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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 6 (20): 1753-1757, 2003
ISSN 1028-8880

Effect of Different Shelters on Growth, Survival and Production of Freshwater mud eel, *Monopterus cuchia* (Hamilton) Reared in Cemented Cisterns of BAU, Mymensingh, Bangladesh

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Abstract: The above experiment was conducted to study the effect of different shelters on growth, survival and production of freshwater mud eel, *Monopterus cuchia* reared in cemented cisterns (1.25 m^2 each) over a period of 12 months from July 2001 to June 2002. Three different shelters namely Shelter 1(mud) Shelter 2 (Water hyacinth) Shelter 3 (PVC pipes) and control (without shelter) were applied to treatment I, II, III and IV, respectively with dead small fish as a food (protein 30%). Each of the cisterns was stocked with 10 fish with mean initial body weight of 35.5±2.55 g. Each treatment was replicate thrice. Significantly ($p<0.05$) highest weight gain (82.63±5.80 g) was obtained in treatment II followed by treatment I (53.80±0.65) and lowest weight gain (24.93±0.89 g) was observed in treatment IV. Significantly ($p<0.05$) highest Survival rate (100%), was observed in treatment II and lowest (50%) was in treatment IV. The highest specific growth rate (0.3290±0.0141) and production (0.945±0.046 Kg/ m^2/year) were found in the treatment II and lowest specific growth rate (0.1457±0.0029) and production (0.099 Kg/m^2/year) was observed in treatment IV. Weight gain was observed in all the treatments from February to November. However slight weight loss (estivation) was noted during the winter months from December to January in all treatments. Water quality parameters including temperature, dissolved oxygen, pH and alkalinity were recorded throughout the study period and were found with in the suitable range. On the basis of survival rate and production, it is suggested that the water hyacinth is a suitable shelter for the culture of *M. cuchia* in the cemented cisterns.

Key words: Growth rate, estivation, shelter, *Monopterus cuchia*

INTRODUCTION

The mud eel, *Monopterus cuchia* (Hamilton), is a fresh water air-breathing, swamp mud eel locally known as Kuchia or Kucha, belongs to a family synbranchidae of the order synbranchiformes, it commonly occurs in the freshwaters of Bangladesh, Pakistan, Northern and Northeastern India and Nepal (Talwar and Jhingran, 1991). In Bangladesh it is commonly found throughout the country, plenty in mud-holes in shallow beels and boro paddy fields particularly in Sylhet, Mymensingh and Tangail districts (Rahman, 1989). It has developed specialized pharyngeal pouches for bimodal gas exchange (Hughes and Munshi, 1973; Munshi, 1985). *M.cuchia* is a carnivorous nocturnal (active by night) and prefers animal based food like small fishes, mollusc and worms. It often spends the day hidings under crevices, water hyacinth, stones and mud Nasar (1997). The habitat or microenvironment plays an important role for the better growth and survival rate of some fish species. (Ali *et al*., 1999).

At present no work on the growth, survival and production so far has been done on this species elsewhere in the world, few isolated studies related to the haematology by (Mishra *et al*., 1977; Narejo *et al*., 2001), histochemistry of the unicellular gland. Mittal and Agrawal (1977), Mittal *et al*. (1980) structure and histochemistry of epidermis and respiratory adaptations by Singh *et al*. (1989) are available.

Since there is no culture system for these freshwater eels, it is necessary to develop a scientific eel culture system with different shelters to observe their growth, survival rate and production under different conditions. Studies on such aspect (shelters) is still lacking. Considering the lack of information, in the same line, the present study was initiated to observe the effect of different shelters on growth, survival and production of *M.cuchia*, which will enable us to save these freshwater eels from extinction.

MATERIALS AND METHODS

A preliminary study was conducted for 3 months with different shelter like mud, water hyacinth and PVC pipe. It was observed that the mud eel, *M.cuchia* prefer water hyacinth as shelter. So that the above study was

conducted round the year to observe effect of different shelters on growth, survival and production of freshwater mud eel in cemented cisterns.

Collection of fish: Live specimens of *M. cuchia* of the same weight (35.5±2.55 g) were collected from local fishermen. Collected fishes were acclimatized for 15 days in a cemented cistern with water hyacinth as a shelter.

Site selection and duration: Twelve-cemented cisterns (1.25 m^2 each) were chosen instead of mud ponds, to avoid burrowing of eel as reported by Nasar (1997). The culture of mud eel with different shelters was conducted for 12 months from July 2001 to June 2002. The cisterns were adjacent to the Faculty of Fisheries, Bangladesh Agricultural University Mymensingh.

Preparation of cisterns: The size of cisterns were 1.25 m^2, each cistern were provided with different shelters like mud, water hyacinth and PVC pipes. About half of the bottom of the 3 cistern soft mud was placed at the center as shelter, at a height about 30.0 cm and designated as treatment I, half of the 3 cisterns provided with water hyacinth as a shelter in treatment II, in 3 cisterns ten PVC pipes of size about 50 cm long with same diameter (4.5 cm) were placed in at the bottom of cistern as a shelter in treatment III and three cisterns were used as control (without shelter) in treatment IV. The depth of water was maintained at 15.0 cm for all the cisterns. The cisterns was provided with alternate day water exchange to prevent accumulation of growth inhibitory ammonia (Seymour, 1980). Ten fish of same size (35.5±2.55 g) were reared in each cistern with three replications.

Feeding and sampling: Initially the feed (dead small fish) was supplied at a rate of 5% of the body weight as reported by (Usui, 1974; Nasar, 1997) given once daily evening at 5.00 PM for one weak basis. It was noted that fishes start feeding in the late evening and observe in the next morning whether food was consumed or not. After one weak the amount of feed were supplied as required by the fish. Sampling was done at an interval of one month to measuring weight of fish and to observe the health condition of fish. The fish were weighed on an electronic balance with the help of small plastic bucket to determine their growth rate. The growth increment in terms of weight was measured. Due to the heavy secretion of mucus on the body of freshwater eel, it was very difficult to handle the live fish, so that the length measurement was avoided.

Water quality parameters: Water quality parameters like temperature, dissolved oxygen, pH and alkalinity were recorded monthly throughout the study period from the cemented cisterns. The results of the water quality parameters are shown in Table 1.

Statistical analysis: Statistical analysis was performed single factor analysis (one ways) of variance (ANOVA). Duncan's new multiple range test (DMRT) was performed to compare the all treatment means.

RESULTS

The growth performance of freshwater mud eel, *M.cuchia* in terms of initial and final mean weight, weight gain, % weights gain, specific growth rate (SGR), survival rate and production of the experimental fishes in different shelters has been presented in the Table 2. The weight gain was significantly ($P<0.05$) highest (82.63±5.80 g) in treatment II with water hyacinth as a shelter followed by (53.80±0.65 g) in treatment I with mud as a shelter and lowest was (24.93±0.89 g) in treatment IV control (without shelter). The specific growth rate (% per day) of fish in different treatments varied between 0.1457±0.0029 and 0.3290±0.0141. Significantly ($P<0.05$) the highest value was obtained in treatment II and lowest in treatment IV. The survival rate of fish varies significantly ($P<0.05$) among the treatments. The highest survival rate of fish (100%) was observed in treatment II with water hyacinth as a shelter and followed by treatment I (80%) with mud as a shelter and the lowest (50%) was observed in treatment IV control (without shelter). The highest fish production (0.945±0.046 Kg/m^2/Year) was obtained in treatment II followed by treatment I (0.572±0.063 Kg/m^2/Year), treatment III (0.389±0.047 Kg/m^2/Year) and the lowest production was obtained in treatment IV (0.099±0.047 Kg/m^2/Year), respectively. The Initial average weight of 35.5±2.25g reached a final weight of 89.30±0.65, 118.13±5.81, 69.50±1.08 g and 60.43±0.89 g for treatment I, II, III and IV with mud, water hyacinth, PVC pipes and control (without shelter) as a shelter, respectively. Which is shown in Fig. 1. The weight gain was observed in all treatments during the months from February to November. However, slight weight loss (estivation) was observed during the months of December to January (winter months) for treatment I, II, III and IV, respectively. The water temperature during the winter months ranging from 11 to 18°C. It was also noted that all the fish were burrows inside the mud in one place. Similar situation was observed in water hyacinth all the fish were found together under the water hyacinth. While the fish, which were in the PVC pipes as shelter, all were found in a single pipe with a diameter of 4.5 cm for hibernation (estivation) in control (without shelter) the all fishes

Table 1: Monthly water quality parameters recorded from the cemented cisterns of *Monopterus cuchia* reared with different shelters

	Parameters			
Months	Temperature (°C)	pH	Dissolved Oxygen mg/L	Alkalinity mg/L
July 2001	30.1	7.45	3.8	57
August	30.3	7.55	3.7	59
September	28.1	7.50	3.8	56
October	27.0	7.42	3.9	54
November	20.1	7.35	4.0	52
December	16.8	7.45	4.12	50
January 2002	10.6	7.55	4.15	46
February	19.8	7.52	4.10	47
March	25.7	7.50	4.05	49
April	27.2	7.45	4.0	52
May	28.5	7.38	3.9	54
June	29.5	7.35	3.8	57

Table 2: Growth, survival and production of *Monopterus cuchia* under different shelters reared in the cemented cisterns of BAU, Mymensingh, Bangladesh

Parameters	Treatment I	Treatment II	Treatment III	Treatment IV
Initial weight (g)	$35.5^{1a}\pm2.55^{2}$	$35.5^{a}\pm2.55$	$35.5^{a}\pm2.55$	$35.5^{a}\pm2.55$
Final weight (g)	$89.30^{b}\pm0.65$	$118.13^{a}\pm5.81$	$69.50^{c}\pm1.0$	$60.43^{d}\pm0.89$
Net gain (g)	$53.80^{b}\pm0.65$	$82.63^{a}\pm5.80$	$34.0^{c}\pm1.0$	$24.93^{d}\pm0.89$
% weight gain	$151.54^{b}\pm2.43$	$232.76^{a}\pm16.3$	$95.77^{c}\pm3.0$	$70.22^{d}\pm2.0$
SGR (%per day)	$0.2527^{b}\pm0.02$	$0.3290^{a}\pm0.01$	$0.1839^{c}\pm0.4$	$0.1457^{d}\pm0.2$
Survival rate %	$80.0^{b}\pm10.0$	$100.0^{a}\pm0.0$	$70.0^{c}\pm10.0$	$50.0^{d}\pm10.0$
Production (Kg/m^2/Year)	0.572±0.063	0.945±0.046	0.389±0.04	$0.099^{d}\pm0.89$

1. Figures in the same row having the same superscripts are not significantly different (p>0.05)
2. Standard deviation

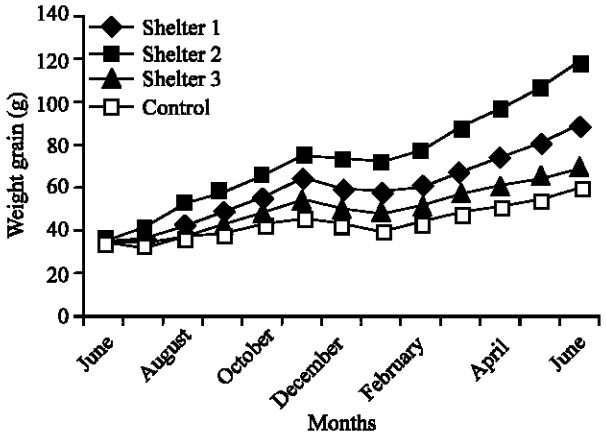

Fig. 1: Mean growth of *M.cuchia* in terms of weight gain (g) at different shelters and months reared in the cemented cisterns of BAU, Mymensingh

were found together in one corner of the cistern. That was might be one of the strategies of the fish to protect themselves from stress of low temperature during the winter months from December to January. Water quality parameters and their monthly fluctuation during the study period as shown in Table 1. The range of the temperature was recorded from 10.6 to 30.3°C, dissolved oxygen values were found between 3.7 to 4.15, the range of pH was 7.35 to 7.55 and alkalinity was ranged between 46 to 59.

DISCUSSION

The present study was conducted to determine the suitability of different shelters on the growth, survival and production of freshwater mud eel, *Monopterus cuchia* in cemented cisterns of BAU, Mymensingh, Bangladesh. Growth rate of *M.cuchia* in terms of increase in body weight during the experimental period was highest (82.63 g) in treatment II receiving water hyacinth as a shelter. The increasing trend of mean weight gain in fish was obtained from February to November months in all treatments. In the present study it was observed that the water hyacinth found to be a best shelter among the supplied shelter for the growth of the mud eel. It might be the orientation of the shelter, water hyacinth provide shelter vertically and fish can place themselves at a suitable place for their comfort to live, aerial respiration and feeding. Teng and Chua (1979) reported similar observations, they used car tyres as a shelter for rearing of estuary grouper *Epinephelus salmoides* and found highest weight gain. Ali *et al.* (1999) used submerged aquatic plants as a shelter and found that the highest growth and survival rates in *Penaeus monodon.* The results of the present study agreed with the findings of Ali *et al.* (1999) and Teng and Chua (1979). The specific growth rate (% per day) was significantly (P<0.05) highest (0.3290) in treatments II and lowest was in treatment IV (0.1457). The increasing trend in mean body weight

of *M.cuchia* was observed during the months from February to November, it might be due to the optimum temperature (22–31°C). Similar results were reported by Rashid *et al.* (1996) in *Pangasius sutchi*. However, slight weight loss (estivation) was observed during the winter months December to January due to low water temperature (10.6–16.8°C). Usui (1974) and Nasar (1997) reported an ideal temperature for proper feeding and growth of *M. cuchia* is between 20 to 35°C and commented that the fish would not eat well below and above the temperature ranges and Usui (1974) reported that the below approx. 12°C eels *A. japonica, A anguilla* and *A. rostrata* do not feed and thus do not grow at all, hibernating and burrows in the mud. The above findings and temperature ranges agreed with the present findings. Brown (1957) reported that temperature altered the rates of metabolic process and could be expected to have a considerable effect on the growth of poikilothermous animals. Nikolsky (1963) observed that metabolic rates were most closely connected with changes in temperature of the surrounding water. The above findings support the present study. In the present study it was observed during the winter that all fish burrows in mud and PVC pipes (hibernation). Similar observation was reported by Nasar (1997) in *A. Japonica, A. anguilla, A. rostrata* and *M. cuchia*, respectively. Significantly highest survival rate (100%) was recorded in treatment II (water hyacinth) and lowest (50%) in treatment IV (without shelter). Teng and Chua (1979) reported the similar survival rate 93.8 to 99.1% with artificial hides (with car tyres as a shelter). The fish production in the present findings was ranging from 0.099±0.089 to 0.945±0.046. The highest production of fish was obtained in treatment II might be due to the greater survival rate of the fish with water hyacinth as a shelter. However the production obtained in the present study was found better than that of Narejo *et al.* (2002) obtained 116.83 Kg/acre/180 days in snake eel, *P. boro* fed with chopped *Lamilliden* (5.2% protein). The water quality parameters was recorded during the study period were found within the suitable range for fish culture. The temperature was recorded from 10.6 to 30.3°C during the study period is more or less similar to that reported by Mumtazuddin *et al.* (1982) and Rahman *et al.* (1982). The dissolved oxygen values during the study period were found between 3.7 to 4.15 mg L^{-1}, which is similar to the findings as reported by Rahman *et al.* (1982). In the present study the range of pH and alkalinity was measured from 7.35 to 7.55 and from 46 to 59 mg L^{-1}, respectively which are in the productive ranges as observed by Swingle (1967) and Rahman (1992).

It is clear from the results of the present study that *M. cuchia* can be reared successfully in cemented cisterns with water hyacinth as a suitable shelter for the better growth, survival rate and production. While control or (without shelter) showed poor growth and fluctuating survival rates.

REFERENCES

Ali, M.S., A.F.M. Shofiquzzoha and S.U. Ahmed, 1999. Effect of submerged aquatic vegetation on growth and survival of *Penaeus monodon* (Fab.). Bangla. J. Fish. Res., 3: 145-149.

Brown, M.F., 1957. The physiology of fishes. Academic press Inc. Publishers. New York, 1: 390-392.

Hughes, G.M. and J.S.D. Munshi, 1973. Nature of the air-breathing organs of the Indian fish. *Channa, Amphipnous, Clarias and Saccobranchus* as shown by electron microscopy. J. Zool. Lond., 170: 245-170.

Mishra, N., P.K. Pandey and J.S. Datta Munshi, 1977. Haematological parameters of an air-breathing mud eel, *Monopterus cuchia* (Ham.) (Amphipnoidae; Pisces). J. Fish Biol., 10: 567-573.

Mittal, A.K. and S.K. Agarwal, 1977. Histochemistry of the unicellular glands in relation their physiological significance in the epidermis of *Monopterus cuchia* (Synbranchiformes, Pisces). J. Zool. Lond., 182: 429-439.

Mittal, A.K., M. Whitear and S.K. Agrawal, 1980. The structure and histochemistry of the epidermis of the *Monopterus cuchia*. J. Zool. Lond., 191: 107-125.

Mumtazuddin, M., M.S. Rahman and G. Mustafa, 1982. Limnological studies of four selected ponds in aquaculture extension station, Mymensingh, Bangla. J. Fish., 2-5: 83-90.

Munshi, J.S.D., 1985. The structure, function and evolution of the accessory respiratory organs of air-breathing fishes of India. In Vertebrate Morphology (Duncker and Fleischer, Eds.), New York: Gustav Fischer, pp: 353- 366.

Narejo, N.T., M. Mamnur Rashid and S.M. Rahmatullah, 2001. Variations in the haematological parameters of the freshwater mud eel, *Monopterus cuchia* (Hamilton) with respect to sex and season. Bangla. Veterinarian, 18: 49-57.

Narejo, N.T., M.M. Haque and S.M. Rahmatullah, 2002. Growth performance of snake eel, *Pisodonophis boro* (Hamilton) reared experimentally with different food items. Bangla. J. Train. and Devt., 15: (in press).

Nasar, S.S.T., 1997. Backyard eel culture: International Institute of rural reconstruction, Silang, Cavite, Philippines, pp: 88.

Nikolsky, G.V., 1963. The ecology of fishes (translated by L. Birkett). Academic press Inc. London and New York, pp: 17-19.

Rahman, A.K.A., 1989 Freshwater fishes of Bangladesh. Zool. Soc. Bangla.Univ. Dhaka, Bangladesh, pp: 364.

Rahman, M.S., M.Y. Chowdhury, A.K.M.A. Haque and M.S. Haq, 1982. Limnological studies of four ponds, Bangla. J. Fish., 2-5: 25-35.

Rahman, M.S., 1992. Water quality management in aquaculture. BARC, Prokashana, Mohakhali, Dhaka, Bangladesh, pp: 84.

Rashid, M.H., S.M. Rahmatullah and M.R. Amin, 1996. Preparation of low cost feed for cage culture of pangus *Pangasius sutchi* (Fowler). Bangla. J. Fish., 19: 45-52.

Seymour, E.A., 1980. The effects and control of algal blooms in fishponds. Aquaculture, 19: 55-74.

Singh, B.N., M.A. Toowheed and J.S.D. Munshi, 1989. Respiratory adaptations in the larvae of *Monopterus cuchia* (Ham.). J. Fish Biol., 34: 637-638.

Swingle, H.S., 1967. Standardization of chemical analysis for waters and pond mud. FAO Fish. Rep., 4: 397-421.

Talwar, P.K. and A.G. Jhingran, 1991. Inland Fisheries of India and Adjacent Countries. Vol. 1, Oxford and IBH Publishing Co. Pvt. Ltd., Calcutta, Pages: 514.

Teng, S.K. and T.E. Chua, 1979. Use of artificial hides to increase the stocking density and production of estuary grouper, *Epinephelus salmoides* Maxwell, reared in floating net cages. Aquaculture, 16: 219-232.

Usui, A., 1974. Eel culture: Fishing News Books Limited, England, pp: 188.