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Impact of silver barb (*Barbades gonionotus* Bleeker) on growth and survival of prawn (*Macrobrachium rosenbergii*) in polyculture system.

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Abstract

Impact of silver barb (*Barbades gonionotus*) on the growth and survival of prawn (*Macrobrachium rosenbergii*) were tested in a polyculture system. There were two treatments and three replication of each. Silver carp (*Hypopthalmichthys molitrix*), catla (*Catla catla*) and prawn *(M. rosenbergii)* were stocked at a stocking density of 10, 3 and 50/decimal, respectively in both treatments. Rohu (*Labeo rohita*) was stocked at a stocking density of 8/decimal in treatments T_1 and silver barb was stocked at a rate of 20/decimal in treatment T_2. The average growth and survival rate of silver carp and catla were higher with rohu (T_1) than with silver barb (T_2). However, differences were not statistically significant .The specific growth rate (SGR) of prawn was higher in T_1 (1.98%) than in T_2 (1.86%). The significantly higher ($P<0.05$) survival of (70.85%) was found in T_1, where rohu stocked with prawn and the lower survival (61.05%) was obtained in T_2, where silver barb was stocked. The yield of prawn in T_1 (649.25 kg/ha) was significantly higher ($P<0.05$) than T_2 (456.95 kg/ha). This finding reveled that survival rate and yield of prawn was affected by silver barb and it has exerted an antagonistic effect on growth, survival and production of prawn. Total fish production was significantly higher ($P<0.05$) in T_2 (2718.9) than in T_1 (2021.14), because the production of silver barb was much higher (1669.84 kg/ha) than rohu (954.97 kg/ha).

Keywards: *M. rosenbergii,* Silver barb, Polyculture

Introduction

Silver barb (*Barbades gonionotus*), a herbivorous species, was introduced to Bangladesh in 1977 and has become increasingly popular owing its bright silvery appearance and good taste. Introduction of sharpunti in the polyculture of native carps increases overall fish yield though it has a slight antagonistic effect on growth and production of native carps (Wahab *et. al.,* 1995). The presence of silver barb decreases the growth of Indian carps while increases that of common carp (Mahean Haque *et. al.,* 1998). It has shown potential as a candidate for culturing in seasonal ponds, borrow pits and rice fields in monoculture (Kohinoor *et. al.,* 1994).

Polyculture increases the yield of fish over monoculture in similar stocking densities by reduction of interspecific resource competition, and probably by mutual enrichment of diet through synergy. Culture of prawn with fish also improves the ecological balance of the pond water, preventing the formation of massive algal blooms (Cohen *et al.* 1983). Giant fresh water prawn *Macrobrachium rosenbergii* being a benthophagic omnivore is an excellent candidate for polyculture. Since prawn can derive part of their nutritional requirements from natural pond productivity, a high portion of expensive commercial feed can be saved especially with high level of natural productivity.

Polyculture of *M. rosenbergii* has been investigated with Chinese and Indian carps (Malecha *et al.* 1981, Costa-Pierce *et al.* 1984, Hoq *et al.* 1996, and Alam *et al.* 2001); But no scientific study has been conducted to find out the effect of silver barb on prawn in prawn polyculture system in Bangladesh conditions. The compatibility of silver barb in prawn polyculture system, however, remains largely unknown. If the species proves environmentally benign and has no adverse effect on prawn then it may be an excellent candidate for prawn polyculture. However, now-a-days prawn polyculture is increasing day by day and many farmers are stocking silver barb with prawn in polyculture system, but the actual impact of silver barb on growth and survival of prawn is yet unknown. Therefore considering the above fact, the present study was undertaken to observe the effect of silver barb on growth and survival of prawn and to determine the feasibility of culturing silver barb in prawn polyculture system.

Materials and method

The study was carried out from April to September in two earthen ponds of Bangladesh Fisheries Research Institute, Freshwater Station pond complex having a water surface area of 21 decimal of each pond. The water of the pond was completely drained out and remained exposed to sun for 7 days until the bottom cracked. The ponds were divided into three plots of 7 decimal size each. These plots were made by bamboo fencing and nylon nets. They were of 5 feet height from ground level so that the prawns cannot move from one plot to other. Bamboo poles were used to fix the net vertically. Lime was applied to the soil at the rate of 1 kg/decimal. After liming the ponds were filled with water. Organic and inorganic fertilizers were applied in the pond. Organic fertilizer, cowdung was broadcasted over the pond at a rate of 10 kg/ decimal. After 3-4 days of organic fertilization, chemical fertilizers were applied at the rate of urea 100-g/decimal and TSP 75 gm/decimal. There were two treatments with three replications of each. The species combination and stocking density of fish and prawn in treatment I were silver carp-10, catla-03, rohu-08, prawn-50 and in treatment II were silver carp-10, catla-03, Thai silver barb -20, prawn-50.

Fish and prawn were fed twice daily at the rate of 3-5% body weight with BFRI formulated feed. The composition of feed were fishmeal 10%, mustard oilcake 25%, rice bran 40% and wheat bran 25%. Growth performance, health condition and biomass of fish and prawn were checked fortnightly by sampling and amount of feed was adjusted accordingly. Besides feeding, fertilization with organic and inorganic fertilizers were applied monthly. Shelters were provided in each pond compartment with dry coconut leaves.

Water quality parameters, such as dissolved oxygen, pH, water temperature and alkalinity will be recorded fortnightly by following standard methods.

At the end of the experiment, each pond was drained consecutively and all the fish and prawn were caught. Most of the fishes and prawns were harvested by two to three seining. Then the remaining fishes and prawns were collected manually after draining.

Statistical analysis with student's t-test was performed on the data to see whether the species in two treatments show any difference.

Results and Discussion

Since all ponds were partitioned using bamboo fence covered with nylon mesh net, water among the compartments in the same pond flowed with wind action. For this reason, water quality parameters were measured from each of two ponds, irrespective of treatment compartments. There were no significant differences in water quality parameters between two ponds. For this reason, all measured values for each parameter were averaged and are shown in Table 1. The water quality parameters were ranging from 27.4°C to 32.1°C for temperature, 140 to 202 for alkalinity, 7.1 to 9.7 for p^H and 3.81 to 7.97 ppm for dissolved oxygen. Islam (1994) reported that the best water temperature level for prawn culture is 25 – 31°C. New and Singholka (1985) have been reported that the temperature below 14°C or above 35°C is lethal for freshwater prawn and maximum growth may occur near 31°C. Cohen *et al.* (1983) observed that dissolved oxygen level should always be maintained above 4.0 ppm for prawn culture. The water quality parameters recorded during the study period were found within the acceptable ranges.

Table. 1. Growth performance of prawn and fish in polyculture system

Parameters	T_1				T_2			
	Silver	Catla-	Rohu	Prawn	Silver	Catla-	Silverbarb	Prawn
Initial length (cm)	5.2	4.8	8.7	8.3	5.2	4.8	9.3	8.3
Initial weight (g)	2.45	2.2	4.15	2.11	2.45	2.2	8.47	2.11
No of fish/dec.	10	3	8	50	10	3	20	50
Final length (cm)	35.4	28.24	34.9	18.24	32.05	24.5	29.2	17.07
Final weight (g)	428.8 [a]	248.7 [a]	538.18	74.2 [a]	416.7 [a]	245.75 [a]	396	60.55 [b]
Net weight gain (g)	426.35	246.5	534.03	72.09	414.25	243.55	387.55	58.44
Specific growth rate (SGR, % day)	2.87	2.62	2.7	1.98	2.85	2.62	2.13	1.86
Survival (%)	85.77 [a]	90.5 [a]	89.8	70.85 [a]	85.34 [a]	89.43 [a]	85.36	61.05 [b]
Production (kg/dec.)	3.68	0.68	3.87	2.63	3.56	0.64	6.76	1.85
Production (kg/hac.) Total fish	2021.14 [b]			-	2718.88 [a]			-
Prawn				649.25 [a]				456.95 [b]

Values in the same row of same species having the same superscript are not significantly different ($P<0.5$)

Production data of the different species of fish and prawn in polyculture system are presented in Table 2. The average growth and survival rate of silver carp was higher in T_1 (428.8 g and 85.77%) than that of T_2 (416.7 g and 85.34%). The average growth and survival rate of catla was higher in T_1 (248.7 g and 90.5%) than that of T_2 (243.55 g and 89.43%). This low survival of silver carps and catla might be due to antagonistic effect of silver barb inclusion in prawn polyculture. Wahab *et. al.* (1995) reported that silver barb compete for food with major carps, rohu, catla and mrigal and decrease their individual growth, but increase the total production. Mahean Haque *et. al.* (1998) stocked silver barb in carp polyculture and found that survival rate of rohu decreased from 92.91% to 88.88% due to its inclusion. They also found harvest weight of catla was 150.67g without silver barb and 143.14 g with it.

Table. 2 Mean physicochemical parameters of water during the study period (ranges are in parentheses)

Parameters	April	May	June	July	August	September
Temperature	30.1 (29-30.2)	29.3 (27.4-31.2)	29.4 (29.3-29.2)	29.7 (28.3 -31.5)	31.1 (30.1-31.9)	31.23 (31.2-32.1)
Alkalinity	179.4 (170-190)	146 (142-148)	145 (135-150)	175 (150-160)	162 (143-170)	167 (140-202)
p^H	8. 1 (7.8 -8.73)	8.65 7.89-9.2)	9.3 (9 -9.7)	8.5 7.18-8.9)	7.25 (7.1-7.94)	7.94 (7.8-8.13)
Dissolved oxygen (mg/L)	7.3 (6.75-7.97)	5.79 (5.6-5.9)	4.16 (3.81-4.44)	6.1 (5.2 -7.1)	5.8 (5.1-6.3)	6.08 (5.2-6.6)

The average weights of prawn were 74.2 and 60.55 g in T_1 and T_2, respectively, these were significantly different ($P<0.05$). The specific growth rate (SGR) of prawn was higher in T_1 (1.98%) than in T_2 (1.86%). The survival of prawn (70.85%) in T_1 was significantly ($P<0.05$) higher than in T_2 (61.05%). This has revealed that prawns were survived better in presence of rohu than that of silver barb. The calculated yield of prawn in T_1 and T_2 were 649.25 and 456.95 kg/ha, respectively over the experimental period of 6 months, which were significantly different ($P<0.05$) (Fig.1). Alam *et. al.* (2001) stocked juvenile prawns at the rate of 35, 50 and 65/decimal and reported survival rate of 65-70%, and yield of 423-662 kg/ha. Hoq *et. al.* (1996) reported *M. rogenbergii* survival rate of 75.7% and yield of 428.4 kg/ha In other study. Similar results were found in the present study.

Total fish production was higher (2781.9 kg/ha) in T_2 and than T_1 (2021.14 kg/ha), because the production of silver barb was very high (1669.84 kg/ha) in comparison to rohu (954.97 kg/ha). The higher initial weight of silver barb may have positive bearing on the better growth in the polyculture. In this experiment initial weight of silver barb was very high (8.47) than rohu (4.15).

Wahab *et. al* (1998) reported that silver barb has a positive response for crustacean and zooplankton. As *M. rogenbergii* also prefers crustacean, so there is a food competition between silver barb and *M. rogenbergii*. On the other hand *M. rogenbergii* becomes very weak and their shell is very soft just after molting. During the experiment, it was observed that silver barb attacked the molted prawn and eat them. In addition, silver barb are very active feeder than prawn and in general they occupy the water column and they consume most of the supplementary feed before it reaches to prawn at the bottom. For these reasons the survival rate of *M. rogenbergii* was decreased in prawn polyculture with silver barb.

From this study, it may be concluded that silver barb has an antagonistic effect on growth, survival and production of prawn and its inclusion in freshwater prawn dominated polyculture may decrease the yield of prawn. Thus silver barb can not be considered to be an appropriate candidate for polyculture with prawn.

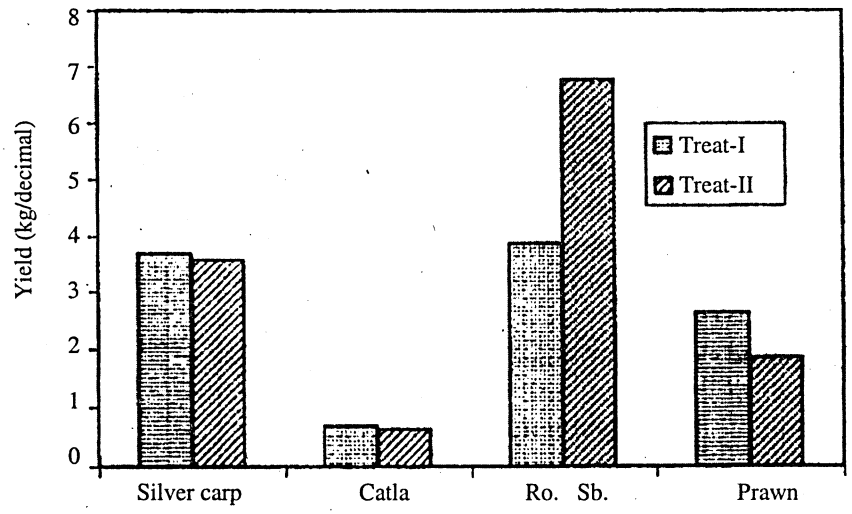

Fig. 1. Yield variation of different species in two treatments

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