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Changes in Hepatopancreas of the Bivalve Molluscs *Lamellidens marginalis* Exposed to Acute Toxicity of Cadmium in Summer

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Abstract: The present work constitutes a study on the effect of cadmium on freshwater bivalve, *Lamellidens marginalis* (90-100mm shell length) from Daulatabad near Aurangabad. The acute bioassay tests under static bioassay was carried on the Lc_0 and Lc_{50} values 1.0 ppm and 3.5 ppm in Summer. Hepatopancreas of the mussels belonging to these groups along with control was studied histologically. Control group showed large number of amoebocytes in interlobular connective tissue. Destruction of digestive secretory cells, infiltration of amoebocytes in tubules and digestive cells and karyolysis were most common due to cadmium, especially in Lc_{50}.

Key words: *Lamellidens marginalis* · Cadmium · Hepatopancreas.

INTRODUCTION

The toxic substance once gets entered in the body, they certainly damage and weaken the mechanisms concerned, such damage may be at cellular or at molecular. Histopathology of oxygen may also be helpful in finding the cause of death and identifying the target organ [1].

Information on mechanism which the aquatic animals may accumulate this elements, reduce their cytotoxic effects and, possibly, eliminate them is at present rather limited. The toxicity of various elements to organisms is dependent on the bioavailability of the elements, or determined by metal specification studies in particular [2 and 3] and is effected by the physicochemical properties of the environment [4].

Histopathology is an indispensable and powerful technique in establishing routine toxicology studies performed for the purpose of risk assessment of living resources useful to human being. Its value lies not only in the sensitivity in terms of toxic levels but particularly in exposing the tissue contents and mechanisms of action at cellular level. To assess its usefulness in toxicology studies with shellfishes, several investigators have performed experiments using various environmental contaminants [5].

There are limited evidences on histopathological changes of hepatopancreas of molluscs due to metal toxicity, especially bivalve molluscs Clarke [6] reported on metal induced changes in the structure of digestive epithelium of the mussel, *Mytilus edulis*. Krishnakumar *et al.* [7] studied cellular response to copper and mercury in the digestive cells, cilia and digestive tubules of mussel *Perna viridis*. The hepatopancreas in bivalve molluscs serves as a site for the storage of metabolic reserves which provides a source of energy utilized during gametogenesis and during the periods of physiological stress [8, 9].

MATERIALS AND METHODS

After collection of the animals from habitat, they were immediately transported to the laboratory. The fouling biomass and mud on shell valves were removed without disturbing the siphonal regions. The equal sized animals (90-100mm shell length) were grouped and kept in

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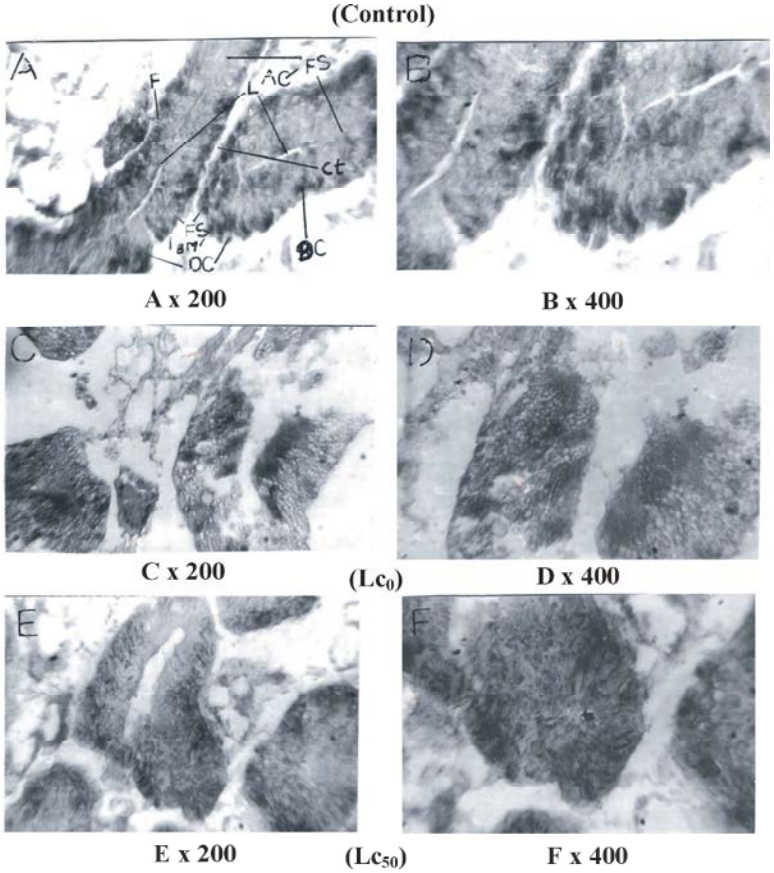
sufficient quantity of water (animal/liter) in aquaria with aeration for 24 hrs. to adjust the animals to laboratory conditions (with renewal of water at interval of 12 to 13 hrs). No food was given during acclimationtime and during experiments. After 24 hrs. animals of equal size (90-100mm shell length) were grouped in 10 and exposed to different test concentrations of cadmium for static bioassay tests.

The stock solution of cadmium was prepared by dissolving appropriate quantity of cadmium chloride ($CdCl_2$. 2 $\frac{1}{2}$ H_2O AR Grade CDH Bombay) in double distilled water. The pH of the water is brought between 6.9 to 7.1 by adding 1N HCl (due to insolubility of cadmium in reservoir water having 7.6 to 8.1). Appropriate test concentrations were then prepared and animals were exposed. The experiments were conducted in natural day-night rhythm. The experiments were repeated three times for confirming observed Lc_0 and Lc_{50} values. The 96 hrs. acute test was recorded.

After 96 hrs. acute toxicity test using Cd for histological studies, hepatopancreas from control, Lc_0 and Lc_{50} groups were fixed in aqueous Bouin's Hollande fluid for 48 hrs. The dissected tissues were dehydrated with alcohol and toluene and embedded in paraffin wax (58 to 60°C). Hepatopancreas sections were cut down at 6-7µ. For histopathological study of hepatopancreas Mallory's triple stain was used. All the photomicrography was made under light-microscope Labo VT-20 Scan model.

RESULTS AND DISCUSSION

The changes is hepatic tubules due to cadmium toxicity along with control are shown in Figs. A-F. In (control) group (Fig. A and B), *Lamellidens marginalis* the hepatopancreas consists of ducts and digestive tubules group in the form of bundles indistinctly separated and connected inter-lobular connective tissue of collagenous fibers. Each tubule is bounded by thin muscle fibers which form the basement membrane.



BM = Basement membrane L = Lumen CT = Connective tissue
AC = Acidophilic cells DC = Digestive cells BC = Basophilic cells

Fig. 1: Histological changes in the hepatopancreas of *Lamellidens marginalis* exposed to cadmium in summer

Each digestive tubule consists of digestive cells or columnar type, vacuolated and acidophilic and secretary or pyramidal type and basophilic type cells.

Exposure to cadmium caused deteriorative changes in summer, Lc_0 group (Fig. C and D), showed swelling of the tubules which was distinct from the connective tissue. The basement membrane of each tubule was ruptured at many places. The nuclei of the digestive and secretory cells stained dark and most these cells detached from the basement membrane and from each other. The number of amoebocytes in the connective tissue decreased considerably and infiltered the tubules. In Lc_{50} group (Fig. E and F), the tubules completely lost their original shape probably due to dissolution of the basement membrane, which resulted in the dispersion of the digestive and secretory cells and formation of vacuoles. These cells mostly showed karyolysis or necrosis. The amoebocytes increase in number in inter-lobular spaces and many surrounded the tubule cells.

The above results revealed that the severity of effect was more pronounced in Lc_{50} groups than in Lc_0 group. Histological and histochemical studies made by Johnson *et al*. [10] suggested that abundance of lipid and glycogen, there by the digestive gland is the site of significant energy stores. Any adverse effect to the tubules can be markedly fatal to the bivalves.

Vacuolization in the tubular cells as a result of stress has been reported in bivalve molluscs [9-11]. This could be step towards the detoxification process that the liver is responsible for disintegration of tubules and necrosis of hepatic cells as a result of stress is also a common feature in many aquatic animals. Akarte [12] observed that the pesticides like Folithion and Leybacid were effective in all the season to *Indondia caeruleus* and *Lamellidens marginalis* to cause cellular destruction of hepatic lobules.

Moore [13] stated that pathological reactions of the lysosomal system in hepatopancreatic cells of bivalve molluscs have proven to be sensitive bioindicators of pollutant effect. In the present study, the destruction of the basement membrane of the hepatic tubules and cell-surface of the digestive cells after cadmium exposure probably caused disfunction of the surface receptors as quoted by Moore [13], resulting in the disturbance of lysosomal system functioning.

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