Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5, Issue 07, July -2018

EFFECT OF PHOTOPERIOD (GREEN LIGHT, 4HRS.) ON BREEDING PERFORMANCE OF LIVE BEARER ORNAMENTAL FISHES

Swati[1] , Archana Sinha [2] and Amar Nath Jha [3]

[1.] *Fish & Fisheries,under aegis of Zoology Department, Baba Saheb Bhim Rao Ambedkar,Bihar University,Muzaffarpur,Bihar,India.*
[2.] *Central Inland Fisheries Research Institute (ICAR), Kolkata Centre, Salt Lake, Kolkata, India.*
[3.] *Zoology Department, Baba Saheb Bhim Rao Ambedkar, Bihar University , Muzaffarpur, Bihar, India.*

Abstract: *The present study was conducted to find out breeding performance of live bearer ornamental fishes such as molly(P .sphenops),guppy(P .reticulata),platy (X . maculatus)and swordtail(X . helleri) using photoperiod(green light,15w for 4hrs)which were maintained for a period of three months in four different glass aquaria setups named as S_I to S_{IV} , in which molly, guppy, platy and swordtail were kept in ratio of one male and two females respectively to observed their breeding performances such as number of youngones, survival rate percent, mortality rate percent and body colour change. Similarly for next three months, same photoperiod phases were maintained in four different glass aquaria setups named as S_A to S_D to observed effect of photoperiod on growth performance of youngones such as average mean length ,average mean weight, specific growth rate percent, percent weight gain percent and colour change. A proper water quality management were done throughout study period and physiochemical parameters such as temperature, pH, dissolved oxygen, nitrite, nitrate , ammonium, phosphate and total hardness were observed and maintained using standard water analysis kits . Feed management were done twice in a day using dried pelleted and dried live frozen feed. Chemical analysis were done after seven days of partial water change to disinfect brooder and their youngones using chemicals such as 'Rid-All-Copper Aid', 'Rid-All-General Aid' and methylene blue. The aim of present study was to found out whether this type of photoperiod phases were playing any role in successful breeding or not ,whether helpful in providing healthy crops or not, also whether it going to boost our national income and progress or not. From economic point of view , this type of photoperiod phases should be applied for breeding of these fishes as from study it was quiet cleared that their beautiful colour appearance remains as such for newly brooders but those taken from dark/light phases, on them body colours started to came back progressively throughout study period,it was unique sign inorder to correct colour disappearance of brooders and youngones those were suffered from colour disappearance during dark/light phases or kept in dark place for breeding procedures. Also to create general awareness among research scholars ,entrepreneurs and women self help group ,to used this valuable information during breeding of these fishes, inorder to have a successful living condition and hence overall promoting national income and progress.*

Keywords *–Breeding performance, Chemical analysis, Feed management, Live bearer ornamental fishes, Photoperiod, Water quality management.*

I. INTRODUCTION

Ornamental fishes are classified into two groups such as live bearer (guppies, mollies, platies and swordtails) and egg layers which are reared as pets and generally kept for relaxation in home or business decoration, or as a hobby. Both from freshwater and marine environments. However, approximately 90% of species from freshwater are bred in captivity while those from marine water are mostly captured [1].Ornamental fishes have a good potential due to enormous geographical spread, extensive species diversity, intensive research and development effort that are already put in the associated institutions [2]. Nowadays ornamental fish trade is a multibillion dollar industry in more than125 countries. Over 2500 species of fish are involved ,of which over 60% are of fresh water origin. Exports from traditional markets to new markets is a general trend noticed during the past decade [3].Global ornamental fish market crossed $ 4.2 billion in 2017 and is projected to grow with a CAGR of more than 7.85% , in value terms, during 2018-2022 [4].Most fish species have well developed colour, sights and are therefore very sensitive to coloured light. For instance the growth rate increased with green light.[5]. Light(in intensity, quality and photoperiod) is extremely variable and can change over a tremendous range, often very rapidly, fish move within their environment and often their environment moves around them, affecting the light that the fish receives [6].Photoperiod acts as an artificial zeitgeber regulating the daily endogenous rhythms in fish and also affects fish growth, locomotor activity, metabolic rates, body pigmentation, sexual maturation and reproduction [7].In fishes ,studies have shown that environmental colour affects their growth [8], feeding and food conversion rate [9] and stress [10].

The aim of present study was to found out effect of photoperiod[green light(15w),4hrs.] on breeding performance of brooder and on growth performance of youngones. Also to create general awareness among research scholars,

@IJAERD-2018, All rights Reserved

unemployed youth and women self help groups to practiced this type of photoperiod phase during breeding of live bearer ornamental fishes, as on one hand this photoperiod phase helps in correcting colour disappearance while on other hand maintained their beautiful colouration which seems to generate income and assist their livelihood, hence overall it playing a significant role in national income and progress.

II. MATERIALS AND METHODS

The materials and methods applied during study period were as:

A. Experimental aquaria :- A total eight glass aquaria were taken with measurement 8"x6"x10" with 5l water holding capacity.

B. Light source:- The photoperiod [green light(15 w),4L:20D] were used as source of light for a period of three months each for brooder and youngones respectively.

C. Candidate species:- The live bearer ornamental fishes such as black molly(*P.sphenops*) and swordtail(*X.helleri*) were procured from near by aquarium shops, guppy(*P.reticulata*) and platy(*X.maculatus*) were taken from dark/light phases and brought to M.Sc. Fish & Fisheries Research Lab at Baba Saheb Bhim Rao Ambedkar Bihar University, Muzaffarpur,Bihar.

D. Ratio:-In each setups I to IV, one male and two females were taken.

E. Acclimatization:- The live bearer ornamental fish species were acclimatized in tap water for one week and fed with dried pelleted and dried live frozen feed.

F. Chemical analysis:- Chemicals such as " Rid-All -Copper-Aid" , "Rid-All-General-Aid", methylene blue and a pinch of salt were used in appropriate amount to disinfect fishes from diseases throughout study period as shown in Figure- 1

Figure- 1 Chemicals used to disinfect fishes

G. Feed management:- The dried pelleted and dried live frozen feed were given twice in a day as shown in Fig.2(a) and Figure -2 (b)

H.

Figure-2(a)Dried Pelleted Feed ***Figure-2(b)Dried Live Frozen feed***

I. Water quality management:- Using standard water analysis kits, physiochemical parameters were observed and recorded as mentioned in Table-1

@IJAERD-2018, All rights Reserved

Table-1 Water Quality Management during study period

Parameters	**Range**	
	On Brooder	**On Youngones**
Temperature	22-32 °c	20-30°c
pH	8	8
Dissolved oxygen	6-9 mg/l	5-8 mg/l
Nitrite	1-3 ppm	0.5-1ppm
Nitrate	0.0-20 ppm	0.0-10 ppm
Ammonium	0-0.5 ppm	0-0.5ppm
Phosphate	1-3 ppm	1-3 ppm
Total hardness	190-260 ppm	180-230 ppm

J. Experimental design:- During first –three months period, photoperiod [green light(15w)for 4hrs.]were maintained in four different glass aquaria setups labeled as S_I to S_{IV} and in each live bearer ornamental fishes molly, guppy, platy and swordtail were kept in ratio of one male and two females respectively,such as(Platy and Guppy were taken from dark/light phases and Black molly and Swordtail were procured from aquarium shop), these setups were filled up with 5l tap water and aeration provided to each setups through aerator which was fixed on wooden table with electric supply. The four traps were used in each glass aquaria inorder to protect the newly bred youngones from fed by mother fish. During this period breeding performance of live bearer ornamental fishes were observed. While during next, three months period, newly bred youngones of each live bearer fish were transferred carefully using hand scoop net to four glass aquaria setups, labeled as S_A to S_D. In these setups, photoperiod [Green light(15w) for 4hrs.] were maintained similar to previous three months period. Each setup were filled up with 5l tap water and aeration provided to each one through aerator. During this period, growth performance of youngones were observed.

K. Breeding and Growth Performance:- 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.

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

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

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

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

L. Growth and Body Indices:- From breeding setups, total no. of youngones were counted and note down ,then survival rate, mortality rate were observed externally and noted down at end of each month. During next three months period, survived youngones were kept in four different setups, S_A to S_D .From each setups randomly molly, guppy, platy and swordtail youngones were taken five in numbers at end of each month. Then their length and weight were measured using graduated scale and electronic balance respectively. This procedure 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.

Statistical Formulas :

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

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

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

Where σ = Standard deviation
x_i = Each value in data set
μ = Mean of value in data set

1/N =No. of observation in data set

@IJAERD-2018, All rights Reserved

III. RESULT

Table – 3.1 Breeding Performance of Brooder during three months (Green light, 4 hrs.)

Setups	Live Bearer Ornamental fishes	Length of Brooder		Weight of Brooder		No. of Youngo-nes	Survival rate %	Mortality rate %
		Range	Mean±SD	Range	Mean±SD			
I	*P.sphenops* (Black molly)	3.4 to 4.0	3.6±0.26	0.57 to 0.69	0.62±0.05	30	86.66	13.33
II	*P.reticulata* (Guppy)	2.8 to 3.5	3.2±0.3	0.24 to 0.60	0.47±0.16	50	100	Zero
III	*X. maculates* (Platy)	4.0 to 4.6	4.4±0.26	0.60 to 0.90	0.77±0.14	40	87.5	12.5
IV	*X. helleri* (Swordtail)	3.4 to 4.0	3.8±0.26	0.50 to 1.00	0.80±0.2	40	95	5

Table –3.2 Breeding Performance of Brooder during study period

Setups	Fish species	Commencement of breeding/week
I	Black molly	3 rd month, ninth week
II	Guppy	3 rd month, tenth week
III	Platy	3 rd month, tenth week
IV	Swordtail	3 rd month, ninth week

Table – 3.3 Growth Performance of Youngones during study period (Green light,4 hrs.)

		Period							
Setups	Youngones	I st month		2nd months		3rd months		SGR %	PWG %
		Avg.len	Avg.wt.	Avg.len	Avg.wt.	Avg. len	Avg.wt.		
A	Black molly	1.32 ±0.08	0.032±0.012	1.68 ±0.08	0.064±0.01	2.38 ±0.12	0.206±0.02	0.0027	0.0018
B	Guppy	1.4 ±0.14	0.036±0.01	1.94 ±0.19	0.094±0.03	2.3 ±0.20	0.196±0.06	0.0327	0.0218
C	Platy	1.44 ± 0.109	0.034±0.01	1.84 ±0.06	0.07±0.009	2.3 ±0.17	0.22±0.014	0.0007	0.0004
D	Swordtail	1.48±0.12	0.048±0.013	1.94±0.109	0.19±0.08	2.42 ±0.08	0.02±0.186	0.2873	0.1916

Table -3.4 Colour Change observed on Brooder during study period (three months duration)

Setups	Species	Colour changes		
		I st month	2nd months	3rd months
I	Black molly(new one)	No colour change	No colour change	No colour change
II	Guppy(dark/light)	A little bit colour starts to come back	A little more	More but not complete
III	Platy(dark/light)	A little bit colour starts to come back	A little more	More but not complete
IV	Swordtail(new one)	No colour change	No colour change	No colour change

@IJAERD-2018, All rights Reserved

Table – 3.5 Colour change observed on bred youngones during study period

Setups	Youngones	Colour change
A	Black molly	No change
B	Guppy	No change
C	Platy	No change
D	Swordtail	No change

IV. DISCUSSION

Ornamental or aquarium fishes have gained considerable importance in recent years .Ornamental fishes lure and draw the attention of global people through its attractive colouration, peaceful nature, tiny size, suitability for captivity and adaptability to live in little spaces. Thus generate culture interest among the people all over the world. In this context, the present study is going to raise national income and progress.
During first-three months durations, it is found that green light (15 watts, 4hrs.) favours breeding performance of brooder. It is observed that in setups-I and IV, commencement of breeding takes place in ninth weeks ,while in setups-II and III, takes place in tenth weeks as shown in Table- 3.2.

The above study justified by works of Milton and Arthington (1983),according to their report embryonic development vary from 26 to 63 days , which found more or less similar, as during study period commencement of breeding takes place in ninth weeks(setups-I and IV) and tenth weeks(setups-II and III).
Youngones in all setups-I to IV ,found to be in numbers 30,50,40 and 40 respectively.
The above study more or less justified by works of MNS Mamun Siddiky and Basudev Mondal (2016) , they did work on "Breeding technique of gold fish, molly, guppy and observed its impact on economy in the rural area of the Purba Midnapore district" and found that molly gave (45 to 60) and guppy (48 to 62) number of youngones.
Survival rate percent found to be maximum in setups-II(100) and minimum in setup-I(86.66),while mortality rate percent found maximum in setup-I (13.33) and minimum in setups-II (zero) as shown in Table-3.1
During study period, it is also found that photoperiod [Green light(15w),4hrs.] when subjected to brooders which were kept for breeding, there a unique observation found, the brooders those were taken from dark/light phases ,on them colour starts coming back in increasing sequence(such as a little bit,a little more and more) ,while those taken as newone on them no colour effect observed and their beautiful appearance remain as such as shown in Table-3.4.

During next three-months duration,photoperiod [green light(15w),4 hrs.] were maintained similarly as previous in four different setups-A to D, to observed effect of photoperiod on growth performance of youngones. During first month, average lengthin setup-I, found to be1.32±0.08, which in setups-II and III, found to be similar as1.4±0.014 and 1.44±0.109, in setup-IV, found to be1.48±0.12; while average weight in all four setups-I to IV, found to be 0.032±0.012,0.036±0.01,0.034±0.0109 and 0.048±0.013 respectively; during second months, average length showed an increasement from first month, which were found as 1.68±0.08, 1.94±0.19, 1.84±0.06 and1.94±0.1095 respectively in all four setups, similarly average weight showed an increasement from first month which were found as 0.064±0.01,0.094±0.03,0.07±0.009 and 0.19±0.08 respectively in all four setups; during third months in setups-I to III, average length found to be more or less similar as 2.38±0.12, 2.3±0.20 and 2.3±0.17 respectively, while in setup-IV, found to be 2.42±0.08, while average weight showed an increasement from second months in setups-I to III, which were found as 0.206±0.02, 0.196±0.06 and 0.22±0.014, which in setup-IV, found to be 0.02±0.186 .

The above study justified by works of Bela Zutshi and Aradhana Singh(2017), they did study on "Interrelationship of photoperiod and feed utilization on growth and reproductive performance in the Red eyed orange molly" and found that in longday photoperiod(18L: 6D), significant increase in growth parameters such as weight gain(2.2±0.04) and specific growth rate(1.2), observed in 60 days duration.
But during study period ,maximum increased in average weight found to be 0.048(first month), 0.19 (second months) and 0.22 (third months) which were significantly less ,similarly specific growth rate percent was less as (0.28733) in comparison to their study, which was(1.2), here differences in result was only due to photoperiod, which was(4L:20D) in comparison to their study as(18L:6D).

During study period ,maximum specific growth rate percent found in setup-D (0.28733) and minimum found in setup-C (0.0007), while percent weight gain percent found maximum in setup-D (0.19155) and minimum found in setup-C (0.0004) as mentioned in Table- 3.3. The effect of photoperiod in terms of colour change not observed on bred youngones as shown in Table-3.5.

@IJAERD-2018, All rights Reserved

V. CONCLUSION

It is concluded that photoperiod [Green light (15w), 4hrs] plays a significant role in successful growth, survival and breeding of these fishes. From economic point of view, such photoperiod should be applied in ornamental fish industry during breeding procedure as their body colour remains as such and no colour change found on newer brooders ,while on other hand brooders taken from dark/light phases, on them disappeared colour starts coming back in increasing sequence. Hence this photoperiod can be used in correcting colour disappearance of these fishes and can maintained their beautiful appearance as well as market value, which overall boost our national income and progress.

VI. ACKNOWLEDGEMENT

Authors wish to expess gratitude to DST, New Delhi, for providing financial assistance during study period. I would like to give my special thanks to M.Sc. Fish & Fisheries Course under aegis of Zoology Department at Baba Sahaeb Bhim Rao Ambedkar Bihar University, Muzaffarpur, Bihar and CIFRI Centre, Saltlake, Kolkata, for helping and providing lab facilities during study period.

VII. REFERENCES

[1] http://www.fao.org/fishery/topic/13611/en, D. Bartley, "Ornamental fish" , 2011.
[2] P. Nammalwar, "Geographical indications of ornamental fishes in India", International conference on Green Certification for ornamental fishes, Marine Products Export Development Authority, Cochin (unpublished), 2008.
[3] V. K. Dey, "The Global Trade In Ornamental Fish", *INFOFISH International* , Vol.4, pp.52-55, 2016.
[4] http://techsciresearch.com, " Global ornamental fish market size, share & ornamental fish market forecast 2023".
[5] A. B. Ruchin, "Influence of coloured light on growth rate of juveniles of fish", *Fish Physiology and Biochemistry*, Vol.30, pp.175-178, 2004.
[6] G. Boeuf, and P. Y. Le Bail, "Does light have an influence on fish growth?, " *Aquaculture*,Vol.177, pp.129-152, 1999.
[7] W. L. Gross, E.W. Roelofs, and P.O.Fromm, "Influence of photoperiod on growth of green sunfish, Lepomiscyanellus", *J. Fish Res. Board Can*, Vol.22, pp.1379-1386,1995.
[8] G. Dowing, and M. K. Litvak, " The effect of photoperiod , tank colour and light intensity on growth of larval haddock", *Aquaculture International*, Vol.7 ,pp.369-382,2000.
[9] S. E. Papoutsoglou *et al.* , "Effects of back ground colour on growth performances and physiological responses of scaled carp (*Cyprinus carpio L.*) reared in a closed circulated system", *Aquaculture Engineering*,Vol.22, pp.309-318, 2000.
[10] G. P. Moberg , and J.A. Mench, "The biology of animal stress: basic principles and implications for animal welfare", *CAB International*, New York, 2000.
[11] https:// shodhganga.inflibnet.ac.in, "General Introduction-The aquarium fish watching "May gladden's ones heart and Broadden's one's mind".
[12] D.A. Milton, and A.H. Arthington, "Reproductive biology of Gambusia affinis holbrooki (Baired and Girard), *Xiphophorus helleri* (Gunther) and *X. maculatus* (Heckel) (Pisces;Poecilidae), *J. Fish. Biol.* , Vol.23, pp.23-41,1983.
[13] MNS.M. Siddiky, and B. Mondal, "Breeding technique of goldfish, molly, guppy and its impact on economy in the rural area of the Purba Midnapore district, West Bengal , India" , *Int. J. Adv. Multidiscip.Res.*,Vol.3(8) ,pp.34-40,2016.
[14] http://dx.doi.org/10.1101/209346, "Interrelationship of photoperiod and feed utilization on growth and reproductive performance in the red eyed orange molly(*P. sphenops*)",2017.

@IJAERD-2018, All rights Reserved