SCANNING ELECTRON MICROSCOPIC STUDIES IN THE GILLS OF FRESHWATER FISH , *LABEO ROHITA* INDUCED BY CYPERMETHRIN

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Abstract: Effect of the cypermthrin on the ultra structure (SEM) studies of the gill tissues of fish *Labeo rohita*. The fish were exposed for 24, 48, 72 and 96 hours in 10% and 20% sublethal concentration of 96 h LC_{50} of cypermthrin (0.0037 ppm). Exposur of fishes to 10% and 20% sublethal concentrations of cypermethrin caused several changes in the gills: secondary lamellar fusion, disintegration of gill lamellae, intensive vasodilatation of the lamellar vascular axis.

***Key words**: SEM , Cypermethrin, Gills, Labeo rohita.*

I. INTRODUCTION

Pesticides are one of the most potentially harmful chemicals linerated into the environment in an unplanned manner. Pesticides drained to the aquatic environment are primarily of agricultural origin and which may also stem from effluent from manufacturing plants. Since there is great concern about toxic hazards in the aquatic ecosystem due to pesticides, either from surface run-off from paddy fields or through direct application into ponds for control of parasites, it is necessary to study the cellular changes in the fish tissue associated with this toxicity. The ultra structural pathological changes in the renal haemopoietic tissue of *Channa punctatus* (Bloch) experimentally infected with 2 species of aeromonads, *Aeromonas hydrophila* and *Aeromonas salmonicida*, were reported. The kidney of aeromonad infected *C. punctatus* was studied by fixed ultra thin sections for transmission electron microscopy. The tissues destruction was initiated at this primary stage of infection[1].

Histological and ultrastructural studies were carried on the liver fish *Oreochromis* sp., collected from highly polluted and less polluted areas (control area) from Wadi Hanifah stream. The major histopathological changes in liver fish collected from polluted area were disruption of the normal tissue arrangement with congestion of blood vessels and leucocytes infiltration. Most hepatocytes appeared vacuolated with peripheral necrotic nuclei. Electron microscopic observations revealed irregular and pyknotic nuclei with marginated nucleoli and heterochromatin. Moreover, dilatation and fragmentation of the rough endoplasmic reticulum cisternae, degeneration and swelling of mitochondria were noted. Myelin-like figures, numerous secondary lysosomes, as

well as multivesicular electron - dens - bodies were occurred in the cytoplasm of most hepatocytes. There was also, an increase in the amount of lipid droplets while the Golgi bodies were hypertrophied. The histopathological and ultrastructural alterations demonstrated in this study are useful biomarkers for field evaluation and tilapia fish was shown to be appropriate for environmental monitoring[2].

Current interest in the field of pesticide detoxification lies on observations under transmission electron microscope, since such observations would lead to a better understanding of the morphological changes, induced in the pituitary and liver at ultra structure levels, as well as the functions of various cells in pituitary and liver. Histopathological studies showed these changes in the gills: secondary lamellar fusion, haemorrhage, oedema, epithelial hyperplasia and chloride cell proliferation. Occasionally multifocal necrosis of inter-lemellar regions of gill filaments but with no apparent haemorrhage was observed under electron microscopy[3]. In the present study mode of action cypermethrin in inter cellular architecture of the gill of fish *Labeo rohita* has been investigated using scanning electron microscopy.

II. MATERIALS AND METHODS

The gills were dissected out, washed repeatedly in 0.2 M phosphate buffer and then fixed in 3% gluteraldehyde. The dehydration was done in acetone grades and was followed by critical point drying. Ultimately dried gills were mounted on the stub and were sputter coated with gold in a gold coating unit (thickness $100A^0$) and were examine and photographed using JEOL JSM 6360 scanning electron microscope (SEM) Japan[4].

III. RESULTS

In the present study, the scanning electron microscopic studies in *Labeo rohita* treated with sublethal concentrations of cypermethrin, normal ultrastructure were observed in the control gill (Plate 1). The gill arch, Racker, filaments and lamellae were observed normal in the control gill. In 10% sublethal concentration of gill tissue in the scanning electron microscopic studies (SEM), the lamellar epithelium were thickness and fusion of gill lamellae was observed in the freshwater fish *Labeo rohtia* (Plate 2). In 30% scanning electron microscopic studies of gill tissue, epithelial cells were fused with each other, the gill lamellae were disintegrated and lamellar vascular axes were intensive vasodilation (Plate 3).

Plate1. Photomorphograph the ultrastructure (SEM) of gill in control fish *Labeo rohita*

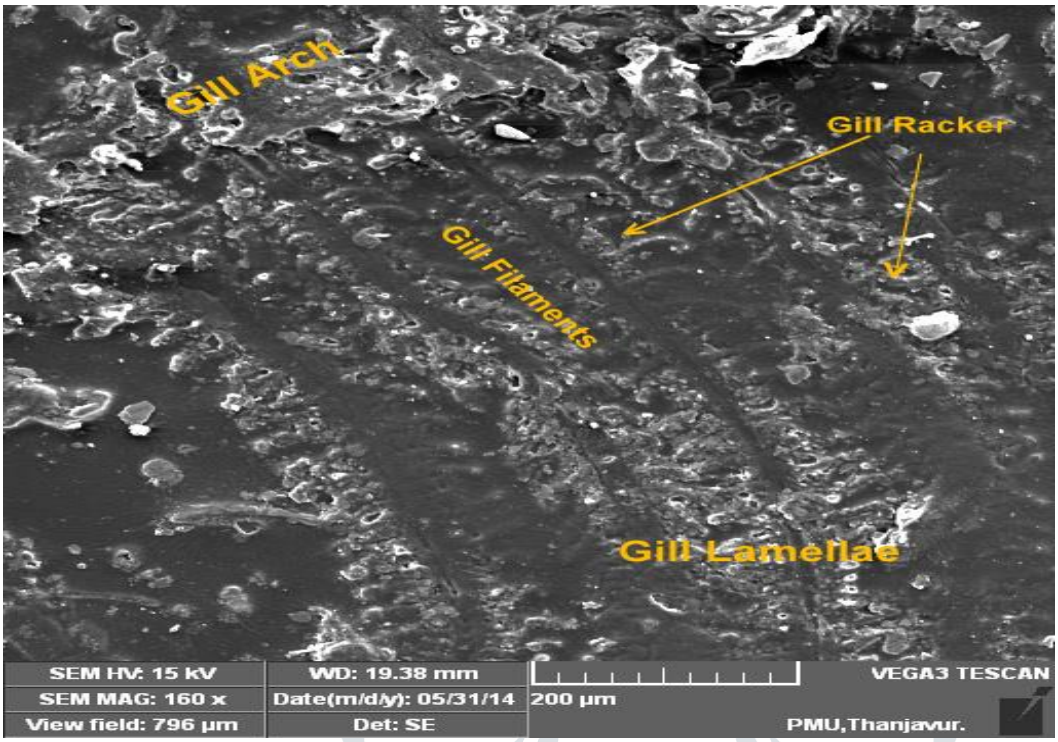


Plate 2. Effect of 10% (SLC) Cypremethrin on the ultra structure (SEM) in gill histology of *Labeo rohita* exposed to 10 days

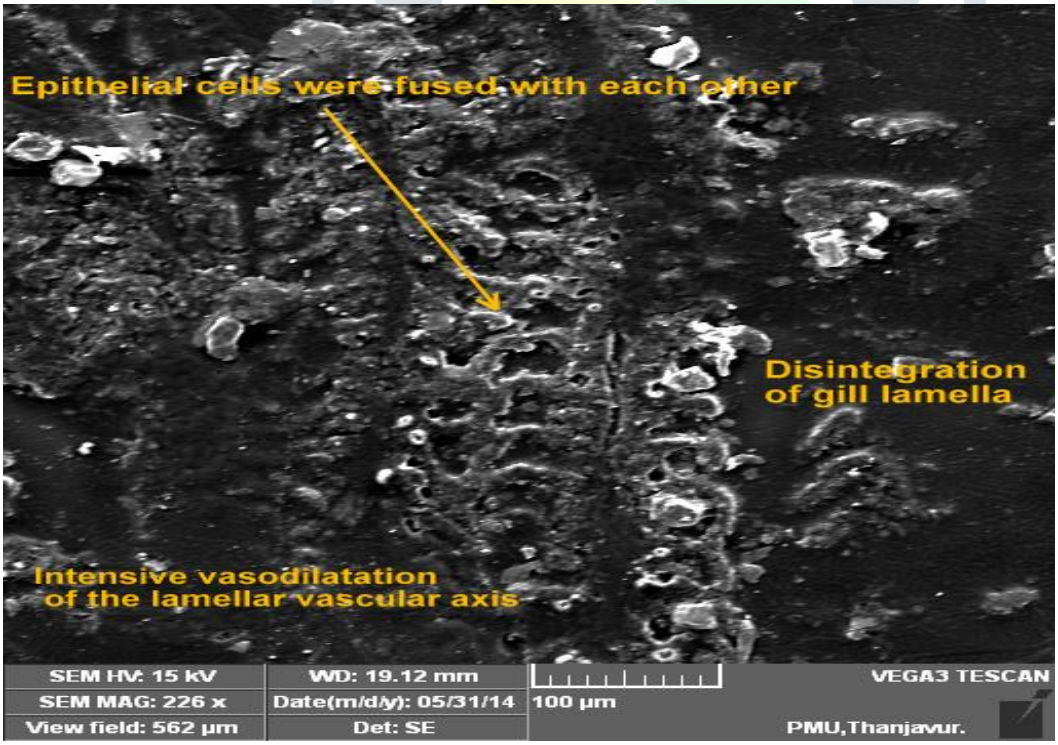
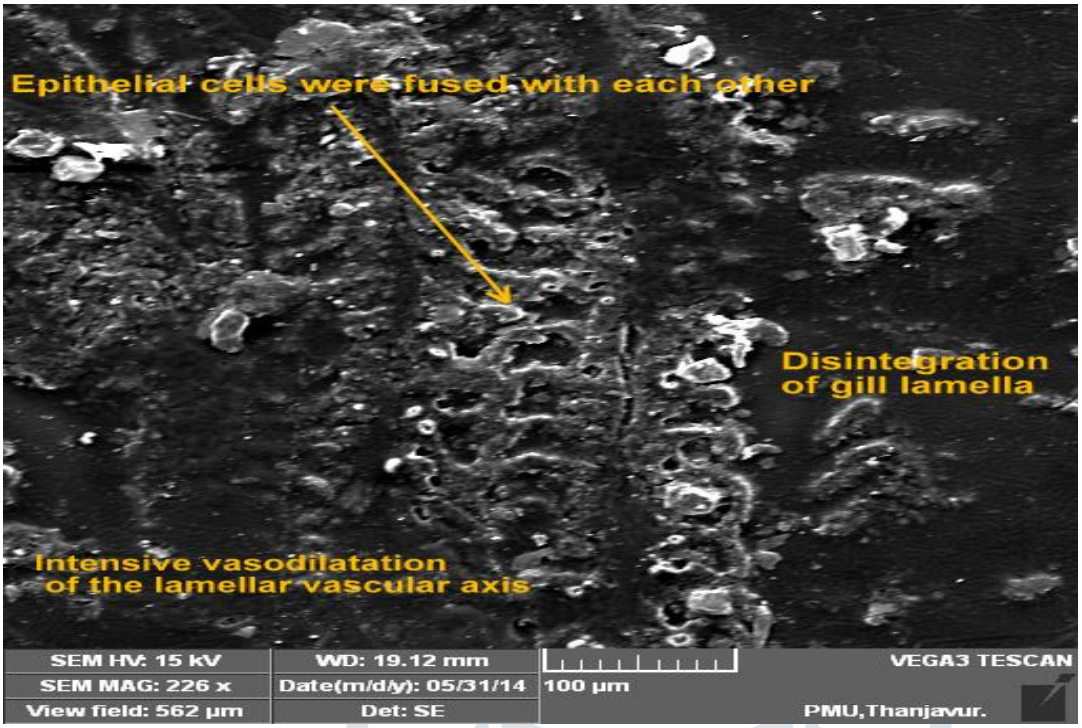


Plate 3. Effect of 20% (SLC) Cypremethrin on the ultra structure (SEM) in gill histology of *Labeo rohita* exposed to 10 days



IV. DISCUSSION

In the present study, the scanning electron microscopic studies in *Labeo rohita*, treated with sublethal concentrations of cypermethrin, normal ultrastructure were observed in the control gill. The gill arch, racker, filaments and lamellae were observed normal in the control gill. In 10% sublethal concentration of gill tissue in the scanning electron microscopic studies (SEM), the lamellar epithelium were thickness and fusion of gill lamellae was observed in the freshwater fish *Labeo rohtia*. In 30% scanning electron microscopic studies of gill tissue, epithelial cells were fused with each other, the gill lamellae were disintegrated and intensive vasodilatation of the lamellar vascular axis. A similar finding was earlier reported by Sahoo *et al.*[5].

The multilamellar peripheral olfactory organs in fish have an acute sense of smell and various aspects of the life history, such as feeding and reproduction are mediated through olfactory cues[6]. The number and shape of the olfactory lamellae are related to the space available in the olfactory cavity of the fish and therefore represent an adaptation that maximizes the sensory area under a given restriction[7]. This study reveals that the olfactory rosette of *T. jarbua* is oval in shape and consists of 18–20 lamellae arranged on either side of the median raphe. In addition, the posterior third of the lamellae is provided with a linguisform process. Thus, the total olfactory area

of this fish is considerably greater than the total retinal area. This entitles it to belong to group of nose fishes, comprising solitary, nocturnal predators[8].

In the early observation of the sensory epithelium of *T. jarbua*, crypt olfactory sensory neurons were difficult to find in histological and scanning electron microscope studies. The olfactory epithelia of almost all teleosts contain ciliated and microvillous olfactory sensory neurons, which, though described only recently, have been reported in many species and seem to represent a conserved trait in the olfactory systems of fish[9].

Smart[10] reported that the lamellar fusion can result from hyperplasia of epithelial cells, indicating advanced structural damage. The author further stated that the epithelial lifting involves epithelium separation from the basement membrane and usually indicates edema or fluid increases. Gills are highly susceptible to toxic chemicals of environmental pollutants, because of direct contact between gills and the external environment. The absorption of toxic chemicals through gills is enhanced by increasing the permeability to water and ions through gill epithelium and by inhibition of ions exchange activity of the chloride cells[11].

The damages observed in the gills in terms of hypertrophy, fusion of secondary lamellae and necrosis could cause a decrease in free gas exchange, thus affecting the general health of fish[12]. The cellular damage observed in the gills in terms of epithelial proliferation, separation of the epithelial layer from supportive tissues and necrosis can adversely affect the gas cxchanges and ionic regulation[13]. The scanning electron microscope is a technique that allows the study of the damage of surface ultra structure of the gill epithelium that cannot be revealed by light or TEM[14]. The observed edematous changes in gill filaments and secondary lamellae probably due to increased capillary permeability. The present results are in agreement with those observed in other fish species of different pollutants[15].

Gills are major respiratory organs and all metabolic pathways depend upon the efficiency of the gills for their energy supply and damage to these vital organs cause a chain of destructive events, which ultimately lead to respiratory distress. Pronounced sectetion of mucus layer over the gill lamellae has been during malathion stress. Secretion of mucus over the gill curtails the diffusion of oxygen[16], which may ultimately reduce the oxygen uptake by the animal.

In gills would be destroyed due to xenobitic chemicals[17] or the membrane functions are disturbed by a changed permeabitity[18], oxygen uptake rate would even rapidly decreased. On the other hand, the metabolic rate

(in relation to respiration) of fish could be increased under chemical stress. Kalavathy *et al.*[19] ported that the dimethoate is efficiently obsorbed across the gill and diffused into the blood stream resulting toxic to fish.

V. CONCLUSION

The present study was undertaken to record the scanning electron microscopic studies in *Labeo rohita* treated with sublethal concentrations of cypermethrin. From this investigation it is observed, the histological changes indicate that cypermethrin are very hazardous pollutant. Moreover, the above mentioned severe alterations indicate that the fish, *Labeo rohita* is an appropriate species to act as a biological marker of water pollution.

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