

**Effect of Photoperiod on Breeding Performance of Molly species**Swati¹, Archana Sinha², Amar Nath Jha³¹Fish & Fisheries, under aegis of Zoology Department,
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Abstract : The present study was conducted to find out breeding performance of molly species such as black molly (*P. spheonops*), white molly (*P. latipinna*), golden molly (*P. velifera*) and cross bred (*P. spheonops* x *P. latipinna*) using natural sunlight 10 h (L) : 14 h (D) for a period of 90 days, each of them were kept in ratio of one male and two females in four different glass aquaria setups named as S-I to S – IV. For next 90 days, photoperiod, sunlight 8 h (L) : 16 h (D) were maintained in four different glass aquaria setups named as S_A to S_D to observed youngones growth performance such as avg. length, avg. weight, avg. specific growth rate percent, avg. percent weight gain. Water quality management were done throughout study period and physico-chemical parameters such as temperature, pH, dissolved oxygen, nitrate nitrogen, nitrate, phosphate and total hardness were measured and maintained using standard water analysis kits. Feed management were done using dried pelleted and dried live frozen feed. Chemical analysis were done to prevent fishes from diseases. During present study, it was cleared how two different photoperiods such as longday and shortday effect breeding and growth performance of brooder and their youngones respectively. What type water quality and feed management along with chemical analysis were required to produce a healthy crops which not only going to make our country compete with world market but also boost our national income, prestige and also act as strong weapon in eradicating unemployment problem. So present study was an attempt to let several unemployed youth, research scholars and women self help group with basic knowledge in breeding processes so that they can earn their livelihood. From study it is quiet cleared that how various breeding procedures with longday photoperiod gives good breeding performance irrespective of shortday photoperiod.

Keywords : Breeding performance, Chemical analysis, Feed management, Molly species, Photoperiod, Water quality management.

I. INTRODUCTION

Live bearer ornamental fishes such as molly, guppy, platy and swordtail are colourful, beautiful and attractive one so called as living jewels. Belongs to family Poeciliidae and found in marine, brackish and fresh water resources.[1] Omnivorous, Ovo-viviparous, Cheaper, hardy and can bred in most type of water. Mature in 04-06 months, gestation period 3-4 weeks after fertilization which takes place internally. Male used to insert its gonopodium with milts in the females and eggs are fertilized inside mothers body. Fecundity rate 20-40 youngones per female in an average. [2] Ornamental fish keeping was initially considered as one of the attractive hobbies practised in the developed countries but recently it is gaining impetus in developing countries too as they now contribute for about two-thirds of the total export value. [3] India possesses rich resources viz. Gulf of kutch complex, Coast of Kerala, Cape comorin, Gulf of Mannar, Palk Bay, Andaman and Nicobar Islands, Coral reefs of Lakshadweep and Minicoy Islands are bound with highly attractive and varied species of ornamental fishes. [4] Currently, global trade in ornamental fish is estimated at about \$ 22 billion, of this India accounts a mere of Rs. 10 Crore, so to achieve a 10% market share of sales by 2015, MPEDA is targeting annual production of 500 million ornamental fishes from more than 300 freshwater indigenous species. [5] About 90 percent of ornamental fishes is traded from Kolkata port followed by 8 percent from Mumbai and 2 percent from Chennai. [6] The manipulation of the photoperiod is currently being used in aquaculture to induce maturation, control spawning and stimulate growth in different species.[7-8] Role of photoperiod and melatonin in the regulation of ovarian function in Indian carp emphasizing that environment with endocrine system helps in the regulation of reproduction. [9]

The aim of present study is to highlight how effect of photoperiod act on breeding performance of molly species, overall enhancing ornamental fish breeding and reducing unemployment problem by giving basic knowledge in breeding processes to beginners and hence assisting an increase in national income by making our country self sufficient in ornamental fish breeding.

II. MATERIALS AND METHODS

The materials and methods which applied during study period were as :

- A. **Experimental aquaria** :- A total eight glass aquaria were taken with measurement 8" x 6" x10" with 10 L water holding capacity.
- B. **Light source** :- The natural sunlight viz. longday (10 h) and shortday (8 h) used as a source of photoperiod.
- C. **Candidate species** : The three molly species such as white molly (*P. latipinna*), Black molly (*P. sphenops*), golden molly (*P. velifera*) and cross (*P. sphenops* (2 F) x *P. latipinna* (1 M)), each procured from near by aquarium shops and brought to M.Sc. Fish & Fisheries Research lab at Baba Saheb Bhim Rao Ambedkar, Bihar University, Muzaffarpur, Bihar.
- D. **Ratio** : In each set ups I to IV, one male and two females were taken.
- E. **Acclimatization** :- The molly species were acclimatized in tap water for one week and fed with dried pelleted and dried live frozen feed.
- F. **Feed management** :- The dried pelleted and dried live frozen feed were given twice in a day as mentioned in Table – 1 and Figure – 1(a) & (b).

Table – 1 Nutritional Composition of Prepared Feed of Molly Sps. and Young ones.

Feed	NUTRITIONAL COMPOSITION					
	Crude protein	Crude fat	Crude fiber	Crude ash	Moisture	Nitrogen free extract
Tokyu baby pellet (Floating type)	Min 32%	Min 4%	Max 5%	Max 10%	Max. 9%	Min. 31%
Optimum (Floating type)	Min 28%	Min 3%	Max 4%	-	Max 10%	-
Blood worm (Freeze dried Live feed)	Min 60%	Min 8%	Max 3%	Max 12%	Max 5%	-
Tubifex (Freeze dried live feed)	Min 58%	Min 8%	Max 7%	Max. 12%	Max. 5%	-



Figure – 1(a) Dried Pelleted feed



Figure – 1(b) Dried Live frozen feed

- G. **Water quality management** :- The water quality management were done using standard water analysis kits as mentioned in Table – 2 .

Table – 2 Water Quality Parameters during study period

Parameters	Range
Temperature	15-30°C
pH	7.5 – 8
D.O.	6-10 mg/l
Nitrate Nitrogen	2.3 – 11 mg/l
Nitrate	10-50 ppm
Phosphate	0.50 – 0.75 ppm
Total Hardness	250-300 mg/L

H. **Chemical analysis** :- The different chemicals were used for prevention of diseases as mentioned in Figure -2.



Figure – 2 Chemical used for Prevention of diseases

I. **Experimental design** :- During first quarterly period, molly species were kept in ratio of one male and two females in four different glass aquaria setups labelled as S – I to S – IV, filled up with 5 L tap water, an aerator was fixed on wooden table with electric supply and used for aeration purpose, four traps were used one in each glass aquaria to protect youngones from fed by mothers fish. Sunlight maintained for 10 hrs. in such a way that all four setups got it properly and continuously (except weather change). During this period breeding performance of mollies were observed.

In second quarter, bred youngones of molly species were transferred by hand scoop net to another four glass aquaria setups which labelled as S_A to S_D, filled up with 5 L tap water, aeration provided by aerator to each setups. Sunlight maintained for 8 hrs. in each setups to observed youngones growth performance.

J. **Growth and Body Indices** :- During study period the length and weight of each brooder were carefully examined before starting of the experiment. Length were measured from tip of snout to the end of caudal fin using divider and finally measured using graduated scale. Weight were weighed and calculated using standard electronic balance. Onwards the average mean length, average mean weight and standard deviation of brooder were calculated using statistical formulas.

Statistical Formulas :

$$\text{Average mean length} = \frac{\text{Sum of the lengths}}{\text{No. of lengths}}$$

$$\text{Average mean weight} = \frac{\text{Sum of the weights}}{\text{No. of Weights}}$$

$$\text{Standard deviation } (\sigma) = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}$$

Where σ = Standard deviation
 x_i = each value in data set
 μ = mean of value in data set
 $\frac{1}{N}$ = No. of observation in data set

K. **Breeding and Growth performance** :- From breeding setups, total number of youngones were counted and noted down. Each were then kept in four different setups, S_A to S_D. At end of each months, five youngones were taken randomly then their length and weight were measured using graduated scale and electronic balance respectively. This procedures continued for a period of three months. Finally average mean length, average mean weight, standard deviation, survival rate percent, mortality rate percent, specific growth rate percent and percent weight gain were calculated using statics formulas.

$$\text{Survival rate (\%)} = \frac{\text{Final no. of fishes}}{\text{Initial no. of fishes}} \times 100$$

$$\text{Mortality rate (\%)} = \frac{\text{Diff. between Initial \& Final no.of fishes}}{\text{Initial no. of fishes}} \times 100$$

$$\text{Specific growth rate (\%)} = \frac{\text{Mean final Wt.} - \text{Mean Initial Wt.}}{\text{experimental period } (T_2 - T_1)} \times 100$$

$$\text{Percent weight gain (\%)} = \frac{\text{Mean fish final wt.} - \text{Mean fish Initial wt.}}{\text{Rearing periods (Total period)}} \times 100$$

III. RESULT

Table – 3.1 Breeding Performance of Mollies [(10 hrs (L) : 14 hrs (D))]

Set ups	Molly Sps.	Wt. of Brooder		Length of Brooder		No. of Young ones	Survival rate %	Mortality rate %	Colour
		Range	Mean $\pm$ SD	Range	Mean $\pm$ SD				
I	<i>P. latipinna</i> (White molly)	0.96 to 1.09	1.27 $\pm$ 0.36	3.7 to 4.1	3.9 $\pm$ 0.16	32	100	zero	All White
II	<i>P. sphenops</i> (Black Molly)	1.03 to 1.75	1.37 $\pm$ 0.29	3.9 to 4.2	4.03 $\pm$ 0.13	20	60	40	All Black
III	<i>P. velifera</i> (Golden molly)	0.81 to 1.36	1.09 $\pm$ 0.21	3.7 to 4.3	3.97 $\pm$ 0.25	30	40	60	All Golden
IV	<i>P. sphenops</i> x <i>P. latipinna</i>	0.82 to 1.76	1.22 $\pm$ 0.3951	3.2 to 3.9	3.53 $\pm$ 0.29	44	100	Zero	20 - White 24 - Black

Table – 3.2 Breeding Performance of Young ones in three months [(8 hrs (L) : 16 hrs (D)) duration]

Set ups	Young ones	Periods						Specific growth rate %	Percent wet gain%
		1 st month		2 nd month		3 rd months			
		Avg. length	Avg. wt.	Avg. length	Avg. wt.	Avg. length	Avg. wt.		
A	White molly	1.6 ± 0.1414	0.072 ± 0.0148	2.14 ± 0.1496	0.152 ± 0.0605	2.78 ± 0.1183	0.424 ± 0.0751	0.5833	0.3888
B	Black molly	1.64 ± 0.1356	0.064 ± 0.0228	2.2 ± 0.2898	0.166 ± 0.0910	2.78 ± 0.1789	0.41 ± 0.0772	0.5833	0.3888
C	Golden molly	1.66 ± 0.1265	0.08 ± 0.011	2.4 ± 0.2280	0.234 ± 0.2679	2.76 ± 0.1549	0.442 ± 0.0728	0.60	0.4
D	Cross (Black x White) molly 24 Black	1.66 ± 0.1095	0.082 ± 0.0742	2.42 ± 0.1327	0.26 ± 0.0663	2.78 ± 0.0774	0.418 ± 0.0659	0.566	0.377
	20 – White	1.6 ± 0.144	0.074 ± 0.0174	2.48 ± 0.1732	0.266 ± 0.0787	2.76 ± 0.1095	0.422 ± 0.0705	0.5833	0.3888

IV. DISCUSSION

During first quarterly period, it is clearly observed that when photoperiod (Sunlight – 10h) such as longday photoperiod favors breeding faster and successfully with maximum survival rate in setups – I and IV (100 %), lowest in setup – II (60 %) and least in setups – III (40 %), which were shown in Table – 3.1. The above observation justified by works of Giannecchini et al. (2012), according to them best reproductive performance is achieved during summer and spring season, when photoperiod were 16 L : 8 D and 12 L : 12 D. It is found that commencement of breeding occurs after eight weeks, which is not justified by works of Santhanam et al. (2013), according to them gestation period is 3 to 4 weeks after fertilization. But in the next observation, that the number of youngones found to be 32, 20, 30 and 41 (20-white and 24- black) in all four different setups S_A to S_D respectively, in this context, the observation of Santhanam et al. (2013), justified the above results that the fecundity rate is 20 – 40 youngones per female in an average.

During second quarterly, photoperiod (Sunlight – 8 h) such that when photoperiod was shorter, it is clearly found that the growth performance of youngones were slower and more or less similar. It showed increasement from first month to third months gradually but with slower rate. During first month, in setups – A to D, avg. mean length and avg. mean weight found to be 1.6 cm, 1.64 cm, 1.66 cm and (1.66 cm, 1.6 cm) and 0.072 mg., 0.064 mg., 0.08 mg. and (0.082 mg., 0.074 mg.) respectively. In the second months, in setups – A to D, found to be 2.14 cm, 2.2 cm, 2.4 cm and (2.42 cm, 2.48 cm) and 0.152 g, 0.166 g, 0.234 g and (0.26 g, 0.266 g) respectively. While in the third months, it is found to be 2.78 cm, 2.78 cm, 2.76 cm and (2.78 cm, 2.76 cm) and 0.424 g, 0.41 g, 0.442 g and (0.418 g, 0.422 g) respectively.

Similarly, other growth factors such as average mean specific growth rate percent and avg. mean percent weight gain in all setups – A to D, found to be more or less similar as shown in Table – 3.2

The above study justified by several workers work, according to Barahona – Fernandes (1979), he did work on sea bass (*Dicentrarchus labrax*) for 18 h light period and Barlow et al. (1995), worked on larvae of barramundi (*Lates calcarifer*) for 16 h and 24 h light periods and found that larvae showed higher growth rates when photoperiod were large.

As during second quarterly, it is found that growth performance of youngones increased with slower rate and more or less similar, when photoperiod was short. Hence, over all longday photoperiod (10 h) and short day photoperiod (8 h) play a significant role in the breeding and growth performance of mollies and their youngones respectively.

V. CONCLUSION

It is concluded that light plays an important role in successful growth, survival and breeding of molly species and their youngones. The longday photoperiod have great impact on breeding, growth and survival than shortday photoperiod. During long day photoperiod breeding and survival were larger and maximum while on shortday photoperiod growth performance were smaller with slower rate.

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