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The histopathological effects of detergent 'Tide' on foot and mantle of the fresh water snail, *Bellamyabengalensis* Lamarck

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Abstract

In this study the fresh water snail (*Bellamyabengalensis*) one of the most abundant gastropod of river Godavari, was investigated to determine the histopathological effects of detergent "Tide" on the foot and mantle under laboratory conditions. The exposure of the snails to sub-lethal concentrations of the detergents resulted in prevalence of desquamation of the epithelial cells, changes in the number of mucocytes, disruption of glandular cells and atrophy of the columnar muscle fibres in the foot and mantle tissues of snails. The results are discussed, particularly in comparison to those of other aquatic organisms.

Keywords:*Bellamyabengalensis, detergent tide, foot, histopathological alterations, mantle*

Introduction

The detergent components are subject to variable effects based on habitat characteristics and other modifying factors. The histopathological studies are indicative of the pollution induced stress, it is gradually gaining popularity among toxicologists (Hinton *et al*. 1973). Exposure to moderate concentrations of detergent can produce recognizable effects. Those are morphological changes, inhibiting effects and behavioural changes. Besides the above, histomorphological change is considered to be an useful bio-assay tool in toxicity studies, as its application demands a high degree of competence and skill to make correct diagnosis (Warner 1967). Detergent toxicity studies on gastropod molluscs are comparatively very inadequate when compared to the fishes. Pathological disturbances in aquatic organisms like fishes due to detergent toxicity were well documented by Chellan*et al*. (2003). Structural changes caused by detergent may occur at any level of the biological organizations literally from molecule to mammals (Glaister 1986). Due to the of detergents important organs like kidney, liver, gill, digestive system and nervous system are damaged. The effect of the cationic surfactant lauryl trimethyl ammonium chloride (C_{12}-TMAC) was investigated on growth, reproduction, cellulolytic enzyme activity, and larval colonization of Asiatic clams, *Corbiculafluminea*(Belanger *et al.,* 1993). *Lymnaeaperegra* is highly sensitive to the anionic surfactants, sodium lauryl sulfate (SLS) with a 96 hrs LC_{50} of 0.54mg/L (Jose and Oliva 1987).The effects of heavy metals, insecticides and pesticides on the snails are extensive than detergents. Panwar*et al*. (1982)studied the toxicity of some chlorinated hydrocarbon and organophosphorous insecticide was investigated in *Viviparusbengalensis*. Pathological and biochemical disturbances of pesticide toxicity in *Vivipara bengalensis* is well documentedby Muley and Mane (1990). The present study is devoted to evaluate the toxicological effects of detergents on *Bellamyabengalensis*.

Material and Methods

B.bengalensis were collected from river Godavari and divided into 5 groups of 10 individuals. One group consisted of control snails while the other four groups were exposed to 96 hrs LC_{50} concentration of detergents. The concentration of detergents which caused 50% mortality to test

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organisms during a specified time expressed in terms of LC_{50}. The lethal concentrations were calculated by using probit analysis. For histological and histochemical studies both the control group and those of experimental groups that survived at the end of 96 hrs exposure were fixed in Susa, dehydrated in alcohol grades and were embedded in paraffin wax. The animals were cut at 6 - 8µ and take serial sections of the animal and stained with Heidenhain's Azan.

Result and Discussion

Results were expressed in LC_{50} values for 96hrs. The LC_{50} values obtained have shown that the detergent Tide has affected the mantle and foot of *B.bengalensis* when compared with their respective controls (Fig. 1 to 4). The foot considered to be the strongest part of the animal is also not spared by the detergents.The normal foot in control experimental snail consists of dorsal and ventral ciliated columnar epithelium, epidermal mucocytes, mucous gland cells, muscle fibres and connective tissue. The epithelium of the foot directly in contact with the polluted water shows desquamation at different concentrations of detergent. The foot shows severe damage at highest concentrations and congestion was severe at 213.7, 263, 316.2 mg. Disruption of muscle fibres and desquamation of epithelial layers can be seen at 69.18 mg (96 hrs). The glandular cells were affected after 96 hrs exposure different parts of foot were affected severely i.e damaged connective tissue, shrunken epidermal cells, broken basement membrane and faintly stained degenerated cells.The mantle is a thin surface which lines the shell and forms the roof of the body cavity. The normal mantle consists of outer and inner columnar epithelial layers, muscle fibres, connective tissue, aggregates of glandular cells and epithelial mucocytes. These cells are damaged after exposure to acute toxicity of detergent (Tide).The mantle edge being directly in contact with the polluted waters accumulated considerable amounts of surfactants in their cells and produce toxic effects like hypertrophy of the epithelial cells with vacuolation and disorganization of cell walls leading to necrosis. After 96 hrs exposure the tissue of mantle showed the desquamation of epithelial cells, atrophy of muscle fibres, necrosis and disruption of shell glands. Pollution is the chief wrecker of the declining of molluscan population. At the banks of the rivers, lakes, canals and streams washer men are active. Much of the detergent thus let into the water make a study of the sub-lethal effects on *Bellamyabengalensis*.The present study has shown several degeneration changes in the histological structure of the mantle and foot of *B. bengalensis* exposed to 96 hrs LC_{50} of the detergents.

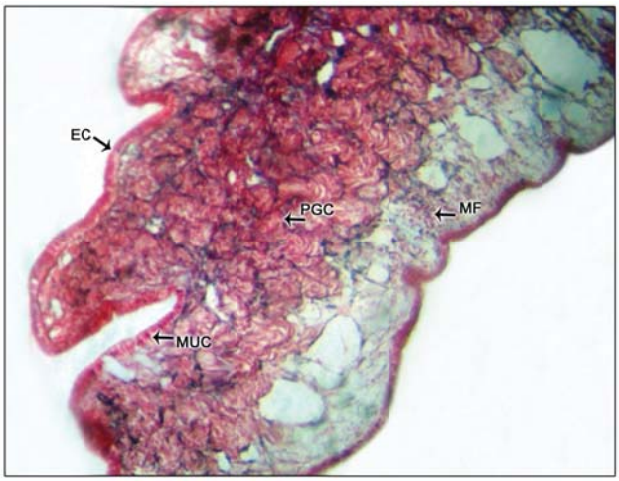

Fig. 1 Sagittal section of foot (Azan) Normal
PGC - Pedal Gland Cells
VC- Vacuolated Cells
CT - Connective Tissue
EM - Epithelial Mucocytes

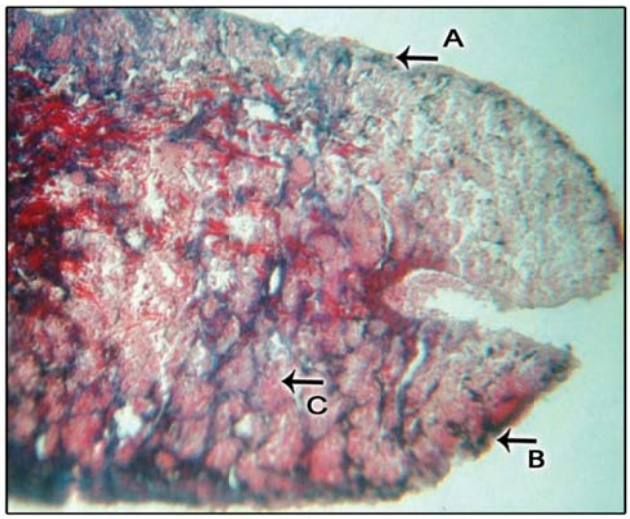

Fig. 2 96 hrs of foot showing
(A) Desquamation of epithelial cells
(B) Broken basement membrane
(C) Shrunken pedal gland cells

In the present study it is interesting to note that histopathological changes induced by detergent are more intense. But there is no information on the histopathological effects of detergents on the tissues of molluscans. Similar degenerative changes were shown in the histological structure of the mantle and foot of *B.dissimilis* exposed pesticides (Jonnalagadda and Rao, 1996).

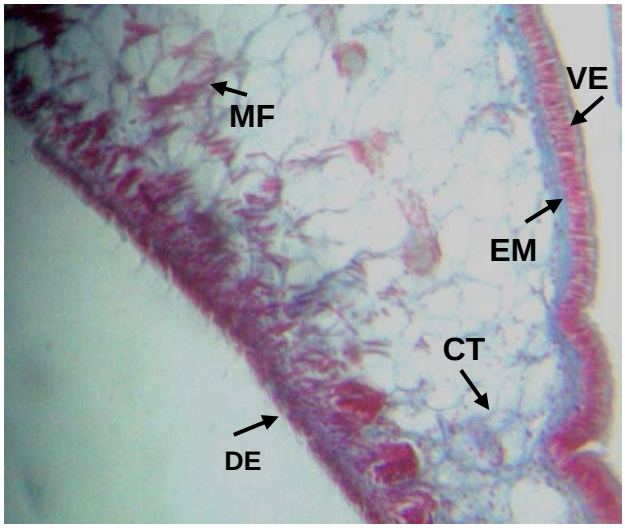

Fig. 3 Sagittal section of mantle (Azan) Normal
DE- Dorsal Epithelium
VE - Ventral Epithelium
MF - Muscle Fibres
CT - Connective Tissue
EM - epithelial mucocytes

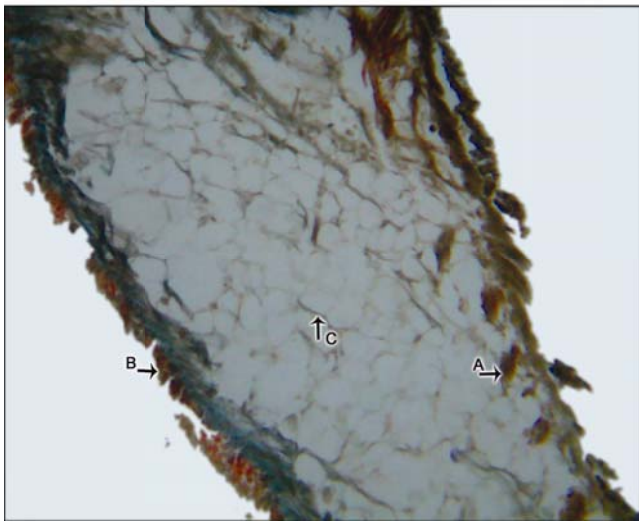

Fig. 4 96 hours mantle showing
(A) Epithelial mucocytes appeared empty with collapsed cell walls
(B) Desquamation of epithelial cells
(C) Atrophy of muscle fibres

Otludil*et al*. (2004) observed similar histopathological changes like desqumation of the epithelial cells, change in the number of mucocytes and atrophy of the columnar muscle fibres were observed in the foot and mantle of great ramshorn snail *Planorbariuscorneus* treated with endosulfan. Vijayakumar (2010) reported the similar histopathological alterations exposed with paraquaton *Lymnaealuteola*. Gupta *et al*. (2006) reported the damage in the mantle of the present snail *Viviparusbengalensis*was exposed to sub lethal concentrations of pentachlorophenol and sodium pentachlorophenate resulting in the formation of intercellular spaces, the shrinkage and elongation of epithelial cells, enlargement of nuclei, shrinkage of the basement membrane and loss of shape of polygonal cells of connective tissue.

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