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Nursery rearing of Thai sarpunti, *Barbonymus gonionotus* larvae using three different supplementary feeds

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Abstract

Nursery rearing of silver barb, *Puntius gonionotus* (Bleeker, 1850) larvae was carried out with three different feeding treatments T_1, T_2 and T_3 having three replications each in nine rectangular glass aquaria (45x25x24 cm) for a period of 28 days in laboratory condition. Live planktonic feed (5000 cells/L), plankton and rice bran having 14.14% protein, and plankton and Saudi-Bangla nursery feed having 30.20% protein were tested as T_1, T_2 and T_3, respectively. Three days old larvae of *B. gonionotus* (average length 5.0±0.15 mm and weight 7.0±0.05 mg) were stocked at a stocking density of 4.1 larvae/L of water in each aquarium. The highest length at harvest (28.06±0.38 mm and weight 135.00±3.05 mg) and also highest SGR (18.79±0.80) were found in T_3 followed by T_2 and T_1. The survival rate in all the treatments was high (92-90%) and treatment to treatment variation was not significant (P<0.05). The result implies that the application of supplemental feeds over control in nursery rearing of *B. gonionotus* larvae had positive role. The non-significant growth variation between T_2 and T_3 indicate suitability of the use of low protein content supplemental feed in the farmers nursery pond during the nursery rearing of *B. gonionotus* larvae.

Keywords: Silver barb, Nursery rearing, Rice bran, Plankton

Introduction

Barbonymus gonionotus (Bleeker, 1850) commonly known as silver barb, is an exotic fish of Bangladesh belonging to Cyprinidae family. Among all the exotic fish species of Bangladesh, it is considered to be one of the best suitable species for aquaculture due to its better palatability, high yield potential and market demand. Azim *et al.* (2004) reported that the excreta of silver barb had enriched pond bottom that was partly eaten by common carp and partly acted as a fertilizer, which might have promoted phytoplankton production. The excreta of silver barb is reported to influence the growth of common carp (Phaohorm, 1980; Dev, 1994; Shahabuddin *et al.,* 1994).

Silver barb has become increasingly popular in Bangladesh following its introduction from Thailand, owing to its rapid growth and the fact that it attains marketable size in 3-4 months (Gupta and Rab, 1994; *Islam et al.,* 1998), has a bright silvery appearance, and good taste. It has occupied a prime position in aquaculture scenario of Bangladesh within a short time after introduction. Besides polyculture, it is also used in monoculture systems in Bangladesh. It was observed that an addition of 2,500 fingerling/ha of silver barb in polyculture has increased the growth of common carp and overall fish production (Haque *et al.,* 1998). Azim *et al.* (1998) reported that duckweed can be used as an effective supplementary feed in the polyculture of silver barb stocked at the rate of 5,000 fingerlings/ha in four species polyculture system. Wahab *et al.* (2001) reported that addition of duckweed and supplementary feed (rice bran and oil cake) may compensate any inter-specific and intra-specific dietary competition with the stocking of Thai silver barb at the rate of 6000 fingerling /ha in the polyculture system. Similar works have been conducted on production of Thai sarpunti in earthen pond in Bangladesh (Kohinoor *et al.,* 1993; Hossain *et al.,* 1998).

Silver barb is a herbivorous species and feeds mainly on aquatic plants, soft grasses and plankton (Phaohorm, 1980; Haroon and Pittman, 1997). Silver barb has been screened as candidate species for rice-cum-fish culture, and a considerable amount of work on their food and feeding habits, and growth performance in rice fields has been reported (Miah *et al.,* 1994; Haroon and Pittman 1997; Vormant *et al.,* 2001). It was found that silver barb ingested more crustaceans during the first sampling day than in the last sampling day (Azim *et al.,* 2004). Mohanta *et al.* (2007) reported that dietary protein can be reduced from 300 to 350 g/kg to 200 and 250 g/kg diet by increasing carbohydrate from 260 to 340 g/kg diet without sacrificing the growth that was undertaken to examine the protein-sparing effect of carbohydrate in the diets for silver barb fry.

Many commercial fish feeds viz. Saudi-Bangla nursery feed (Saudi-Bangla Fish Feed Bangladesh Ltd.), Quality nursery feed (Quality Fish Feed Bangladesh Ltd.) and Aftab nursery feed (Aftab Feed Bangladesh Ltd.) are commonly used for mass production of *B. gonionotus* seeds. Among these, Saudi-Bangla nursery feed for carps and catfishes has become popular because of its high protein content (30%) and also fish can take it easily due to its high compactness. The production of good quality seed depends on adequate supply of nutritional requirements as well as on the range of their tolerance to the different environmental factors. The effect of various parameters such as appropriate feed, feeding rate, feeding frequency etc. are to be properly understood and managed accordingly for increasing growth and survival of the fry. Fish farmers of the country are using high protein content artificial feed for the nursery rearing of this species in their nursery ponds which is not cost effective. So, suitable feed for nursery rearing needs to be identified and finally ensured. In view of the above, an experiment was conducted to develop suitable nursery rearing technique of this species by observing the effects of different feeds on the growth and survival of *B. gonionotus* larvae.

Materials and Methods

The experiment was conducted in nine rectangular glass aquaria (45×25×24 cm) each containing 17 L of deep tube-well water in the Wet Laboratory of Bangladesh Agricultural University, Mymensingh for a period of 28 days from 22 April to 13 May, 2007. The experiment was designed with 3 treatments (T_1, T_2 and T_3) having 3 replications (R_1, R_2 and R_3) each. Three days old larvae (average length 5.0±0.15mm and weight 7.0±0.05mg) of *B. gonionotus* collected from Brahmaputra Fish Seed Complex, Shombhuganj, Mymensingh were stocked in each aquarium at a stocking density of 4.1 larvae/L of water i.e. 70 larvae per aquarium and was reared for 28 days. Half of the water of each aquarium was exchanged by fresh deep tube-well water once a day to avoid water quality deterioration due to food wastage. The faecal out-put and wastage of feed were removed from the aquarium by siphoning. Aeration was provided to each aquarium for 22 h everyday from air blowers and was stopped for one hour each time during feed supply. The ingredients used for the formulation of three different feeds for T_1, T_2 and T_3 are shown in Table 1. Proximate composition of rice bran and Saudi-Bangla nursery feed as analyzed is presented in Table 2. Only plankton at the rate of approximately 5000 cells/L of water was provided in T_1. In addition to plankton, rice bran and Saudi-Bangla nursey feed at the rate of 3% of body weight of stocked larvae were also provided for T_2 and T_3, respectively. The daily ration was given twice a day (0900 and 1600 h). For plankton study, five liters of water samples were collected every week from each aquarium and then passed through plankton net of 55 blotting silk of 100 µm mesh size. The collected samples were concentrated to a volume of 40 ml and preserved in plastic vials with 5% formalin for further analysis. From the concentrated volume of plankton samples, 1 ml was taken by a dropper and then put on the Sedwich-Rafter counting cell. The counting chamber was covered with a cover slip so as to eliminate the air bubbles. Then Sedwich-Rafter counting cell was placed under a compound microscope (Clesceri *et al.,* 1989). Calculation of the abundance of plankton was done using the following formula (Stirling, 1985):

$$N = (A \times 100 \times C) / (V \times F \times L)$$

Where,
N= No. of plankton cells or units per liter of original water
A= Total no. of plankton counted
C=Volume of concentrate of the sample in ml
V=Volume of field in cubic mm
F=Number of fields counted
L=Volume of original water in liter

Table 1. The ingredients used for the formulation of three different experimental diets for *B. gonionotus* larval rearing

Ingredient	T_1	T_2	T_3
1. Plankton **Phytoplankton** • Bacilariophyceae • Chlorophyceae • Rhodophyceae • Cyanophycea • Euglenophyceae **Zooplankton** • Copepoda • Rotifera • Cladoceran • Arthropoda	Present	Present	Present
2. Rice bran	Absent	Present	Absent
3. Saudi-Bangla nursery feed	Absent	Absent	Present

Table 2. Proximate composition (%) of rice bran and Saudi-Bangla nursery feed used for *B. gonionotus* larval rearing

Supplemental feed	Parameters					
	Dry matter	Crude protein	Ether extract	Crude fibre	NFE[1]	Ash
Rice bran	83.38	14.14	18.15	9.44	49.49	8.33
Saudi-Bangla nursery feed	89.96	30.20	11.60	9.60	25.90	22.68

[1]Nitrogen free extract (NFE) was calculated as 100-% (moisture+ crude protein+ crude fiber)

The plankton was identified with the aid of standard keys (Prescott, 1962; Needham and Needham, 1962; Bellinger, 1992). Proximate composition of the feed ingredient i.e. estimation of protein, lipid, ether extract, crude fiber, NFE and ash were done by following the standard method (AOAC, 1980) (Table 2). The proximate composition of plankton used in T_1, T_2 and T_3 were not analyzed. The fish were sampled at weekly interval to determine the increase in length and weight. Sampling was done in the early morning when the fish stomach was almost empty to avoid the biasness of weight due to the presence of excessive feed. Ten (10) fish were randomly collected from each aquariam. The weight (mg) was taken by an analytical balance (College B204S, Switzerland) and the length (mm) by placing the larvae on a petri dish on a 1 mm graph paper. The specific growth rate was calculated as the percentage of increase of body weight per day over given time interval by the following equation (Ricker, 1997):

Specific growth rate (SGR) = $(LnW_2\text{-}LnW_1)/ (T_2\text{-}T_1) \times 100$
Where,
W_2= final live body weight (g) at time T_2
W_1= final live body weight (g) at time T_1

The experiment was terminated on the 28th day and the fry were harvested from the aquarium and their final length and weight were measured. The survival rate was estimated as follows:

Survival rate (SR %) = (No. of fish harvested×100)/ Initial no. of fish

The physico-chemical parameters such as water temperature, dissolved oxygen (DO), free carbon di-oxide (CO_2), total alkalinity (carbonate and bi-carbonate), pH and ammonia-nitrogen were measured with the help of Aqua Mate Water Testing Kit (Model WAKQ-1A).

The variation in length gain (mm), weight gain (g), specific growth rate (SGR) and survival rate of the larvae under different treatments were tested using one way analysis of variance (ANOVA). Significant results (P<0.05) were further tested using DMRT to identify significant differences among means. The statistical analysis was performed with the aid of the computer software MSTATC program.

Results and Discussion

The highest gain in length at harvest (28.06±0.38 mm) and in weight (135.00±3.05 mg) was observed in T_3 and followed by T_2 and T_1. The growth of fish as obtained from T_2 and T_3 was significantly ($P<0.05$) different from T_1, though there were no significant variation in growth between T_2 and T_3 (Table 4). This was probably due to variation in the quality of feed administered to different treatments.

Table 3. Average water quality parameters of ponds belonging to different treatments during the study period

Treatment	Temperature (^{0}C)	P^H	Dissolve oxygen (DO) (mg/L)	Total alkalinity (mg/L)	Ammonia- nitrogen (mg/L)
T_1	27.5	8.9	5.70	68	0.27
T_2	26.8	8.5	5.75	75	0.25
T_3	27.0	8.8	5.80	80	0.34

Table 4. Growth parameters and survival of Thai sarpunti, *P. gonionotus* larvae after 28 days of rearing

Treatment	Initial size		Size at harvest		SGR (% day)	Survival rate (%)
	length(mm)	Weight(mg)	Length (mm)	Weight (mg)		
T_1	5.0±0.15	7.0±0.05	23.16±0.37^a	88.66±1.85^a	17.28±0.07^a	92.36±1.25^a
T_2	5.0±0.15	7.0±0.05	27.26±0.49^b	126.66±7.26^b	18.55±0.20^b	90.13±0.69^a
T_3	5.0±0.15	7.0±0.05	28.06±0.38^b	135.00±3.05^b	18.79±0.80^b	90.60±0.58^a

(Average ± SE); values of the parameter in each column with different subscripts (a, b) differ significantly (P<0.05).

Guerrero (1976) reported that weight of fish stocked at 10,000/ha with supplemental feeding of rice bran was significantly greater than that of control. Yakupitiage *et al.* (1991) also reported that rice bran (crude protein 13.3%) fed at 1% body weight per day significantly improved the fish growth in duck-fish integrated system. Santiago *et al.* (1989) also reported that a combination of natural and artificial feed increased the growth rates in milk fish. Kohinoor *et al.* (1993) reported that feeding with rice bran gave significantly better production of *B. gonionotus* (2384 kg/ha/ 6 months) than that with only fertilization (2128 kg/ha/6 months) treatments.

The highest SGR (18.79±0.08) was also observed in T_3 and followed by T_2 and T_1 (18.55±0.20 and 17.28±0.07, respectively). The SGR values of T_3 and T_2 were found to differ significantly from that of T_1 but there was no significant variation in SGR in values of T_1 and T_3. As *B. gonionotus* is a plankton feeder, the regular supply of plankton contributed to the growth and nutrition in all the three treatments, simultaneously regular supply of supplementary feed in T_3 and T_2 was probably responsible for the additional growth in those treatments. Wee and Ngamsnal (1978) obtained much lower SGR values (1.27-1.85) in *P. gonionotus* fed with varying dietary protein levels (15-55) under laboratory condition. The values obtained in the present study were much higher than that reported by the above authors. This may be due to supply of live feed with supplementary feed in the present experiment.

In case of physicochemical parameter no marked difference were observed during the experimental period. The ranges of water quality parameters as recorded from the aquaria belonging to different treatments during the study period were: temperature 27-27.5°C, pH 8.5-8.9, DO 5.7-5.8 mg/L and total alkalinity 68-80 ppm (mg/L) and the ammonia-nitrogen from 0.25-0.34 ppm (Table 3). No free CO_2 were detected in any aquarium during the experimental period. According to Jhingran (1983) the values of all these parameters were found to be within suitable range for fish farming. Rahman *et al.* (1982) recorded, 26-32.2°C water temperature, DO values of 0.48-8.60 mg/L, total alkalinity 22-90 mg/L for the experimental ponds. Lakshmanan *et al.* (1971) made a fortnightly observation on water quality parameters in polycutlure of Indian major carps for one year and recorded pH value of 6.0-9.3 and total alkalinity of 19.4-78.2 mg/L. These values are similar to those as obtained in the present study.

The highest survival rate was observed in T_1 (92%) followed by T_2 and T_3 (90% and 90%, respectively) but there were no significant variation (P>0.05) in survival rate of *B. gonionotus* among the treatments. Continuous aeration and regular siphoning off of excess feed and fish excreta and water exchange etc. minimized deterioration of water qualities probably resulted in survival rate (90-92%). Hossain *et al.* (1998) found 84% survival rate in earthen pond. Yakapitiyage *et al.* (1991) reported that survival rate of Thai sarpunti was (47-92%) with supplementary feeding of fish in duck-fish integrated system. Generally it is accepted that growth of the fish has an inverse relationship with the stocking density as a result of the space-limiting effects that operate on the population (Johnson, 1965; Rahman *et al.*, 2002) reported high survival rate of *O. pabda* at a density of 4 larvae/L).

Supplemental feeding is the single largest recurring cost in intensive and semi-intensive fish culture system. It forms approximately half of the total fish farming cost (Segal and Toor, 1991). It is, there fore, important to the low income farmers to utilize their investments in feed as minimum as possible.

The results of the present study clearly demonstrated that the use of low cost supplemental feed has significant role in promoting the growth of *B. gonionotus* larvae. So, it may be concluded that the use of low cost supplemental feed (rice bran only) with regular fertilization is the most cost effective method for the rearing of *B. gonionotus* larvae in farmer's nursery ponds in Bangladesh.

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