

Spermatogenesis in freshwater Mussel, *Lamellidens corrianus*, when subjected to Cerebralectomy.

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ABSTRACT

Lamellidens corranus is a freshwater mussel. During spermatogenesis compact follicles, spermatogonia, spermatids, spermatocytes with mature follicles occurred during different stages were recognized. The experiment was conducted throughout the year, the animals were grouped into three, group a) Control animal, group b) Unilaterally cerebralectomized animal and group c) Bilaterally cerebralectomized animals. A comparative study showed an abnormal growth in cerebralectomized animals as compared with control. Thus, cerebral ganglia accelerated the growth of gamete which was more pronounced in bilaterally cerebralectomized animals.

Key words: Spermatogenesis, Cerebralectomized, Season, *Lamellidens corranus*.

INTRODUCTION

Bivalve species can be found all around the globe in a variety of environments, from the poles to the tropics (Tebble 1966, Hayward and Ryland 1995, Dance and Ward 2002). Over such a range, differences in environmental conditions such as in water temperature, salinity, food availability and water current occur. These differences influence growth, survival and reproduction and, ultimately, they limit and determine the distribution of species. In many bivalve species, spawning occurs once a specific threshold temperature is reached (Loosanoff and Davis 1963, Lammens 1967, DeWilde and Berghuis 1978, Giese and Kanatani 1987, Drent 2004). Overall, temperature is seen as a key factor directly or indirectly affecting physiological processes. After severe winters, the amount of settled bivalve larvae (spat) on the seafloor appears to be higher than after mild winters (Reise 1987, Beukema et al. 2001). At a local scale, physiological processes in bivalves are affected by other environmental factors as well. Food quality and quantity, tidal level and sediment type are known to influence growth and reproduction, and these seem to have locally a more important role (Newell and Hidu 1982, De Montaudouin 1996, Beukema and Cadée 1997, Honkoop and Beukema 1997, Beukema et al. 2002, Carmichael et al. 2004).

The physiological components regulating intraspecific growth differences among individuals living in the same environment may be affected by

differences in energy acquisition (food consumption and assimilation), differences in the allocation of energy among maintenance, growth, reproduction and other consuming activities, and differences in the metabolic cost of growth (Bayne, 1999). The energy budget or 'scope for growth' provides a means of integrating the basic physiological processes into an index of energy available for growth and reproduction. In bivalves, the scope for growth has proved to be an accurate predictor of total production, which includes growth rate and gamete production (Pouvreau et al., 2000; Rueda and Smaal; 2004). Thus, the present study was undertaken in *Lamellidens corrianus*, so as to study the impact of cerebral ganglia ectomy unilaterally and bilaterally on reproduction with special emphasize on spermatogenesis in summer, monsoon and winter season.

MATERIALS AND METHODS

During different seasons, the collection of 15 individuals of the shell length 90-110 mm, were brought from the pond situated at Nandrabad, 19 Km away from Aurangabad to the laboratory and were brushed so as to remove the biomass and mud. There were then kept for about 2 to 3 hour in the laboratory conditions. The surgical operations were performed so as to remove cerebral ganglion unilaterally and bilaterally within 30 second. The animals were divided into 3 groups non-operated served as control and other two were experimental further fixed in Bouin's Hollande for 24 hour. The gonad were dissected, dehydrated and processed as per micro technique methods and serial section were cut at 6-7 mm thickness and were stained

with Mallory's triple stain the section were observed under the research microscope before photomicrography.

RESULT AND DISCUSSION

Lamellidens corrianus from the Nandrabad pond is a dioecious animal which cannot be morphologically differentiated. Gonad development in bivalve's studies is energy demanding processes, histologically in summer gametogenesis, maturation of gametes occurred in monsoon and mature partially spawned in winter. The various physiochemical parameter were also studied, (Table 1)

In summer there was formation of number of sperms, the nutritive cells and lipid globules were many in the control group animals compared to both experimental animals. The size of spermatogonia in control animals was $2.8 \pm 0.029\mu\text{m}$, in mean diameter and in unilaterally cerebralectomized animal and bilaterally cerebralectomized animals showed a significant increase in size to $2.9 \pm 0.096 \mu\text{m}$ and $3.6 \pm 0.196\mu\text{m}$ respectively.

In monsoon during the maturation of gamete stage the follicle were compact, few sperms were observed in control animals, but number of sperms has been increased in bilaterally cerebralectomized animals. The size of spermatogonia is $2.3 \pm 0.100\mu\text{m}$ in control, $2.4 \pm 0.086\mu\text{m}$ an increased size in unilaterally cerebralectomized animal and $2.6 \pm 0.021\mu\text{m}$ in bilaterally cerebralectomized animals.



MAP : THE MAP OF AURANGABAD DISTRICT



West

Figure 1: Nandrabad pond

Table 1: The Physico-chemical Parameters of the FreshWater Nandrabad Pond, Aurangabad.

S.N.	Season Month	Rainfall (mm)	Day Length	pH	Temperature (°C)	Dissolved Oxygen ml / l	Chlorides (mg/l)
1	Summer May, 2000	--	13.07	7.7	33°C	4.40	17.89
2	Monsoon August 2000	23	13.32	7.6	29°C	5.24	09.94
3	Post Monsoon October - 2000	--	12.18	7.5	23°C	7.66	11.36
4	Winter February - 2001	--	11.25	7.6	22°C	9.67	12.78

**Figure 2:** The Photograph showing inner view of Shell : Adductor muscles scars and hinge teeth in *L. corraianules*

In winter spawning occurs with sperms in experimental group, few spermatids, and few relics' sperm and very few spermatogonia were seen, very few lipid globules were seen only in experimental group animals. The size of spermatogonia in control was $8.8 \pm 0.76 \mu\text{m}$, increase growth in cerebralectomized animals $1.5 \pm 0.015 \mu\text{m}$ and $2.1 \pm 0.379 \mu\text{m}$, respectively.

In spermatogenesis studies in bivalves, it has been noted that secondary spermatocytes are rarely observed, Sastry (1979). Brain gonadotrophic hormones in spermatogenesis of *P. verdis* play an essential role for normal maintenance and for development of mature spermatogonia, Nagabhusanam et al (1976).

In the present histological observation showed the increase in the size of the spermatogonia in the experimental animals in all the seasons might be due to removal of cerebral ganglia. Increased size or growth of the gamete, Lubet and Streiff, (1982), support the present results. Peredo et al (1990), also compared the sperm morphology in freshwater bivalves and drawn similar conclusions. In the two major groups of molluscs the cephalopod and gastropod evidences for the endocrine control reproduction system is well established, Golding 1974, Wells and Wells (1972). The

physiological components regulating intraspecific growth differences among individuals living in the same environment may be affected by differences in energy acquisition (food consumption and assimilation), differences in the allocation of energy among maintenance, growth, reproduction and other consuming activities, and differences in the metabolic cost of growth Bayne, (1999).

Thus, considering the importance of endogenous regulation in the general physiology and reproduction in bivalves from a freshwater environment the present study is aimed at understanding the role played by cerebral ganglia in phases of gamete growth in different seasons of the freshwater bivalve *Lamellidens corraianus* (Lea).

Thus, cerebral ganglia plays an important role, mostly inhibitory, in regulating gonad development in the *L. corraianus*, but perhaps more elaborate researching factors which trigger the metabolic demand and control reproduction is needed.

It is clear from the above table that glyphosate effects on kidney in a snake-headed freshwater fish *Channa punctatus* and shows a significant decrease in protein content. Proteins play a vital role and have the top

priority in the body of organisms, proteins are composed of amino acids which are organic compounds made of carbon. As whole the body is made up of proteins, though proteins has chief significant and high priority in the living world by their biological specificity among various types of cell (Bhushan *et al.*, 2002). Fish are main organisms that are used to identify and document pollutants released into their environment. Various studies have been noticed and states that glyphosate a herbicide is toxic to fish which give rise to morph and functional changes in aquatic animals. While various facts shows negative outcomes from glyphosate exposure, which including birth defects and neurological, fetal death and neurodevelopment (Battaglin *et al.*, 2005; Jurewicz and Hanke 2008).

CONCLUSION

It was concluded that the herbicide glyphosate is very harmful for both flora and fauna in an aquatic medium. The glyphosate is mainly used in various orchids and agriculture purposes. As, is washed out through rain and ultimately reaches to the nearby river or lakes, and ultimately affect directly or indirectly on the fauna organisms which in turn effect the human health by food chain.

Conflicts of interest: The authors stated that no conflicts of interest.

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