HOME-MADE FEED GENERATES HIGHER INCOME IN THAI KOI, *Anabas testudineus* (BLOCH 1792) FARMING IN BANGLADESH

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ABSTRACT

To find out the appropriate feed for Thai koi, *A. testudineus* farming in Bangladesh an experiment was conducted in well fenced earthen ponds of Fisheries Field Laboratory Complex", under the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh for a period of 99 days (21st April to 28th July'06). The experiment were designed with three treeatment (T_1, T_2 and T_3) having three replication of each (R_1, R_2 and R_3). Three feeds namely Suny feed, home made mixed feed and Saudi-Bangla fish feed having 24%, 28.45% and 35% protein respectively were considered as supplemental feed in T_1, T_2 and T_3 respectively. Two hundred and fifty fries (average length 3.63 ± 0.015 cm and weight 0.90 ± 0.18 g) were cultured. The highest weight gain (78.90 ± 0.11g), length gain (12.36± 0.05cm) and SGR (4.57± 0.00) were observed in T_3 and followed by T_2 and T_1 respectively. The lowest (2.166 ± 0.05) FCR were observed in T_2 and followed by T_3 and T_1. All the growth parameters differ significantly ($p<0.05$) among the treatments. Higher (73-78%) survivals were found in all the treatment and the survival rate of T_1 significantly differ ($p<0.05$) from T_2 and T_3. Measured water quality parameters in different treatments during the experimental period were found to be similar and their ranges were within acceptable limit for fish culture. The total cost of feed was lowest (75086.17 $Tkha^{-1}days^{-99}$) in T_2 and highest was in T_3 (110404.43 $Tkha^{-1}days^{-99}$). The highest production 2435.80 $kgha^{-1}days^{-99}$ were also found in T_3 and followed by T_2 and T_1, respectively. But the highest net profit and benefit cost ratio (204606.52 $Tkha^{-1}$ and 1.76 respectively) were observed in T_2 where the home-made feed was used in Thai koi culture followed by T_3 and T_1. Thus the farming of Thai koi by using home-made feed having 28.45% protein could generate higher income in Bangladesh

Key words: *Anabas testudineus*, home-made feed, protein, benefit cost ratio

INTRODUCTION

The demand of fish requirement in Bangladesh increasing with her densely populated nation. Once upon a time people of the country meet up their demand of fish through captureing from open waterbodies. The increased population increased their rates of fish capturing to meet up their deamnd of fish. They were not concern to meet up their demand through aquaculture production. Thus the productions from natural open water resources are showing a decreasing trend due to reduction of availability of some species. Moreover many species become endemic in selected region and are in threats of different levels of extinction. However the situation of meet up their demand of fish only from capturing has changed as attempts have been made to enhancing the production of fish from impounded waters through aquaculture practices. The government and non-government organization, private enterprenure and individual fish farmers have adopt production of fish through aquaculture from last 10-15 years. From the begining the aquaculture systems of Bangladesh were mainly constituted with polyculture of Indian Major Carps (IMCs) viz. rohu (*Labeo rohita*), catla (*Catla catla*) and mrigal (*Cirrhinus cirrhosus*). They enjoyed a prime position in the aquaculture scenario of Bangladesh by contributing 90% aquaculture production (Hussain and Mazid, 2001). But now a day's fish farmers lost interest for culturing only IMCs as the survivability and growth rate of these species have reduced greatly due to scarce of healthy seed of these species. Thus attempts were also made to further enhancement of the aquaculture production through incorporation of some suitable exotic fish species in our aquaculture system. Now fish farmers are interested with some of the exotic species including silver carp (*Hypophthalmichthys molitrix*), bighead carp (*Aristichthys nobilis*), grass carp (*Ctenopharyngodon idellus*), common carp (*Cyprinus carpio* var. *communis*), mirror carp (*C. carpio* var. *specularis*), Thai pangas (*Pangasius hypophthalmus*), tilapia

(*Oreochromis mossambicus*), silver barb (*Barbodes gonionotus*) and very recently with Thai koi (*Anabas testudineus*).

In recent time this species is introduced in Bangladesh from Thailand which looks like *A. testudineous* of our country. As *A. testudineous* in Bangladesh is locally know as "koi" thus the introducd fish locally known to as Thai koi to the Bangladeshi people. Distribution of this species in Bangladesh, India, Sri Lanka, Myanmer, Thailand, China, Philippines and Combodia are reported respectivley by Rahman, 1989; Talwar and Jhingran, 1991; Pethiyagoda, 1991; U Hla Win, 1987; Vidthayanon, *et al.*, 1997; Kottelat,1998; Herre, 1953 and Rainboth, 1996. After introducing in our country, within a very short time it occupy a prime position in the aquaculture scenario of Bangladesh. The higher growth rate and larger size compared to our local koi make interest of Bangladeshi fish farmers to culture this new koi in their earthen pond. But proper culture technique and appropriate feed for potential growth of this species in Bangladesh context are not studied. Considering these facts an attempt was made to study the growth and survival performances of Thai koi with varying feed components to determine the suitable feed for its maximum production in Bangladesh.

MATERIALS AND METHOD

Study Period and Area

The experiment was carried out for a period of 99 days from 21st April to 28th July, 2006. It was conducted in the "Field Laboratory Complex", of the Faculty of Fisheries, Bangladesh Agricultural University, Mymensigh. Nine rectangular ponds having same volume (10.66 x 7.6 x 1.0) m3 were used to conduct the experiment.

Experimental set up

The experiment was designed with three treatments (T_1, T_2, T_3,) having three replication of each (R_1, R_2, R_3). Each treatment was designed by considering three different feed (Sunny feed, mixed feed and Saudi-Bangla fish feed). Fries having average initial length (3.63 ± 0.015)cm and average initial weight (0.90 ± 0.18)g were collected from the Bhramaputra Fish Seed Multiplication Farm, Shomvogonj, Mymensingh and stocked in pre-prepared pond at a stocking density of 3085 fries/hactor.

Feed Formulation and Application

Among three feeds used in this experiment Suny & Saudi-Bangla fish feeds were purchased from Swadeshi Bazar, Mymynsingh town and mixed feed were prepared by handmade where percent of rice bran, mustard oil cake and fish meal were 20%, 40% and 40% respectively. The analyzed proximate compositions of the supplied feeds are shown in Table 1. The quantities of feed supplied to the different experimental unit were adjusted with every fifteen days interval. The percent of feed supply were inversely related with increasing age of the fish which are shown in Table 2.

Table 1. Proximate composition of three feed ingredients

Components	Suny feed	Mixed feed	Saudi-Bangla feed
Protein	24%	28.45%	35%
Fat	4.5%	11.15%	5%
Ash	18%	15.15%	16%
Crude protein	6%	5.48%	6.5%
Moisture	11%	13.42%	12%

*NFE=Nitrogen free extract calculated as 100 - % (moisture + protein + lipid + ash)

Other Management

Regular cowdung and fertilization were done at every 14 days interval for the avilability of planktons in all the ponds. Cowdung were used at the rate of 493.72kg/ha and urea and TSP were used at the rate of 37.03g/ha and 12.34/ha.

Table 2.The percentages of feed used in nine ponds during 99 days of culture period

Percent of feed provided at different stages of life	Initial stage	14th days	28th days	42th days	56th days	70th days	84th days
	100%	80%	40%	20%	5%	3%	1%

Analytical method

Proximate compositions of the feed ingredients were subject to the estimation of protein, lipid, ether extract, crude fiber, NFE and ash by standard method (AOAC, 1980). The proximate composition of plankton used in T_1, T_2 and T_3 were not analyzed.

The fishes were sampled at weekly interval to determine the increase in their size (length and weight). Sampling was done in the early morning when the fish stomach was about to be empty. The SGR or Percentage of body weight increase per day was calculated according to Ricker (1979) as follows:

Specific growth rate (SGR) = $(\text{Ln}W_2\text{-Ln}W_1)/ (T_2\text{-}T_1) \times 100$

Where,

W_2= final live body weight (g) at time T_2

W_1= final live body weight (g) at time T_1

The food conversion ratio is determined by the amount of feed consumed to weight gain and was determined by the following formula (Castel and Tiews, 1980):

$$\text{FCR} = \frac{\text{Feed fed (dry matter)}}{\text{Live weight gain}}$$

The experiment was terminated at 99th day and the fish were harvested from the ponds and the final growth and survival of fish were estimated. The survival rate was estimated by subtraction of initial stocking larvae from the harvested fish.

The physico chemical parameters such as dissolved oxygen (DO), free carbon di-oxide (CO_2), total alkalinity (Carbonate and by carbonate), pH and temperature were estimated weekly in each aquarium with aquamate water testing kit (Model WAKQ-1A).

The plankton that was providing to the T_1 and T_2 was grown in a nursery pond and was collected using 50 µm mesh sized plankton net. The collected plankton populations were count numerically with the help of sedgwick-Rafter counting cell under a compound microscope (Olympus, BH2). Calculation of plankton samples were done by using the following formula (Rahman, 1992).

$$N = \frac{A \times 100 \times C}{V \times F \times L}$$

Where

N = No. of plankton cells or units/L

A = Total no. of plankton counted

C = Volume of final consternate of the sample in ml.

V = Area of a field= 0.1 cm^3

F = Number of fields counted

L = Volume of original water in L

Economic analysis

An economic analysis was performed to estimate the net profit from different treatments. The cost of different inputs rather than the cost of leasing ponds are shown in Table 4. The approximate cost of each diet was calculated on the basis of Mymensingh local market price (2006) of all ingredients used. The cost of Suny feed was Tk. 19/kg, mixed feed Tk. 20/kg and Saudi-Bangla fish feed Tk. 23/kg. The selling price for Thai koi was estimated as Tk. 200/kg.The net return/profit was measured by deducting the gross income from the gross cost/treatment. The benefit cost ratio (BCR) was also measured by dividing the gross income by gross cost.

Data analysis

The means of differnt parameters from different treatents during experimentation with different feed were all tested using one way analysis of variance (ANOVA). Significant results ($p<0.05$) were further tested using DMRT to identify significant differences among means. This statistical analysis was performed with the aid of the computer software MSTAC program.

RESULTS AND DISCUSSION

Growth Survival and Production of Thai koi

The growth performance of *A. testudineus* in terms of length and weight during the experimentation are presented in Table 3. The specific growth rate (SGR) and survival rate during the experimentation are also shown in Table 3.

Table 3. Growth, survival and production of *A. testudineus* in earthen ponds after 99 days experimentation

Treatment	Parameters					
	Weight gain (g) (M ± SE)	Length gain (cm) (M ± SE)	SGR (M ± SE)	FCR (M ± SE)	Survival rate (%) (M ± SE)	Production ($Kgha^{-1}$)
T_1	72.67± 0.24^a	11.19± 0.90^a	4.49± 0.00^a	2.50± 0.03^c	73.00± 0.57^a	2268.64±10.87^a
T_2	76.18± 0.04^b	11.57± 0.01^b	4.54± 0.00^b	2.166 ± 0.05^a	77.00± 1.00^b	2370.56±11.75^b
T_3	78.90± 0.11^c	12.36± 0.05^c	4.57± 0.00^c	2.40± 0.03^b	78.33± 1.20^b	2435.27±11.55^c

Values of the parameter in each column with different superscripts (a, b & c) differs significantly ($p<0.05$).

The highest length and weight gain (12.36 ± 0.05 cm and 78.90 ± 0.11 g respectively) was obtained in T_3 and the lowest length and weight gain (11.19 ± 0.90 cm and 72.67 ± 0.24 g respectively) in T_1. The highest SGR value (4.57±0.00) was observed in T_3 and the lowest SGR value (4.49±00) was found in T_1. All the growth parameters among differnt treatment differ significantly ($p<0.05$) from one another. After 99 days of culture period a high range (73-78%) of survival rate of Thai koi was observed. The fish in T_3 showed the highest (78%) survival rate and followed by T_2 and T_1 (77 and 73%, respectively) though there are no significant variation ($p<0.05$) between the survival rate of T_2 and T_3.

The feed conversion ratio (FCR) and total fish production in $kgha^{-1}$ are also shown in Table 3. The lowest (2.16) and highest (2.50± 0.03) FCR values were observed in T_2 and T_1 respectively. The highest total production (2435.27 $kgha^{-1}$) was obtained in T_3 and followed by T_2 and T_1 (23703.56 and 2269.13 $kgha^{-1}$) after 99 days culture period. The production of T_3 was significantly ($p<0.05$) different from T_2 and T_1.

The highest growth and survival rate were obtained with Saudi-Bangla feed (T_3) and followed by mixed feed (T_2) and sunny feed (T_1) where the percentages of protein were 35, 28.25 and 24% respectively. The result indicated that protein content of diet affected the growth and survival of Thai koi. The result in treatment T_2 and T_3 in this experiment is in agreement with the report of Yakupitiyage *et al.* (1998) in which the estimated required dietary protein level for climbing perch was ranged from 25-35%. Doolgindachabaporn (1994) also recommended that the feed containing 30.6% protein as the best feed formula in terms of growth and survival for *Anabas* fry. The survival rate of Thai koi in all the treatment was in higher range (73-78%) than some other popular culture fish species in Bangladesh. Shahbuddin *et al.* (1988) found the survival rate of rohu, *Labeo rohita* to be 52-73% and Islam *et al.* (1999) found survival rate of mirror carp fed on different supplementary diets in between 32 to 63%. The high survival rate of climbing perch was also reported in Thailand by Potongkam (1972) and Sangrattanakhul (1989).

The overall production parameter obtained from Thai koi farming in per hactare was in higher range than other culturable fish species of Bangladesh. The production of *Catla catla, Labeo rothita, Hypophthalmichthys molitrix, Cirrhinus mrigala and Puntius sarana* in polyculture system was 4818.88 kg $ha^{-1}yr^{-1}$ was reported by Chakrabortey *et al.* (2005). Kohinoor *et al.* (1993) obtained 2384 $kgha^{-1}months^{-6}$ by culturing *Puntius gonionotus* in fertilized ponds with supplemental feeding. This higher production performance of Thai koi compared to some other popular fish species is increasing the interest of farmers to culture this species in their ponds.

Water Quality Parameters

In case of water quality parameters no marked difference were observed during experimental period. The ranges of physico-chemical parameters in different treatment during the study period were: temperature 27-29°C, pH 7.5-8.1, DO 6.1-6.5 mg/L and transparency ranged from 27-34 mg/L. The presence of plankton cells of differnet treatment varies from 36.5 ±10.50 $\times 10^5$ to 36.8 ±12.00 $\times 10^{5a}$ cell/L of water.

The range of different physico-chemical parameters in different treatment during the experimental period were in suitable range for fish culture. According to Jhingran (1983) the values of all these parameters were found suitable for fish farming. Rahman *et al.* (1982) recorded, 26.5-32.2°C water temperature, DO values of 0.48-8.60 mg/L, for selected ponds

The Benefit Cost Ratio

The gross cost (Tk.ha^{-1}), gross income (Tk.ha^{-1}), net income (Tk.ha^{-1}) and benefit cost ratio (BCR) are shown in Table 4. The gross cost in different treatment varied due to the variation of price of feed cost. The highest cost of feed (110404 Tk.ha^{-1}days^{-99}) was needed in T_3 (the feed used was Saudi-Bangla fish feed) and the lowest cost of feed (75086 Tk.ha^{-1}days^{-99}) was needed in T_2 (the feed used was home made mixed feed). The highest net profit was obtained from T_2 (204606.52 Tk.ha^{-1}days^{-99}) and followed by T_3 (181630.26 Tk.ha^{-1}days^{-99}) and T_1 (164965.14 Tk.ha^{-1}days^{-99}) respectively. The highest benefit cost ratio (BCR) was also found in T_2 (1.76) and followed by T_3 (1.59) and T_1 (1.57) respectively.

Table 4. Cost and returns of *Anabas testudineous* production (Tkha^{-1}/99days)

Parameters	T_1 (Suny feed)	T_2 (Home made feed)	T_3 (Saudi-Bangla feed)
Price of fingerlings	30857.50	30857.50	30857.50
Pond preparation	86401.00	86401.00	86401.00
Feed cost	9374343.55	75086.17	110404.43
Fencing cost	49372.00	49372.00	49372.00
Fertilizer cost	8269.81	8269.81	8269.81
Labour cost	20119.0	20119.0	20119.0
Gross cost	288762.86	270105.48	305423.74
Gross income	453728.00	474712.00	487054.00
Net profit	164965.14	204606.52	181630.26
BCR	1.57	1.76	1.59

The highest growth, survival and production were found in T_3 but the net return and benefit cost ratio was highest in T_2 where the home-made feed was used in Thai koi culture. This is due to the higher price of Saudi-Bangla fish feed (23Tk.kg^{-1} feed) compared to home-made feed (20Tk.kg^{-1} feed). The home made mixed feed contains 28.45% protein which is in the suitable range of protein requirement for Thai koi culture feed (Yakupitiyage *et al.*, 1998). The ingredients including rice bran, mustard oil cake and fish meal needed to make the mixed feed are easily available to the fish farmers. Thus it could be recommended to our fish farmers to use home made feed having approximately 30% protein content could generate higher income in their fish ponds.

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