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# Effect of light exposure and shelter on growth performance and survival of *Mystus cavasius* (Hamilton, 1822) fingerlings

**Gopal Chandra Rout, Krina Patel, Sonali Mahapatra, Sandeep Behera and Mahavadiya DR**

**Abstract**
The present research was designed to study the effect of light exposure and shelter on *Mystus cavasius*. Fingerlings were stocked in each tank for the evaluation of growth and survival, continued for six weeks. The fingerlings were reared in three treatments with three replications, first was normal open tank, second was provided with shelter for hiding and third was completely covered with polythene sheet to provide dark environment for six weeks. Specific growth rate, feed conversion ratio, protein efficiency ratio and survival rate were observed at every fifteen days interval. At the end of the experiment result showed that maximum weight was observed in tanks which were provided with hiding space however the length of fish after six weeks of experiment were not varying much.

**Keywords:** Cannibalism, captive condition, *Mystus cavasius*, growth performance

## 1. Introduction
*Mystus cavasius* (Hamilton, 1822) [10] is a Bagrid catfish belongs to family Bagridae of order Siluriformes (Gupta, 2014) [8]. It is a highly prized food fish and found naturally in a variety of lentic and lotic freshwater environments of the Indian subcontinent (Das *et al.*, 2018) [5]. It is commonly known as Gangetic Mystus which has been reported to be distributed in India, Thailand, Bangladesh, Pakistan, Nepal, Sri Lanka and Myanmar (Day, 1878; Talwar and Jhingran, 1991; Tripathi, 1996; Rahman *et al*., 2004; Chakrabarty and Ng, 2005) [6, 20, 21, 17, 4]. It can be popularly known as Gulsha which is a non-air breathing fish well adopted to adverse ecological condition (Kohinoor 2009) [12]. Alligarh (UP) local fishermen call it "SUTIA KATUA" or only sutia because of its long thread like maxillary barbels. This fish is usually found in fresh water and is mostly available in rivers (both fast flowing and slow flowing), canals, beels, ponds, ditches and inundated fields (Nath and Dey, 2017; Roy and Hossain, 2006) [15, 18]; also, has been reported from tidal rivers and lakes (Talwar and Jhingran, 1991) [20]. It has high market demand as food fish with high market price (Talwar and Jhingran, 1991; Rahman *et al*., 2004; Siddiqui *et al*., 2010; Hossen *et al*., 2014) [20, 17, 19, 11] due to good protein content in its flesh (Roy and Hossain, 2006; Siddiqui *et al*., 2010; Ashashree *et al*., 2013) [18, 19, 1]. It has also made its entry in the ornamental fish market and recently has been documented to be exported as indigenous ornamental fish from India (Gupta and Banerjee, 2014) [9]. This species has a carnivore feeding habit, mainly feeding on insect larvae, small fish, crustaceans and debris. Till now its fishery is mainly capture based and it is on the verge of extinction (Kohinoor, 2009) [12], so for the maintenance of population for future generations its captive culture is needed. The fish are not only used as food fish but it has also ornamental value so it may create an income opportunity to rural farmers. Cannibalism is the main problem in the captive rearing of catfish. So, to overcome this problem our research focuses on growth performance of *M. cavasius* by using providing different environmental condition that is providing hide-outs then dark environment and open environment. So, in this research it was studied the effect of different captive conditions for rearing of *Mystus cavasius*.

## 2. Materials and Methods
### 2.1 Experimental fish
For the present experiment, *Mystus cavasius* fingerlings were chosen as sample specimen. The fingerlings were uniform in size of 7.25 cm length and 2.697 gm weight.

Fingerlings were collected from local fish market captured from the canal and ditches of Pipili, Odisha. Before starting the experiment, the sample specimens were being acclimatized in the well maintained FRP tank for 10 days and fed with rice bran and ground nut oil cake mixture (1:1) twice a day.

### 2.2 Experimental design
The experiment was carried out in circular FRP tank (250 l capacity) under three different treatments. The research design followed was completely randomized design (CRD) consisting of three treatments and three replications. In first treatment (T1), the fingerlings were reared in normal tank where as in second treatment (T2) tank provided with shelters for hiding and in third treatment (T3) tanks were completely covered with polythene sheet to provide dark environment. Total 135 fingerlings were stocked @ 15/tank. The research was carried out in CRD in three treatments with three replicas.

### 2.3 Tank preparation and stocking
Prior to start of the experiment, FRP tanks used for treatments were first disinfected with KMnO4 solution (1-2 mg/liter). After disinfection tanks were cleaned with fresh water and dried in sunlight for one day. Next day dried tanks were filled with water and sufficient aeration was provided. Then the acclimatized fingerlings were stocked fifteen number in each tank and cultured for 45 days.

### 2.4 Preparation of feed and application
All ingredients for feed preparation like fish meal, soyabean meal, meat and bone meal, groundnut oil cake, rice flour, maize bran, binder was purchased from local market and vitamin- mineral mixture was purchased from local medical store. The proximate composition of all ingredient has been evaluated to calculate the protein requirement of *M. cavasius*. The inclusion rate of different feed ingredients (Table 2) was calculated using Microsoft excel, 2019. The required quantities of all ingredients mixed together and feed was prepared by manual mixing.
Feed was given at the rate of 5-8% body weight for 45 days. Feeding was adjusted on the basis of feed consumption and feeding rate was decreased from 8% to 5% of the average body weight. The amount of feed used in experiment was calculated daily.

**Table 1:** Proximate composition of different feed ingredients

| Ingredients | Moisture (%) | Protein (%) | Lipid (%) | Fiber (%) | Ash (%) |
|---|---|---|---|---|---|
| Fish meal | 17.61 | 61.2 | 7.52 | 1.54 | 24.89 |
| Soyabean meal | 14.46 | 44.9 | 13.54 | 12.10 | 9.73 |
| Meat and bone meal | 9.93 | 48.0 | 3.90 | 1.12 | 1.60 |
| Groundnut oil cake | 7.93 | 34.3 | 9.62 | 1.12 | 1.60 |
| Wheat flour | 7.67 | 13.58 | 8.4 | 18.5 | 13.5 |
| Rice flour | 11.29 | 13 | 6.8 | 19.6 | 14.2 |
| Maize bran | 11.66 | 13 | 10 | 10.45 | 20.85 |

**Table 2:** Amount of different feed ingredients used for feed composition

| Ingredients | Treatment (35% protein) |
|---|---|
| Fish meal | 21 |
| Soyabean meal | 14 |
| Meat and bone meal | 14 |
| Groundnut oil cake | 15 |
| Wheat flour | 12 |
| Rice flour | 10 |
| Maize bran | 10 |
| Binder | 1 |
| Vitamin- mineral mixture | 2 |

### 2.5 Water quality parameters
Physico-chemical parameters like water temperature, dissolve oxygen, pH, alkalinity and ammonia were measured weekly and data were recorded periodically to provide optimum environment. Temperature, dissolve oxygen and pH measured by Celsius thermometer, digital DO meter and digital pH meter respectively.

### 2.6 Evaluation of growth Parameters
Sampling was done at initially and at the end of study to assess the growth of fishes. Fishes were starved overnight before taking the weight. The weight was taken by an electronic weighing balance and length was recorded with the help of standard measuring board.

#### 2.6.1 Estimated weight gain
Weight gain= final weight (g) – initial weight of fish (g)

#### 2.6.2 Specific growth rate (SGR)

$$SGR\ (\%/day) = \frac{Ln\ W2 - Ln\ W1}{T} \times 100$$

Where, T = experiment period; W2= final weight; W1 = initial weight

#### 2.6.3 Feed conversion ratio (FCR)

$$FCR = \frac{Feed\ in\ take\ (g)}{Weight\ gain\ (g)}.$$

#### 2.6.4 Protein efficiency ratio (PER)

$$PER = \frac{wet\ weight\ gain\ of\ fish\ (g)}{weight\ of\ protein\ fed\ (g)}\ (Dry\ feed\ based)$$

#### 2.6.5 Survival

$$Survival\ (\%) = \frac{Total\ no.\ of\ live\ animals}{Total\ no.\ of\ initial\ animals} \times 100$$

### 2.7 Statistical analysis
All the collected data were subjected to one-way analysis of variance (ANOVA) and tested Duncan's New Multiple Range Test (DMRT) to identify significant differences among the mean values. This statistical analysis was performed with the

support of the computer software SPSS program version 16 (Zar, 1984) [22].

## 3. Results

### 3.1 Water quality analysis

Water quality was observed regularly and results of water quality parameters such as dissolve oxygen, temperature, pH, alkalinity, hardness and ammonia obtained has been enlisted in Table 3.

**Table 3:** Water quality observed during the study

| Parameters | Range |
|---|---|
| Dissolve oxygen (mg L-1) | 3.78-3.92 |
| Temperature (0C) | 28.5-30.2 |
| pH | 7.67-8.36 |
| Alkalinity (ppm) | 252-296 |
| Hardness (ppm) | 132-192 |
| Ammonia (ppm) | 0.02-0.05 |

### 3.2 Growth parameters

The growth parameters such as weight gain, specific growth rate, food conversion ratio, protein efficiency ratio was measured initially and at the end of the experiment. The survival was also observed at the end of research study.

At the end of experiment results showed that treatment T2 showed highest growth significantly growing from 2.70 ± 0.008a g to 6.20 ± 0.01c g compared to all other treatment ($p< 0.05$). However it was also seen that all the treatments had significant difference where treatment T1 and T3 showed the final weight of 4.54 ± 0.19a g and 5.58 ± 0.001b respectively. The study shows that the there is an effect of habitat on the growth of *M. cavasius*. Specific growth rate (SGR) was also observed at the end of study and its values for T1, T2 and T3 were 0.08 ± 0.003a, 0.10 ± 0.002c and 0.09 ± 0.001b respectively. The result showed that there was significant difference in SGR among the treatments ($p<0.05$). Similar results were observed in the case of protein efficiency ratio (PER) where treatment T2 showed highest PER (0.68 ± 0.001c) whereas treatment T1 and T3 showed 0.43 ± 0.04a and 0.61 ± 0.007b. The food conversion ratio (FCR) was observed highest in 5.96 ± 0.01 in treatment T1, followed by 4.10 ± 0.02 in treatment T3, and 3.66 ± 0.02 in treatment T2. There was no significant difference in the survival among the treatments. All the growth parameters observed during the research study is shown in table 4.

**Table 4:** Growth parameters observed during the study

| Treatments | Initial Weight(g) | Final Weight(g) | Specific Growth Rate | Food Conversion Ratio | Protein Efficiency Ratio | Survival (%) |
|---|---|---|---|---|---|---|
| T1 | 2.70 ± 0.004a | 4.54 ± 0.19a | 0.08 ± 0.003a | 5.96 ± 0.64b | 0.43 ± 0.04a | 100 ± 0.0a |
| T2 | 2.70 ± 0.008a | 6.20 ± 0.01c | 0.10 ± 0.002c | 3.66 ± 0.006a | 0.68 ± 0.001c | 100 ± 0.0a |
| T3 | 2.69 ± 0.003a | 5.58 ± 0.001b | 0.09 ± 0.002b | 4.10 ± 0.04a | 0.61 ± 0.007b | 100 ± 0.0a |

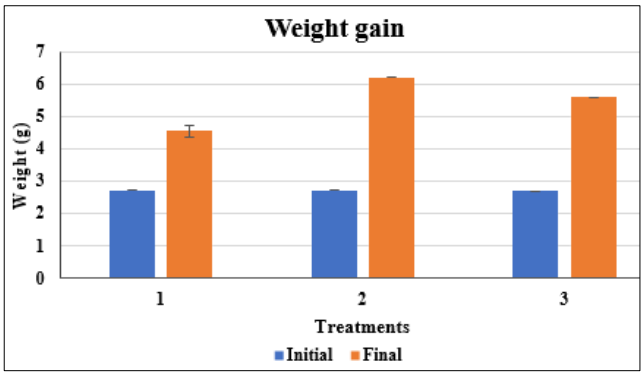


**Fig 1:** Weight gain

## 4. Discussions

The present study highlights the growth performance of *M. cavasius* under different captive conditions. The results of the study found that treatment T2 that provides hide out and shelter gives exhibited the best results compared to other treatments. This is mainly because catfishes are shy in nature and show cannibalistic behavior hence, hide out provide the suitable condition for their growth. A study has conducted on the growth performance, and survivability of wild juvenile of *Scylla serrata* based on with and without shelter and found higher growth rate in shelter condition and shelter has no significance effect on survivability (Mirera and Moksnes, 2014) [13]. In post-mating female of mud crab (*Scylla paramamosain*) under dark condition found low SGR, FCR, weight gain ratio (WGR), Gonad somatic index compared to normal light condition (Farhadi *et al*., 2021) [7]. Catfishes also exhibits nocturnal feeding behavior and stressed in the light environment both of which contribute to improved growth in presence of hide-outs (Rahman *et al*., 2019) [16]. Hide-outs facilitate maximum locomotory activity, territory occupation, and light influence for seeking of shelter and subsequent hiding action resulting in improved growth performance of this catfish species (Barriga *et al*., 2016) [2]. Till yet no research work has been done on *M. cavasius* growth performance by using different captive conditions. Reduced light condition and shelter promote higher growth rate of *Clarius gariepinus* on the basis of SGR and mean percentage per capita mortality (Mostafa *et al*., 1997) [14]. Similar work was done in stinging catfish which showed better growth performance in dark and sheltered condition and growth performance was analyzed on the basis of survivability (Rahman *et al*., 2019) [16]. Shelter seeking tendency of channel catfish fingerlings during rearing period showed higher growth rate (Brown *et al*., 2011) [3].

## 5. Conclusion

The findings of the present study clearly showed that *M. cavasius* gives best growth in treatment T2 containing hide outs. Hide outs reduces cannibalism and increases survivability of the fingerlings. Hence it can be concluded that it is beneficial for rearing *M. cavasius* fingerlings by providing hiding space to obtain maximum growth during the rearing period in captive condition.

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