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Effects of feed on survival and growth of local sarpunti (*Puntius sarana,* HAMILTON) fry in glass aquaria

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Abstract

A study was conducted to study the effects of feed on survival and growth of local sarpunti (*Puntius sarana*) fry in nine glass aquaria (45 × 25 × 24 cm) for a period of 35 days in the Wet Laboratory of Fisheries Faculty, Bangladesh Agricultural University, Mymensingh. Each glass aquarium contained 10L of tap water and the stocking rate was $6L^{-1}$ of water. Three feeding treatments such as live feed (Plankton, 8,700/L), SABINCO feed containing 25% protein and formulated feed containing 30% protein were used for T_1, T_2 and T_3, respectively. Each treatment had three replications. The growth performances in terms of length gain, weight gain and SGR (%/day) were 19.1±0.1 mm, 81.5±2.9 mg and 9.9±3.1 respectively in case of T_1 and it was followed by T_3 (10.9±0.1, 13.5±1.1 and 5.3±1.7, respectively) and T_2 (7.8±0.4, 10.2±0.8 and 4.6±1.7, respectively). The highest survival rate was also found in T_1 (77%) while the lowest in T_2 (56.1%). T_1 showed significantly ($p<0.05$) higher health condition (3.4±1.3) followed by T_3 and T_2 (1.3±0.1 and 1.2±2.1, respectively) but T_2 and T_3 did not differ significantly ($p<0.05$) from each other.

Keywords: Effects of feed, survival and growth, *Puntius sarana*

Introduction

Puntius sarana (Hamilton) locally called "deshi sarpunti or local sarpunti or saral punti or puda or punti" is an indigenous and medium size food fish in Bangladesh. It is a very tasty, most popular and favorite table fish among barb species as a result it has a high market value in Bangladesh. Basu and Gupta (1939) reported that its flesh contained 17.5% crude protein, 2.0% fat and 74% water. This freshwater barb (Olive barb) was abundantly available in haors, baors, beels, rivers and natural depression of Bangladesh in two decades back (Gupta, 1980). Now this fish is considered to be a critically endangered species (IUCN-2000). The species is omnivorous in nature and feeds on aquatic insects, fish, algae and shrimps (Talwar and Jhingran, 1991). *P. sarana* bears exceptional criteria for its suitability in aquaculture like high market price and famous as a food fish. In addition *P. sarana* has many other unique features including its ability to respond positively to grow well in seasonal ponds. In addition, its larval rearing is possible using the locally available feed such as rice bran, zooplankton, tubificid worms, that indicate its suitability for aquaculture. In spite of all these advantages, very little attempt has been made in Bangladesh for its revival as well as for inclusion in commercial aquaculture.

Development of artificial breeding techniques and larval rearing methods are the major tools for ensuring the supply of fingerlings to fish farmers for pond culture. There are numerous seasonal ponds in Bangladesh that are not been properly utilized for fish culture for various reasons. These seasonal ponds are very productive and valuable assets for the farmers but they do not have the technology to utilize the seasonal ponds for culture of fish to improve their social, economical and the nutritional status (Mirza *et al.,* 1997). Small fish can profitability be cultured in shallow water bodies with low cost diets, where large carps do not survive (Felts *et al.,* 1996) and they also stated that small fish provide food and nutrition, subsistence and supplemental income to the great majority of people of this country. These

small finfish along with some of the small prawn are the only source of animal protein for the rural landless and the poor people. Small fish particularly *P. sarana* can be successfully cultured in seasonal ponds (Akhteruzzaman *et al.*, 1991). Chakraborty *et al.* (2003) and Parvez and Khan (2005) reported on successful larval rearing techniques of *P. sarana* but most of the fry produced faced the problems of lower growth and survival, susceptibility to disease and deformities thus they can not meet the demand of farmers. In view of the above, the present experiment was undertaken to determine a suitable feed as well as a suitable rearing technique for *P. sarana* fry in laboratory condition.

Materials and Methods

The experiment was conducted in the Wet Laboratory of Bangladesh Agricultural University, Mymensingh-2202. Seven days old fry of *P. sarana* (5.0±00 mm and 2.5±00 mg in length and weight, respectively) were stocked in nine glass aquaria (45x25x24 cm each) containing 10L of deep tube-well water. The speed of the water supply was controlled with the help of porous pipe in each aquarium. The experiment was designed with 3 treatments having three replications of each. Sixty larvae were used in each aquarium at a stocking density of 6 fry/L of water and were reared for 35 days.

The diets for the rearing of *P. sarana* fry in laboratory condition was only live feed (plankton) for T_1, only SABINCO feed for T_2 and mixed feed for T_3 and were administered twice in a day (0900 and 1800 hrs). The ingredient of the feeds used for larval rearing is shown in Table 1.

Table 1. Ingredients of different feed used for rearing of *P. sarana* fry

	Treatments			
	T_1 (Plankton)		T_2 (SABINCO feed)	T_3 (Mixed feed)
Ingredients	Phytoplankton	Zooplankton	Fish meal (25%)	Fishmeal (30%)
	Bacillariophyceae	Rotifera	Rice bran (28.5%)	Rice bran (26%)
	Chlorophyceae	Cladocera	Wheat bran (28.5%)	Wheat bran (26%)
	Cyanophyceae	Copepoda	Mustard oil cake (15%)	Mustard oil cake(15%)
	Euglenophyceae	Cyclops	Binder (2%)	Binder (2%)
			Vit-premix (1%)	Vit-premix (1%)

The live food was always kept available for the larvae and the larvae were always fed up to their satiation level. Fifty percent water of each aquarium was exchanged with fresh deep tube-well water once in a day. The fecal output and waste of feed were removed from the aquarium by siphoning. Aeration was provided for 22 h everyday from three air blowers and was stopped for 2 h for feeding and cleaning the aquaria. During cleaning, dead fry from each aquarium, if any, were removed immediately and the number was recorded.

Proximate composition of the feed ingredient was done to estimate the amount of protein, lipid, crude fiber, ash, vitamin and minerals by standard methods (AOAC, 1980).

Ten (10) fishes were randomly collected from each aquarium at seven days interval. The weight (mg) was taken by an analytical balance (College B204S, Switzerland) and the length (mm) was measured by placing the fry in a Petri dish on a 1 mm graph paper. Sampling was done before application of feed to avoid the biasness of weight due to presence of excessive feed.

The following parameters were used to evaluate the growth of P. *sarana* fry under different treatments:

Length gain (mm) = Average final length – Average initial length
Weight gain (mg) = Average final weight – Average initial weight

$$\text{Specific growth rate (SGR)} = \frac{\text{Log}_e W_2 - \text{Log}_e W_1}{T_2 - T_1} \times 100$$

Where W_2 = Final live body weight (mg) at time T_2
W_1 = Initial live body weight (mg) at time T_1

After completion of the experiment at 35 days the number of total live fingerlings in each aquarium was counted separately for calculation of the survival rate.

Weight (mg) of the fry in different treatment was divided by total length (mm) to find out weight per millimeter, which indicates the health condition of the fry.

For the study of both phytoplankton and zooplankton in case of T_1, five litres of water samples were collected every week and then passed through plankton net of 55 blotting silk of 100μm mesh size. The collected samples were concentrated to 40 ml and preserved in labeled plastic vials with 5% formalin for further analysis. From the concentrated volume of plankton samples, 1ml 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 and left for a few minutes to allow the plankton to settle down. Then Sedwich-Rafter counting cell were placed under an electric microscope (magnification-10×10) and both phytoplankton and zooplankton were counted from 10 random fields (units) out of 1000 units. After necessary calculation, the total number of both phytoplankton and zooplankton were expressed as number per litre. The qualitative analysis of both phytoplankton and zooplankton was done according to Prescott (1964).

Temperature, dissolved oxygen (DO) and pH of water of each aquarium under each treatment were recorded on sampling dates. Temperature was recorded by using a Celsius thermometer, DO was measured by a digital DO meter (Multi 340i/set, Germany) and pH was measured by a portable digital pH meter (MICRO-TEMP, pH 500).

The data obtained in the study were analyzed by one way-analysis of variance (ANOVA), followed by Duncan's Multiple Range Test at a significance level of $P<0.05$. These statistical analyses were performed with the aid of the computer software MSTATC program.

Results and Discussion

The growth parameters i.e., length gain, weight gain, specific growth rate (%/day) are presented in Table 2. The weekly growth in terms of weight and length are shown in Fig. 1 and 2. The length gain, weight gain and specific growth rate were found to be the highest in T_1 followed by T_3 and T_2. Significantly ($p<0.05$) higher survival rate, length gain, weight gain and SGR in T_1 (where, only plankton feed were used) than T_2 (SABINCO feed) and T_3 (formulated feed) in the present study was probably due to the fact plankton feed was

qualitatively better than SABINCO feed (T_2) and formulated feed (T_3) and was well accepted by the stocked fry since the present experiment was performed in the laboratory where the environmental parameters were extremely controlled. In case of specific growth rate (%/day), T_1 was also significantly ($p<0.05$) different from T_2 and T_3 but there was no significant difference between T_2 and T_3. Wee and Ngamsnal (1987) obtained much lower SGR (%/day) values (1.27-1.85%) in *P. gonionotus* fed with varying dietary protein levels (15-55%) under laboratory condition. The SGR values as obtained in the present study were much higher than those of Wee and Ngamsnal (1987). This might be due to implementation of the experiment in different environment and use of live feed.

Table 2. Growth performance of local sarpunti (*P. sarana*) fry in laboratory condition

Treatments	Initial length (mm)	Length gain (mm)	Length gain (%)	Weight gain (mg)	Weight gain (%)	Specific growth rate (%/day)	Survival rate (%)	Health condition (mg/mm)
T_1	5.0±0.0	19.1±0.1^a	1910±0.3^a	81.5±2.9^a	8150±8.7^a	9.9±3.1^a	77.6±1.4^a	3.4±1.3^a
T_2	5.0±0.0	7.8±0.4^b	780±1.2^b	10.2±0.8^b	1020±2.4^b	4.6±1.7^b	56.1±2.4^b	1.2±2.1^b
T_3	5.0±0.0	10.9±0.1^b	1090±0.3^b	13.5±1.1^b	1350±3.3^b	5.3±1.2^b	61.3±1.9^b	1.3±0.1^b

(M±SE); Values of the parameter in each column with different superscripts (a, b and c) differs significantly ($p<0.05$)

The survival rates of *P. sarana* fry in three different treatments were 77.7, 56.1 and 61.3% in T_1, T_2 and T_3, respectively after 35 days of experimental period (Table 2). A significantly ($p<0.05$) higher survival rate was observed in T_1 compared to the other two treatments (T_2 and T_3). Health condition of *P. sarana* fry in T_1, T_2 and T_3 were 3.4 mg/mm, 1.2 mg/mm and 1.3 mg/mm, respectively. A significantly ($p<0.05$) better health condition was observed in T_1 compared to the other treatments (T_2 and T_3). In T_1, the water qualities remained undeteriorated resulted the highest survival rate. On the contrary, the water quality sometimes deteriorated in T_2 and T_3 due to production of ammonia, carbon-di-oxide etc. resulting in comparatively lower survival rate than that of T_1. The survival rate of *P. sarana* fry in the present study was relatively higher due to provision of live feed as well as extremely controlled water quality like continuous supply of water through porous pipe in the aquaria resulting in higher dissolved oxygen content and lower carbon dioxide and also due to immediate removal of waste material from the aquarium. The results obtained agree with those of Parvez and Khan (2005) who obtained higher growth and survival rate of *P. sarana* by using plankton than with the artificial feeds. Mustafa *et al.* (1981) reported that *P. sarana* preferred to feed on aquatic plants, algae, plankton and crustaceans. Chakrabarty *et al.* (1973) reported that zooplankton was considered to be the best feed for early stage of Indian major carps as they obtained the highest survival rate and best growth rate with zooplankton. In another study Yeasmin *et al.* (1998) found that catfish larvae feeding on live feed, exhibited significantly higher growth than those of artificial diet.

The physico-chemical conditions such as temperature, dissolved oxygen and pH of water ranged between 26.00 and 28.60°C, 3.34 and 4.85 mg/L; and 7.25 and 7.87 T_1, T_2 and T_3, respectively (Table 3). Ahmed (1997) reported that the minimum water quality to maintain fish health should be 5ppm, 6.7-8.6, <3ppm, <0.02 ppm and >20 ppm for DO, pH, free CO_2, ammonia and alkalinity, respectively. In the present experiment water quality parameters were properly maintained. Hence, the observed variation among treatments was definitely due to variation in quality of feed not due to water quality parameters.

Table 3. Physico-chemical condition of water in the aquarium during the experimental period

Treatment	Parameters	Initial	1st week	2nd week	3rd week	4th week	5th week
T_1	Temperature ^{0}C	27.40±0.5	28.60±0.5	26.00±0.5	28.20±0.5	27.00±0.5	27.50±0.5
	*D O (mg/L)	3.95±0.08	4.54±0.06	3.75±0.03	4.54±0.08	4.85±0.05	4.55±0.06
	pH	7.56±0.25	7.47±0.19	7.77±0.29	7.57±0.31	7.67±0.19	7.45±0.36
T_2	Temperature ^{0}C	27.00±0.3	26.80±0.5	28.50±0.4	28.00±0.5	27.50±0.5	27.10±0.8
	*D O (mg/L)	3.54±0.08	4.34±0.08	4.56±0.08	4.14±0.08	4.54±0.08	4.10±0.05
	pH	7.47±0.15	7.67±0.29	7.87±0.50	7.57±0.70	7.47±0.20	7.45±0.65
T_3	Temperature ^{0}C	26.52±0.5	27.00±0.5	27.50±0.5	28.50±0.5	28.34±0.5	27.50±0.3
	*D O (mg/L)	3.34±0.02	4.44±0.08	3.54±0.05	3.66±0.07	4.64±0.08	3.60±0.05
	pH	7.57±0.19	7.77±0.19	7.870.19	7.42±0.19	7.25±0.19	7.40±0.15

M±SE (Mean ± standard error)
*Dissolved oxygen

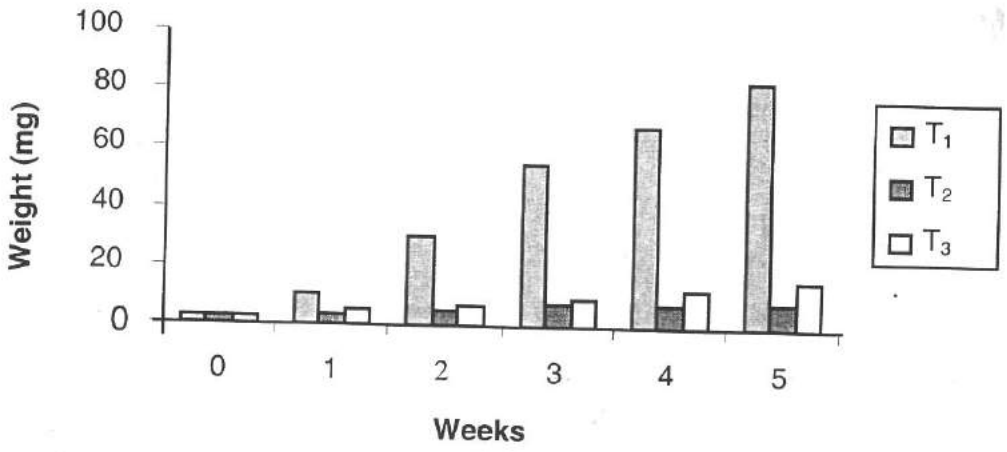

Fig.1. The weekly growth in terms of weight of *P. sarana* in different treatments

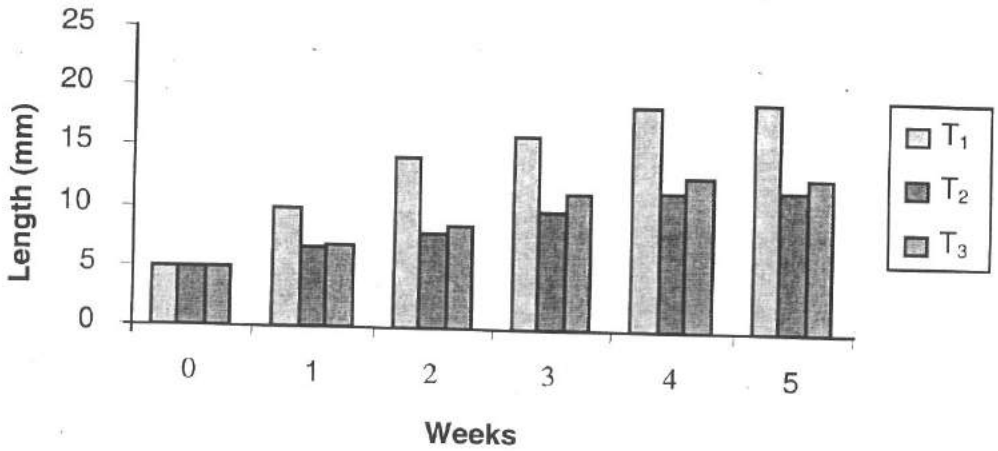

Fig. 2. The weekly growth in terms of length of *P. sarana* in different treatments

Plankton population in case of T_1 comprised of four groups of phytoplankton such as Cyanopphyceae (%), Chlorophyceae (%), Bacillariophyceae (%) and Euglenophyceae (%) and four different groups of zooplankton such as Rotifera (%), Copepoda (%), Cladocera (%) and Nauplius (%) were recorded that is presented in Table 4. The study of Mookerjee *et al.* (1947) revealed that *P. sarana* subsisted on higher aquatic plants (45%), algae (21%), protozoans (20%) and organic matters (8%).

Table 4. The number of different groups of plankton during study period in case of T_1

Plankton	Groups	Numbers (M±SE)/ Liter of water
Phytoplankton	Cyanophyceae	17250±1206
	Chlorophyceae	32000±8158
	Bacillariophyceae	6750±378
	Euglenophyceae	2516.6±232
Zooplankton	Rotifera	5100±357.4
	Cladocera	2116.6±206
	Nauplius	2066±104.6
	Copepoda	2000±181

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