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Effect of high and low cost brood feeds on the hatching and survival rate of freshwater prawn, *Macrobrachium rogenbergii* larvae

M. Lokman Ali*, M. Mumnur Rashid, S.U. Ahmed[1], K.R. Hasan[1] and M.M. Alam
Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, [1]Bangladesh Fisheries Research Institute, Riverine Station, Chandpur
*Corresponding author & Present address: Bangladesh Fisheries Research Institute, Mymensingh-2201

Abstract

Effects of high and low cast feed on the hatching and survival rate of freshwater prawn *Macrobrachium rogenbergii* larvae were observed. Three different treatments (T_1, T_2 and T_3) were designed with three types of feeds as follows: T_1, Saudi-Bangla Prawn feed 100%; T_2, Saudi-Bangla prawn feed 50% + low cast feed 50%; T_3, low cast feed 100%. The prawns were reared from February to May 2001 until they became mature enough to breed. The results showed that the average value of hatching rate was 90.14%, 89.69% and 89.29% and the average survival rate of larvae was 39.44%, 38.88% and 38.33% in T_1, T_2 and T_3 respectively. There were no significant differences ($P>0.05$) between hatching and survival rate of *M. rogenbergii* from different feeding trails. The price of Saudi-Bangla prawn feed was very high (Tk. 24/kg) than the local feed (Tk. 14/kg). So, use of local feed was recommended for *M. rogenbergii* brood rearing.

Keywords: *M. rogenbergii*, Brood feeds, Hatching rate, Survival rate

Introduction

Macrobrachium rogenbergii (de Man), locally known as "Golda Chingri" is one of the most valuable prawns in Bangladesh. It has great demand for human consumption as a source of animal protein and foreign exchange earning of Bangladesh. This species is widely distributed in freshwater as well as in brackishwater mainly in ponds, rivers, canals and estuaries (Ahmed, 1957). Among all kinds of shrimp and prawn of Bangladesh, *M. rogenbergii* is the biggest (Shafi and Quddus, 1973) and probably one of the biggest, in the world (Rao, 1967). *M. rogenbergii* is gaining popularity throughout the country in relation to its high market demand and its suitability to stock with other commercially important fin fishes. In order to mitigate the ever increasing demand of this prawn larvae, which cannot be met from the natural source only, efforts are being made towards increased seed production through installation of freshwater prawn hatchery in the country. In prawn hatchery operations, survivability of larvae depends on the knowledge of their biology as well as their successful management.

Now-a-days hatchery operators noticed many problems of broodstock management of prawn. Among of those, brood prawn nutrition is a major concern in hatchery operation. Very little is known about the brood stock feed for gonadal maturation of prawn. The socio-economic condition of the hatchery operators does not allow to use presently available very expensive commercial brood prawn feeds. Some private entrepreneurs are producing large numbers of post-larvae of *M. rogenbergii* for their culture in ponds throughout the country. These hatcheries are also facing problems due to high price of artificial feeds for brood rearing. So an immediate need to reduce feed costs for brood rearing is very important for profitable brood prawn culture. At present, low cost quality feed is not available in the country. In Bangladesh, a large number of indigenous raw materials, both agricultural and industrial wastes, are available, which can serve as potential prawn brood feed ingredients. Considering the above facts, cost-effective feed using local feed ingredients for broodstock of prawns is necessary to fulfil the immediate need of our hatchery operators. Polyculture of *M. rogenbergii* has been practiced with Chinese and Indian carps (Hoq *et al.*, 1995; 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 hatching rate and survivability of *M. rogenbergii*.

Materials and Methods

An experiment was carried out in the backyard hatchery of Bangladesh Fisheries Research Institute (BFRI), Riverine Station, Chandpur to observe the effects of high and low cost feeds of *Macrobrachium rogenbergii* broods on their hatching and survival rate.

A local feed was formulated using 21% fishmeal, 45% mustard oil cake, 28% rice-bran, 5% wheat flower and 1% vitamin-mineral premix (Table 1a and 1b). This feed contained 30% protein which similar to Saudi-Bangla prawn feed (Table 2). Three Treatments were designed for feeding with three replications as follows: Treatment T_1, Saudi-Bangla prawn feed 100%, Treatment T_2, Saudi-Bangla prawn feed 50% and low cost feed 50% and Treatment T_3, low cost feed 100%.

Table 1a. Formulation (%) of low cast feed

Ingredients	% protein in ingredient	Percentage (%) inclusion	Protein (%) contributed	Price of ingredient (Tk./Kg)	Price of feed
Fish meal	57.76	21.0	12.13	24	14 Tk./Kg
Mustard oil cake	30.33	45.0	13.65	12	
Rice-bran	11.89	28.0	03.33	6	
Wheat flower	17.80	05.0	00.89	8	
Vitamin-mineral premix	-	01.0	-		
Total	-	100.00	30.00		

Table 1b. Proximate composition of low cast feed (% dry matter basis)

Food value	Percentage (%)
Moisture	9.5
Protein	29.5
Fat	5.6
Fiber	7.3
Ash	14.4
Carbohydrate	32.7

Table 2. Proximate composition of Saudi-Bangla prawn feed (% dry matter basis)

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

Source: Saudi-Bangla Fish Feed Ltd.

The experiment was carried out in a 135 m^2 pond, partitioned into nine units by bamboo fencing covered with nylon mosquito net. Average effective water depth was about 1 m. The pond was drained out and treated with lime and cowdung at the rate of 1 and 10 kg/decimal, respectively. It was then filled with underground water and fertilized at the rate of 100g urea and 75g TSP/decimal for enhancing the natural food production prior to stocking. After fertilization, prawns were released into the pond compartments.

The prawns were stocked at a density of 2/m^2. The average length and weight of the prawns was 10.3±0.86 cm and 20.5±0.94 g respectively. Feeds were supplied to the prawns at 3 % of their body weight. Three types of feeds were supplied to respective treatments. The culture period was four months. The physico-chemical parameters of the plots were recorded fortnightly. Temperature was recorded by a Celsius thermometer. The pH, DO and ammonia were measured by a portable water test kit.

Determination of hatching rate

Fecundity was estimated by gravimetric method. Hatching rate was calculated from the previously calculated total number of eggs (fecundity) (Ali, 2002) using the following formula:

$$\text{Hatching rate} = \frac{\text{Total no. of hatched larvae}}{\text{Total no. of eggs}} \times 100$$

Determination of survival rate

After hatching of eggs, larvae of Zoea-1 stage (New and Singholka, 1985) were transferred to the larvae rearing *chari* containing 12 ppt saline water. Nine cemented *charis* were used for rearing of larvae from three different feeding treatments. Stocking density for larvae in the *chari* was 60/L. Aeration was maintained in the *chari* continuously from a centrally connected air pump and aerator. The larvae were fed only *Artemia* nauplii twice a day up to 10 days. After 10 days, artificial feed (egg custard) was also fed at the rate of 30% of the body weight together with the live food. The larvae were reared up to post-larval stage (PL), when they took the shape of adult prawn and started swimming changing from backward to forward movement and changing from upside down to normal position. At the end of the experiment, all prawns were collected and counted to find out the survival rate. It was calculated as:

$$\text{Survival rate (\%)} = \frac{\text{No. harvested PL}}{\text{No. of stocked larvae}} \times 100$$

Statistical analysis

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

Results and Discussion

Water quality parameters

Values of water quality parameters during the experimental period are shown in Table 3. The values were same in all units because one pond was divided into nine plots by fine mesh net. Average value of dissolved oxygen was 5.71±0.53 mg/L, temperature, 26.8°C±0.26, p^H, 7.68±0.84 and NH_3, 0.31±0.49 mg/L. Above values of the water quality parameters observed during experimental period were well within the acceptable range given by New and Singholka (1985).

Table 3. Average values of water quality parameters measured fortnightly during the experimental period from February to May, 2001

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

Hatching rate

The hatching rates of the prawn in different treatments are shown in Table 4. The average hatching rate for T_1 was 90.14%, for T_2, 89.69% and for T_3, 89.29%. There were no significant differences (P>0.05) between the hatching rates of *M. rogenbergii* maintained in different feeding regimes.

The average hatching rate was 90.14%, 89.69% and 89.29% in T_1, T_2 and T_3 respectively (Table 4). Joshim (2000) found that the average hatching rate of hatchery broodstock was 89.87% and hatchery reared wild broodstock was 98.76% and Hasan *et al.* (2002) found 82-96% hatching rate of *M. rogenbergii* in backyard hatchery, which are similar to the results of the present study.

Table 4. Values of hatching and survival rate of *M. rosenbergii* in different treatments

Treatments	Hatching rate		Survival rate	
	Range of hatching rate	Average of hatching rate	Range of survival rate	Average of survival rate
T_1	88.32–92.25	90.14^{a*}	38.33–41.67	39.44^{a*}
T_2	87.34–91.72	89.69^{a}	36.68–41.67	38.88^{a}
T_3	88.52–90.13	89.29^{a}	35–40	38.33^{a}

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

Survival rate

The estimated results of survival rate of *M. rogenbergii* eggs are presented in Table 4. The average survival rate of the larvae in T_1 was 39.44%, T_2, 38.88% and T_3, 38.33%. There were no significant differences (P>0.05) between the hatching rates of *M. rogenbergii* in different feeding trails.

Sureskumar *et al.* (1998) observed the survival rate of *M. rogenbergii* larvae to be 35%. Chiranjib *et al.* (1999) stocked larvae at the density of 60/L and found survival rate to be 54.4%. Alam *et al.* (1993) observed 44.02% survival rate of *M. rogenbergii* using *Artemia* as larval feed. BOBP (1993) reported that 50% PL could be produced in prawn hatchery at a stocking density of 60-80 zoea-1/L of *M. rogenbergii.* Similar results were obtained in case of 60 zoea-1 /L of *M. rogenbergii* in backyard hatchery (Pramanik and Haldar, 1996). It is evident that survival rate varies due to the different management system of larval rearing. It also varies with quality of brine and presence of iron in water (Ali, unpublished data)

Similar hatching and survival rate of *M. rogenbergii* larvae at three different feeding trails indicated that hatching and survival rate 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% rice-bran, 5% wheat

flour and 1% vitamin-mineral premix was prepared. The cost of this feed was Tk. 14.00/kg. It was apparent that this feed was substantially cheaper than the Saudi-Bangla prawn feed, the cost of which was Tk. 24.00/kg. Though the difference of price of the feeds was remarkable there were no significant differences between the hatching and survival rates in 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.

References

Ahmed, N. 1957. Prawn and prawn fishery of East Pakistan. Government Press, Dhaka, East Pakistan, pp 31

Alam, M.J., Jahan, D.A, Pramanik, W.A. and Hoq, M.E. 2001. Polyculture of freshwater prawn, *Macrobrachium rogenbergii* (de Man) with carps: effects of prawn stoking density. Bangladesh J. Fish. Res., **5**(2): 135-144.

Alam, M.J., Ang, K.J. and Cheah, S.H. 1993. Use of *Moina mierura* (Kurz) as an *Artemia* substitute in the production of *Macrobrachium rogenbergii* (de Man) post-larvae. Aquaculture, **109**: 337-349.

BOBP (Bay of Bangal Programme), 1993. A mannual for operating a small scale recirculation freshwater prawn hatchery. BOBP, Madras, India. pp: 22.

Chiranjib, C., Chatterjee, T.K., Chakraborty, S.K and Chakraborty, C. 1999. Effects of stocking density and light intensity on growth and survival in larvae rearing of giant freshwater prawn, *Macrobrachium rogenbergii.* Environ. Ecol., **17**(2): 288-290.

Hasan, K.R., Haldar, G.C., Haque, M.A. and Lokman Ali, M. 2002. Development of *Macrobrachium* backyard hatchery. Final Report, Bangladesh Fisheries Research Institute, Riverine Station, Chandpur-3602, Bangladesh, pp: 66.

Hoq, M.E., Islam, M.M. and Hossain, M.M. 1995. Polyculture of freshwater prawns (*Macrobrachium rogenbergii*) with Chinese and Indian major carps in farmers' pond. J. Aqua.. Trop., **11**(2): 135-141.

Joshim, M., 2000. Comparative study on the breeding performance of hatchery broodstock and hatchery reared wild broodstock of *Macrobrachium rogenbergii.* M.S. Thesis. Institute of Marine Science, University of Chittagong. pp: 73.

Ali, M.L., 2002. Studies on the effects of feeds on the reproduction of freshwater prawn *Macrobrachium rogenbergii.* M. S. Thesis. Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh, pp: 63.

New, M.B. and Singhaolka, S. 1985. Freshwater prawn farming. A manual for the culture of *Macrobrachium rogenbergii. FAO Fish. Tech. PoP.,* 1/FIRI/T 225, pp: 118.

NFEP (Northwest Fisheries Extension Project), 2001. Pond grow-out of freshwater prawn (*Macrobrachium rogenbergii*) in three species polyculture system. NFEP Paper No. 28, the Northwest Fisheries Extension Project (2nd phase)- a GoB and DFID collaborative project, Department of Fisheries, Parbatipur, Dinajpur, Bangladesh.

Pramnik, W.A. and Mahmud, Y. 1995. Manual on Galda prawn production in Backyard hatchery and its culture technique in pond. Bangladesh Fisheries Research Institute, Riverine Station, Chandpur-3602, Extension manual no. 10, pp: 16.

Pramanik, M.W.A. and Haldar, G.C. 1996. Development of backyard hatchery system and larvae rearing technique in different stocking densities. J. Indian Fish. Soc. India, **28**(1): 1-6.

Rao, R. M., 1967. Studies on the biology of *Macrobrachium rogenbergii* (de Man) of the Hoogly estuary with notes of its fishery. Proc. Nat. Inst. Sci. India, Part : Biol. Sci., **33**(5-6): 252-279.

Shafi, M. and Quddus, M.M.A. 1973. Age, growth and food of the giant prawn,. *Macrobrachium rogenbergii* (de Man). Bangladesh J. Biol. and Agr. Sci., **2**(2) : 3-6.

Sureshkumar, S., Kurup, B.M and Bhattathiri, P.M.A. 1998. Comparative study on the reproductive potential of male morphotypes of giant freshwater prawn, *Macrobrachium rogenbergii* in broodstock rearing and larval production. Indian J. Marine Sci., **27**(3-4): 373-377.