

Culture feasibility of African catfish (*Clarias gariepinus* Lin.) fry in glass tank and synthetic hapa system using supplemental diets

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Abstract

An experiment was carried out with 10 days old *Clarias gariepinus* fry over a period of 42 days to determine the effects of different feeds on growth and survival of African catfish fry in glass tanks. The experiment was designed into four treatments each having three replications. Thus treatment 1 (T₁) was named as Tank Tubifex (TT) and treatment 2 (T₂) as Tank Sabinco (TS), treatment 3 as Pond Tubifex (PT), and treatment 4 (T₄) as Pond Sabinco (PS). Live *Tubifex* (protein levels 64.48%) was supplied to treatments 1 and 3 and rest of the treatments were supplied Sabinco starter-1 (protein levels 40.13%). The highest and the lowest growth in total length and weight were 12.90 cm, 18.77 g and 6.17 cm, 4.04 g recorded from the treatments 3 and 2, respectively. Growth of catfish fry under treatment 3 in terms of both length and weight were significantly higher ($P < 0.01$) than those of the other treatments. However treatment 2 showed the significantly lowest ($P < 0.01$) growth performance among the various treatments. The highest survival rate (92%) was also obtained with treatment 3. *Tubifex* proved to be the best larval feed in respect of growth and survival rate.

Key words : African catfish fry, Glass tanks, Hapa, Supplemental diets

Introduction

Catfish is one of the very delicious and highly priced fishes which can be cultured in haors, baors, beels, jheels, canals and ponds. It has been drawing the attention of more and more fish culturists in Bangladesh day by day. Once easily available in the nature, the fish has, in the recent times, become scarce because of many adverse changes in their natural breeding and growing habitats. For this reason, catfish fry is very rare in nature. In Thailand *Clarias* meat is well known for its palatability (Tongsanga *et al.* 1963). Similarly, *Clarias* is in great market demand in the Philippines as a food fish (Carreon *et al.* 1973). *Clarias* is also fetching high market price in Bangladesh. African catfish (*C.*

gariepinus) was introduced in Bangladesh in December 1989 from Thailand. The fish seemed to adapt well in Bangladesh condition and was successfully bred for the first time in our country by Mollah and Karim (1990). The authors reported that the fecundity of African catfish is immensely higher (50,000-150,000) and breeding season is much longer (March - November) in Bangladesh.

Understanding of food and feeding habits of fishes are the prerequisites for effective management of a certain fishery. The food and feeding habits of fish vary with time of day, season, species, size of fish, ecological factors and with different food substances present in the waterbody. Information of daily food consumption by the fish fry under natural conditions is insufficient and scanty. To gain a better growth and survival of fish fry live feed is highly essential. Natural food provides a substantial availability of the protein and other essential nutrients required by fish. *Tubifex* have been reported to be an important live food for the larvae of many commercially viable fishes (Jhingran 1975). The tubificids worms are also used throughout the world, including Bangladesh, as food for the aquarium fish. Few attempts have been made in rearing *Clarias* larvae with only live food such as *Tubifex* sp. (Mollah and Nurullah 1988) and *Artemia* nauplii (Bairage et al., 1988). Alam and Mollah (1988) found significantly higher survival rate and 10 times more growth of catfish (*C. batrachus*) larvae fed tubificids when compared with formulated dry fed. Mollah (1991) found similar growth rate in *C. batrachus* and *C. gariepinus* larvae. Although works on larval feed have been carried out but till today there has been lacking a suitable rearing technique, especially in the pond system. Considering the above facts the present study has been undertaken to determine a suitable rearing technique of African catfish (*C. gariepinus*) fry using supplemental feed.

Materials and methods

The proposed research work was carried out in a rectangular pond of size 0.006 hac. Twelve cultural basins were selected each having a size of 60 X 32 X 33 cm. The effective size of basins were maintained at 60 X 32 X 20 cm each having 10 liters of water. Six basins were glass aquaria which were set in the laboratory and the rest were synthetic hapa having mesh size of 1.00 mm. A bamboo frame was made and placed in the pond where all the synthetic hapa were fixed with the frame in such a position that 20 cm of the structure of each synthetic hapa remained below water. A small opening was kept at one top-corner of each hapa for providing feed and sampling of fry. The larvae were reared up to 10 days in metal trays and fed *Tubifex* and other prepared feed. the experiment was designed into four treatments each having three replications. In treatments 1 and 2 glass tanks were used where *Tubifex* and Sabinco starter feed were supplied having a protein level of 64.48% and 40.31% (Table 1). In treatments 3 and 4 synthetic hapa were used providing similar supplemental feed. Ten days old African catfish fry of initial total length of 2.90 ± 0.01 cm and

weight of 0.30 ± 0.01 g were released at same stocking densities i.e. 50 individuals per experimental basins. Fry were acclimatized with experimental pond water in plastic bowl and then stocked in the synthetic hapa and glass aquaria at 1700 h on 7 July 1995. The larvae of treatments 1, 2, 3 and 4 were fed two times a day at 0800h and 1600h respectively. Feeds were supplied in excess of satiation. Two third of water from each aquarium was changed once daily in the morning before feeding. A weekly record of water quality parameters such as pH, dissolved oxygen and temperature were also maintained. The parameters were determined by pH meter (Jenway microprocessor pH meter, model no. 2050). Digital DO meter (Jenway oxygen meter, model no. 3050) and a celsius/centigrade thermometer respectively. Plankton samples were collected from the rearing pond at every 7 days interval. Ten litres of water samples were passed through the plankton net for filtration of plankton. Two plankton samples were taken at every sampling day. Two clear white plastic bottles were used for plankton preservation. The bottles had a capacity of 200 ml. Five percent formalin was used for preservation of plankton samples. The number of phytoplankton was expressed as units per liter. In that case the colonial as well as the filamentous algae each were treated as a single unit. The water of zooplankton was expressed as cells per liter. The number of larvae died in a day were recorded carefully. All the fry were counted during sampling period from both tanks and hapa. However, a final count was made at the end of the experiment.

Table 1. Proximate composition (% dry weight) of *Tubifex* sp. (after Jhingran, 1975) and Sabinco starter-1

Feed	Moisture	Crude protein	Lipid	Ash	Nitrogen free extract
<i>Tubifex</i> worms	-----	64.48	16.00	7.28	15.04
Sabinco starter-1	9.70	40.31	4.28	14.40	-----

The data obtained in present experiment were analyzed statistically to see whether the effects of different feed on growth (length and weight) and health condition of fry were significant. The mean values were compared according to Duncan's New Multiple Range test at the 0.01 probability level.

Results

The maximum and minimum gain in length were 12.90 cm and 6.17 cm in the treatments 3 and 2 respectively. The highest and lowest growth in weight were 18.77 g and 4.04 g in the treatments 3 and 2 respectively during the experimental period. Table 2 shows the data related to growth parameters of *C. gariepinus* under different treatments during the experimental period. The length

gain of catfish fry under treatments 1 and 3 were significantly higher ($P < 0.01$) than those of the treatments 2 and 4. Similar trend was also observed in case of weight gain. In both cases, better result gain was shown by the catfish fry under treatments 1 and 3 where natural feed was supplied.

The average survival rate in the treatments 1, 2, 3 and 4 were 87%, 56%, 92% and 70% respectively. The survivability of catfish fry under treatment 3 was higher when compared to those of the others. However, the lower survivability was shown by the fish under treatment 2.

The values of water temperature are also shown in Tables 3 and 4 respectively. Temperature of the experimental glass tank and synthetic hapa were found to range from 26.7°C to 29.6°C and 27.5°C to 30.5°C , respectively. The highest pH values of experimental glass tank and synthetic hapa were 8.08 and 7.76 and the lowest pH values of those were 6.80 and 6.20, respectively. The values of dissolved oxygen (DO) are also shown in Tables 3 and 4. Irregular fluctuations in the concentration of DO were observed. The range of dissolved oxygen (DO) values in the experimental glass tank and synthetic hapa (pond) were 4.95 to 5.60 m/l and 5.50 to 6.50 mg/l respectively.

Table 2. Growth parameters of *C. gariepinus* fry under different treatments during the experimental period

Parameters	TT (T_1)	TS (T_2)	PT (T_3)	PS (T_4)
Initial length (cm)	2.90 ^a	2.90 ^a	2.80 ^a	2.80 ^a
Final length (cm)	10.45 ^b	6.17 ^d	12.90 ^a	7.89 ^c
	± 0.151	± 0.364	± 0.212	± 0.276
Length gain	7.55 ^b	3.27 ^d	10.10 ^a	5.08 ^c
Initial weight (g)	0.30 ^a	0.30 ^a	0.29 ^a	0.29 ^a
Final weight (g)	10.74 ^b	4.04 ^d	18.77 ^a	6.28 ^c
	± 0.580	± 0.248	± 0.249	± 0.305
Weight gain	10.44 ^b	3.74 ^d	18.48 ^a	5.99 ^c
Ratio (g/cm)	1.028 ^b	0.655 ^d	1.455 ^a	0.796 ^c
Specific growth rate (SGR)	8.52 ^b	6.19 ^d	9.93 ^a	7.32 ^c
Survival rate (%)	87	56	92	70

Length - $T_3 > T_1 > T_4 > T_2$ Weight - $T_3 > T_1 > T_4 > T_2$ Ratio - $T_3 > T_1 > T_4 > T_2$ Survival- $T_3 > T_1 > T_4 > T_2$

Six planktonic groups consisting 20 genera were identified from experimental pond during the study period (Table 5). Four groups of phytoplankton and two groups of zooplankton were found. Fourteen genera of phytoplankton belonging to Chlorophyceae (7), Cyanophyceae (4), Euglenophyceae (2) and Bacillariophyceae (1) were found. Six genera of zooplankton were also identified belonging to crustacea (3) and rotifera (3).

Table 3. Water quality parameters (temperature, pH, dissolved oxygen) from rearing pond

Parameters	Sampling							
	Initial	1st	2nd	3rd	4th	5th	Final	Mean
Temp.	28.00	28.20	30.50	30.00	30.00	28.30	27.50	28.92
pH	7.75	7.76	7.00	6.20	7.20	7.00	6.88	7.11
DO	6.50	6.10	6.40	5.50	6.50	6.30	5.60	6.13

Table 4. Water quality parameters (temperature, pH, dissolved oxygen) from laboratory glass tank

Parameters	Sampling							
	Initial	1st	2nd	3rd	4th	5th	Final	Mean
Temp.	26.70	27.50	27.80	27.00	28.50	29.00	26.80	27.62
pH	8.08	8.08	7.00	6.80	7.20	7.20	7.13	7.35
DO	5.50	5.00	5.30	5.60	4.95	5.20	5.40	5.57

Table 5. Generic status of plankton (phytoplankton and zooplankton) in the experimental pond

A. Phytoplankton	
1. Chlorophyceae	<i>Pediastrum, Chlorella, Gloeocystis, Tetraedron, Volvox, Ulothrix</i>
2. Cyanophyceae	<i>Irocystis, Merismopedia, Chlocooccus, Coelastrum,</i>
3. Euglenophyceae	<i>Aphanocapsa</i>
4. Bacillariophyceae	<i>Euglena, Phacus</i>
B. Zooplankton	
	<i>Navicula</i>
1. Crustacea	<i>Cyclops, Diaptomus, Diaphanosoma.</i>
2. Rotifera	<i>Filinia, Bracionus, Polyarthra</i>

Discussion

Effects of natural (*Tubifex*) and artificial (Sabinco Starter-1) feeding conditions on the growth of African catfish (*C. gariepinus*) fry in glass tanks and synthetic hapa (pond) were investigated in this experiment. Growth and survival rate of catfish fry were significantly higher in the treatment provided with live food (treatments 1 and 3) when compared with the treatment provided with formulated food (treatments 2 and 4). The maximum gain in length and weight were 10.10 cm and 18.48 g respectively which was obtained in the treatment 3 where live feed was supplied. The minimum gain in length and weight i.e. 2.27 and 3.74 g were obtained respectively in the treatment 2 where artificial formulated feed was supplied. This was possibly due to more affinity of catfish fry to *Tubifex*. This result coincides with the findings of different authors. Alam and Mollah (1988) reported *C. batrachus* larvae fed on live feed (*Tubifex* sp.) to exhibit significantly superior growth than artificial feeds. Hashim *et al.* (1993)

observed better results supplemented with live *Tubifex* than those reared without supplemental diets. Polling *et al.* (1988) used zooplankton, *Artemia* and trout fry starter meal (dry food) as a feed for *C. gariepinus* larvae over 12 days of experiment. Among the supplied food the highest growth was recorded from fish fry supplied with *Tubifex* which was followed by zooplankton, *Artemia* and dry feed. Mollah and Nurullah (1988) successfully reared *C. batrachus* larvae with live feed (*Tubifex* sp.).

Protein levels of *Tubifex* was 64.48% and Sabinco starter-1 was 40.31% in the treatments, 1, 3 and 2, 4 respectively. Henken *et al.* (1986) reported that crude protein requirement of *C.* varied from 41.2 to 43.6 which were depended on temperature. Chuapoehuk (1987) carried out experiment with 7 diets containing 20, 25, 30, 35, 40, 45 and 50% protein each of which was used to feed 200 walking catfish (*C. gariepinus*) fry kept in circular concrete tanks for 60 days. He found that 30, 35 and 40% protein gave excellent growth but the diet containing 30% protein produced optimum growth. Degani *et al.* (1989) and Madu and Tumba (1989) reared catfish fingerling in an outdoor rearing system with feeds of different protein levels. They found that 40% crude protein gave better result than lower and higher. Mollah and Hossain (1990) reported that 39.5% protein appeared suitable for rearing of *C. batrachus*. According to Cruz and Laudencia (1976) the crude protein requirement for *C. batrachus* was 37.72%.

Water quality parameters did not show any significant difference in both the culture systems and hence did not influence the growth and survival of catfish fry. However, water quality parameters remained in the suitable range of tropical fish culture and the mean value of temperature, pH and DO for *Clarias* culture were 30.88⁰C, 8.34 and 5.9 ppm. The values of temperature and pH for experimental pond coincided with the findings of Viveen *et al.* (1985). Mollah (1984), Britz and Hecht (1987) and Haylor and Mollah (1994) observed that 30⁰C is the favourable temperature of *Clarias* larvae rearing. Henken *et al.* (1986) reported that the growth rate of African catfish at 29⁰C is higher than at 24⁰C. The pH value was in alkaline range in the pond which was suitable for fry rearing. Tarnchalanukit *et al.* (1983) indicated that the improved water quality in ponds allows greater growth and survival of *Clarias*.

Survival rate was significantly higher in the treatments provided with *Tubifex* and with the net cage systems when compared with culture in glass tanks. The survival rate was 92% in case of live feed whereas it was 56% when formulated feed was supplied. The highest survival rate was noticed in the pond conditions where natural feed was supplied. The survival rate of 70% obtained from similar environmental condition applying artificial feed could also be considered satisfactory. This results coincide with the findings of Alam and Mollah (1988) who reported that the survival rate (80.2%) obtained with artificial feed containing 56% fish meal, 90% bakers yeast and 14% wheat flour was comparable to those

fed *Tubifex* sp. (91.5%). Kestemont and Statmans (1992) reported that from an initial body weight of 1.86 mg at hatching, *Phoxinus phoxinus* larvae reared to about 30 mg in 4 weeks time and survival rate was higher than 96%. On the other hand the dry feed was not suitable for the *Phoxinus phoxinus* larvae where mortality rate was increased.

According to Ahmed (1994), *Tubifex* alone was a suitable feed which is very difficult to obtain throughout the year. The author further mentioned that considering the survival rate (75%) obtained and protein content (52%) in Sabinco starter-1 feed, it could be recommended as an alternative artificial feed for commercial production of African catfish especially when *Tubifex* is not available. In both the cultural basins, growth and survival of catfish fry were significantly increased with the live feed, *Tubifex*. Till now commercial production of *Tubifex* has yet to be developed. So, we have to depend on a particular season to have required quantity of *Tubifex*. On the other hand, artificial feed like Sabinco starter-1 is available throughout the year. Moreover growth and survival of catfish fry on this feed was not too low. Thus, this feed could be considered as an alternative to natural feed for the large scale production of African catfish fry.

As a cultural basin, net cages fixed in waterbodies might be better when compared with culture in aquaria. Net cage system, are less labour intensive, low cost showing a higher growth performances in the present experiment. Thus for rearing of young catfish fry a net cage system set would be preferable. However, more research works are necessary in order to make a final conclusion about the cultural system for African catfish fry.

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