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Effect of high and low cost brood feeds on gonado-somatic index and fecundity of freshwater prawn *Macrobrachium rogenbergii* de Man

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Abstract
Studies were conducted to observe the effects of different types of feeds on the gonado-somatic index (GSI) and fecundity of freshwater prawn *Macrobrachium rogenbergii*. Three different treatments (T_1, T_2 and T_3) were designed with three types of feed as follows: (i) Saudi-Bangla Prawn feed 100% - T_1, (ii) Saudi-Bangla prawn feed 50%+local feed 50% - T_2 and (iii) local feed 100% - T_3. The results showed that the average value of gonado-somatic index (GSI) was 14.39, 14.35 and 14.36 and the average fecundity of *M. rogenbergii* was 99,741, 98,125 and 97,911 in T_1, T_2 and T_3 respectively. No significant difference ($p>00.5$) was between gonado-somatic indices (GSI) and fecundities of *M. rogenbergii* among different feeding trails. The price of Saudi-Bangla prawn feed was very high (Tk. 23/kg) than the local feed (Tk. 14/kg). So, use of local feed was recommended for *M. rogenbergii* brood rearing.

Key words: Prawn feed, Gonado-somatic index, Fecundit, *M. rogenbergii*

Introduction

Among the wide array of prawn species available in Bangladesh, the long legged giant freshwater prawn, *Macrobrachium rogenbergii* (golda chingri) is the largest, most desirable and contribute a lot to the major share of the exported prawns. *M. rogenbergii* grows fast, tolerate salinity changes and can be cultured in freshwater ponds. While the demand of this prawn has been progressively in home and abroad, the production of the same from natural water is declining in our country day by day due to over fishing and environmental hazards. In the fish culture feed cost accounts about 60-70% of the total cost which is very expensive to poor farmers of Bangladesh. In the market, there are some commercial prawn feeds, which are also expensive. Unsuitable feed, unavailability of fry and lack of technological know-how are the main drawbacks for increasing prawn production in freshwater ponds. Now-a-days Government and private hatcheries are producing large number of post-larvae of *M. rogenbergii* for their culture in ponds

throughout the country, but these hatcheries face problems due to high price of artificial feeds for brood rearing. Polyculture of *M. rogenbergii* has been investigated with Chinese and Indian carps (Hoq *et al.* 1996, NFEP 2001, Alam *et al.* 2001) but no scientific study has been conducted to find out the suitable low cost feed for *M. rogenbergii* brood rearing. So, the present experiment was designed to determine the effect of high cost and low cost feed on the gonado-somatic index and fecundity of *M. rogenbergii.*

Materials and methods

Observation of the effects of high and low cost feeds of *Macrobrachium rogenbergii* broods on their gonado-somatic index and fecundity was carried out in the backyard hatchery (Pramanik and Mahmud 1995) of Bangladesh Fisheries Research Institute, Riverine Station, Chandpur. Three Treatments were designed for feeding with three replications as follows: T_1=Saudi-Bangla prawn feed 100%, T_2=Saudi-Bangla prawn feed 50% and Local feed 50% and T_3=Local feed 100%. Local feed was prepared by using local ingredients such as fish meal, mustard oil cake, rice-bran, wheat flower and vitamin-mineral premix by maintaining the protein level 30% (Table 1) which was equal to that of the Saudi-Bangla prawn feed (Table 2). An earthen pond of 135 m^2 area was chosen for the experiment. The water of the pond was completely drained out and remained exposed to the sun for 15 days until the bottom cracked. After complete drying, the pond was tilled to improve the soil quality by exposing sub-soil to the atmosphere there by speeding up the oxidation process and the released of nutrients that were locked in the soil. Lime was applied to the soil at the rate of 1 kg/dm. After liming the pond was divided into nine plots of 15 m^2 size each. These plots were divided by using nylon nets. They were of 4 feet height from ground level so that the prawns, stocked in one plot cannot move towards the other plot. Bamboo poles were used to fix the net vertically. After complete netting the pond was filled with water. The nets were cleaned periodically during the experiment to maintain the water quality of each plot equal. Organic and inorganic fertilizers were applied in the pond. Organic fertilizer of cowdung was broadcasted over the pond at a ratio of 10 kg/dm. After 6-7 days of organic fertilization, the chemical fertilizers were applied at the rate of urea 100g/dm and TSP 75g/dm. The juveniles were stocked at a density of 2/m^2. The average length and weight of the juveniles were 10.3 cm and 20.5 g respectively. Feeds were supplied to the prawns at 5-3% of their body weight. Three types of feeds were supplied to each three replicates of the nine experimental ponds. The physico-chemical parameters of the plots were recorded fortnightly. Temperature was recorded by a Celsius thermometer. The p^H, DO and ammonia were measured by a portable water test kit (HACH Company, love land, Colorado).

Table 1. Percentage composition of local feed

Ingredients	Percentage (%)	Protein (%)
Fish meal	21.0	12.13
Mustard oil cake	45.0	13.65
Rice-bran	28.0	03.33
Wheat flower	05.0	00.89
Vitamin-mineral premix	01.0	-
Total	100.00	30.00

Source: BFRI

Table 2. Feed analysis of Saudi-Bangla prawn feed (finisher pellet)

Food value	Percentage (%)
Moisture	11
Protein	30
Fat	4
Fiber	6
Ash	17
Carbohydrate	32

Source: Saudi-Bangla Fish Feed Ltd.

Determination of Gonado-Somatic Index

Gonado-somatic index (GSI) of prawn is the percentage of gonadal weight in relation to the total weight of prawn. GSI was determined for each prawn by the following formula:

$$GSI = \frac{\text{Weight of gonads (g)}}{\text{Weight of prawn (g)}} \times 100$$

Determination of fecundity

Fecundity was determined using gravimetric method (Lokman Ali 2002). Mother prawns were collected from different experimental plots. The prawns were transported to the backyard hatchery with plastic drum. The total weight of individual prawn was taken by an electronic balance. A portion of ovary was sampled from the mother prawn in a clean petridish with the help of forceps. The mother prawns were then released in the aquarium with 6 ppt saline water for hatching of the eggs. The water from sampled eggs was blotted by a blot paper and then dried at room temperature. Number of eggs in the sampled portion was counted. After hatching, the weight of each mother prawn was taken. The weight of total eggs i.e. the weight of the gonad was calculated from the following formula:

Weight of gonad (total eggs) = Weight of mother prawn before hatching - Weight of mother prawn after hatching.

Finally, the total no. of eggs i.e. the fecundity of each individual prawn was calculated with the help of the following formula:

$$\text{Total no. of eggs (fecundity)} = \frac{\text{Weight of total eggs} \times \text{No. of eggs in the sampled portion}}{\text{Weight of the sampled eggs}}$$

Statistical analysis

One way analysis of variance (ANOVA) was performed on the yield data to determine treatment effects. Significant differences between treatments were isolated using Duncan's multiple range test (DMRT) at 5% level of significance.

Results

Water quality parameters

Respective values of water quality parameters during the experimental period were same in all the treatments because one pond was divided into nine plots by fine mesh net. The values *viz.*, water temperature, dissolved oxygen (DO), pH, transparency and ammonia (NH_3) under different treatments are shown in Table 3. Average value of dissolved oxygen was 5.71 mg/L, temperature, 26.8°C, p^H, 7.68 and NH_3, 0.31 mg/L.

Table 3. Average values of water quality parameters in each fortnight during the experimental pe from February to May

Parameters	February		March		April		May	
	1st	15th	1st	15th	1st	15th	1st	15th
Temperature	22.0	24.0	25.3	26.9	27.6	29.1	29.5	30
Dissolved Oxygen (mg/L)	5.5	5.6	6.0	6.9	4.3	6.0	5.8	6.2
p^H	7.3	7.6	8.0	7.2	7.9	8.1	7.8	7.9
Ammonia (NH_3) (mg/L)	0.2	0.3	0.25	0.23	0.33	0.37	0.26	0.3

Gonado-Somatic Index

The gonado-somatic indices (GSI) of *M. rosenbergii* of different treatments are shown in Table 4. The average value of GSI for T_1 was 14.39, for T_2 was 14.35 and for T_3 was 14.36. There were no significant differences ($P>0.05$) between the gonado-somatic indices of *M. rogenbergii* of different feeding trails.

Table 4. Values of gonado-somatic index and fecundity of *Macrobrachium rosenbergii* of different treatments

Treatments	Gonado-somatic index		Fecundity	
	Range of GSI	Average of GSI	Range of fecundity	Average of fecundity
T_1	13.35 - 15.39	14.39[a*]	60,525-1,36,502	99,741[b*]
T_2	13.36 - 15.15	14.35[a]	62,024-1,29,355	98,125[b]
T_3	13.73 - 15.50	14.36[a]	62,920-1,30,620	97,911[b]

* Values in the same column with same superscripts did not differ significantly ($p>0.05$)

Fecundity

The estimated results of fecundity of *M. rogenbergii* are presented in Table 4. Average fecundity of *M. rogenbergii* in T_1 was 99,741, in T_2 was 98,125 and in T_3 was 97,911. Statistical analysis indicated that there were no significant differences ($P>0.05$) between the fecundity of *M. rogenbergii* of different feeding trails.

Discussion

The water quality parameters were ranging from 4.3 to 6.9 mg/L for dissolved oxygen, 22°C to 30°C for temperature, 7.2 to 8.1 for p^H, and 0.2 to 0.37 mg/L for ammonia. New and Singholka (1985) reported that the temperature below 14°C or above 35°C is lethal for freshwater prawn and maximum growth occured near 31°C. Generally, winter is not the breeding season for *M. rogenbergii* due to some environmental disadvantage (Rao 1965). Wulff (1982) reported that juveniles of freshwater prawn could tolerate dissolved oxygen levels of 1.0 to 1.5 mg/L at early morning and suggested not to allow the prawn at such level for extended period. Cohen *et al.* (1983) observed that dissolved oxygen level should always be maintained above 4.0 mg/L for prawn culture. Michael (1969) described that the best p^H level for culturing fisheries organisms is around 7.5 to 8.5.

The average gonado-somatic index was 14.39, 14.35 and 14.36 for T_1, T_2 and T_3 respectively. The lowest GSI value being 13.35 and highest being 15.50. The differences were not statistically significant ($p>0.05$). Patra (1976) observed the average GSI value of *M. rogenbergii* to be 14.88, ranging from 12.81 to 17.78. Similar results were found in the present experiment.

The fecundity of the freshwater prawn, *M. rogenbergii* was found to be 99,741 in T_1, 98,125 in T_2 and 97,911 in T_3. There were no significant differences between the fecundities of *M. rogenbergii* in different feeding trails at the 5% level of significance. Patra (1976) found mean fecundity of *M. rogenbergii* from natural brood to be 1,30,000. Ling and Merican (1961) found average fecundity of *M. rogenbergii* to be 90,000. Costa and Wanninayake (1986) reported that the fecundity of *M. rogenbergii* ranged from 19,000 to 1,37000. Sureshkumar and Kurup (1998) found that the mean fecundity of *M. rogenbergii* was 95,687 ranging from 30,666 to 2,27,161. The fecundity found during the present study was within the above range of hatchery broods. The deviation in fecundity may be attributed to the differences in size of gravid females. As the average size of the

prawn is generally higher in case of wild stock, the fecundity also increases exponentially due to the size of the prawn. The differences in fecundity may also be due to the differences in the habitat of the stock or may be due to their genetic variations. According to Bromage *et al.* (1992) fecundity varies with season, climatic conditions, environment and nutritional status.

Similar gonado-somatic index and fecundity of *M. rogenbergii* larvae at three different feeding trails indicates that gonado-somatic index and fecundity of larvae were not significantly affected by three types of brood feed. Cost of feed is a major factor in the financial management of brood rearing. During the present experiment, a local feed consisting of 21% fish meal, 45% mustard oil cake, 28.0% rice-bran, 5.0% wheat flower and 1.0% vitamin-mineral premix, was prepared the cost of which was Tk. 14/kg. It was apparent that this feed was substantially cheaper than the Saudi-Bangla prawn feed, the cost of which was Tk. 23/kg. Though the difference of price of the feeds was remarkable but there were no significant differences between the gonado-somatic index and fecundity from these two types of feeding trails. Considering all the above facts, the local feed was recommended for the brood rearing of *M. rogenbergii* in ponds.

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