Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(6): 1120-1124

Received: 04-09-2018
Accepted: 06-10-2018

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Effect of photoperiod on pearl spot (*Etroplus suratensis*) seed production under hatchery conditions

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Abstract
An experiment was conducted to compare the seed production of pearlspot (*Etroplus suratensis*) under different photoperiod combinations. Photoperiod combinations of 1000 lux/ 6 hours, 1000 lux/ 8 hours, 1000 lux/ 10 hours and control on seed production of Pearl Spot (*Etroplus suratensis*) were tried. Each combination represented treatment and was duplicated 300 litre FRP tank system. Temperature was maintained at 26.7 ºC ±1.0 ºC. Fishes with mean body length and weight of 16.7 cm and 119.44 g respectively, were stocked at a rate of 4 fishes / tank (2 pair).The experiment was conducted for a period of 90 days. One way ANOVA of the data clearly affirmed that significant differences (p<0.05) was observed among the 6L:18D treatment which produced significantly greater (p<0.05) number of a seeds in single spawning (1453 Nos) than the treatment with longer photoperiods and control.

Keywords: Pearlspot, breeding, seed production, photoperiod

Introduction
Etroplus suratensis is widely distributed in almost all the brackish water and freshwater of peninsular of India. It is essentially a brackish water fish that has become naturally acclimatized to freshwaters. It possesses certain requisite qualities essential for aquaculture such as good body weight, growth rate, and high adaptability for food, tasty and nutritive flesh (Mukundan & James, 1978) [14] and good market price (Joseph, 1980; Jayaprakash & Phil, 1980; Rattan, 1994) [11, 10, 19]. It is widely distributed and extensively found along the east and south-west coasts of Peninsular India and Srilanka (Padmakumar *et al*., 2012) [15]. Successful induced breeding of this fish has not been reported so far mainly because of the complex breeding behaviour of the fish. Over exploitation of indigenous Pearl spot seeds from wild resulted in the depletion of standing stock in recent times. The low fecundity habit of Pearl spot represents one of the major constraints that hinder expansion in pearl spot reproduction. As *Etroplus suratensis* to exhibit such a complex and unique courtship behaviour, involving pairing, nesting and parental care. Therefore some techniques have been developed to counteract this problem. Temperature plays an important role in teleost fishes because it can modulate all physiological processes and endocrine regulations. Temperature can play a greater or lesser role in arresting or delaying some gametogenesis stages, particularly the most advanced ones including maturation and ovulation**.** Artificial light has been used previously by some workers to induce and extend the natural spawning season in tilapia. Riddha *et al.* (1998) [20] showed the possibility of extending spawning season of *Oreochromis spirulus* from 6-7 months to a year round one. The photoperiod directly influences the fish behavior, especially in their feeding and reproductive habits. The manipulation of the photoperiod is currently being used in aquaculture to induce maturation, control spawning and stimulate growth in different species. It is believed that melatonin is the key hormone involved in the regulation of endogenous rhythms by photoperiod cues. During the hours of darkness synthesis of melatonin by photoreceptor of pineal is increased. Melatonin action is linked to other reproductive endocrinology. The importance of these environmental factors in the initiation and termination of their reproductive activities seems to differ among fish species; the gonadal development of some fish is entrained to the period when there is an increase in photoperiod and temperature. The objective of this study was therefore to compare the effect of better ranges of photoperiod regimes on seed production of *Etroplus suratensis.*

Materials and methods

One light intensity regime were tested in combination with three different photoperiods (6, 8 and 12 h^{-1}).The photoperiod combinations as follows: 1000 lux/ 6 h, 1000 lux/8 h 10 h, 1000 lux / 10 h and control. Each combination used in the study were represented a treatment and each was conducted in duplicate. All the FRP spawning tanks, each measuring (1m*1m*0.5m) were illuminated using 2.29 feet LED light fixed at 70 cm above the tank. This illumination gave 1000 lux light intensity on the water surface at the centre of the tank. The average size of the brooder was 119.44 g. The photoperiod was controlled by 24 hr time controller. All tanks were aerated with compressed air. Mud pots (hard substrate) and PVC Pipe were kept for egg attachment and hideouts respectively. Each brooder tanks were stocked with *Etroplus suratensis* broodstock at 4 fishes / tank. Fishes were fed with 1.2mm floating feeds twice daily @ 3% of fish body weight. During the course of experiment, Dissolved oxygen (DO), Temperature, pH, TDS, Conductivity, Resistivity, ORP were monitored daily by using digital multiparameter instrument. Alkalinity, Hardness, Calcium, Magnesium, Ammonia were monitored weekly by by using the standard procedures given by (APHA, 2005) [2] This experiment was conducted for a period of 90 days.

At end of the experiment, following spawning parameters were determined: Average no. of. eggs / tank, Fertilization Rate, Hatching Rate, Swim up fry, Swim up with Yolk sac, Total seed production / tank, Larval survival Rate and ISI-Interspawning interval (days). Based on the information derived from biological data, individual statistical relationship such as One Way ANOVA, Duncan multiple range test (Duncan, 1955) [4], were analysed following the Bio-statistical Method of Christenson (1996) and Microsoft Excel.

Results and Discussion

In this study, 6L: 18D treatment spawning occurred thrice and seed production started shortly after the stocking and increased gradually with time, while in the other treatment 8L:16D spawning occurred twice but that spawning was observed after 28 th and 39 th days of stocking, In 10L:14 D spawning occurred twice but spawning was observed after 44 th and 67 th days of stocking and in control spawning occurred twice after 54 th and 86 th days of stocking. Over the entire period of study (90 days), the water quality parameters were maintained in optimum range. The photoperiod directly influences the fish behaviour, especially in their feeding and reproductive habits.

Ridha and E M Cruz (2000) [21], conducted a study to compare the effect of six light intensity/photoperiod combinations (2500 lux/18 h, 2500 lux/15 h, 2500 lux/12 h, 500 lux/18 h, 500 lux/15 h, 500 lux/12 h on the seed production in Nile tilapia *Oreochromis niloticus*. These results showed that the 2500 lux/18 h treatment yielded good result than other treatments. Reared gilthead seabream, under five photoperiod regimes 8L:16D, 16L:8D, 12L:12D, 24L:0D and natural) exhibited better growth related to long day length but the differences appeared only after a long exposure time (45–145 days according to the light regimes) and were maintained up to 220days (Silva-Garcia,1996) [22]. Poncin, P., 1992 [18] stated that the pineal organ, which is a component of the circadian system, is influenced by the light/dark cycle and it is involved in the control of circadian and circannual rhythms in vertebrates. Felix S., 2017 reported natural spawning in pearl spot, the fertilized eggs (350-400 nos.) were found attached on the sides of mud pot in indoor hatchery conditions. Ezhilarasi V., 2018 [5] attempted induced breeding of Pearl spot by using different hormones, The mean fecundity and mean fertilization rate obtained after induced breeding with HCG was 1920±62.44 eggs per female and WOVA FH was 1630.00± 66.58 eggs per female.

The higher number of eggs were observed in T1 (1960 eggs) followed by T2 (1216eggs), T3 (998 eggs) and C (981eggs).The better fertilization rate (%) observed in T1 (89.89%) followed by T2 (88.44%) C (86.13%) and C (84.39%). Higher hatching percentage (%) observed in (90.98%) T1 followed by T2 (90.35%) C (86.54%) and T3 (85.85%). Higher larval survival rate (%) observed in T3 (94.18%) followed by T2 (93.67%), T1 (90.20%) and C (88.71%). Finally, Higher Ave total seed/ spawning was observed in T1 (1453 seeds) followed by T2 (1039 seeds) T3 (662 seeds) and C (614 seeds).These results indicated the advantage of using optimum range of medium or short artificial light duration 6L: 18D h and 8L: 16D for better breeding performance in pearlspot seed production. The breeders under shorter photoperiod exhibited higher seed production. Many exogenous factors involving water temperature and light (intensity and duration) often interact to regulate the onset of gonadal maturation, the spawning season, spawning frequency and the calibration of the endogenous rhythm of tilapia reproduction (Lauenstein, 1978; Jalabert & Zohar, 1982; Philippart & Ruwet, 1982) [12, 9, 17]. It is believed that melatonin hormone is the key hormone involved in the regulation of endogenous rhythms by photoperiod cues. During the hours of darkness, synthesis of melatonin by photoreceptors of the pineal is increased. Reproduction in tilapia is regulated by an inter related series of endogenous and exogenous stimuli, of many exogenous factors involved, water temperature and light (intensity and duration) are considered to be most important environmental cues involved in the onset of gonadal maturation and in the calibration of the endogenous rhythm, both factors often interact to regulate the spawning season and spawning frequency (Lauenstein 1978; Jalabert & Zohar 1982; Phillipart & Ruwet 1982) [12, 9, 17]. The reproductive performance of *E. suratensis* fed with commercial feed for a period of 90 days in terms of Fertilization rate, Percentage of hatching, and Larval survival rate are depicted in Figs. 1 to 3.

The initial mean weight of the peral spot on the first day of stocking was 119.44 g. At the end of the experiment (90th day), the final mean weight was recorded as 139.7 g. The growth of *E. suratensis* fed with commercial fed for a period of 90 days in terms of ABWG, and SR, are depicted in Figs. 4 to 5. The mean weight gain of *E.suratensis* reared in freshwater showed highly significant (Table 2). Further, as per the Duncan Multiple Range Test, it was inferred that mean growth and reproductive performance value of *E. suratensis* reared in freshwater fed with commercial diets showed significance difference among the different photoperiod duration. Average values of water quality parameters monitored during 90 days of growth and reproductive trial for *E. Suratensis* values are given Table 4. In the present study, the lower FCR was obtained in T1 (1:26) followed by C (1:28), T3 (1:29) and T2 (1:35). The higher FCE was observed in T1 (79.36) followed by C (78.12), T2 (74.07) and T3 (77.51). Reproductive parameters of *Etroplus suratensis* with different photoperiod under hatchery conditions (Table 1), Bio-Growth parameters of *Etroplus suratensis* with different photoperiod under hatchery

conditions (Table 2), Photoperiod for growth and breeding of pearl spot (Table 3) and Water quality Parameters of *Etroplus suratensis* with different photoperiod under hatchery conditions (Table 4) are given below:

Table 1: Reproductive parameters of *Etroplus suratensis* with different photoperiod under hatchery conditions

Parameters	Control (C)	6L:18D (T1)	8L:16D(T2)	10L:14D(T3)
Average no.of eggs	981±0.04^{b}	1960±0.02^{a}	1216±0.08^{a}	998±0.05^{b}
Fertilization Rate	86.13±0.02^{a}	89.89±0.02^{b}	88.44±0.06^{b}	84.39±0.07^{a}
No. of Hatchlings	637±0.06^{a}	1806±0.07^{c}	970±0.02^{b}	723±0.02^{a}
Hatching Rate	86.54±0.01^{a}	90.98±0.07^{b}	90.35±0.06^{b}	85.85±0.01^{a}
Swim up with yolk sac	583±0.03^{a}	1719±0.09^{b}	953.5±0.57^{a}	672.50±0.05^{a}
Larvae Survival Rate (%)	88.71±0.08^{a}	90.20±0.07^{a}	93.67±0.09^{a}	94.18±0.06^{a}
Swim up fry	576.5±0.06^{a}	1702±0.09^{b}	915±0.07^{a}	642±0.05^{a}
Ave total seed / Spawning	614±0.02^{a}	1453±0.05^{b}	1039±0.07^{b}	662±0.01^{a}

Table 2: Bio-Growth parameters of *Etroplus suratensis* with different photoperiod under hatchery conditions

Parameters	Control (C)	6L:18D (T1)	8L:16D(T2)	10L:14D(T3)
Initial Mean Length	16.88±0.03^{a}	16.87±0.02^{a}	15.98±0.05^{a}	17.23±0.03^{a}
Final Mean Weight	129.95±0.05^{a}	119.25±0.05^{b}	100.58±0.06^{a}	128±0.05^{b}
Final Mean Length	21.55±0.02^{d}	19.25±0.01^{b}	17.80±0.09^{a}	21.20±0.05^{a}
Final Mean Weight	149.25±0.14^{b}	137.55±0.11^{ab}	124.95±0.09^{a}	147.05±0.05^{ab}
Ave Mean Weight	19.30±0.04^{a}	18.30±0.01^{a}	24.36±0.01^{a}	19.05±0.05^{a}
FCR	1.28±0.02^{a}	1.26±0.02^{a}	1.35±0.06^{b}	1.29±0.07^{a}
FCE	78.12±0.01 ^{a}	79.36±0.01 ^{a}	74.07±0.01 ^{b}	77.51±0.01 ^{a}

Table 3: Photoperiod for growth and breeding of pearl spot

Group	Light/Dark cycle	Duration (Period
T1	06/18	6am – 12 Noon
T2	08/16	6am – 2 Noon
T3	10/14	6am – 6pm

Table 4: Water quality Parameters of *Etroplus suratensis* with different photoperiod under hatchery conditions

Parameters	Control	6L:18D	8L:16D	10L:14D
DO	5.16±0.31^{a}	5.31±0.06^{a}	5.0±0.11^{a}	5.0±0.10^{a}
Temperature	26.86±0.08^{a}	26.56±0.13^{a}	25.96±0.08^{a}	26.6±0.15^{a}
pH	7.86±0.03^{a}	7.76±0.03^{a}	7.76±0.06^{a}	7.76±0.03^{a}
TDS	888.50±0.75^{a}	863.18±0.02^{a}	946.66±0.52^{b}	901.16±0.62^{a}
Conductivity	1.63±0.03^{a}	1.63±0.03^{a}	1.66±0.03^{ab}	1.76±0.03^{b}
QRP	255.33±0.08^{a}	572±0.07^{b}	256.16±0.08^{a}	553.66±0.07^{a}
Resistivity	575.33±0.37^{b}	252.66±0.37^{a}	554.33±0.17^{b}	553.66±0.07^{b}
Alkalinity	153.33±0.03^{a}	158±0.02^{a}	152.66±0.03^{a}	160±0.03^{a}
Hardness	263.33±0.01^{a}	270±0.07^{a}	248.33±0.01^{a}	233.33±0.08^{a}
Calcium	32.66±0.07^{a}	34.33±0.02^{a}	43.00±0.08^{a}	42.66±0.02^{a}
Magnesium	116.66±0.03^{a}	130.00±0.13^{a}	133.33±0.10^{a}	150±0.08^{a}
Ammonia	0.02±0.01^{a}	0.03±0.01^{a}	0.03±0.02^{a}	0.08±0.00^{a}

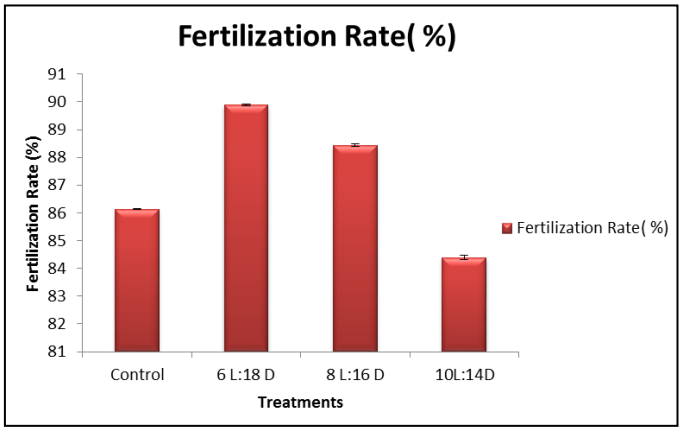

Fig 1: Fertilization rate in pearlspot under different photoperiod conditions

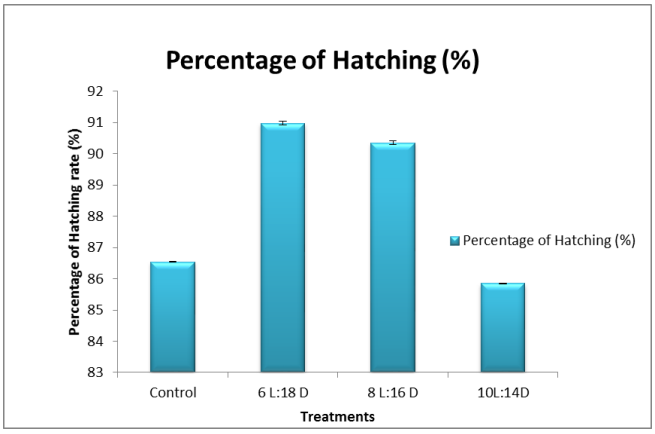

Fig 2: Percentage of hatching rate under different photoperiod conditions

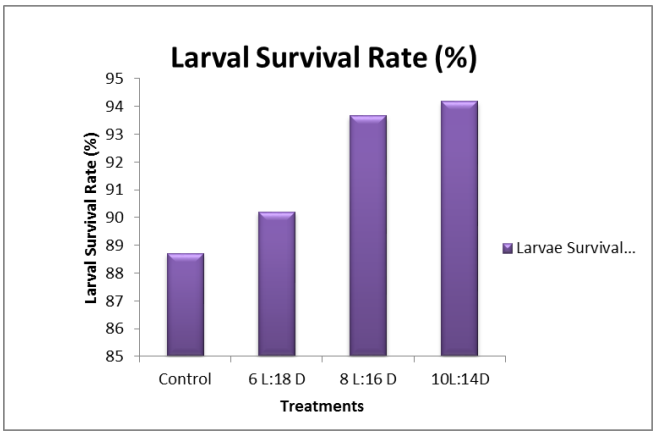

Fig 3: Percentage of Larval survival rate in pearlspot under different photoperiod conditions

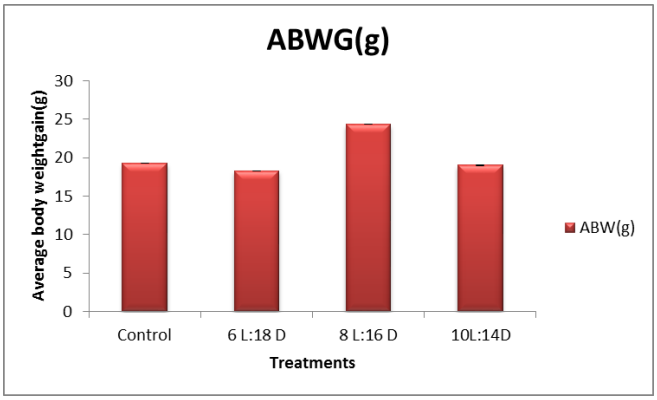

Fig 4: Average body weight gain in pearlspot under different photoperiod conditions

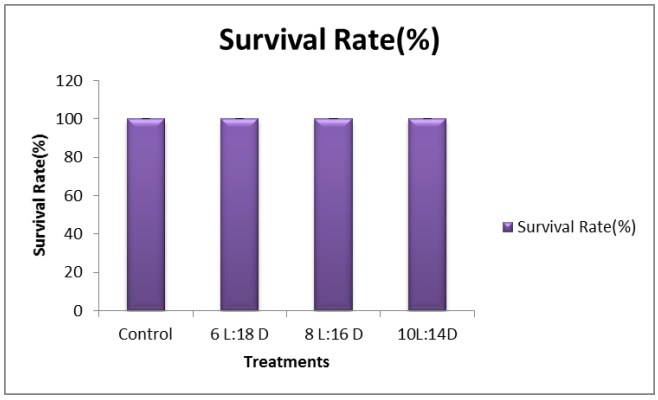

Fig 5: Survival Rate (%) in pearlspot under different photoperiod conditions

Conclusion

The present study evaluated several combinations of photoperiods with same light intensity upon the reproductive performance of *Etroplus suratensis*. The present results revealed that, optimum seed production was possible when the fishes were exposed to a light intensity of 1000 lux/6 hr and 1000 lux/8 hr with optimum water temperature 26.7 ºC. Therefore, the potential for maximizing seed production of pearl spot in the hatchery condition using through different light periods. Further studies are required to test the effect of different combinations of light intensity and photoperiod on gonadal development, seed production and associated endocrinology.

References

1. Allison R, Smitherman RO, Cabrero J. Effect of high density culture and form of feed on reproduction and yield of *Tilapia aureus*. In: T.V.R. Pillay and W.A. Dill (Eds.), Advances in Aquaculture. Fishing News Books Ltd., Farnham, Surrey, 1979, 168-170.
2. APHA, Standard methods for the Examination of the Water and Wastewater, 22nd edition. American Public Health Association, Washington, D.C. 2005, 541.
3. Biswas AK, Morita T, Yoshizaki G, Maita M, Takeuchi T. Control of reproduction in Nile tilapia *Oreochromis niloticus* (L.) by photoperiod manipulation. Aquaculture. 2005; 243:229-239
4. Duncanm DB. Multiple ranges and multiple (F) test. Biometrics. 1955; 11:1-42.
5. Ezhilarasi V. Comparative evaluation of different hormones on the reproductive performance of pearl spot (*Etroplus suratensis*). Journal of Entomology and Zoology studies. 2018; 6(2):322-325.
6. Felix S. Fecundity of Pulicut Lake Pearl Spot (*Etroplus Suratensis*).Indian Journal of Research. 2016; 5(12):476-447
7. Felix S. First report on induced spawning of Indian pearl spot (*Etroplus suratensis*). Journal of Entomology and Zoology studies. 2017; 5(6):709-713
8. Gross WL, Roelofs EW, Fromm PO. Influence of photoperiod on growth of green sunfish, Lepomis cyanellus. Journal of the Fisheries Research Board of Canada. 1965; 22:1379-1386
9. Jalabert B, zohar Y. Reproductive physiology in cichlid fishes, with particular references to *Tilapia and Sarotherodon.* In: The Biology and Culture of Tilapia, ICLARM Conference proceedings 7. (ed.by R.S.V pullin & R.H. Lowe- McConnell), Manila, Phillipines, 1982; 129-140.
10. Jayaprakash V, Phil M. Culture possibilities of pearl spot *Etroplus suratensis* in Kerala. Seafood Export J. 1980; 12(11):13-15
11. Joseph MM. Brackish water finfish and shell fish resources of Karnataka India. In: Proceedings seminar on some aspects of Inland aquaculture in Karnataka. 1980, 17-26
12. Lauenstein PC. Intensive culture of tilapia with geothermally heated water. In: Proceedings of the Culture of Exotic Fishes Symposium (ed.by. W.S. Hoar, D.J. Randall & E.M. Donaldson), New York: Academic Press, 1978, 82-85.
13. Makinen T, Ruhonen K. effect of delayed photoperiod on the growth of a finnish rainbow trout (*Oncorhynchus mykiss* Walbaum) stock, Journal of Applied Icthyology. 1992; 8:40-50
14. Mukundan MK, James MA. Nutritional quality of some food fish. Fisheries Technology. 1978; 15:85-87
15. Padmakumar KG, Bindu L, Manu PS. *Etroplus suratensis* (Bloch), the State Fish of Kerala. Journal of Bioscience. Ind. Acad. Sci. 2012; 37(6):925-931.
16. Paessun MA, Allison R. Maximizing Tilapia Production in recirculating system by sequential rearing, Aquaculture. 1984; 42:185-189
17. Phillipart JC, Ruwet JC. Ecology and distribution of Tilapia. In: The biology and Culture of Tilapia. ICLARM Conference proceedings 7.(ed.by R.S.V pullin & R.H. Lowe- McConnell), Manila, Phillipines, 1982, 129-140.
18. Poncin P. Influence of the daily distribution of light on

reproduction in the barbel, *Barbus barbus* (L.) Journal of Fish Biology. 1992; 41:993-997
19. Rattan P. Ecobiology of Pearl Spot (*Etroplus suratensis* Bloch) in Goa Waters, Ph. D. Thesis, Goa University 1994, 401.
20. Ridha MT, Cruz EM, Al-Ameeri AA, Al-Ahmed AA. Effects of controlling temperature and light duration on seed production in tilapia, *Oreochromis spilurus* (Guether). Aquaculture Research. 1998; 29:403-410.
21. Ridha MT, Cruz EM. Effect of light intensity and photoperiod on Nile tilapia *Oreochromis niloticus* L. seed production. Aquaculture Research. 2000; 31:609-617.
22. Silva-Garcia AJ. Growth of juvenile gilthead *Seabream parusaurata* L. reared under different photoperiod regimes. Israeli Journal of Aquaculture, Bamidgeh. 1996; 48:84-93.