Effect of photoperiod (CFL Bulb,15Watts;04 hrs.) on breeding and growth performance of live bearer ornamental fishes

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Abstract: *The present study was conducted to find out impact of photoperiod on breeding, growth, maturation and colour change of live bearer ornamental fishes(molly, guppy, platy and swordtail).CFL bulb used as source of artificial light, maintained in each setups-I to IV for observing breeding and survival of brooder and in the setups-A to D for growth and maturation of youngones, each for three months duration. During study period, the average mean length, the average mean weight ,survival rate percent, specific growth rate percent and average daily gain percent were observed. Water quality analysis were done throughout study period and physico-chemical parameters such as temperature, pH, dissolved oxygen, nitrite, ammonia, phosphate and total hardness were measured and maintained using standard water analysis kits.Siphoning done weekly. Feeding were done using freeze dried live feed (tubifex and bloodworm)and dried pelleted feed(optimum and tokyu) ,two times(morning and evening) for brooder and four times for youngones in a day with timing 7a.m., 11a.m.,3p.m. and 7p.m. During study period, it was observed that the increasement in growth found from first month to third months. Also increased in the length and the weight of youngones in each setups during the same time period vary and there were no similarity. The maximum specific growth rate percent was found in setup-D(0.37) and minimum in setup-B(0.1166).The maximum average daily gain percent was found maximum in setup-D(0.2466) and minimum in setup-B(0.0777).The maturity of youngones visible at the end of third months. No colour change was observed on brooder and youngones. The aim of present study was to find out whether photoperiods(CFL bulb,15watts,04hrs.) was best suited for breeding, survival, growth and maturation of these fishes or not, inorder to have a healthy crops,which going to make our country compete with world market as well boost our national income,prestige and also act as strong weapon in eradicating unemployment problem.*

Keywords*: Breeding,Feeding,,Growth,,Live bearer ornamental fishes,Maturation,Photoperiods*

I. INTRODUCTION

Ornamental fish trade is a multibillion dollar industry today in more than 125 countries. About 30 freshwater fish species dominate the global market such as live bearers, neon tetra, angel fish, goldfish and discus.[1] In India,among freshwater ornamental fish trade,98% are captured,2% captured from wild and rest2% of total trade are marine fish of which 98% captured and 2% from cultured stock.[2] India's overall trade was about1.06 million US$ during 2009.[3]Photoperiod is an important environmental factor that directly or indirectly influences fish growth , feeding, locomotor activity, metabolic rates, body pigmentation, maturation and reproduction.[4] Photoperiod and temperature are the best coordination for stimulating growth and reproduction by affecting internal timing system.[5] Ornamental fish culture and trade acts as an excellent business opportunity,especially for women in India,hence strong demand from domestic and export markets.[6]
        Overall the aim of present study was to let unemployed youth, research scholars and entrepreneurs to have basic knowledge on effect of photoperiods on breeding, growth, survival, maturation and colour change of these fishes.Hence the present study is going to help in removing unemployment problem of youth and using CFL bulb as source of photoperiod for (04hrs.) for breeding is going to provide healthy fish crops with bright and attractive colouration, raising ornamental fish culture.

II. MATERIALS AND METHOD

The materials and methods which were applied during study:
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 artificial CFL bulb(15 watts), used as a source of photoperiod.
C.   **Candidate species**:The four live bearer ornamental fish species such as black molly (*P. sphenops*), guppy(*P. reticulata*),platy(*X . maculatus*)and swordtail (*X . helleri*) 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 four fish 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 to brooder and four times to youngones in a day as mentioned in Table – 1 and Figure – 1(a) & (b).

Table – 1 Nutritional composition of prepared feed used during study period

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

Table-2 Water quality analysis during study period (CFL bulb,04hrs.)

Parameters	Ranges	
	Brooder	Youngones
Temperature	27-30º C	29-32 ºC
pH	7.5-8	7.5-8
Dissolved oxygen	5-9 mg/ l	5-8 mg/ l
Nitrite	1-2 ppm	0-0.5 ppm
Ammonia	0-0.5 ppm	0-0.5ppm
Phosphate	1-2 ppm	1-2 ppm
Total hardness	160-250 ppm	170-230 ppm

H.   **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.CFL bulb (15watts,04 hrs.) were maintained in each four setups to observe breeding performance of brooder.In second quarter, bred youngones of each four 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. CFL bulb (15watts,04hrs.) were maintained in each setups to observe youngones growth performance.

I.   **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 :

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

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

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

Where σ = Standard deviation

x_i = each value in data set

μ = mean of value in data set

$\dfrac{1}{N}$ = No. of observation in data set

J.   **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, specific growth rate percent and average daily gain percent were calculated using statics formulas.

Survival rate (%)   = $\dfrac{Final\ no.\ of\ fishes}{Initial\ no.\ of\ fishes}$ x 100

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

Average daily gain (%)   = $\dfrac{Mean\ fish\ final\ wt. - Mean\ fish\ Initial\ wt.}{Rearing\ periods\ (Total\ period)}$ x 100

III. RESULTS
Table-3   Breeding performance of brooder during study period (CFL bulb.,15 watts, 4hrs.)

Setups	Length of brooder(cm)		Weight of brooder (mg)		No. of youngones	Survival rate %
	Range	M±SD	Range	M±SD		
I(Molly)	3.3-4	3.73±0.311	0.4-1	0.78±0.25	20	90
II(guppy)	2.4-2.6	2.5±0.082	0.15-0.25	0.19±0.0019	30	95
III(Platy)	2.7-3.2	2.6±0.396	0.42-0.43	0.43±0.243	30	90
IV(Swordtail)	3.5-5	4.07±0.66	0.74-1.00	0.83±0.13	40	90

Table-4 Growth performance of youngones during study period

Setups	First month		Second months	
	Avg.len±SD	Avg. wt.±SD	Avg.len ±SD	Avg.wt.±SD
A (Black molly)	1.28±0.077	0.04±0.0109	1.96±0.2059	0.128±0.05347
B (Guppy)	1.38±0.077	0.01± 0.01095	1.68±0.1732	0.042±0.0195
C (Platy)	1.42±0.0774	0.04±0.01095	2.1±0.16733	0.208±0.02039
D (Swordtail)	1.36±0.10954	0.042±0.01183	2.26±0.1549	0.222±0.0161

Where Avg.len, Average mean length and Avg.wt.,Average mean weight

Third month

	Avg. len±SD	Avg. wt.±SD	SGR%	ADG%
A (Black molly)	2.12±0.313	0.156±0.08625	0.1933	0.1288
B (Guppy)	1.96±0.1019	0.08±0.03162	0.1166	0.0777
C (Platy)	2.6±0.1788	0.25±0.01414	0.35	0.2333
D (Swordtail)	2.52±0.2145	0.264±0.0626	0.37	0.2466

Where SGR%, Specific growth rate percent and ADG%, Average daily gain percent

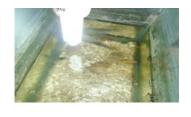**Figure-1((a) Platy(Brooder)**

Figure-1(b) Youngones

Figure-2(a) Guppy(Brooder)

Figure-2(b) Youngones

Figure-3(a) Swordtail (Brooder)   Figure-3(b) Youngones

Fig.(1-3) Photoperiod effect on breeding and growth of live bearer ornamental fishes

IV. DISCUSSION

Breeding and survival

During study period , in all setups-I to IV, photoperiod (CFL,15watts, 4hrs.) were maintained for a period of three months, to observe its effect on breeding of black molly, guppy, platy and swordtail respectively. The average mean length of brooder in all four setups-I to IV found to be 3.73±0.311 cms., 2.5±0.0819cms., 2.63±0.396 cms. and 4.07±0.66 cms. respectively, where as average mean weight in all four setups-I to IV, found to be 0.78±0.245 mg, 0.19±0.0019 mg, 0.43±0.243 mg and 0.83±0.130 mg in all four setups respectively.Number of youngones found to be 20, 30 , 30 and 40 in all four setups-I to IV respectively, and survival rate of youngones found to be 90% in setups(I, III and IV),and more than it in set up(II), Table -3 and which were also observed in Figures-1 to 3. The above study is in line with the works of Alvarez Verde *et al.*(2015), they did study to evaluate   the effect of light intensity on growth of juvenile Brazilian flounder using light intensity (5, 180,700 and 2000) lux in triplicate and maintained in twelve tanks containing juveniles and found that weight were higher for those reared in 5 and 180 lux then at 700 and 2000 lux.As during present study,15 watts CFL bulb (700-100 lumen) was used to observe breeding performances and found that breeding and survival of youngones were average in number and successful.Also supported by works of Khalil Eslamifar *et al.*(2013),they did work to evaluate effect of background colour on growth performance,skin pigmentation,physiological condition and innate immune responses of gold fish and at end found that growth performances markedly rose   in white background compared to other treatments(black, blue or red),also best suited for growth.That's why in present study fishes showed good breeding responses as CFL bulb provided white background.

Growth and maturity

During next three months, photoperiod (CFL bulb, 15 watts, 04hrs.) were maintained in all four setups- A to D, to observe its effect on growth performance of youngones. In first month, the average mean length of youngones in all four setups –A to D,were found to be 1.28±0.077 cm, 1.38±0.077 cm, 1.42±0.0.0774 cm and 1.36±0.10954 cm respectively, where as the average mean weight found to be 0.04±0.0109mg, 0.01±0.01095mg, 0.04±0.01095mg and 0.042±0.01183mg respectively in all four setups-A to D.

In the second months,the average mean length in all four setups –A to D,were found to be 1.96±0.2059cm., 1.68±0.1732 cm., 2.1±0.16733 cms. and 2.26±0.1549 cms., respectively , where as the average mean weight in all four setups were found to be 0.128±0.05347 mg,0.042±0.0195 mg,0.208±0.02039 mg and 0.222±0.0161mg respectively.In the third months, the average mean length in all four setups-A to D found to be 2.12±0.313 cms., 1.96±0.1019 cm, 2.6±0.1788 cms. and 2.52±0.2145 cms. respectively, where as the average mean weight found to be 0.156±0.08625mg ,0.08±0.03162 mg, 0.25±0.01414 mg and 0.264±0.0626 mg respectively in all four setups. It was observed that growth performance of youngones showed increasement from first month to third months.The increasement in length and weight vary in each setups during same time period and there were no similarity.The maximum specific growth rate percent were found in setup-D (0.37) and minimum in setup-B (0.1166).The maximum percent weight gain percent were found in setup-D (0.2466) and minimum in setup-B (0.0777), Table-4.

Maturity

At the end of third months ,maturity on youngones were clearly visible.

Colour change

No colour change observed on bred youngones throughout study period.

The present work is in line with the works of S.E Papoutsoglou *et al.*(2000) as they did work on effect of background colour on growth performances and physiological responses of scaled carp(Cyprinus carpio L.) which reared in closed circulatory system and observed that white adapted carp showed highest specific growth and

increased body weight in comparison to black and green adapted fish respectively. Also supported by works of A. Strand (2007), and Opio, Ngugi and Rasawo(2014), according to them best growth rate, weight gain, specific growth rate and survival were achieved in white background than in black ,blue back and other lighter tanks.

V. CONCLUSION

It is concluded from present study that photoperiod (CFLbulb,15watts,04hrs.) shows significant role in growth,survival and maturation of youngones and it do not play any role in colour loss. Hence this photoperiod can be suggested to use in ornamental fish breeding,culture and industry.

VI. ACKNOWLEDGEMENT

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