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THE EFFECT OF CONFIDOR ON HISTOLOGY OF THE GILL, LIVER AND KIDNEY OF FISH *LABEO ROHITA* (HAMILTON)

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Abstract: The fresh water Indian Major carp fish, *Labeo rohita* (Hamilton) was exposed to Sub-lethal (Static, 96 h LC_{50}) concentrations of confidor for 96 h. The static LC_{50} values obtained were 14,260 mg/L, 13,710 mg/L and 11,900 mg/L for 24, 48 and 96h. The vital tissue like gill, liver and kidney were isolated and studied for the changes in the histology of these organs. The damages in primary and secondary gill lamellae of the fish exposed to sub-lethal concentration of confidor were observed. The damages in the gills of the fish exposed to the higher concentration were more compared to sub-lethal exposures. Shortened and clubbing of the ends of the secondary gill lamellae, fusion of adjacent secondary gill lamellae and necrosis in the primary gill lamellae were well marked. Many marked degenerative changes were observed in liver of the fish *Labeo rohita* exposed to sub-lethal concentration of confidor. Pathological changes observed in the liver include change in the shape and size of the hepatocytes, rupture and degeneration of hepatic cells, formation of more number of vacuoles, etc. Changes in the kidney of the fish *Labeo rohita* exposed to sub-lethal concentration of confidor were vacuolization, degeneration of cell membrane, damage of haemopoietic tissue and renal tubules and hypertrophy of nuclei, etc. The resulting changes were shown in photographs were discussed in detail with the available literature.

Key Words: *Labeo rohita,* confidor, secondary gill lamellae, hepatic cells, haemopoietic tissue and renal tubules.

INTRODUCTION

Fishes are sensitive to different concentrations of pesticides and their tissues are prone to pathological effects (Murthy, 1986). Toxicant impairs the metabolic and physiological activities of the organisms, but such studies alone do not satisfy the complete understanding of pathological conditions of tissues under toxic stress. Hence, it is useful to have an insight into histological analysis. The importance of study of the histopathological changes brought about by different pesticides in the different organs of fish has been well documented (Eller, 1971; Smith *et al.*, 1972; Bansal, 1979; Mallalt, 1985; Roy *et al.*, 1986; Richmonds and Dutta, 1989; Roy and Munshi, 1987–1991; Tilak *et al.*, 2001 and Veeraiah, 2001).

Hence an attempt has been made to study the histopathological changes in the tissues of gill, liver and kidney of a freshwater fish, *Labeo rohita* exposed to sub-lethal (96h, LC_{50}) concentration of confidor for 96h.

Confidor (Imidacloprid) is a relatively new, systemic chloro – nicotinyl insecticide. It is chemically related to the tobacco toxin 'nicotine'. Like nicotine, it acts on the nervous system (Caroline Cox, 2001). The chemical works by interfering with the transmission of stimuli in the test organism's nervous system.

MATERIALS AND METHODS

Freshwater fish *Labeo rohita* (Hamilton) of size ranging from 5 to 6±2cm were acclimatized in laboratory conditions for one week. Toxicity experiments for confidor commercial grade were conducted using static method for 24, 48 and 96 hours exposure. LC_{50} values for 24, 48 and 96 hrs were 14,260 mg/l, 13,710 mg/l and 11,900 mg/l respectively. Fishes were exposed for 96 h to sub-lethal (96h, LC_{50}) concentration of confidor. Feeding of fish was stopped one day prior to the experimentation. At the end of each exposure period, fish were selected randomly for histopathological examination.

The vital tissues like gill, liver and kidney were isolated from control and exposed fish. The physiological saline solution (0.75% Nacl) was used to rinse and clean the tissues. They were fixed in aqueous bouin's fluid. They were passed through different series of alcohol. They were cleared in xylene and embedded in paraffin wax. Sections were cut at 6 µ thicknesses, stained with Ehrlich hematoxylin / eosin, dissolved in 70% alcohol and were mounted in Canada balsam (Humason, 1972). The slides were viewed under microscope. The possible changes in tissues of fish treated with confidor were observed and photomonographs were taken from the Olympus Microscope.

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RESULTS AND DISCUSSION

Pathology of gill

Gills are the primary route of entry for any pollutant. The causes marked degenerative changes in the gills of the exposed fish. The damages of gills of fish *Labeo rohita* exposed to sub-lethal concentration of confidor were observed in primary and secondary gill lamellae. Shortened and fusion of secondary lamellae, vascular degeneration, bulging of tip of primary gill filaments, necrosis of the primary lamellae, Hyperplasia and hypertrophy were noticed. (Fig. 1A and B).

Histopathological changes in the gills of fishes due to pesticides and chemicals have been reported by Munshi and Singh (1971), Mallatt (1985); Roy *et al*., (1986) Richmonds and Dutta (1989), Powell *et al*., (1992), Dutta *et al*., (1993) and Tilak and Veeraiah (2001). The epithelial layer of secondary lamellae of gill of fish forms a barrier between the fish blood and surrounding water. Gaseous exchange needed to sustain life takes place through this barrier and any thickening induced by physical, chemical or biological agents hinders the respiratory function of this organ (Eller, 1971). Due to the damage of the secondary gill lamellae the diffusing capacity will be reduced and consequently the fish subjected to some form of hypoxia (Hughes *et al*., 1976). Jyotsna *et al*., (1984) reported similar results in fish exposed to malathion and chlordane. Similar changes were also observed by Vijayalakshmi and Tilak (1996) and Tilak and Veeraiah (2001) in gills of the fish *Labeo rohita* exposed to chloropyrifos.

In case of higher concentration and prolonged exposure, clubbing and space formation between two adjacent gill lamellae and lifting of the epithelial layer from the secondary lamellae also occurred. This lifting and swelling of the epithelium could serve as a defense mechanism in protecting the internal structure from the contaminated water (Dutta, 1995).

Hyperplasia may in some situations represent an adaptation by the any organism to protect underlying tissues from any irritant (Meissner and Diamandospoules, 1977). However increased thickness of the epithetial layer including mucous cells hyperplasia and fusion of adjacent secondary lamellae would not only decrease the surface area available for oxygen extraction but also increase the oxygen diffusion distance from water and blood (Skidmore and Tovell, 1972). Thus, while hyperplasia may indeed be having a protective function, it may also hinder the respiratory, secretary and excretory functions of the gills (Eller, 1975). Gill alterations observed in this study may result in severe physiological problem ultimately leading to death of the fish (Richmonds and Dutta, 1989; Dutta *et al*., 1993).

Liver: The changes in liver of the fish *Labeo rohita* exposed to sub-lethal concentration of confidor were characterized by vacuolization in the cytoplasm, degeneration of hepatocytes at the periphery and change in the shape of the hepatocytes. The decrease in diameter of the hepatic cell was due to shrinkage of the cell. The nuclei became pyknotic and eccentric (Fig. 1C and D).

The liver plays an important role in detoxification. It is the site of biotransformation for the majority of toxicants. Sastry and Sharma (1978) noticed similar changes in the liver of *Channa punctatus* treated with endrin. Pesticide induced changes in the liver of fish can be regarded as an index for the identification of pollution stress on fish (Cough, 1975). The histopathalogical alterations resulting from an exposure to malathion may affect the functional efficiency of the liver, leading to malfunctioning of several organ systems of the fish. This in turn may cause death of the fish which would eventually cause a change in the population structure (Dutta *et al*., 1993b).

Figure 1: T.S. Through the gill, Kidney and Liver of the control and exposed fish, *Labeo rohita.*

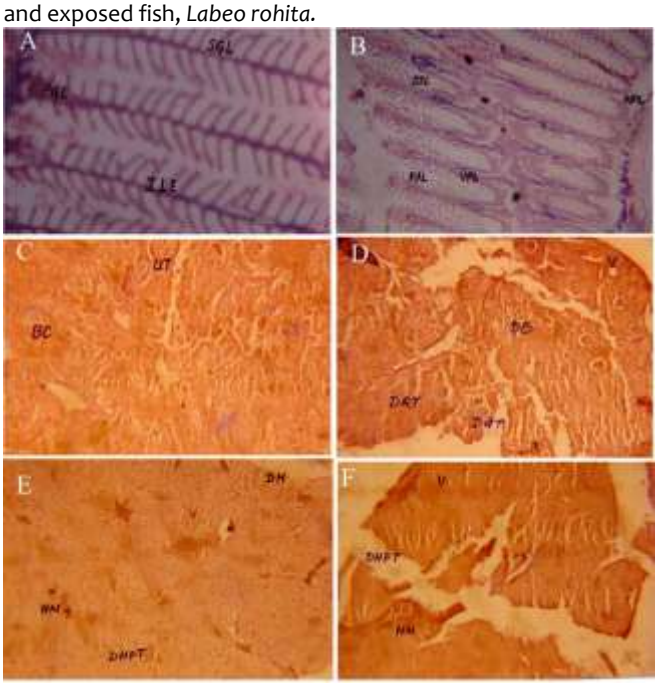

Fig. 1. A. Control Gill and B. Sub-lethal exposure Gill:
Labels: PGL: Primary gill lamellae; SGL: Secondary gill lamellae; ILE: Inter lamellar epithelium.
Fig.1.C. Control Kidney and D. Sub-lethal exposure of Kidney:
Labels: BC: Bowmans capsule; UT: Uriniferous Tubule
DHT: Damage of haematopoietic tissue; DRT: Damage of renal tubule
DB: Damage of bowmans capsule; V: Vacuolization
Fig.1.E. Control liver and F. Sub-lethal exposure of liver;
Labels: HN: Hypertrophy of Nuclei; DH: Degeneration of Hepatocyes
DHPT: Degeneration of Hepato Pancreatic Tissue
V: Vacuoles

Kidney: On microscopic examination the kidney of the fish *Labeo rohita* treated with the sub-lethal concentration of confidor demonstrated necrosis of cell and renal tubules, cloudy swelling in renal tubules, degeneration of cytoplasm within pyknotic nuclei, and disorganization of connective tissue (haemopoietic tissue). The disintegration of cell membrane, hypertrophy of nuclei, vacuoles, and the swelling of glomeruli were also appeared (Fig.1).

Similar results to some extent were observed earlier (Rudd and Linelly, 1956) in gold fish at chronic exposure to the DDT. The same results were also shown by Khillare and Wagh, (1987) who showed the long term toxicity effect on kidney of the fresh water fish *Barbus stigma*. Degeneration of epithelial cells and loss of parenchymatous cells of renal tubules were observed earlier in *Ophiocephalus punctatus* treated with endrin (Matheur 1969). Heptachor also produced the abnormality from the kidney tubules in *Labeo rohita* (Konar, 1970). When *Labeo rohita* was exposed to cypermethrin highly degenerative changes were observed in haemopoietic tissue which include severe necrosis, cloudy swelling in renal tubules, cellular hypertrophy and granular cytoplasm (Veeraiah, 2001).

CONCLUSIONS

The fish *Labeo rohita* commonly cultured in this region is heavily affected by the pesticide intoxication through leaching from the nearby agricultural fields and irrigation canals. The compounds accumulate in adipose tissue and then absorbed by different tissues in the body. This brings about anatomical or physiological changes. As a result fishes ultimately die in certain cases. The fish affected by the pesticide may pose a health problem to the consumers. Therefore the amount of pesticide in aquatic medium should be monitored to prevent fish mortality.

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