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EFFECT OF PHOTOPERIODS ON GROWTH AND MATURATION OF GUPPY (*Poecilia reticulata)*

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Abstract: *The present study was conducted to find out growth and maturation of newly born youngones of guppy using different photoperiods (6hrs.,12hrs.,18hrs.,24hrs.,24hrs.-Dark and 24hrs.-Sunlight)for a period of 50days.10watts ,two LED Batten were used as source of artificial light in each setups-A to D ,such that 20watts with 2000lumens,whereas in setup-E(dark) and in setup-F(Sunlight) were maintained. Each setup with three replicates,20 youngones taken in one, such that a total 60 youngones were kept in each setup-A to F. During study period ,the average length, the average weight ,survival rate percent and sex* identification *were observed. Water quality management were done throughout study period and physico-chemical parameters such as temperature, pH, dissolved oxygen, nitrite ,nitrate, ammonia, total alkalinity and total hardness were measured and maintained using standard water analysis kits. Siphoning done weekly .Feed management were done using live feed(infusoria), freeze dried live feed(tubifex),prepared feed and dried pelleted feed four times in a day with timing 7a.m., 11a.m.,3p.m. and 7p.m. respectively.During study period,it was cleared that the growth and maturation were maximum and fast in setup-F(24 hrs.,Sunlight) and minimum and slow in setup-A(24hrs.,LED).The aim of present study was to findout which photoperiods were best suited for growth , maturation and survival of youngones, 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. So present study was an attempt to let several research scholars, youth, and women self help groups with basic knowledge in using different photoperiods to have a successful and fast growth of youngones.*

Keywords: *Feed management, Growth, Guppy, Maturation, Photoperiods, Water quality management*

I. INTRODUCTION

Live bearers were primarily presented in Europe at the end of the 18th century, and became the most popular species in Europe and USA in terms of production and trade.[1]The country exported ornamental fish to be the tune of around Rs.5.65 crores in 2015-16.[2]However it has touched Rs.9.5 crores in 2016-17, with an increase of 40% over last year.[3] India's overall ornamental fish trade was about 1.06million US$ during 2009.[4] India has recorded at least 150 commercially important ornamental fish species and trade mainly indigenous freshwater species collected from rivers.[5] In the context of present study, the effect of photoperiod regimes (24L:0D and 18L:6D) on Nile tilapia fry showed several changes and which have been reported in terms of growth, survival, reproductive patterns & levels of relevant hormones.[6] Photoperiod is an important environmental factor that directly or indirectly influences fish growth, feeding, locomotor activity, metabolic rates, body pigmentation, maturation and reproduction.[7] Photoperiod and temperature are the best coordination for stimulating growth and reproduction by affecting internal timing system.[8]

Overall the aim of present study was to let unemployed youth, research scholars and entrepreneurs to have basic knowledge on effect of photoperiods on growth and maturation of guppy youngones and also to share with them that guppy which were kept outside in sunlight have maximum and fast growth in comparison to those which were kept indoors, also those kept in (18 hrs. and 12 hrs.) photoperiods showed good growth and maturation but less in comparison to natural photoperiod. Hence present study is going to helps in removing unemployment problem and overall playing major role in making our country self-sufficient in ornamental fish culture.

II. MATERIALS AND METHOD

A. Experimental Area:- The experiment took place at OFTRI Farm,Veerpura, Sarda, Udaipur , Rajasthan, for a period of 50 days.

B. Experimental Aquaria:- A total six experimental setups, each with three replicate such that setup-A(A1,A2and A3);setup-B(B1,B2andB3);setup-C(C1,C2andC3);setup-D(D1,D2andD3);setup-E(E1,E2andE3)andsetup-F(F1,F2andF3) ,where a total eighteen aquaria were taken with measurement(15"x9"x1 feet) ,with 20L water holding capacity.

C. Light Source:- Eveready LED Batten (two in number), with (10watts and1000Lumens) were used as source of light.
D. Candidate Species:- A total 360, newly born youngones of guppy *(P. reticulata*) were collected from cemented tank of OFTRI Farm and kept 20 in numbers in each aquarium, such that a total 60 youngones in three replicates ,in each setup-A TO F.

E. Light Measuring Tool:- A digital lux meter , Model LX-101A of HTC Company was used for measuring light.

F. Water Source:- The stored tap water were used as source of water.

G. Acclimatization:- The newly born guppy youngones were acclimatized in tap water for one week and fed with live feed infusoria and egg yolk.

H. Experimental Setup:- A total six setups-A to F were constructed ,each with three replicate, out of six ,five setups-A to E were made inside a room on five shelves and covered with black curtain and setup-F maintained outside in farm premise on cemented rack. The two LED batten of 10 watts were fixed above three replicates of each setup. The different photoperiods such as in setup-A (24hrs.-LED), setup-B (18 hrs.-LED), setup-C (6 hrs.-LED), setup-D (12hrs.-LED), setup-E (24hrs.,Dark) and setup-F(24hrs. sunlight) were maintained ,aeration provided to each three replicate , to each setup for 8 hrs. daily. Electric supply maintained 24hrs., switching of photoperiods and aeration in each setup maintained manually throughout study period.

I. Water Quality Management:- The water quality test were measured weekly using water analysis kits and physiochemical parameters were recorded as mentioned in Table1.

Table1. Water quality management

			Parameters					
Setups	***Temperature***	***pH***	***D.O***	***Nitrite***	***Nitrate***	***Ammonia***	***T.Alkalinity***	***T.Hardness***
A	26.8-30°c	7-7.6	7-9 ppm	0-1 ppm	0-5 ppm	0-5 ppm	90-160 ppm	130-200 ppm
B	26.8-30°c	7-7.6	7-9 ppm	0-1 ppm	0-5 ppm	0-5 ppm	90-150 ppm	130-230 ppm
C	26-30°c	7-7.6	7-9 ppm	0-1ppm	0-5 ppm	0-5 ppm	90-160 ppm	140-220 ppm
D	26-30°c	7-7.6	7-9 ppm	0-0.50ppm	0-5 ppm	0-5 ppm	90-150 ppm	150-220 ppm
E	26-30°c	7.2-7.6	8-10 ppm	0-0.25ppm	0-5 ppm	0-5 ppm	70-140 ppm	170-200 ppm
F	25-31°c	7.2-7.6	6-10 ppm	0-0.25ppm	0-0 ppm	0-5 ppm	70-120 ppm	160-220 ppm

J. Feed Management:- During study period ,youngones were fed with different types of feed such that live feed (Infusoria), freeze dried live feed(Tubifex), prepared feed and dried pelleted feed(Toya), four times in a day, with timing 7 a.m.,11 a.m.,3 p.m. and 7 p.m. respectively.

K. Growth Performance:- The lengths and weights of each youngones were measured and noted before starting of the experiment and then onwards these were recorded weekly. The lengths were measured from tip of snout to the end of caudal fin using divider and graduated scale and weights were measured using standard electronic balance. At end of the experiment the average mean length, the average mean weight, survival rate percent, undifferentiated sex and number of males and females were identified in each setup, recorded and calculated using statics formulas.

Statistical Formulas:

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

$$\text{Average mean length} = \frac{\text{Sum of the lengths}}{\text{No. of lengths}} \times 100$$

$$\text{Average mean weight} = \frac{\text{Sum of the weights}}{\text{No. of the weights}} \times 100$$

III. RESULT

Table2. Growth and maturation of Guppy youngones using different photoperiods

Setup-A (Photoperiod-24 hrs. LED)

Replicates	Average length	Average weight	Survival rate%	Sex ratio(M:F)
A1	1.8375 cm	0.044 mg	80	6:7
A 2	1.8722 cm	0.0497 mg	90	9:9
A 3	1.8056 cm	0.0368 mg	90	5:12

Setup-B (Photoperiod-18 hrs. LED)

Replicates	Average length	Average weight	Survival rate%	Sex ratio(M:F)
B 1	1.9529411 cm	0.061935 mg	85	5:12
B 2	2.01764 cm	0.069076 mg	85	7:10
B 3	2.1176 cm	0.07235 mg	85	6:11

Setup-C (Photoperiod-6 hrs. LED)

Replicates	Average length	Average weight	Survival rate%	Sex ratio(M:F)
C 1	1.85 cm	0.0455 mg	100	7:13
C 2	2.015 cm	0.08 mg	100	6:14
C 3	1.9316 cm	0.0529 mg	95	3:16

Setup-D (Photoperiod-12 hrs. LED)

Replicates	Average length	Average weight	Survival rate%	Sex ratio(M:F)
D 1	1.925 cm	0.068 mg	100	1:19
D 2	1.975 cm	0.0784 mg	100	6:14
D 3	1.92 cm	0.066 mg	100	1:19

Setup-E (Photoperiod-24 hrs. Dark)

Replicates	Average length	Average weight	Survival rate%	Sex ratio(M:F)
E 1	1.815 cm	0.059 mg	100	1:19
E 2	2.0 cm	0.0908 mg	100	2:18
E 3	1.92 cm	0.06 mg	100	1:19

Setup-F (Photoperiod-24hrs. Sunlight)

Replicates	Average length	Average weight	Survival rate%	Sex ratio(M:F)
F 1	2.49375 cm	0.147811 mg	75	4:11
F 2	2.541176 cm	0.158811 mg	85	7:10
F 3	2.6 cm	0.189429	85	9:8

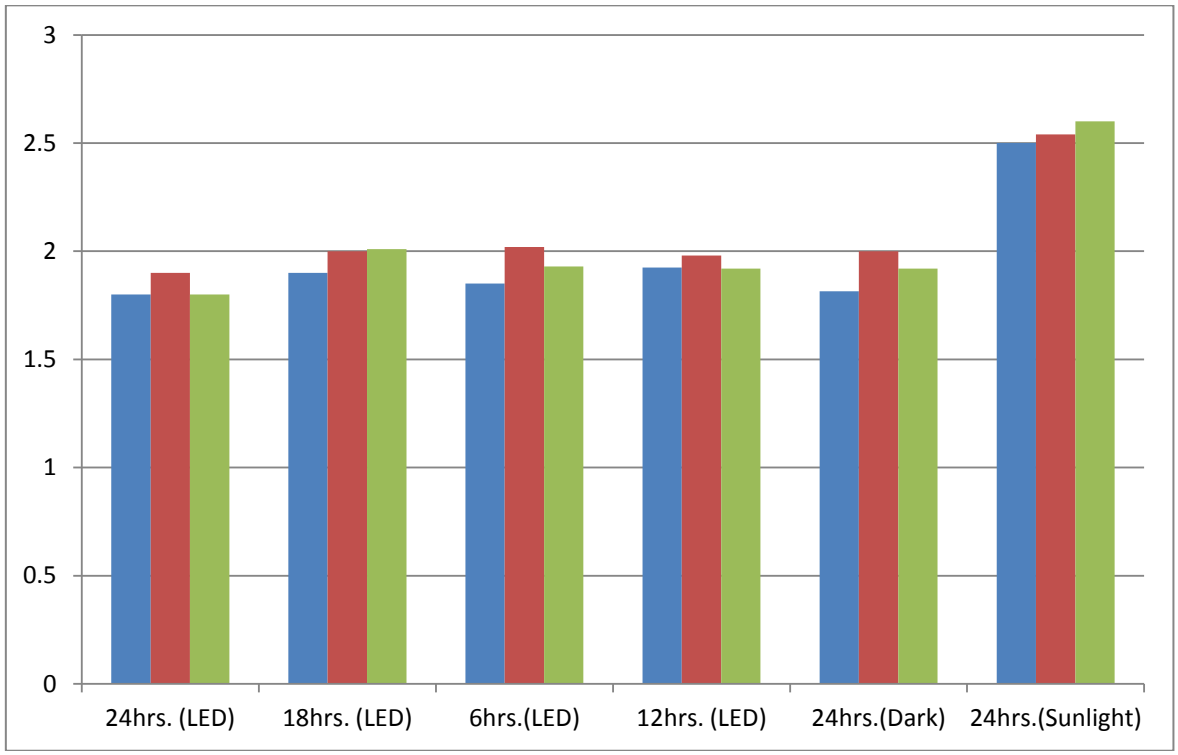


Figure1. Effect of different photoperiods observed on growth performance (average length) of youngones in different setups-A to F (24 hrs.LED-24 hrs. Sunlight) respectively.

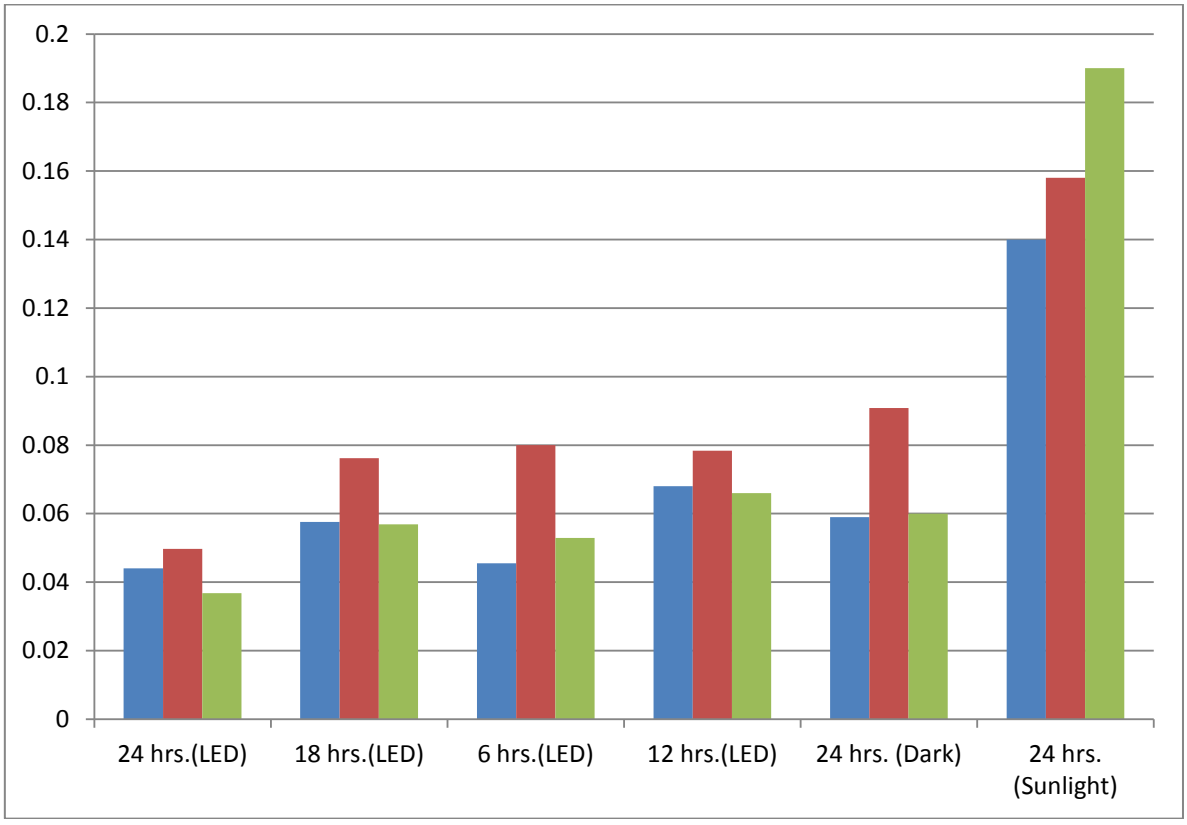
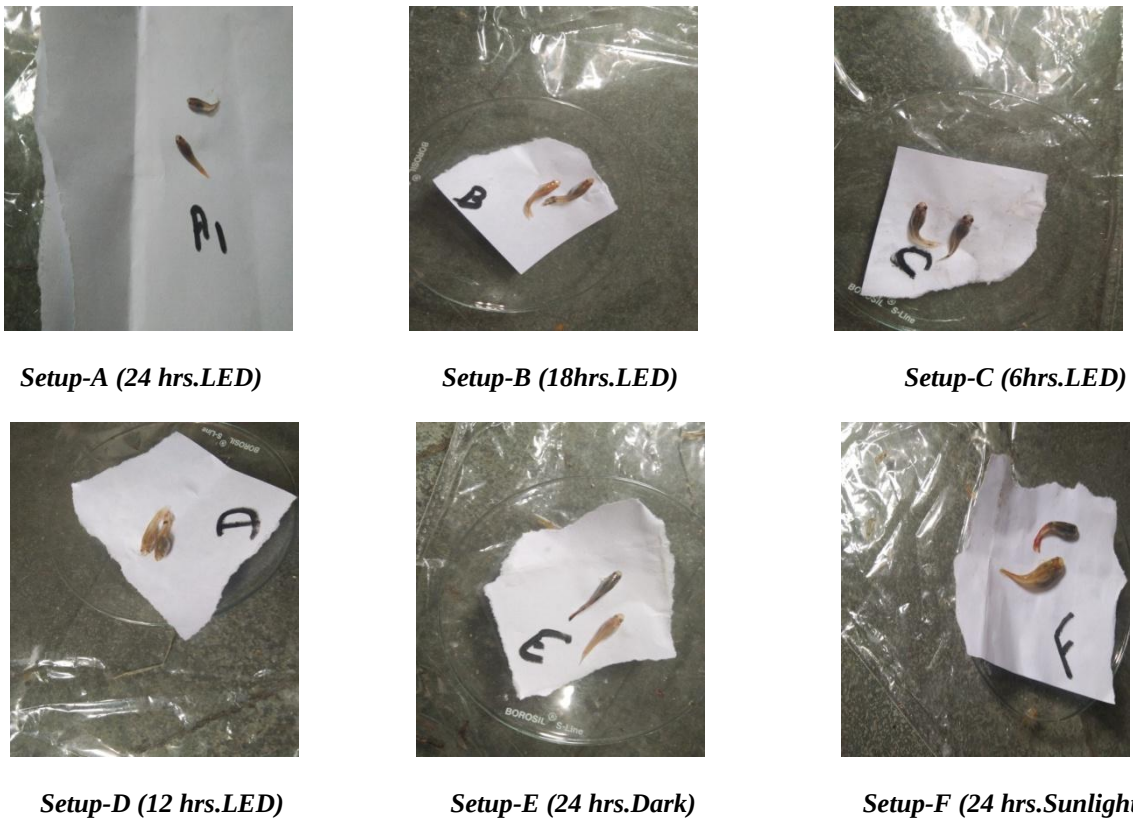


Figure2. Effect of different photoperiods observed on growth performance (average weight) of youngones in different setups-A to F(24hrs.LED to 24hrs.Sunlight) respectively.



Setup-A (24 hrs.LED) ***Setup-B (18hrs.LED)*** ***Setup-C (6hrs.LED)***

Setup-D (12 hrs.LED) ***Setup-E (24 hrs.Dark)*** ***Setup-F (24 hrs.Sunlight)***

Figure3. Effect of different photoperiods on growth and maturation of youngones in setups- A to F.

IV. DISCUSSION

Live bearers belong to the family "Poecilidae" and the most popular ornamental fish for breeding. Guppies, mollies, platies and swordtails are member of this family.The live bearer guppy fish (*P. reticulata*) are the most popular among hobbyists because of their vibrant colours , different shapes and sizes and easy to breed and keep.

During study period of 50days duration, the effect of different photoperiods were observed on growth and maturation of youngones of guppy, which were kept in setups A-F with different photoperiods, such as in setup-A (24L :00D,1300-2500Lux) , setup-B (18L:06D, 2150-4000Lux), setup-C (06L:18D, 1600-3200Lux), setup-D (12L:12D, 2600-5200Lux), setup-E (00L:24D) and setup-F (12S.L:12D, 1650-4000Lux) . Finally at end of 50 days experiment , their average length, ,average weight, survival rate% , number of males, number of females, undifferentiated sex and sex ratio were observed, calculated and noted down as shown in Table-2.

During study period, the effect of different photoperiods on growth and maturation of youngones found from maximum to minimum in decreasing order as in setup-F (24 hrs. Sunlight), setup-B (18 hrs. LED), setup-D (12 hrs.LED), setup-C (6 hrs.LED), setup-E (24 hrs. Dark) and setup-A (24 hrs.LED). The average length in three replicates of each setup found to be as setup-A (A1-1.8375cm, A2- 1.8722cm and1.8056 cm); setup-B (B1- 1.95cm, B2- 2.01cm and B3-2.11cm); setup-C (C1-1.85cm,C2-2.015cm and C3-1.9cm); setup-D (D1- 1.92cm, D2-1.97cm and D3- 1.92cm); setup-E (E1-1.81cm,E2- 2.0cm and E3- 1.92cm) and in setup-F(F1- 2.49cm,F2- 2.54cm and F3- 2.6cm) . On other hand the average weight in three replicates of each setup found to be as setup-A (A1- 0.044mg, A2- 0.0497mg and A3-0.0368mg); setup-B (B1-0.0619mg, B2- 0.0690mg and B3- 0.0724mg); setup-C (C1- 0.0455mg, C2- 0.08mg and C3-0.0529mg);setup-D (D1- 0.068mg, D2- 0.0784mg and D3-0.066mg); setup-E (E1- 0.059mg, E2- 0.0108mg and E3-0.06mg) and in setup-F (F1-0.1478mg,F2-0.1588g and F3-0.1894mg) as shown in Figure-1 and Figure-2.

The above study is not justified by works of Rajeswari, Rajasree and Bala Subramanian (2017) ,they did work on "Effect of light levels on growth, survival, and skin colour enhancement of marine angelfish [*Apolemichthys xanthurus*, (Bennett,1833)], for a period of 120days and found that fishes reared under low light level(250-500Lux) exhibited higher weight gain(73.90±06), specific growth rate(0.616±0.01) and survival rate(90%) i.e. low light level was more suitable for better growth.
But during study period, we found that in setup-A (1300-2500Lux) was used and observed that in all three replicates average length and average weight of youngones found to be(1.8375,1.8722 and 1.8056) cms and (0.044,0.0497 and 0.0368) mgs respectively, which were least in comparison to all other setups- B to F , in setup-F where (1650-4000Lux)

was used and here average length and average weight found to be (2.49,2.54 and 2.6) cms and (0.1478,0.1588 and 0.1894) mgs respectively, which was highest among all other setups where low light level was used as shown in Figure - 3.

Through present study it is quiet cleared that for best growth and maturation, high light level is needed whereas in low light level growth and maturation is almost least . Hence it is our advise to research scholars, unemployed youth and women self help groups to use high light level and even sunlight and also photoperiods(18 hrs. and 12 hrs.) could be used for best growth and maturation of youngones.

V. CONCLUSION

It is concluded that for high growth and maturation of youngones, photoperiods (24 hrs. Sunlight, 12L:12D), (18hrs.LED,18L:06D) and (12hrs.LED,12L:12D) are best. It is also concluded that when photoperiods (24hrs.LED, 24L:00D) and (6hrs.LED,06L:18D) were observed then its effect on growth and maturation of youngones Found to be least.

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VII. REFERENCES

[1] F.A.Chapman, S.A.Fitz-Coy,E.M.Thunberg, and C.M.Adams, "United States of America trade in ornamental fish", *Journal of the World Aquaculture Society,* Vol.28(1), pp.1-10,1997.

[2] A.J. Vinayak, "Aquarium trade will be worth Rs.1,200 crores in a decade", Business Line (The Hindu),15th May, 2017.

[3] P.K.Krishnakumar, "Ornamental fish industry hit by new regulations", The Economic Times, 16th June, 2017.

[4] UNCOMTRADE,Basic query.aspx, 21 March, 2014.

[5] K . Madhu , R. Madhu, and G. Gopakumar, "Present scenario of marine ornamental fish trade in India, captive breeding, culture, trade and management strategies", *Fishing Chimes* , Vol.28, pp.10-11,2009.

[6] A.F.M.El-Sayed, and M. Kawanna, "Effects of photoperiod on the performance of farmed Nile tilapia (*Oreochromis niloticus*) ,I- growth ,feed utilization efficiency, survival of fry and fingerlings", *Aquaculture*,Vol.231, pp.393-402, 2004.

[7] A.K.Biswas,T. Morita, G.Yoshizaki, M. Maita, and T.Takeuchi, "Control of reproduction in Nile tilapia(*Oreochromis niloticus L.*) by photoperiod manipulation", *Aquaculture*, Vol.243, pp.229-239, 2005.

[8] N.Bromage, M.Porter, and C.Randall, "The environmental regulation of maturation in farmed finfish with special reference to the role of photoperiod and melatonin", *Aquaculture*, Vol.197, pp.63-98, 2001.

[9] D. Alderton, "Livebearers: Understanding guppies, mollies, swordtails and others", Irwin, California, Bow Tie Press, pp.144, 2012.

[10] D. Zin, and T.Han, "Breeding of guppy (*Lebistes reticulate*, Peters, 1859) under laboratory condition", Universities Research Journal, Vol.6 (2), pp.123-129, 2014.

