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SEASONAL CHANGES IN THE OOCYTES OF FRESHWATER MOLLUSC, *LAMELLIDENS CORRIANUS* (LEA)

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Abstract: Reproductive phenomenon in freshwater molluscs is less studied in comparison to marine ones. Seasonal changes in the oocytes due to maturation of female gametes and onset of breeding period show some changes. Freshwater bivalve, *Lamellidens corrianus* showed seasonal gametogenic changes that depend upon external factors like salinity, light, food and temperature. Present study highlights the spawning activity of freshwater bivalve, *Lamellidens corrianus* in different seasons. In current exploration, specimens were collected in all the three seasons and studied for micrometric analysis of female gonads to find out the seasonal differences. With the observation, the author concluded that in *Lamellidens corrianus,* environmental factors synchronized the gonadal development at an early stage in the process of adulthood so that spawning can be coordinated to achieve synchronous release of gametes.

Keywords: *Lamellidens corrianus*, Mollusca, Oocytes, Seasonal changes.

INTRODUCTION

Bivalves are members of Mollusca, the second largest phylum of Animal Kingdom (Verma and Prakash, 2020). Freshwater molluscs specially the pelecypods (bivalves) including *Lamellidens corrianus* are filter feeder and are used as food and for many other purposes. Different types of pelecypodes like oysters, mussels, clams etc. which are not only economically valuable but edible too seen seaside. Furthermore, some of the pelecypode species are found both in lotic and lentic freshwater bodies in India. (Yasmeen, 2019).

In reproductive cycle, the gonad development, spawning, fertilization and growth are the major phases. These phases function continuously in coordination with seasonal environmental changes and produce the pattern characteristic of a particular species. So, the studies on seasonal changes in oocytes of the freshwater bivalves are helpful in shellfish culture practices. These are used as far instant study of reproductive activity. Considering the importance of these various species of bivalve molluscs, several investigators made notable contribution in various aspects of biology, ecophysiology, biochemistry etc.

In *Mytilus edulis,* the glycogen storage shows a clear annual periodicity, which is related to reproductive activity (De Zwaan and Zandee, 1972; Gabbott and Bayne, 1973; Gabbott, 1975). Both the local activity of the enzyme and percentage of the enzyme which is in the active form increase two-to threefold in the mantle tissue during summer and coincide with the glycogen accumulation in this period. Still substantial information is available for dioecious marine bivalve species which include many aspects of exogenous and endogenous regulation in reproduction and energy metabolism. Histopathology is an extremely useful tool for assessing seasonal variations in oocytes and also for assessing effects of toxicants at individual level (Yasmeen and Pathan, 2021). So, current work has been carried out on freshwater pelecypode *Lamellidens corrianus* (Lea) to cover the information in this area.

MATERIALS AND METHODS

The specimens of freshwater bivalve mollusc, *Lamellidens corrianus* of 80 to 85 mm shell length were collected from Jayakwadi backwater (Nathsagar) at Paithan and brought to the laboratory. This source is located about 45 km. away from Aurangabad (MS). After that the shells of the molluscs under study were brushed and washed with clean water so as to remove the mud and attached algal biomass. The healthy specimens were selected and acclimatized at laboratory condition in fresh aerated reservoir water and food was not provided to these bivalves throughout. The renewal of water was done regularly at an interval of about 12 hours. Aquarium contained 15 liter fine aerated reservoir water and experiment was run for 12 days. Average size of aquarium available is of 15 liter which might be enough for the bivalves to keep in it and the experiment was run for 12 days just to see the changes which might be prominently seen on 7_{th} and 12^{th} day. The water from aquarium was changed frequently at an intermission of about 12 hours throughout the period of study.

Five animals of approximately same size from aquarium during summer, monsoon and winter seasons were selected for fixation on 7^{th}, and 12^{th} day for histological study of gonads. The animals were soaked carefully with the help of filter paper and were fixed in Bouins Hollande's fixative. On 7^{th} and 12^{th} day, the *Lamellidens corrianus* were sacrificed and tissue gonads was obtained then processed for preparation of paraffin blocks. Dehydration of gonadal tissue was done through serial grades of ethyl alcohol and tertiary butanol respectively while xylene was replaced by toluene during the process. The tissues were embedded in paraffin wax at 58°-60°C and the sections of gonad were cut at 6.0 to 7.0 μm thickness using Weswox spence-rotary-microtome (MT-1090 a). The materials were stained with Mallary's Triple stain. All the sections were observed under the research binocular microscope and wherever necessary, measurements were made with the help of stage micrometer and oculometer before microphotography with Nicon camera.

For measurement of size of oocytes micrometry tools are used which include ocular micrometer and stage micrometer. Ocular micrometer is small circular disc of glass with graduations engraved on its surface but the lines are arbitrarily engraved which is not standard measurement. Stage micrometer also called as objective micrometer is a glass slide with inscribed lines which are exactly 0.01 mm (10 micrometer) apart. To note down the size of the experimental object first calibration of ocular micrometer with stage is essential for those ocular scales superimposed with stage micrometer, after graduations of stage align with the graduations of ocular properly count how many ocular divisions equal one division (0.01mm) of the stage micrometer. Afterwards removed the stage, place the object and counted the number of ocular lines covered the object, calculated these lines with the stage lines which is the size of object. While measuring the size of the oocytes, minimum three oocytes are taken and their mean and standard deviation were calculated.

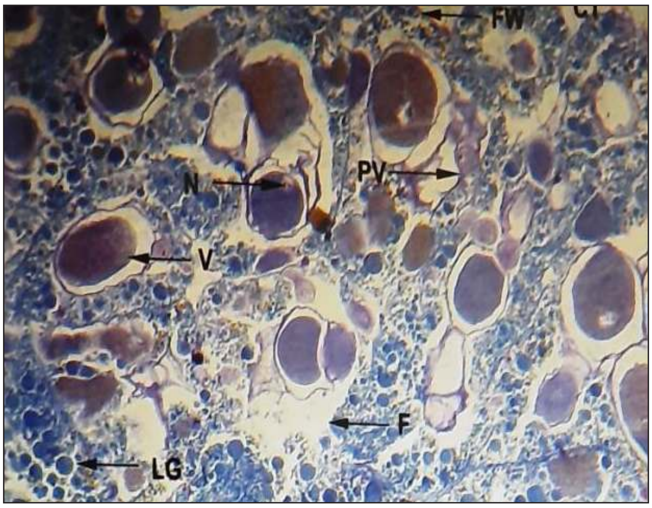
RESULTS AND DISCUSSION

The details of the histological structure of female gonads and measurements of the developing oocytes from female gonads in *Lamellidens corrianus* of different groups on 7^{th} and 12^{th} day were given season wise in table 1 and figure 1. During summer season, on 7^{th} day the previtellogenic oocytes showed the diameter of 72.46±12.546 μm, which was somewhat higher than monsoon (48.728±4.462 μm) and lower as compared to winter (87.57±11.80 μm). As compared to vitellogenic oocytes, in summer it showed the diameter of 156.206±17.1026 μm which was somewhat closer to the vitellogenic oocytes of monsoon (154.962±12.249 μm), but in winter it was again higher (193.57±11.8019 μm). On 12th day of experiment, as far as the size of previtellogenic and vitellogenic oocytes is concerned, it was again higher in winter as compared to monsoon and summer.

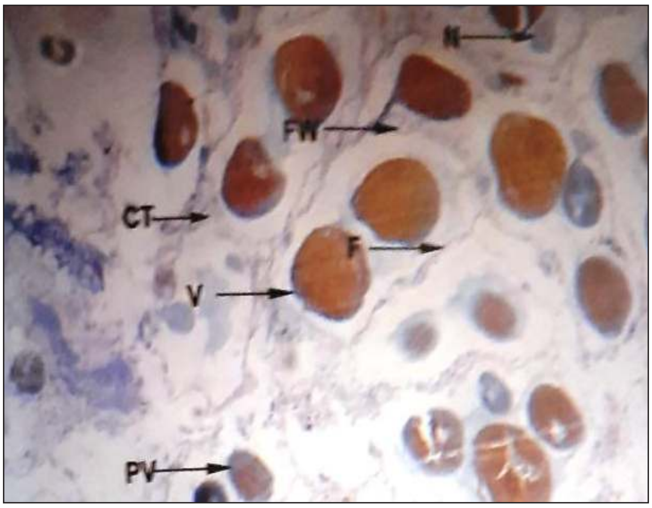
Size of the water body, availability of food and environmental parameters play an important role

Table 1: Size specific changes in previtellogenic and vitellogenic oocytes (in μm) in different seasons.

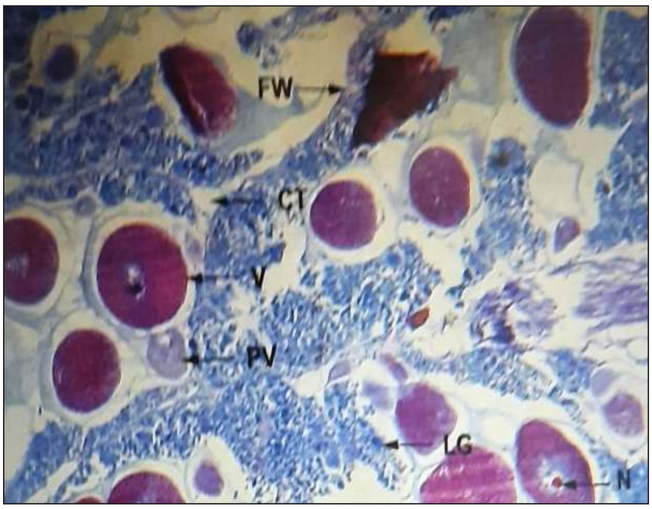
Experimental Period		Size of oocytes in Summer	Size of oocytes in Monsoon	Size of oocytes in Winter
7th Day	Previtellogenic oocytes	72.46±12.546	48.728±4.462	87.57±11.80
	Vitellogenic oocytes	156.206±17.1026	154.962±12.249	193.57±11.8019
12th Day	Previtellogenic oocytes	63.119±17.1123	52.818±16.273	72.44±8.215
	Vitellogenic oocytes	114.288±16.923	173.829±12.814	180.182±10.60



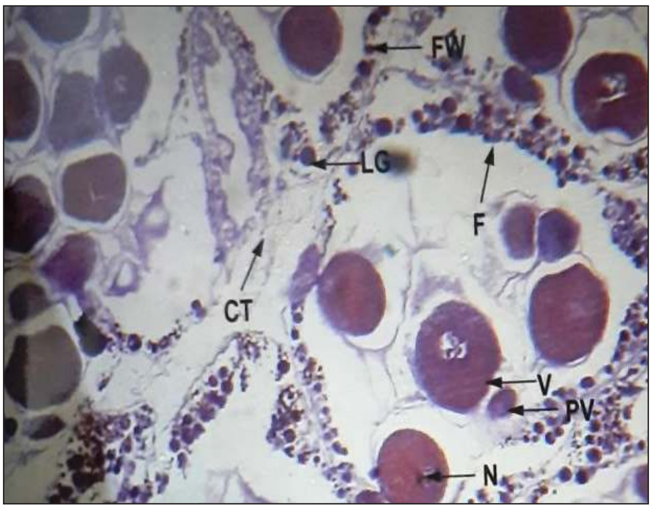
Summer 7th day



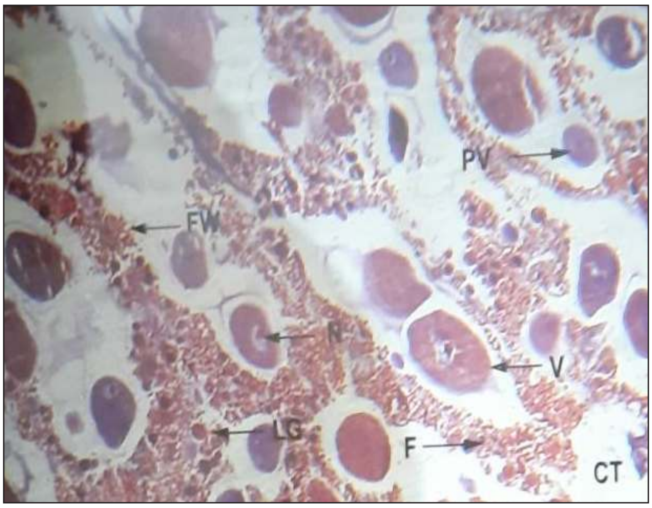
Summer 12th day



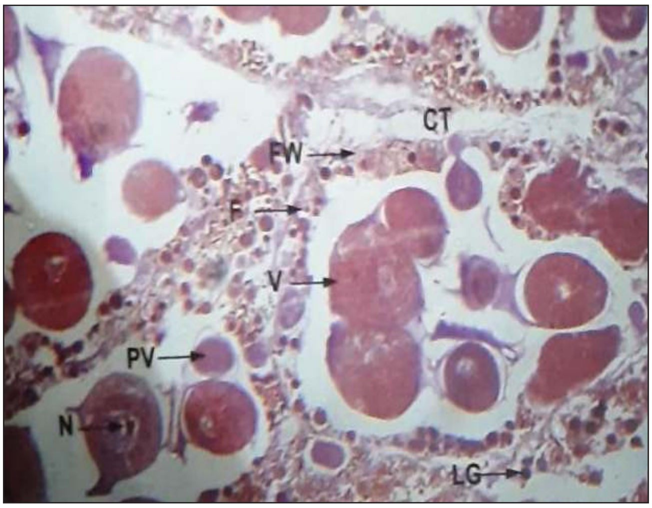
Monsoon 7th day



Monsoon 12th day



Winter 7th day



Winter 12th day

Fig 1: Seasonal changes in oocytes on 7th and 12th day in *Lamellidens corrianus* during summer, monsoon and winter seasons.

F =Follicle	**FW = Follicular wall**	**LG =Lipid globule**
N = Nucleus	**PV =Previtellogenic oocytes**	**V=Vitellogenic oocytes**
CT = Connective tissue		

on the gametogenic activity like spawning and maturation of oocytes. Berg *et al*. (1958) noticed that seasonal changes in metabolic movement are more firmly identified with food supply or regenerative action than to temperature. The connection between gametogenesis, body stores and routine pace of oxygen utilization in bivalves has been recorded by Bayne and Thompson (1970), Widdows and Bayne (1971) and Bayne (1973). They found that the routine oxygen consumption rate increases during active gametogenesis. After the culmination of the cycle, the energy hold of the body is significantly decreased and the starvation brings about fast decay. This enables the animal to give a quick reaction towards the changed climate conditions that requires expanded oxygen utilization.

It has been observed that gametogenesis starts during summer, maturation in monsoon whereas ripening of gonads and spawning occur during winter season in the case of *Lamellidens corrianus*. In view of oxygen consumption, reproductive state and the internal status of this bivalve, it can be stated that the high rate of oxygen consumption during summer probably correlates with both the animal's greater energy demand for gametogenesis as well as to survive in decreased oxygen condition at the time of increased temperature and low food accessibility. In case of Indian bivalves, Nagabhushanam and Mane (1975) described a relationship between natural constituents and the yearly conceptive pattern in *Katelysia opima*. Impact of seasonal variations from gonadal changes has been studied on *Lamellidens marginalis* (Bloomer, 1931) and *Anodonta cygnea* (Bloomer, 1930, 1934, 1935 and 1939). Some researchers including Patil and Bal (1967), Lomte and Nagabhushanam (1969), Ghosh and Ghose (1972) and Nagabhushanam and Lohagaonkar (1978) studied the reproductive cycles in fresh water molluscs in Indian water and reported the significant changes.

In the present study, author noticed that gametogenesis starts in *Lamellidens corrianus* during summer in May and maturation of gametes during post-monsoon in August. In winter, the follicles with partial emptying of gametes predominate. In winter season, few developing oocytes had also been seen. On the basis of histological studies, it was noticed that gametogenesis starts with rise in temperature in summer and pre monsoon in the gonad of animal studied but at a slow rate due to low food availability and rise in energy demand for maintenances of physiological activities. Thus, author concluded that in *Lamellidens corrianus*, ecological variables synchronize the gonadal advancement at a beginning phase during the time spent development so that spawning can be composed to accomplish coordinated arrival of gametes.

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