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EFFECTS OF ORGANIC FERTILIZER AND SUPPLEMENTARY FEEDS ON GROWTH PERFORMANCE OF SILVER CARP (*HYPOPHTHALMICHTHYS MOLITRIX*) AND BATA (*CIRRHINUS REBA*) FRY IN NURSERY PONDS

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ABSTRACT

Experiment was conducted to evaluate the effects of an organic fertilizer and supplementary feeds on the growth performance of silver carp*(Hypophthalmichthysmolitrix)* and bata (*Cirrhinusreba)* fry for a period of 90 days.It was carried out under 3 (three)treatmentswere consisted of mustard oil cake (T_1), cow dung (T_2) and rice bran + mustard oil cake (T_3) with each three replications. The fries were initially fed at the rate of 30% of body weight and it was reduced to 15% gradually. The rate of cow dung application was 988 kg/ha. During the experimental period, the water parameters werein suitable range.The average weight gain of silver carp and bata in T_3 (4.69±0.17 g and 2.05±0.08 g) was significantly ($p<0.05$) higher than those of T_1 (3.00±0.16g and 1.81±0.02 g) and T_2 (2.32±0.09 g and 1.19±0.13 g). The survival rate was found significant 59.12, 55.05 and 63.33 % for Silver carp and 52.15, 51.10 and 55.18 % for bata in T_1, T_2 and T_3respectively. The SGR of silver carp and bata in T_3 (2.55±0.43%bwd^{-1} and 2.29±0.08%bwd^{-1}) was significantly ($p<0.05$) higher than those of T_1 (2.32±0.46%bwd^{-1} and 1.95±0.47 %bwd^{-1}) and T_2 (1.91±0.40 %bwd^{-1} and 1.72±0.28 %bwd^{-1}). Among the treatments, significantly highest production of Silver carp and Bata(2276.01±85.95 and1855.38±35.95 kg/ha)was achieved from T_3 followed by T_1 (2116±6.72 and 1745.98±12.31 kg/ha) and T_2 (2058.48±26.68 and 1432.82±16.82 kg/ha).

KEYWORDS: Fertilizer, Supplementary Feeds, Silver Carp, Bata, Fry, Nursery Ponds

INTRODUCTION

Aquaculture in Bangladesh is mainly major carp and exotic carppolycultureoriented. Indian major carps; rohu (*Labeorohita*), catla (*Catlacatla*) and mrigal (*Cirrhinusmrigala*), Bata (*cirrhinusreba*)and exotic carp; Silver carp (*Hypophthalmichthysmolitrix*), big head carp (*Arichthysnobilis*), Grasscarp (*CtenopharyngodonIdella*) and*Cyprinuscarpio* are the widely used species in polyculturesystem. Timely and sufficient supply offry/fingerlings is one of the most important requirement for the development of aquaculture. Fingerling rearing in nurseries is an important and crucial step in fish culture. The adverse conditions and improper management may often lead to severe consequences resulting in mortality of fry to an extent of 90-98%(Alikhuni*et al.*1964). Growth, survival and production of fry and fingerlings in nursery ponds depend on stocking density, type and quality of fertilizers and supplementary feeds. Fertilization andsupplementary feeds management in nursery pond play major role in growth and survival of fry/fingerlings for optimizing production. Fish production can be increased up to 5,000 kg/ha by feeding and fertilization (Ekram, 2002).Pond fertilization is done to augment the production of plankton which serves as natural food of the fishes; because fertilization stimulates both the autotrophic and heterotrophic levels which increase fish production (Grag and Bhatnagar, 2000).In the nursing of fingerling operation feed is the major input and represents up to 60% of the total expenditure (De Silva,

1992).So appropriate technology should be developed to reduce rearing cost.Use of locally available low cost feed and organic fertilizer(eg. cow dung) to enhance plankton productionand proper species composition may be an effective tool in this regards.The presence of Silver carp increased the production of Bata possibly through provision of micro-pelleted faecal feed to bottom feeders (Roy *et al.* (2003).

Silver carp, *Hypophthalmichthysmoltrix* (valenciennes), an exotic and widely cultured species in Bangladesh, is a filter-feeding omnivores. The fishhas been widely introduced throughout theworld for aquaculture and it is contributing22% (>3 million tons) of world carpaquaculture production (FAO,2005).Silver carp widely used for biological control of plankton in aquaculture ponds, ;lakes ;reservoirs and swage lagoons .

Cirrhinusreba is an important food fish , which is distributed over Indian sub-continent(Jhingran,1991; Rahman,2005).It is locally known as reba carp,bhagnabata, raik or tatkini and considered as one of the most important indigenous minor carp species in Bangladesh. The fish is highly popular to the consumers due to its oily flesh and taste qualities. Reba carp is a water column feeder and omnivore in nature and grows to a maximum size of 40 to 50 cm in length(Rahman, 2005; Felts et al 1998).During the last 14 years, the population of Bata has declined considerably due to increased fishing pressure, and various anthropogenic activities leading to siltation, aquatic pollution, and loss of natural habitat for spawning and growth (Akhteruzzaman et al., 1998; Hussain and Mazid, 2001). These factors not only destroyed the breeding grounds but also caused havoc to the availability of brood fish including fry and fingerlings (Hussain and Mazid, 2001). As a result, recently the fish is considered as one of the most endangered species in Bangladesh (IUCN, 1998). To maintain this fish population as well as its conservation and rehabilitation, development of a suitable technology for breeding, and rearing of fry and fingerlings in nursery ponds is urgently needed.

A little work has been undertaken to evaluate effects ofan organic fertilizer and supplementary feeding on growthperformance survival and production of Silver carp and bata fry. Therefore the present study was conducted with a view to serve the growth performance, Survival rate and Specific growth rate of *Hypophthalmichthysmolitrix* and *Cirrhinusreba* in nursery ponds.

MATERIALS AND METHODS

Study Area and Experimental Design

The research was carried out for 60 days from 12th August to 11th October, 2012 in nine experimental ponds,Department of Fisheries, University of Rajshahi, Bangladesh. The ponds were rectangular in shape and the surface area of each pond was 0.0024 hector with an average depth of 1 meter. The ponds were well-exposed to sunlight and sandy loam bottom soil types and dependable on rainfall and deep tube well water. The present experiment was conducted with three treatments viz. T_1 (Mustard oil cake), T_2 (organic fertilizer: Cow dung) and T_3 (Mustard oil cake + Rice bran) each with three replications.

Pond Preparation, Stocking and Fertilization

Before starting the experiment the ponds were dried and freed fromaquatic vegetation. After drying liming (CaO) was done in all the ponds at rate 1 kg/decimal. Ponds were then filled with ground water at a depth of about 1 meter. In treatment T2 only cow dung was applied (988 kg/ha) as basal dose.After five days, aquatic insects and predatory zooplankton were eradicated by applying sumithion (100ml/deci). After seven days, Fry ofsilver and Bata were stocked early in the morning in all the ponds at the density of 123500 Silver carp and 123500 Bata per hector. All the fry were collected from private nursery operator in Rajshahi district.

Only treatment T_2fertilizedwithcow dung (988 kg/ha) which was done weekly.In treatment T_1 the stocked were fed only with rice branand in treatment T3 stocked were fed with rice bran and mustard oil cake twice daily (morning 7-8 am and afternoon, 4-5 pm). The fish were initially fed at a rate of 30% of their body weight for the first fortnight and 20% of their body weight for the second and third fortnight and gradually reduced to 15% of their body weight for the last fortnight. To estimate the growth of fish, 10% fries from each treatment were sampled fortnightly to monitor the fish growth and to adjust feeding rates.

Study of Water Quality Parameters

Different physico-chemical parameters of pond water were recorded fortnightly throughout the experimental period between 10 A.M. and 12 A.M. Physical parameters such as; water temperature (°C), transparency (cm) were measured at the pond site on every sampling day.Water transparency of the experimental ponds was measured by a Secchi-disk in cm. Water temperature was recorded with a Celsius thermometer at 15-20 cm depth. The dissolved oxygen concentration of water was determined by the aid of a water quality test kit (HACH kit model FF-2, made in USA).pH of water was measured by using HACH kit (model FF-2, cat. No. 2430-01, made in USA) and nd total alkalinity of water sample was determined by titrimetric method using methyl orange indicator. Ammonia-Nitrogen was measured by using a HACH kit (model FF-2, cat. No. 2430-01, made in USA). Rochelle salt solution and Nessler reagent were used to measure the NH3-N. A colour comparator (value ranging from 0 to 3.0 mg/I) also used for the same.

Harvesting of Fish

At the end of the experiment the water of the ponds were pumped out and all the fishes were harvested. Then the final growth gained by the fishes was recorded by measuring the length (cm) and weight (g) of the harvested fishes by using a measuring scale and a balance respectively.

Estimation of Survival Rate, Growth and Production of Fish

The following parameters were used to evaluate the growth performance of fry under different treatments.

Length Gain

Length Gain (cm) = Average final length – Average initial length

Weight Gain (g)

Weight gain was calculated by the following formula and it was expressed as g.

Weight gain (g) = Mean final weight (g) - Mean initial weight (g)

Specific Growth Rate (% per Day)

The specific growth rate was calculated by using the following equation-

$$\text{SGR (\% bwd}^{-1}) = \frac{\text{In final weight-In initial weight}}{\text{Culture period in days}} \times 100 \qquad \text{(Brown, 1957)}$$

Survival Rate (%)

At the end of the experiment, the fishes were harvested and the survival rate was calculated by using the following equation-

$$\text{Survival rate (\%)} = \frac{\text{Number of fish harvested}}{\text{Number of fish stocked}} \times 100$$

Production (kg/ha/60Days)

Yields were calculated by deducting biomass at stock for biomass at harvest and it was expressed by kg/ha/60 days.

Statistical Analysis

Data of water quality, growth, survival rates (%) and fish production were subjected to using one-way analysis of variance (ANOVA) and tested Duncan's New Multiple Range Test (DMRT, 1955) to identify significant differences among the mean values at 0.05% level. This statistical analysis was performed with the support of the computer software SPSS (Statistical package for social sciences, version 16) program (Jar, 1984).

RESULTS

Water Quality Assessment

The mean values of physicochemical parameters over 60 days nursing of silver and bata fry are presented in Table 1. The mean water temperatures, Dissolved Oxygen (DO) level , pH,Total alkalinity (mg/L) and Ammonia nitrogen in T_1, T_2 and T_3 did not significantly differ ($p<0.05$). Mean levels were significantly different ($p>0.05$), increasing from T_1 to T_3. The mean secchi disc transparency was significantly higher ($p<0.05$) in T_2 followed by T_1 and T_3.

Table1: Mean (±SD) Values of Water Quality Parameters under Different Treatments during the Study Period

Parameters	Treatments		
	T_1	T_2	T_3
Temperature (°C)	30.4±0.11a	30.27±0.29a	30.43±0.09a
Transparency (cm)	32.65±1.92 b	39.47±2.64a	33.33±3.79b
DO (mg/l)	4.83±0.18 a	4.79±0.29a	4.89±0.175a
pH	7.7±0.04a	7.64±0.07a	7.67±0.16a
Total alkalinity (mg/l)	110±5.05a	115.5±9.1a	117±7.17a
NH_3-N (mg/l)	0.12±0.01a	0.14±0.03a	0.13±0.03a

Figures in A Row Bearing Common Letter(S) Do Not Differ Significantly ($P<0.05$)

Table 2: Growth Performance, Survival Rate and Production (Mean ±SD) of Two Carp Fries after 60 Days of Rearing in Nursery Ponds

Species	Parameters	Treatments		
		T_1	T_2	T_3
Silver Carp	Mean Initial length (cm)	1.62±0.13a	1.62±0.13a	1.62±0.13a
	Mean Final length (cm)	7.26±0.21b	6.66±0.16c	8.46±0.38a
	Mean Length gain (cm)	5.64±0.09b	5.44±0.93b	6.84±0.26a
	Mean Initial weight (g)	0.098±0.02a	0.098±0.02a	0.098±0.02a
	Mean Final weight (g)	3.02±0.17b	2.42±0.10c	4.79±0.19a
	Mean Weight gain (g)	3.00±0.16b	2.32±0.09c	4.69±0.17a
	Specific growth rate (SGR % bwd^{-1})	2.32±0.46a	1.91±0.40b	2.55±0.43a
	Survival rate (%)	59.12±1.18b	55.05±0.98c	63.11±2.00a
	Production (kg/ha./60days)	2116.74±6.72b	2058.48±26.68c	2276.01±85.95a
Bata	Mean Initial length (cm)	1.48±0.13a	1.48±0.13a	1.48±0.13a
	Mean Final length (cm)	5.17±0.19b	4.55±0.11c	6.03±0.29a
	Mean Length gain (cm)	3.69±0.07b	3.07±0.04c	4.55±0.16a
	Mean Initial weight (g)	0.09±0.03a	0.09±0.03a	0.09±0.03a
	Mean Final weight (g)	1.87±0.09b	1.28±0.14c	2.14±0.11a

Table 2: Contd.,

Mean Weight gain (g)	1.81±0.02b	1.19±0.13c	2.05±0.08a
Specific growth rate (SGR % bwd^{-1})	1.95±0.47a	1.72±0.28b	2.29±0.51a
Survival rate (%)	52.15±0.97b	51.10±1.06b	55.18±0.76a
Total Production(kg/ha./60days)	1931.36±9.51b	1745.65±21.68c	2065.69±60.95a

Figures in a Row Bearing Common Letter Do Not Differ Significantly (P<0.05)

Growth, survival and production parameters of silver and bata fingerlings are shown in Table 2. The fingerlings in T_3treatment showed the highest gain in both length (6.84±0.26cm and 4.55±0.16 cm) and weight (4.69±0.17 and 2.05±0.08 g) compared to the T_1 and T_2 treatments. However, the mean final length and weight of fingerlings in different treatments were significantly different (P<0.05). SGR in T_3 was significantly higher (P<0.05) than in $T_1$and T_2. The highest survival rate of silver and batawas also observed in T_3 and the lowest in T_2. There was a significant variation (P<0.05) in the survival rate of silver carp and bata fingerlings among different treatments. Production was higher in treatment T_3 and lowest in treatment T_2. However, production of fingerlings differ significantly (Pb0.05) among the three treatments (Table 2).

DISCUSSIONS

All water quality parameters tested throughout the experimental period revealed that all parameters were within the permissible levels for optimum fish growth. The mean values of water quality parameters in ponds for the complete rearing period were varied as follows: temperature 30.27±0.29 to30.43±0.09°C; Transparency(Secchi-disk reading) 32.65±1.92 to 34.47±2.64 cm;pH 7.64 ±0.07 to 7.7±0.04;dissolved oxygen (DO) 4.79±0.29 to 4.89±0.17 mg/L, alkalinity 110±5.05 to 117±7.17 mg /Land NH3-N 0.12±0.01 to 0.14±0.03 mg / L .All these values were not different significantly among the treatments and were within the permissible limits in pond water for fish culture as reported by Boyd (1982).Chakraborty (2009) stated that 3.1-5.62 ppm of dissolved oxygen of a water body is good for productivity; water bodies having dissolved oxygen below 5.0 ppm are unproductive. Wahab*et al.* (1995), Kadir*et al.* (2007) and Milstein *et al.*, (2009) recorded NH_3-N of 0.09 to 0.99 mg/l, 0.11 to 0.52 mg/land 0.6 to 0.29 mg/l, respectively. The concentrations of ammonia-nitrogen of the present study were within acceptable limits.

Growth in terms of length, weight, weight gain and SGR of fingerlings of silver and bata was significantly higher in T_3 where Mustard oil cake and rice bran was supplied as feed than those of T_1 (fed mustard oil cake only) andT_2(applied cow dung only). The low growth rate of fry in treatment $T_1$and T_2 appeared to be related to the use of mustard oil cake in the rearing system that might have produced a stressful situation and toxic substance which could be the probable cause for poor growth in treatment T_1 (Haque et al., 1993) and planton along is not enough for the proper growth of silver and specially for bata in treatment T_2. Rahman *et al.*, (2009) reported that final length (cm) of Reba carp ranges from 4.80 to 6.80 cm and weight gain 0.99 to 2.54g in a 56 days experimental period.

In the present study, the specific growth rates of silver carp (SGR%bwd^{-1}) was found 2.32±0.46, 1.91±0.40 and 2.55±0.43 % per day in T_1, T_2 and T_3 respectively. And the specific growth rates of Bata (SGR% bw/day), 1.95±0.47, 1.72±0.28 and 2.29±0.51 % per day was found in T_1, T_2 and T_3 respectively. Hossain and Islam (2006), reported the SGR (bwd^{-1}) of silver carp ranged from 2.44 to 2.59% which is similar to to the present study.Toyub, M.A. *et al.*, (2010) reported that the specific growth rate (SGR%/day) of *H. molitrix*was determined 0.21 to 2.84 fed on fishmeal and mustered oil cake

The survival rate of silver carp was found 59.36 ±3.61, 55.10±2.52 and 63.33 ±3.06 in treatments T_1, T_2 and T_3 respectively. And the survival rate of bata was found 52.35 ±2.00, 51.15±5.13 and 55.04 ±4.04 in treatments T_1, T_2 and T_3 respectively. Toyub*et al.,* (2010), reported the survival rate of silver *H. molitrix* was 25.00 to 77.80%.

Among three treatments, the production of silver carp was 2116.74±6.72 kg/ha (T_1), 2058.48±26.6 kg/ha (T_2), 2276.01±85.95 kg/ha (T_3) and Bata 1745.98±12.31 kg/ha (T_1), 1432.82±16.68 kg/ha (T_2), 1855.38±35.95 kg/ha (T_3) respectively. The highest production was observed in T_3.Green (1992) and Diana et al (1994) added that supplemental feeding in fertilized ponds resulted in significantly higher growth rates and greater yields than fertilization alone .The highest production was observed in T_3. Lakshmanan*et al.* (1971) presented that the fish fed a mixture of mustard oilcake and rice bran. Fish production were in the range of 2230 to 4209 kg/ha/yr. Fry production from Hossain *et al.,* (1997) obtained a yield of 3.64-9.91 kg/deci with 80 days from 3 seasonal nursery ponds with supplemented feeding. Boyd (1990) suggested that feeding of carp with mixture of oilcake and rice bran 1:1 give better production. Rahman *et al.,* (2009) in a experiment fed bata fry wheat flour for the first 7 days, finely ground mustard oil cake for the next 7 days and a mixture of rice bran and mustard oil cake (1: 1) for 15 to 56 days. Feeding was at the rate of 15 kg/million hatching day^{-1} for the first two weeks, 20 kg for the second two weeks, 25 kg for the third two weeks and 30 kg for the forth two weeks. The end of experiment net production of Bata ranges from 1099.17±34 to 1568±13.93 kg/ha/56 days and from the study, it is clear that the growth of silver carp and batafry is faster by using supplementary feed (Rice bran+ Mustard oil cake) in T_3.

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