species have responded positively to eyestalk ablation under captivity. The present study also corroborates this fact in general, as estuarine, farm raised *P. merguiensis* were found to mature within 3-5 days. The initial stage of ovarian maturation in the present study was comparatively longer (2-3 days) than the final stages. But the time taken for the entire maturation process was only 3-5 days which is comparable to that of wild shrimps in captivity (Lim *et al.*, 1987).

Development of broodstock of commercially important shrimps by maintaining them in facilities installed in the sea has found to be easier and cheaper than on land, as it reduces the cost of construction of maturation ponds, sea water supply and water purification systems. Such systems are eco-friendly and non-polluting too. in commercial venture, this will be an easier method for inducing maturation among shrimps reared in brackish water conditions.

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