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Observations on the Larval Rearing of *Macrobrachium rosenbergii* (De Man) by Using Different Types of Feed in Bangladesh Coastal Environment

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Abstract: An experiment was carried out at Brackishwater Station, Bangladesh Fisheries Research Institute, Paikgacha, Khulna from July to August, 1999 to assess the effect of feed on larval survival of *Macrobrachium rosenbergii.* Three treatments viz. *Artemia* nauplii plus egg custard (T_1), *Artemia* nauplii only (T_2) and rotifer-000 only (T_3) were taken for the study each with three replicates. The experiment was conducted in celluloid tanks with *M. rosenbergii* larvae at a density of 50 nos./litre of water. Highest average survival rate (30.0%) was found in T_1 and the lowest (4.5%) obtained in T3. Analysis of variance showed that the difference in larval survival under different treatments were significantly different ($p<0.01$). The results obtained implied that there is a immense potentiality for increasing freshwater prawn seed production through closed water system by using *Artemia* nauplii plus egg custard as feed.

Key words: Larval Rearing, Macrobrachium Rosenbergii

Introduction

The giant freshwater prawn, *Macrobrachium rosenbergii* known as "galda chingri" is available both in freshwater and brackishwater environment of Bangladesh. The prawn have a long larval history and require some salinity to grow (Ling, 1969; Fuzimura, 1972) but their growth, maturation, gonadal development and breeding etc can easily take place in freshwater. The prawn farming in Bangladesh is entirely dependent on natural seeds and is getting very popular and lucrative due to high priced export commodity. High demand, low investment and high return have been stimulated many coastal poor people to be involved in the prawn seed collection. It is observed that prawn are not susceptible to white spot disease and they are more disease resistant than "bagda chingri" (*Penaeus monodon*). Due to its indiscriminate collection wild seed as well as mother stock are gradually declining. Prawn farmers are now facing trouble of culturing the species due to non-availability of seed.

The technique of prawn seed production have been developed in many countries like Thailand, Indonesia, Malaysia, Srilanka, Hawai, Taiwan, Vietnam, China and Japan. Ling (1962) was the first prioneer for successful prawn seed production. Later on, Ling and Merican (1961), Fujimura (1966) and Fuzimura and Okamoto (1972) were successful to produce post larva (PL) of freshwater prawn in mass scale under controlled condition. Few attempt had been made in Bangladesh to produce seed of *M. rosenbergii* (Ahmed and Mahmood, 1978; Islam *et al*., 1983; Bhuiyan *et al*., 1983). Recently some hatcheries have been established in Bangladesh for the production of prawn seed but did not show any significant progress due to higher mortality. Considering the above circumstances, the present study was undertaken to assess the effect of different types of feed on larval survival of *M. rosenbergii.*

Materials and Methods

The experiment was conducted in nine circular celluloid tanks at the hatchery complex of Brackishwater Station, Bangladesh Fisheries Research Institute, Paikgacha, Khulna during July to August, 1999. The tanks were connected with three bio-filters. Aeration was provided in the tanks with the help of air compressor and air blower (Fig. 1). The tanks were divided and placed under three treatments (viz. T_1, T_2 and T_3) each having three replicates.

Construction of bio-fitters: A circular celluloid tank of 350 litre capacity was used as a bio-filter for the freshwater prawn hatchery. Three holes of 2.2 cm dia around the centre of the plastic sheet *were* made, besides many holes of 1.3 cm dia maintaining 2.5 cm distance were done on the rest part of the sheet. This sieve like sheet was used as a filter plate for the bio-filter which could easily be removed by pressing the inner side of the tank. The plate was placed about 25.0 cm above the bottom with the help of 6 pieces of 10.0 cm dia PVC pipe of about 25.0 cm in length. The gap between filter plate and bottom of the tank was expressed in terms of false bottom of the bio-filter. Three short PVC pipes of 2.2 cm dia were fitted into the 2.2 cm hole of the plate and the lower end of the pipes were extended upto 3.0 cm in the false bottom. Three PVC "T" of 2.5 cm dia were attached to the upper end of each PVC pipe. Another short piece of 1.9 cm dia PVC pipe was also fastened to the out let of PVC "T" and the end of the short piece was extended upto the middle of the larval rearing tank. A plastic tube of 1.0 cm dia was introduced into the false bottom through the pipe which attached to the filter plate and the other end of the tube was connected with the air compressor. The celluloid tank was filled with disinfected small sized gravels at a height of 50.0 cm. The treated saline water of 12-15 ppt was poured into the tank. A layer of disinfected oyster shell were spread over the upper surface of the gravels which act as a buffer substances.

Construction of larval rearing tank: A circular conical bottomed celluloid tank of 140 litre of water capacity was used as the larval rearing tank. The rearing tank was set up in such a way on plastic drum that the height of the tank was slightly more than the bio-filter. A hole of 1.8 cm dia was done 8.0 cm below the upper edge of the rearing tank. A short PVC pipe of 1.8 cm dia was inserted through the hole at 45^0 angle and the other end of the pipe was extended upto the bio-filter. The tank was filled with treated saline water of 12-15 ppt upto the mouth of the PVC outlet. A fine mesh sized screen was fastened to the mouth of the outlet through which water could pass only.

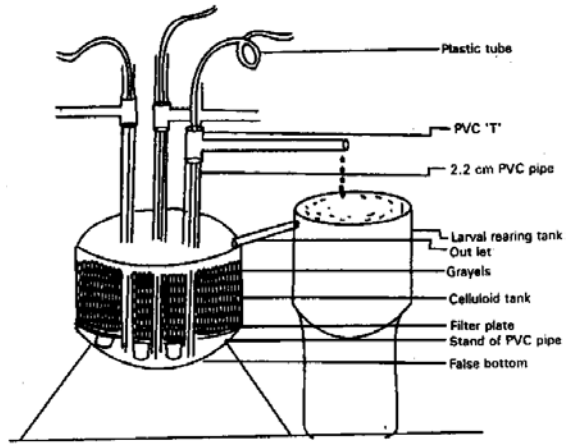

Fig. 1: Bio-filter and larval rearing unit of *M. rosenbergii*

Recirculation system of the bio-filter: n air blower of 1.5 Kw and 2.0 HP air compressor were used to operate the hatchery for producing post larvae of "galda chingri". During the period of electricity breakdown, diesel operated generator of 1.5 HP was used. The accumulated water was pushed up from the false bottom by the air pressure through the PVC pipe and fell in the rearing tank. The excess water was passed through the outlet and fell in the bio-filter. The water coming from rearing tank into the bio-filter was passed through the gravels of biofilter and stored at the false bottom. This filtered water reentered into the rearing tank through the PVC pipe by the air pressure. Thus desirable quantity of saline water could re-use through filtration and re-circulation into closed system of freshwater prawn hatchery.

Bio-filter to become active: In closed water system hatchery, un-ionic ammonia was produced in the re-circulated water due to metabolic activity of larvae, decomposition of un-used feed, moulted shell and dead larvae etc. Un-ionic ammonia caused mass mortality of larvae. This toxic ammonia was broke down to nitrite and nitrate by the activity of bacteria like *Nitrosomonas, Nitrobacter* and *Pseudomonas* etc (Das, 1889). Ammonia liquid was applied in bio-filter for the growth of beneficent bacteria four times at 4 days interval at a dose of 1.5 ppm. After 21-25 days of ammonia applying, the bio-filter was become active. Before starting the operation, the level of ammonia in the bio-filter was 0.01-0.02 ppm.

Disinfection of saline water and equipment: Brackishwater of 12-15 ppt was stored at over head tank through the gravel filter which is indirectly connected with the tidal river, Shibsa. The water was kept in the tank for 4-5 days to settle down the suspended particles. The accumulated water was passed through the sand filter and ultra-violet (UV) filter and stored again in the over head tank. Finally, the water was stored in the cistern from the over head tank. The water was treated with bleaching powder (80% chlorine content) at a dose of 12 ppm for killing the harmful organisms and aeration was provided vigorously for two days to eliminate the smell of chlorine. After day 2, water was again treated with sodium thiosulphate at a dose of 10 ppm to eliminate/neutralize the access chlorine and aerated vigorously for 2 days and to keep stable for one day to settle down the suspended particles. This sterilized water was transferred to bio-filter and rearing tank after filtering by fine mesh sized net. The necessary materials such as pipes, gravels, cover and others for hatchery operation were disinfected by soaking in a solution of 12 ppm bleaching powder containing 60% chlorine for 12 hours. After 12 hrs, all the materials were washed with hot boiled freshwater to remove the smell of used powder. During the culture period, siphoning pipe, bowl, pail, water exchanging nets and others were washed two times with gentle hot water prior to use in the siphoning.

Hatching and larval management: The berried females were collected from the brood ponds and disinfected for 15 minutes with 20 ppm formalin. The disinfected females were then kept in a aquarium having 5 ppt saline water. The females were hatched after two days of stocking 1.1 the aquarium. The females were fed with fresh snail/fish flesh at the rate of 10% of the body weight. After hatching, females were removed from the aquarium and bottom and other sides of the aquarium were cleared very carefully and 80% of the water was removed from the aquarium and added disinfected water. Hatchling was reared two days in the aquarium. Newly hatched larvae were not fed for the first two days. After day 2, the larvae were disinfected for 20 minutes with 20 ppm formalin bath and then stocked in nine rearing tanks each containing 140 litre of 12 ppt saline water at a density of 50 nos./litre for rearing.

The larvae of nine tanks were under three treatments namely T_1 *(Anemia* nauplii plus egg custard), T_2 *(Anemia* nauplii only) and T_3 (Rotifer-000 only). In T_1 the larvae were fed with *Anemia* (brine shrimp) nauplii (BSN) twice a day at 09:00 am and 17:00 pm for the first 10 days maintaining the density of 3-5 BSN/ml. And after day 10, the larvae were fed with prepared feed, egg custard (egg and powder milk = 1:1) twice a day besides *Artemia* nauplii at the rate of 500% of the body weight. In case of T_2, the larvae were fed with *Artemia* nauplii only twice a day at 09:00 am and 17:00 pm from day 3 to post larva stage. In T_3, the larvae were fed with only rotifer-000 (zooplankton powder) at the same time of T_1 and T_2 at the rate of 300-100% of the body weight from the day 3 to PL stage. The uneaten feed, moulted shell and other wastes were siphoned out prior to every feeding time.

Water quality parameters of culture media like temperature, salinity, dissolved oxygen, pH and un-ionic ammonia were measured daily basis. The data were statistically analyzed following the principle of Randomized Block Design (RBD). Duncan's New Multiple Range (DMR) test was then done for treatments comparison.

Results and Discussion

The values of physico-chemical conditions such as like temperature, salinity, dissolved oxygen, pH and un-ionic ammonia of culture media have been depicted in Table 1. During the period of study no apparent variation in temperature of rearing media under different treatments was found. The water temperature as recorded was between 26.0-33.0°C. The range of salinity (12-15 ppt) of culture media under three treatments was the same. Dissolved oxygen content of culture media of different treatments was ranged between 6.0-7.8 mg/l. The pH value was ranged between 6.3 to 7.7 in all the rearing tanks of the treatments. Un-ionic ammonia content of rearing tanks as recorded was varied between 0.08-0.20 mg/l. Highest value (0.14-0.20 mg/l) was recorded in T_3 and the lowest (0.08-0.11 mg/l) was in T_1. The values of different parameters except un-ionic ammonia of the present study were comparatively same stated by Khondhker (1996). The level of

Table 1: Mean values ± sd with range of physico-chemical parameters of the culture media under different treatments

Treatments	Temperature (°C)	Salinity (ppt)	Dissolved oxygen (mg/l)	pH	Un-ionic ammonia (mg/l)
T_1	29.6 ± 2.32	13.2 ± 1.5	7.1 ± 0.46	7.0 ± 0.42	0.09 ± 0.01
	(26.0-33.0°C)	(12.0-15)	(6.5-7.6)	(6.5-7.5)	(0.08-0.11)
T_2	29.2 ± 2.29	13.2 ± 1.5	7.2 ± 0.54	7.2 ± 0.37	0.10 ± 0.01
	(26.2-32.8°C)	(12.0-15)	(6.6-7.8)	(6.9-7.7)	(0.09-0.12)
T_3	29.6 ± 2.04	13.2 ± 1.5	6.8 ± 0.61	6.7 ± 0.32	0.17 ± 0.03
	(26.5-32.5°C)	(12.0-15)	(6.0-7.0)	(6.3-7.0)	(0.14-0.20)

Table 2: Survival rate (%) and production of *M. rosenbergii* larvae under different treatments

Treatments	Date of stocking	No. of stocking larvae	Stocking density no./l	Rearing period (days)	Average survival (%)	Total no. of produced PL
T_1	01.07.99	21,000	50	42	30.0[a]	6300
T_2	01.07.99	21,000	50	53	12.0[b]	2520
T_3	01.07.99	21,000	50	60	4.5[c]	945

Figures in the same column with different superscript are significantly different ($p < 0.01$)

un-ionic ammonia was similar with the value described by Ling (1962).

The average survival and production of post larva are presented in Table 2. The survival rate of larva was found to vary from 4 to 30%. Highest rate of survival (28.5-31.3%) was recorded for the treatment T_1 and the lowest (3.9-5.1%) was in T_3. The cause of such variation was probably due to higher nutritive and growth promoting value of egg custard. In T_1, the larvae were fed with *Artemia* nauplii and egg custard but in T_3, the larvae were fed with rotifer-000, which was not so nutritive like egg custard and nauplii. In T_3, the level of unionic ammonia was also higher than the other treatments. Mass mortality observed in T_3 and T_2 while the larvae attain to metamorphosis to PL stage which might possibly due to the lack of nutrition. The rate of survival obtained Rom T_1 in the present experiment was higher than the earlier production of 11.93 PL/l (Islam and Khan, 1990), 10.22 PL/) (Adisukresno *at al.,* 1982) and 9.5 PL/l in closed re-circulatory system (Lee, 1982). However, a good performance of *Artemia* nauplii and egg custard was also observed by Yambot and Vera Cruz (1986) where the authors found 25.7% survival for *M. rosenbergii* larva which is agreement with the present findings. It was observed that larvae became very agile during the age of 20-25 days and started jumping and clung to the wall of the rearing tank and become mortile. Similar observation was also reported by Islam *at al*. (1983). Strong aeration was provided to prevent this jumping tendency.

The variations in the rate of survival observed under different treatments were found statistically significant. Comparison of mean survival between the different treatments using DMR test showed that the mean survival under T_3 was significantly lower than that of T_1 and T_2. The mean survival of larvae obtained under T_1 was significantly higher than those of T_2 and T_3. Of the three treatments, highest survival (30.0%) was found under T_1 where the larvae were fed with *Artemia* nauplii and egg custard. The result obtained from the present study indicated that rearing of freshwater prawn larvae by improved management technique can be considered economically viable and acceptable. So, the production of post larva of prawn could be increased significantly by using *Anemia* nauplii and egg custard as larval feed. This technique would be more useful for culturing prawn larvae in the remote areas where saline water is not available and transportation of saline water/brine solution is very costly.

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