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Effect of unilateral eye stalk ablation (ULEA) on Gonadosomatic Indices and Gonad Maturation of Freshwater Crab, *Paratelphusa hydrodromous* (Henderson 1893)

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Abstract
Present study was carried to investigate the effects of ULEA on gonadal maturation of both sexes of field crab, *P. hydrodromous*. Experimental animals were collected from Campus of Barkatullah University, Bhopal Madhya Pradesh, India. Apparently 30 males and 30 females were selected for investigation. For experiment, two groups were arranged *viz.*, control group for male and female (with intact eyestalk) and experimental group of both males and females (eyestalk ablated). Animals were maintained in fibre tubs and were reared during the course of experiment (45days). After the completion of the study, animals from both groups were scarified for the respective gonads *i.e.,* testes in males and ovaries in females. Values of GSI in both the sexes in experimental group are much higher than that of control group (with intact eyestalk). On the basis of histological study, in control male group revealed that the testes reached up to the formation of spermatocytes and spermatids and control female ovaries showed presence of oocytes in initial vitellogenesis. On the other hand, the experimental male gonads showed spermatids and spermatozoans and experimental female ovaries showed presence of oocytes in advance vitellogenisis that is secondary oocyte stage and post vitellogenic oocytes also. "t" test revealed significant difference between the GSI of control and experimental group.

Keywords: eyestalk ablation, gonad maturation, gonadosomatic index, *Paratelphusa hydrodromous*

Introduction
Eyestalk in crustaceans is known to have a neuro-haemal organ which functions due to the presence of X-Organ (Sinus Gland Complex), which secrete gonad inhibitory hormone (GIH) (Adiyodi and Adiyodi 1970). Hormones released from the sinus gland affect gonad development and many other physiological processes.

After shrimps and lobsters, crab is an esteemed sea food delicacy and a commercial crustacean aquaculture product. (Savad and Ragan, 2001). Crab meat is a rich source of proteins, vitamins and minerals. with the help of eyestalk ablation technique in crustaceans the total egg production and the percentage of females in a given population that will participate in reproduction can be increased in short period of time (Bray and Lawrence 1992). Crab meat has many therapeutic properties also. Excision of eyestalk is an endocrinological experiment to investigate the functions of neuropeptide hormones of the eyestalk. These hormones directly control the gonad development in crustaceans. (Hussain and Parmar, 2017).

The present investigation is an attempt to know about the effect of eye stalk ablation on the gonadal maturation and gonadosomatic indices in fresh water crab *Paratelphusa hydrodromous*.

Materials and Methods
The studies on "Effects of unilateral eye stalk ablation on gonad maturation and gonadosomatic indices of *Paratelphusa hydrodromous"* was carried out at the Department of Zoology, And Applied Aquaculture Barkatullah University Bhopal (23.2599^0 N and 77.4126^0 E) Madhya Pradesh, India|.

Methodology
Collection of test animals
The crabs were collected from the ponds and stagnant water tanks of university campus by netting or hand picking. Specimens were collected in plastic containers and brought to the Departmental Laboratory. Due to the previous knowledge of the activity behaviour already described for *Crustacean* species (Short, J. W. A. 2004), the collections were carried out at Dawn and dusk. Morphometry 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).

Fig 1: (a) showing external morphology of field crab, *Paratelphusa hydrodromous.* **(b)** Eyestalk ablated female **(c)** male

Taxonomic position of *Paratelphusa hydrodromous* (Henderson, 1893)
Phylum- Arthropoda
Class - Crustacea
Order - Decapoda
Sub order - Pleocyemata
Infra order - Brachyura
Super family - Gecaricinucoidea
Family - Parathelphusideae
Genus - *Paratelphusa*
Species - *hydrodromous* (Henderson 1893)
Experimental animals were acclimatised to laboratory conditions and were then transferred to plastic tubs with water level as much that their appendages remain submerged and their carapace remained partially wet. water of the plastic tubs was changed on weekly basis. Crabs were fed with minced chicken or earth worms twice a day according to their body weight.

Experimental set up
30 animals from both sexes with average body weight of 10g and average carapace diameter of 3-3.5cm were selected for the experiment. Experimental groups included,
Group I- Control animals (eyestalk intact- males and females)
Group II- Experimental (eyestalk ablated- males and females)
Right eyestalk was removed in experimental group crabs by cutting it with a sharp and sterilised scissors and the wound was cauterized with a hot blunt needle in order to prevent the loss of haemolymph and mortality.
At the end of experiment animals were sacrificed for the gonads by removing dorsal carapace**.** The female reproductive system consists of a pair of H shaped ovaries, a pair of seminal receptacles also called as spermatheca, and a pair of oviducts. The oviducts pass ventrally from the seminal receptacle. Similarly, the male reproductive system consists of a "H" shaped structure with a pair of testes, pair of vas deferentia and ejaculatory ducts.
After the dissection the male and female gonads were weighed and their GSI was calculated, by following formula:

$$GSI = \frac{\text{Wet weight of gonad}}{\text{Live weight of the whole animal}} * 100$$

Observations
Gonadosomatic index
The Gonadosomatic indices of the control and experimental groups was studied according to the size and weight of the crab. In the present study, the values of GSI showed significant increase in the eyestalk ablated group. Average values are shown below:

Table 1: showing the values of GSI in experimental and control group

Mean GSI of control group	Mean GSI of experimental group
Males- 9.71	Male -11.27
Females-9.32	Females -10.75

Histological Observations
Control Group
Histological sections of control females revealed that the ovary was covered by a thin connective tissue called ovarian epithelium and each oocyte was enclosed in a oogenetic pouch and showed the presence of oogonia and follicular cells. In other words, we can say that they were in immature stage.
Testes of control males revealed that the testicular lobules show presence of spermatogonia and spermatocytes and zone of germination was observed. From this it is clear that the testes of control males were in immature and maturing stage of development.

Experimental Group
On microscopic examination the ovarian tissues beside having the oogonia, oocytes in initial vitellogenesis, advance vitellogenesis and post vitellogenic oocytes were also observed. This shows that the ovaries of experimental group show fast maturation than ovaries of control females.
Similarly, testicular sections showed more advanced stages of development than control group. Spermatocytes, spermatids and spermatozoa were seen. This indicates the maturing and mature stages of development respectively.

Fig 2: Pictorial view of Macroscopic view of ovary of crab showing different lobules and a pair of oviducts

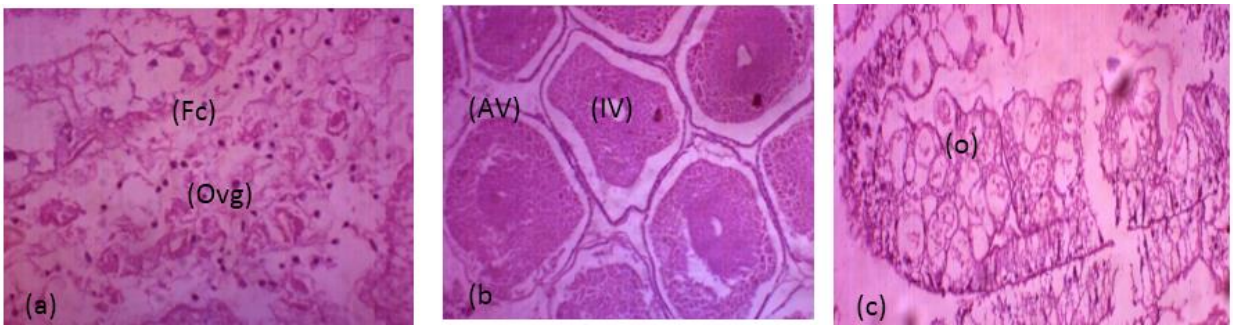

Fig 3: Pictorial view of (a) Immature ovary of freshwater crab *Paratelphusa hydrodromous* at 100x showing presence of oogonia(ovg) and follicular cells(fc) (b) maturing ovary at 100x presence of oocytes in initial vitellogenesis (I) and advanced vitellogenesis(AV) (c) mature ovary at 400x showing mature oocytes.

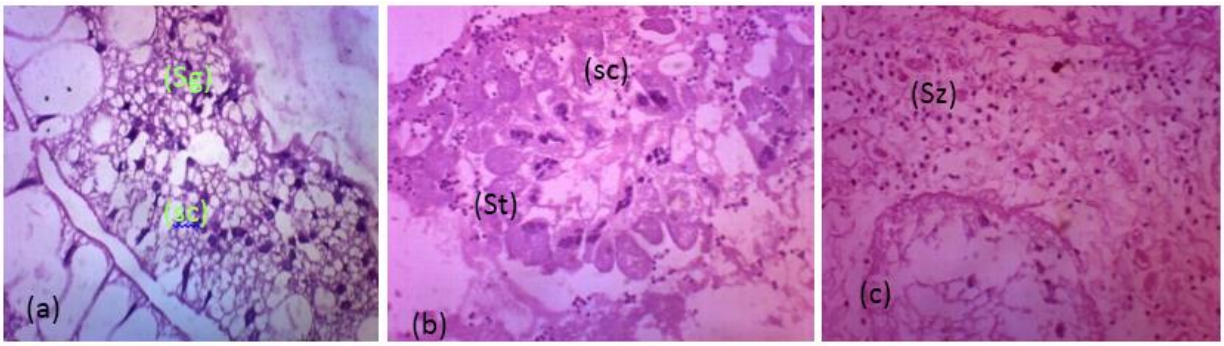

Fig 4: Pictorial view of testes of freshwater crab *Paratelphusa hydrodromous* (a) immature stage: presence of spermatogonia (sg) and spermatocytes (sc), 400x; (of control group) (b) maturing stage: presence of spermatocytes and spermatids (st) in cell division, 1000x; (c)mature stage: cross section of a seminiferous tubule with the presence of spermatozoids (sz), 400x;

Statistical Analysis

After calculating GSI of control and experimental groups the values were subjected to student 't' test at 5% level of significance. Results obtained indicate values of GSI of eyestalk ablated crabs are significantly larger than non-ablated crabs. The GSI value of eyestalk ablated females was greater than eyestalk ablated males.

Discussion

The results given above were comparable by other studies such as studies done by Chamberlain and Lawrence (2009) they had stated that eye stalk ablation caused increase in gonadal size doubled the mating frequency as compared to normal. The main concern of our study was to know the effect of unilateral eyestalk ablation on gonadal maturation of *P. hydrodromous.* From the previous literature it was confirmed that the crustacean eyestalk contain gonad inhibiting hormone in the X- organ. The results of this investigation were determined by various parameters including gonadosomatic index (GSI), change in weight, colour and size of animals and their gonads as well as histological changes in testes and ovaries.

Removal of the eye-stalk has accelerated the gonad development, it may well be stated that the eye-stalks of *P. hydrodromous* contain the gonad inhibitory factors, the supply of which ceases to be by the removal of the eyestalks, thereby increasing the activity of gonad development. In the present investigation, we observed an increase in the gonadosomatic index in both sexes of *P. hydrodromous* after the eye-stalk ablation, indicates increased reproductive activity due to the removal of gonad inhibiting factor present in the X-organ of the eye-stalk. The increase in the size of testes and ovaries, after the eye-stalk ablation, are the testimony of the fact that the eye-stalks of *P. hydrodromous* contain testis inhibiting factors. From, the results we concluded that there is a significant increase in the GSI in the animals belonging the Group 2 as compared to Group 1.

The present work is supported by many research works and literature already published on eye stalk ablation in prawns and shrimps in aquaculture and their GSI value is a great indicator for the progressive maturation of gonads in many species of decapods. Some of them are explained here:

Pandey and Kumar (2007) also gave the evidence about high GSI value due to fast gonadal maturation. The histological details of eye stalk ablated ovaries were mainly composed of post vitellogenic oocytes. During this, the size of ovary enlarges than the pre- vitellogenic oocytes. They observed that a major portion of basophilic cytoplasm was acquired by post vitellogenic oocytes. Their microscopic investigations revealed that mature oocytes were larger and cortical rods (CR), a structural modification that indicates final maturation were also seen.

Conclusion

From the present investigation it is evident that the eyestalk ablation played an important role either acting directly or indirectly on the target organs and could have helped in the gonadal development and increase in GSI in eye stalk ablated 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. Bray WA, Lawrence AL. Reproduction of Penaeus species in captivity. In: Fast, A. W. and Lester, J. L. (Eds.). Marine Shrimp Culture: principle and practices. Elsevier, Netherlands, 1992, 93-170.
3. Emmerson. Induced maturation of Prawn Penaeus indicus. Mar. Ecol. Prog. Ser. 2:121-131. Primavera, 1985. A review of maturation and reproduction in closed – thelycum panaeids. In: Proc. of 1st Int. Conf. on the culture of penaeid shrimp (1984) SEAFDEC Aqua. Dept. 1980.
4. Fingerman M. Crustacean endocrinology, a retrospective, prospective and introspective analysis, Physiol. Zool. 1997, 257, 70.
5. Raja S. The edible crab Scylla serrata and fishery in indo-pacific region. A review (M.Sc. dissertation), Annamalai University, India, 1981.
6. Rao PV. FA0 Fish. Rep., 1967; 57:285-302.
7. Savad AM, Raghavan PR. Mud Crab culture and flattening techniques, status and prospects Seafood Savad, A.M. and Raghavan, P.R. (2001). Mud Crab culture and flattening techniques, status and prospects Seafood Export Journal, xport Journal, 2001; 32:25-29.
8. Showkat Hussain, Priyanka Parmar, Susan Manohar, Pooja Yadav. Effect of photoperiodism on ovarian maturation of fresh water prawn Macrobrachium lamerii lamerii. International Journal of Fisheries and Aquatic Studies, 2017.