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Comparative study on growth performance between Vietnam koi and Thai koi in mini ponds

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Abstract

An experiment was carried out to determine the comparative growth study of Vietnam koi (*Anabas testudineus*) and Thai koi (*Anabas testudineus*) for a period of 90 days in eight experimental ponds in the northern side of the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. Four treatments were considered having two replicates. For Vietnam koi treatments were named VT₁ and VT₂ and for Thai koi were TT₁ and TT₂. All the fish were of same age group having mean body weight of 0.30 g. Feeding frequency in all the treatments were two times a day. Fish were fed quality fish feed at a rate of 60% of their body weight for the first thirty days that was gradually reduced to 25% for the next thirty days and 10% till the termination of the experiment. The mean value of water temperature were 29.78 in VT₁, 30.42 in VT₂, 30.50 in TT₁ and 29.99°C in TT₂, dissolved oxygen were 7.21, 7.42, 7.14 and 7.34 mg/l in VT₁, VT₂, TT₁ and TT₂, respectively, mean pH values were 7.42 in VT₁, 7.29 in VT₂, 7.50 in TT₁ and 7.45 in TT₂, ammonia were 0.21, 0.24, 0.28 and 0.23 mg/l in VT₁, VT₂, TT₁ and TT₂, respectively and alkalinity were 200.00, 205.00, 210.00 and 205.00 ppm in VT₁, VT₂, TT₁ and TT₂, respectively. The result of the present study showed that the best weight gain of 80.00 g was observed in VT₁ after 90 days of culture period. Average weight gain (g) were 0.83, 0.88, 0.51 and 0.61; SGR (per day) were 3.93, 3.95, 3.65 and 3.71%; FCR were 1.50, 1.67, 1.70 and 1.90; survival rate were 78.50, 76.50, 90.00 and 82.00% and fish production were 7,839, 15,923, 5,519 and 11,820 kg/ha/3 months in VT₁, VT₂, TT₁ and TT₂, respectively. Growth of both the species was higher in lower stocking densities, whereas, production was increased in higher stocking densities. The present research findings suggested that Vietnam koi has high growth potential in comparison to Thai koi under mini pond culture condition.

Keywords: Vietnam koi, Thai koi, Growth, Production

Introduction

Aquaculture contributed 40.1% to the world total fish production. Aquaculture is a rapid growing sector in South Asia, particularly in Bangladesh. It contributes 4.39% to the gross domestic products (GDP), 2.46% to the export earning and supply about 60% of the animal protein to the nation (DoF, 2013). In Bangladesh 260 freshwater species, 475 marine fish species (DoF, 2013) and 92 varieties of exotic fishes under 53 species, 17 families and 5 orders were recorded (Galib *et al.*, 2010).

Koi (*Anabas testudineus*) is one of the common exotic fish species in Bangladesh. It is considered to be the most economic and important fish of Bangladesh because of its high market demand, having good nutritional value and delicious taste. Once the native koi was very much abundant in almost all freshwater system in Bangladesh (Mahmood, 2003). In late 1980s, the catches of the fish have drastically declined from open waters due to various ecological changes in inland water bodies and thus has been recognized as an endangered species. Koi fishery contributed about 2.8% of total pond catch since the 1980s (DoF, 1992) and in recent year it decreases to 0.85% (DoF, 1999) to the total pond catch. The fish is now sold at an exorbitant price in the market. But in culture aspects, the growth rate of native strain is very slow in ponds ecosystem.

In order to fulfill ecological niche and other factor, as much as 12 exotic fish species had been introduced in our country for culture purpose (DoF, 2013). Through this consequence Thai koi (*Anabas testudineus*) had been introduced in 2002 from Thailand for their high taste, growth, nutritious value and a good market price (Alam *et al.*, 2006). Culture potential of Thai koi has increased in various parts of Bangladesh especially in Mymensingh due to its fast growth rate. However, due to inbreeding problem, growth rate of Thai koi is declining day by day in many areas.

Recently another very fast growing fish known as 'Vietnam koi', had been introduced in Bangladesh in 2010 for its higher production and growth than the other variety of koi. Vietnam koi had been imported from Vietnam with the support from Innovation Consulting (Pvt.) Ltd. and Swiss funded Katalysit (Sarnalata Agro-Fisheries Ltd., Mymensingh). Initial study showed this variety of koi looked like our native koi and had tremendous growth rate. It was observed that Vietnam koi attained maximum size of 400g within 120 days culture period (Personal communication, Dr. H. Rashid, 2013). According to another report showed Vietnam koi grows as much as 250-300 g within 120 days culture period and the body color is almost similar to "Desi koi" (Sarnalata Agro-Fisheries Ltd, 2013). So it is thus important to observe the growth potential of Vietnam koi and to compare with other koi species available in Bangladesh. Thus the present study aims at to investigate culture and growth potential of Vietnam koi and Thai koi in mini ponds.

Materials and Methods

The experiment was conducted in eight in mini ponds located in the northern side of the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. Lime was applied to the ponds at a rate of 0.5 kg/decimal. No fertilizer was used during pond preparation. Two treatments were considered for Vietnam koi and two treatments for Thai koi. In each treatment two replications were considered (Table 1). Vietnamese koi and Thai koi fry were collected from Sarnalata Agro Fisheries Ltd., Radhakanai, Fhulbaria, Mymensingh. Commercial pellet feed named "Quality Fish Feed" were selected for the study. At the beginning of the experiment feed was supplied at a rate of 60% (1st month), 25% (2nd month) and 10% of their body weight of all treatments. Feed was supplied two times in a day (morning at 9.00 am and evening 5.00 pm). Hydrological parameters like temperature, dissolved oxygen pH, ammonia and alkalinity of the water of ponds were measured at fifteen days intervals. Temperature was recorded by using a Celsius thermometer (°C), D.O., pH, ammonia and alkalinity were measured directly by using water quality parameter measurement kits in mg/l between 8:30 to 9:30 am. Fish sampling was done at fifteen days interval in the morning at around 7:30 to 8:30 am. During each sampling fish were caught by cast net and weight was taken by precision weighing balance (accuracy up to 0.1 g). Weight gain (g), average daily weight gain (g), percent weight gain, specific growth rate (SGR), food conversion ratio (FCR), survival rate (%) and production (kg/ha/90days) parameters was used to evaluate the growth and production of fish.

Table 1. Experimental layout of present experiment

Treatment (koi)	Replication	Pond size (dec)	Stocking density/dec	Total fish stock/pond	Stocking size(g)
VT ₁ (Vietnam koi)	R ₁	0.65	200	130	0.3
	R ₂	0.65	200	130	0.3
VT ₂ (Vietnam koi)	R ₁	0.65	400	260	0.3
	R ₂	0.65	400	260	0.3
TT ₁ (Thai koi)	R ₁	0.65	200	130	0.3
	R ₂	0.65	200	130	0.3
TT ₂ (Thai koi)	R ₁	0.65	400	260	0.3
	R ₂	0.65	400	260	0.3

Data analysis

The data obtained on the growth of fish, FCR, survival rate and production were statistically analyzed to see whether the influence of different treatments on the growth (weight) and production of fishes was significant or not. Significant differences between treatments were calculated by T test (student's T test).

Results and Discussion

Water quality parameter

The hydrological parameters of four different treatments were recorded at 15 days interval of 90 days experimentation. Temperature of TT₁ was significantly higher than other treatments. The maximum temperature (30.50°C) was recorded in Thai koi in T₁ on 01 June, 2013 which was due to high intensity of sunlight and minimum temperature (29.78°C) was recorded in Vietnam koi (Table 2) in T₁ on 03 May, 2013, might be due to moderate intensity of sunlight. Dissolve oxygen 7.42 mg/l and alkalinity 210 ppm were significantly higher in VT₂ and TT₁, respectively. Ammonia 0.28 mg/l was higher in TT₁ than VT₂.

Table 2. Water quality parameters in four different treatments during the study period

Water quality parameters	VT ₁	VT ₂	TT ₁	TT ₂
Temperature (°C)	29.78 ± 0.83	30.42 ± 0.90	30.50 ± 1.19	29.99 ± 0.89
Dissolved oxygen (mg/l)	7.21 ± 0.15	7.42 ± 1.17	7.14 ± 0.20	7.34 ± 0.21
pH	7.42 ± 0.17	7.29 ± 0.04	7.50 ± 0.19	7.45 ± 0.23
Ammonia (mg/l)	0.21 ± 0.03	0.24 ± 0.03	0.28 ± 0.05	0.23 ± 0.02
Alkalinity (ppm)	200 ± 1.41	205 ± 0.707	210 ± 1.42	205 ± 0.707

Mondol (2012) measured water temperature ranged from 17 to 31°C. Ahmed *et al.* (2013) found maximum temperature was 38.0°C during August which was higher than normal and found minimum temperature (31.8°C) during July. During the experimental period dissolved oxygen content of the ponds were found between 7.14 to 7.42 mg/l which was similar to Hossain (2000) and Kohinoor (2000). Ahmed *et al.* (2012) found pH ranged from 6.5 to 8.5. During the experiment ammonia range was from 0.21 to 0.28 mg/l which was higher than Ahmed *et al.* (2012) who reported that 0.001 to 0.03 mg/l but similar to Mondol (2012) who observed the values of ammonia ranged from 0.20 to 0.55 mg/l. Alkalinity range of present study was 200 to 210 ppm which was higher than Alikunhi (1957) and Uddin (2002) who reported that the acceptable value was 100 ppm. Karim (2006) recorded that alkalinity were 115.42, 121.28 and 120.57 ppm which was similar to the present findings.

Growth and survival rate

In the present study, the mean initial weight was 0.3 ± 0.00 in all the treatments. Mean final weight (g) was 75.00 ± 1.00, 80.00 ± 1.00, 47.00 ± 1.00 and 55.00 ± 1.00 in VT₁, VT₂, TT₁ and TT₂, respectively (Table 3). In TT₂ treatment FCR value (M±SE) was highest (1.90 ± 0.03) and lowest (1.50 ± 0.15) in VT₁ treatment. Survival rate was highest (90.00 ± 1.41) in TT₁ and lowest (76.5 ± 0.38) in VT₂. Production of 90 days experiment was highest 15,923 kg/ha in VT₂ treatment.

Table 3. Growth parameters of Vietnam koi and Thai koi during the study period

Treatments	Growth parameters								
	Mean initial weight (g) (M±SE)	Mean final weight (g) (M±SE)	Mean weight gain (g) (M±SE)	Average daily weight gain (g) (M±SE)	% weight gain (M±SE)	SGR (%/day) (M±SE)	FCR (M±SE)	Survival rate (%) (M±SE)	Production (kg/ha)
VT ₁	0.3 ± 0.00	75.00 ± 1.00**	74.70 ± 1.00**	0.83 ± 0.02**	24,899.5 ± 333.50**	3.93 ± 0.01**	1.50 ± 0.15	78.5 ± 1.06	7,839
VT ₂	0.3 ± 0.00	80.00 ± 1.00**	79.70 ± 1.00**	0.88 ± 0.01**	26,399.5 ± 166.49**	3.95 ± 0.01	1.67 ± 0.18	76.5 ± 0.38	15,923
TT ₁	0.3 ± 0.00	47.00 ± 1.00**	46.70 ± 1.00**	0.51 ± 0.02**	15,499.5 ± 266.49**	3.65 ± 0.03**	1.70 ± 0.11	90.00 ± 1.41	5,519
TT ₂	0.3 ± 0.00	55.00 ± 1.00**	54.70 ± 1.00**	0.61 ± 0.01**	18,233 ± 332.99**	3.71 ± 0.01	1.90 ± 0.03	82.00 ± 1.50	11,820

** Significant at 1% level of probability

Haque *et al.* (2006) mentioned that average weight of fish were 69.60, 65.46 and 61.15 g in T₁, T₂ and T₃, respectively. The result of the present study was higher than those of above mentioned research but closely related to Karim (2006) noticed that average weight gain of Thai koi were 91.00, 84.13 and 76.50 g in T₁, T₂ and T₃, respectively. According to Karim (2006) the FCR values of Thai koi were 1.73, 1.86 and 1.94 in T₁, T₂ and T₃, respectively during 98 days culture period which was closely related to the findings of present experiment. According to Jahan *et al.* (2013) the FCR values were 1.60 in high stocking density and 1.80 in low stocking density which was almost similar to the findings of the present experiment. Akteruzzaman (1988) reported that the survival rate of *Anabas testudineus* varied from 60 to 80 %. Karim (2006) observed survival rates of Thai koi were varied from 82.03 to 90.00 %. But the results of present study were almost similar to the research finding of Kohinoor *et al.* (2007) who observed that the survival rates of Thai koi were varied from 79 to 92%. In the present study the production of Thai koi in T₁ and T₂ treatments were 5,519 and 11,820 kg/ha/3 months with the stocking density of 200/dec and 400/dec, respectively. From the research findings of Karim (2006) it was mentioned that the production of Thai koi were 6,113.25, 6249.1 and 6377 kg/ha in T₁, T₂ and T₃, respectively which were lower than the findings of present experiment. It was found by Hossain (2009) in the study that the productions were 3,620.38, 5,069, 6,401.44 and 4,810.64 kg/ha in T₁, T₂, T₃ and T₄, respectively in 75 days which were much lower than the present experimentation.

In the present study it was observed that there were differences in mean weight gain between Vietnam koi and Thai koi. This may also different in various treatments. The highest mean weight gain was observed in T₂ (79.70 g) of Vietnam koi, whereas, the lowest mean weight gain was noticed from T₁ (47.70 g) of Thai koi. In T₁ of Vietnam koi mean weight was measured higher (74.70 g) when compared with T₁ (46.70 g) and T₂ (54.70 g) of Thai koi. The result indicated that the growth rate of Vietnam koi was higher than Thai koi. Initial stocking density and weight were similar in both treatments but the production was higher in Vietnam koi in T₂. The production of Vietnam koi was 7,839 and 15,923 kg/ha in T₁ and T₂ and the productions of Thai koi was 5,519 and 11,820 kg/ha in T₁ and T₂, respectively. The executive findings of the study indicates that production of Vietnam koi was 4103 kg/ha more than the production of Thai koi in the same treatments.

Economic analysis

A simple economic analysis was performed to estimate the net profit from the Vietnam koi and Thai koi culture operation. The cost of production was based on the Mymensingh whole sale market price of the input used in the year 2014. The cost of commercial pellet feed was Tk. 45.00 /kg. The selling price of Vietnam koi and Thai koi was in Tk. 180/Kg in T₁ and T₂. It was observed that the highest net profit (8, 72,390 Tk/ha/3 months) was obtained from T₂ of Vietnam koi and lowest profit (3, 70,100 Tk/ha/yr) was obtained from the T₂ of Thai koi (Table 4).

Table 4. Economic analysis of Vietnam koi and Thai koi at the end of the experiment

Treatments	Input cost (BDT)/ ha								
	Pond preparation	Fingerlings	Feed	Harvesting Labor & others	Total cost	Production Kg/ha	Sell price	Net benefit	% profit
VT ₁	40,000	1,00,000	5,40,000	5,50,000	12,30,000	7,839	14,11,020	1,81,020	15
VT ₂	40,000	2,00,000	12,03,750	5,50,000	19,93,750	15,923	28,66,140	8,72,390	44
TT ₁	40,000	1,00,000	4,27,500	5,50,000	11,17,500	5,519	9,93,420	-1,24,080	Loss
TT ₂	40,000	2,00,000	9,67,500	5,50,000	17,57,500	11,820	21,27,600	3,70,100	22

Jahan *et al.* (2013) mentioned that the net profit of Thai koi was 11, 56,207 Tk/ha/year using formulated diet which was much higher than the value obtained in the present investigation.

Conclusion

The results of the present study demonstrated that Vietnam koi has high growth performance in comparison with Thai koi. Vietnam koi looked like our native koi and has lucrative growth rate which attracts the farmers as well as customer's attention. Many of the derelict mini ponds remained as derelict, which could be brought under Vietnam koi cultivation. Whereas, Vietnam koi attained marketable size (maximum size of 400g) within 3-4 months culture period. In such way villagers and poor farmers can earn money within very short time by culturing Vietnam koi in ponds remain in homestead and roadside. More over women can also participate in koi culture beside their household works and can contribute to family income. Thus Vietnam koi could be a good candidate in this regard for culture. Poverty alleviation could be increased and fate of poor farmers could be improved through culture of Vietnam koi individually or with other small indigenous species (SIS) of fishes.

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