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Effect of photoperiodism on ovarian maturation of field crab, *Paratelphusa hydrodromous* (Henderson, 1893)

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Abstract
The impact of photoperiodism on the ovarian maturation and gonadosomatic index of fresh water crab, *Paratelphusa hydrodromous* (Henderson, 1983) was investigated in the laboratory over a period of two weeks. 20 healthy female crabs of uniform weight and size were collected. The experimental crabs were divided into three groups namely, control, continuous dark and continuous light. The ovarian maturation was investigated by microscopic and histological observations. G.S. I (ovarian indices) of all the 3 groups has been calculated. There was a considerable increase in size of gonads and total egg production over a very short period in continuous dark group of test animals, on the other hand control animals gained maturity after a long period. The GSI revealed after the study shows marked difference as that of control group. Therefore, it was concluded that complete darkness is useful to accelerate ovarian maturation in *Paratelphusa hydrodromous*.

Keywords: photoperiodism, ovarian maturation, GSI

Introduction
Photoperiodism is a process in which an organism responds to changes of duration in daily, seasonal, or yearly cycles of light and darkness. Photoperiodic reactions can be reasonably predicted, but temperature, nutrition, and other environmental factors also modify an organism's response.

In the present scenario the rate of commercial crustacean fisheries is declining. Major reasons that are responsible for declining crustacean population include inadequate legislation, increases in the consumption rate, decrease in the size of the crustaceans, destruction of habitat and progress in worldwide usage. The only solution to increase the crustacean populations for consumption is by manipulating the reproductive capacity of the individual, thereby increasing the maturation period. Reproduction process in crustacean is controlled by both internal and external causes. The external cause includes temperature, photoperiod, food availability and salinity; they all have great influence on reproductive performance [1]. Photoperiodism causes various affects in behaviour and physiology of crustacean [2]. Reproductive cycle of crustacean species is mainly controlled by temperature and photoperiod since those are important exogenous factor enhancing growth of organisms [3]. Ecdysis and growth of freshwater prawn Macrobrachium, is stimulated by temperature and photoperiod [4]. Photoperiod also regulates the timing of ovarian growth and maturation. Endogenous factors include both neuroendocrine and non-neuroendocrine systems. A number of hormones from neuroendocrine organs play an important role in controlling reproductive maturation in crustacean [6, 7, 8]. Gonad maturation in crustaceans principally regulated by two antagonistic neuropeptides. Gonad-inhibiting hormone (GIH), also called vitellogenesis-inhibiting hormone (VIH), which is synthesized in the X-organ of the eyestalk and stored in the sinus gland (SG) of the eyestalk and finally released into hemolymph in decapod crustaceans [9, 10, 11, 12] and gonad stimulating hormone (GSH), which is produced by the brain and thoracic ganglion. Besides these, methylfarnesoate and ecdysteroids secreted by mandibular organs and Y-organs respectively this also control female reproduction [7]. Present experiment is an attempt to demonstrate the effect of light and dark condition on the ovarian maturation of *P. hydrodromous*.

Materials and Methods
The studies on "Effects of Photoperiodism on ovarian maturation and gonadosomatic indices (ovarian index) of *Paratelphusa hydrodromous*" field crab was carried out at the Department of Zoology, And Applied Aquaculture Barkatullah University Bhopal, Madhya Pradesh, India.

Materials
Plastic tubs, hollow pipes, electronic weighing balance (ATOM A-110C), scale/Vernier callipers, hand net, dissection box, formalin 10%, ethyl alcohol, microtome, wax, stains (hematoxylin-eosine), slides, coverslips, DPX and experimental animals.

Methodology
Collection and identification of test animals
The crabs were randomly collected from the selected sites by netting or hand picking. Specimens were collected in plastic containers and brought to the departmental laboratory. Department of Zoology, Barkatullah University. According to study on the activity behaviour of crustaceans, [Short JW. A revision of Australian river prawn, Macrobrachium (Crustacea, Decapod, Palaemonidae). Hydrobiology. 2004; 525:1-110], the collections were carried out at dusk.

Morphological analysis was carried out by using normal scale and Vernier callipers. Crabs were identified with the help of identification keys following Henderson (1893) and Alcock).

(1909). Further authentication was done with the help of checklist of Indian fauna of fresh water crabs by Pati *et al.*, (2013) from Zoological survey of India (ZSI) Kolkata.

Taxonomic position of *Paratelphusa hydrodromous* (Henderson, 1893)

Phylum: Arthropoda
Subphylum: Crustacea
Class: Malacostraca
Order: Decapoda
Sub order: Pleocyemata
Infra order: Brachyura
Super family: Gecaricinucoidea
Family: Parathelphusideae
Genus: Paratelphusa
Species: hydrodromous (Henderson 1893)

Fig 1: showing external morphology of field crab, *Paratelphusa hydrodromous*. (left) & aprone of a female (right).

Experimental set up

Experiment was conducted in triplets where crabs were kept in fibre tubs with water level as much that their appendages remain submerged and their carapace remained completely dry and fed with fresh earthworms and chicken. The excess feed and faecal matter has been siphoned out every day to avoid contamination of the water. The water is change after 5 days. 45 healthy crabs of uniform size and weight, 3-3.5cm. average carapace diameter and 10g mean body weight in the uniform gonadal condition were selected for the experiment.

The total period of the experiment investigated in the laboratory was 14 days. The experimental crabs were divided into the following three groups each having 15 animals each.

Group 1: Normal or control: This group was subjected to natural diurnal daylength of photoperiod.

Group 2: These crabs were kept in 24hrs. constant darkness. They were placed in a fibre tub covered with thermocol, in order to maintain animals in constant darkness throughout the experimental work.

Group 3: Animals received 24 hrs. of light every day. A 15-watt bulb (light source) was suspended from the thermocol frame approximately 7 inches above the water level, to prevent the temperature change of water.

Histology

At the end of the experiment, Crabs from both control as well as experimental groups were then sacrificed and their ovaries were dissected out. Ovaries were weighed and processed for histological studies and the GSI values were calculated. Wax blocks of ovaries were prepared and sections were cut at 6-7µm in thickness, stained by hematoxylin and eosin. Slides were examined under compound microscope. The ovarian indices were calculated using the following formula.

Result

After 14 days of experiment, various observations were made as follows:

Group 1: The crabs of the control group showed the lowest GSI value. Histological observation of ovaries showed abundance of oogonial cells (Og) and pre-vitellogenic oocytes (PO) near germinal zone. They are basophilic in nature.

Group 2: This group was exposed to 24 hrs. of complete darkness. Highest values of ovarian index were observed in this group as compared to control and continuous light group. Microscopic observation of group B slides showed large number of post-vitellogenic oocytes. Yolk deposition is almost completed in all these oocytes and whole of the Ooplasm up to perinuclear region was occupied by yolk globules.

Group 3: This group exposed to 24 hrs. continuous light and showed intermediate values of ovarian index. Histological observation of group 3 shows predominance of vitellogenic oocytes (VO) Ooplasm of these oocytes is granular, small yolk vacuoles have been observed to make their appearance in the periphery of Ooplasm of the oocytes. Nucleus stain purple with haematoxylin, which is centrally located, increases in size and had a wavy nuclear membrane. Small, oval follicular cells around oocytes have been observed.

Table 1: showing the values of mean gonadosomatic indices of *Paratelphusa hydrodromous* at the end of experiment.

Groups of crabs	Mean gonadosomatic index (%)
Group 1(control)	9.42
Group 2 (24 hrs. complete darkness)	11.56
Group 3 (24 hrs. complete light)	10.25

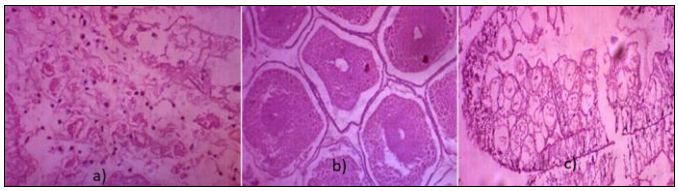

Fig 2: showing immature, maturing and mature oocytes (from left to right respectively) in the ovarian follicles of field crab, *Paratelphusa hydrodromous*.

Statistical Analysis

After calculating GSI of control and experimental groups was subjected to student ‘t’ test of significance at 5% level of significance.

Conclusion

From the present investigation it is evident that the photoperiodism played an important role either acting directly or indirectly on the target organs and could have helped in ovarian development and increase in GSI in e crabs of continuous dark group.

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References

1. Adiyodi KG, Adiyodi RG. Endocrine control of reproduction in decapod crustacea. Biol. Rev. Camb. Philos. Soc. 1970; 45:121-165.
2. Bishop JM, Herrnkind WF. Buying and molting of pink shrimp, Penaeus duorarum (crustacean: penaeidae), under selected photoperiods of white light and UV-light. The Biol. Bull. 1976; 150:163-182.
3. Meusy JJ, Payen GG. Review: Female reproduction in Malacostracan crustacean. Zool. Sci. 1988; 5:217-265.
4. Pervaiz PA, Susan M. Studies on the effect of photoperiodism and temperature on moulting of a freshwater prawn Macrobrachium dayanum. Int. J Fish. Aquat. Stud. 2015; 3:325-328.
5. Kumaran T, Devakumar D, Jayanthi J, Ragunathan MG. Effect of photoperiodism, Eyestalkablation on the ovarian development and electrolytic changes in a freshwater crab, Oziotelphusa senex senex. Int. J Curr. Res. Biosci. Plant Biol. 2015; 2:130-135.
6. Chang E, Chang S, Mulder E. Hormones in the lives of crustaceans: an overview. Am. Zool., 2001; 41:10901097.
7. Nagaraju GPC. Is methyl farnesoate a crustacean hormone? Aquaculture. 2007; 272:39-54.
8. Nagaraju GPC. Reproductive regulators in decapod crustaceans an overview. J Exp. Biol. 2011; 214:3-6.
9. Bocking D, Dircksen H, Keller R. The crustacean neuropeptides of the CHH/MIH/GIH family: structures and biological activities. In: Wiese, K (Ed), the crustacean nervous system. Springer, Heidelberg, 2002.
10. Nagaraju GPC, Prasad GLV, Reddy PS. Isolation and characterization of mandibular organ inhibiting hormone from the eyestalks of freshwater crab, Oziotelphusa senex senex. Int. J Appl. Sci. Eng. 2005; 3:61-68.
11. Ollivaux C, Vinh J, Soyez D, Toullec JY. Crustacean hyperglycemic and vitellogenesis-inhibiting hormones in the lobster Homarus gammarus. FEBS J, 2006; 273:2151-2160.
12. Chang ES, Mykles DL. Regulation of crustacean molting: a review and our perspectives. Gen. Comp. Endocrinol. 2011; 172:323-330.