SUBLETHAL TOXICITY OF SYNTHETIC PYRETHROID, CYPERMETHRIN ON KIDNEY OF LABEO ROHITA (HAMILTON)

PRAJAPATI RAKESH, GADHIA MOHINI

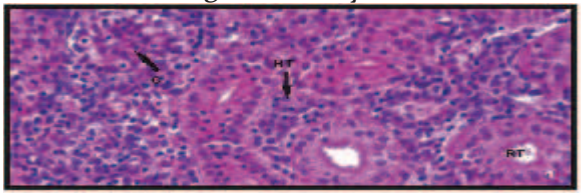
Abstract: The aim of this study was to assess the effect of cypermethrin on *Labeo rohita*. The effect was assessed on the basis of the results of sublethal (0.03 ppm) toxicity tests and on the comparison of result of histopathological tissue (L.S.) examinations of a control and experimental group exposed to cypermethrin 10 % EC. Shrinkage in renal tubules resulted in intratubular space. Cytoplasmic precipitation with damage in nuclei was noticed. Brush border of proximal tubules was disrupted. Haematopoetic tissue was also damaged.

Keywords: sublethal toxicity, Cypermethrin, Labeo rohita, kidney.

Introduction: Comprising over 70% of the Earth's surface, water is undoubtedly the most precious natural resource that exists on our planet. Without the seemingly invaluable compound comprised of hydrogen and oxygen, life on Earth would be non-existent. Farmers used chemicals to hider diseases from crops, these chemicals come through run off into lakes, creeks or rivers and cause water pollution. Therefore, pesticides are one group of toxic compounds linked to human use that have a profound effect on aquatic life and water quality. Pesticides are substances used to control pests, including insects, water weeds and plant diseases. They are categorized according to their target use. Toxicity of pesticides include their effects to some humans, animals and useful plants. Water quality is closely linked to water use and to the state of economic development. As per statistic, production and productivity have increased. However, the high chemical usage of pesticides to bring about these spectacular increases in food production is not without its problems. A visible parallel correlation between higher productivity, high chemical input use and environmental degradation effects is evident in south Gujarat where commercial agriculture is widespread. Cypermethrin is a synthetic pyrethroid insecticide used to control many pests, such as moth pests attacking cotton, fruit and vegetable crops, including structural pest control, or landscape maintenance. This has resulted in its discharge into the aquatic environment and consequently several laboratory studies have been performed which have shown that cypermethrin is extremely toxic to fish and aquatic invertebrates at very low concentrations. Fish sensitivity to pyrethroids was explained by David *et al.* (2003) through their relatively slow metabolism and elimination of these compounds. Kidney absorbs foreign substances from the blood with a view to send out them out from the body. Any change in the kidney of fish indicates the deterioration of water quality; since fish are biological indicators of water quality, the present study was undertaken to evaluate the aquatic toxicity of Cypermethrin with special emphasis to histopathology of gills from freshwater well known edible teleost, *L. rohita* exposed to sublethal concentration (0.03) of Cypermethrin.

Research Methodology: Healthy and active fresh water fish *L. rohita* having weight of 8 ± 2 gm and size of 9 ± 2 cm were procured from the Krishna Fisheries, Sayan village of Surat district, India. Before investigation fish were maintained atleast for 10 days in large glass aquaria containing chlorine free tap water. All aquaria were kept in the laboratory in cool place and covered with nets to prevent the escape of animals and the foreign particles falling in. Dead specimens were removed immediately. Water was renewed every day and fish were fed daily with commercial dried feed pellets and fine powder of rice bran and oil cake. Cypermethrin (10% EC) was obtained from Heranba Industries Limited, Vapi, Gujarat, India and used to check its impact on fish. The median tolerance limit (TLm-96 hrs) of cypermethrin for the freshwater fish, *L. rohita* was determined in the laboratory through static renewal bioassay test using standard method as described in APHA, (1995). Fishes were exposed to sublethal concentration (0.03 ppm) of Cypermethrin for 8 days. The kidney pathology was examined after 1, 2, 4 and 8 days. The kidney was removed carefully from control and treated aquaria, fixed in Bouin's fluid and processed for microtomy at 5µm. Sections were stained with haematoxylin, eosin, mounted in DPX and observed under the microscope (Kapoor, 1976).

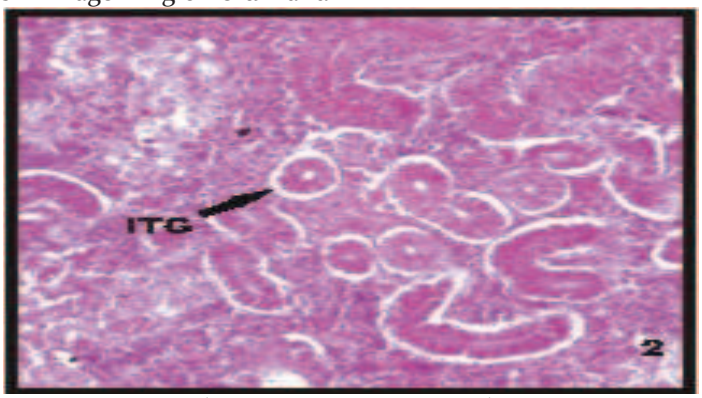
Research Findings and Analysis:



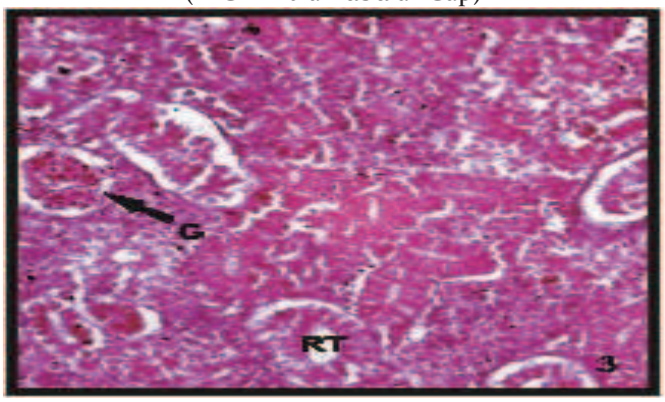
(G – Glomerulus, HT – Haematopoetic Tissue, RT – Renal Tubule)

Fig. 1 shows the normal structure of kidney (L.S.). First and second day of exposure of *L. rohita* to

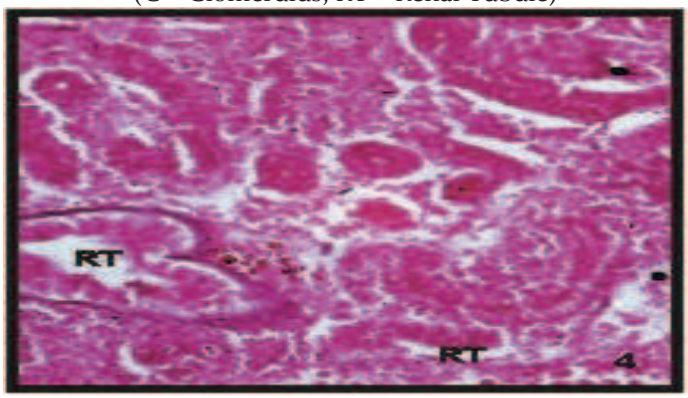
sublethal concentration of Cypermethrin brought changes in the form of shrinkage in glomeruli and renal tubules (Fig. 2 & 3). Cloudy swelling in



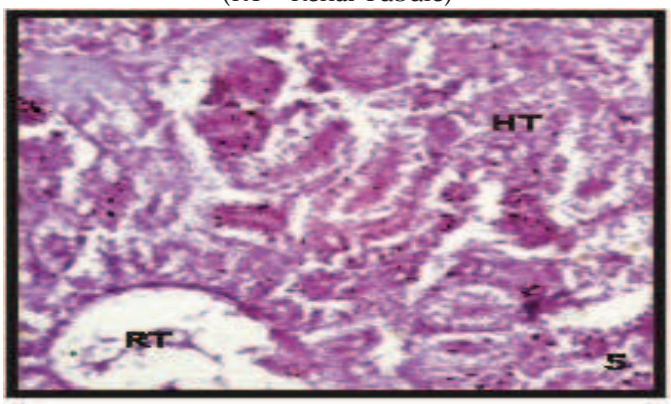
(ITG – Intra Tubular Gap)



(G – Glomerulus, RT – Renal Tubule)



(RT – Renal Tubule)



(HT – Haematopoetic Tissue, RT – Renal Tubule)

Haema topoetic tissue was observed. These changes were directly proportional to the exposure of

treatment with the end of fourth day (Fig. 4). The eighth day of exposure showed further degenerative changes in protoplasm. Most of the renal tubules lost their identity which was continued till the end of treatment (Fig. 5). Similar observations were made by Csepai, (1978) in *Cyprinus carpio* chronically exposed to Anthio 40% EC the organo chlorine and organophosphate compounds. Interestingly, most of the alterations in present study were seen in the tubular cells rather than in the glomeruli which were spared. Moderate to marked cellular infiltrations comprised which might be explained as a defense mechanism in the fish to counter toxic metabolites. Oral administration of Endosulfan at the dose level of 10 mg/day for two and four weeks showed toxic interference with the biochemistry and histology of rat liver and kidney. Similarly pathological alterations were observed in the kidney (Nisha and Joshi, 2003). The toxic sublethal concentration of fenvalerate in vital organs including kidney of *Cirrhinus mrigala* was evaluated. Renal tubules and haematopoetic tissue were severely affected. The presence of tubule degeneration, coupled with the absence of necrosis in the in the kidney in the present study indicated that the kidney suffered damage after exposure to the Cypermethrin but the short period of confinement might have prevented the establishment of necrosis in this organ. Very interesting changes like occlusion of tubular lumen was observed in the present study. The same had also been reported by Marina and Claudia, (2007).

References:

1. APHA, (1995): In: Standard Methods for the Examination of Eater and Waste Water. American Public Health Association, 1015 fifteenth street, NW Washington, DC 20005, 8.1 – 8.89.
2. Csepai, F., (1978): Histological detectable dystrophies in the carps kidney exposed to chronic effect of some pesticides. *Magy. Allatorv. Lapja*. 33, 55-58.
3. David, M., Shivakumar, H.B., Shivakumar, R., Mushigeri, S.B. and Ganti, B.H., (2003). Toxicity evaluation of cypermethrin and its effect on oxygen consumption of the freshwater fish, *Tilapia mossambica*. *Indian J. Environ. Toxicol.,* **13** : 99-102.
4. Kapoor, P.C., (1976): In: A Laboratory Manual of Histological Techniques. Prakash book Depot, Bara bazaar, Bareilly – 243001, 1- 32.
5. Marina, M.,P., Camargo and Claudia, B., R., Martinez, (2007). Histopathology of gills, kidney and liver of Neotropical fish caged in an urban stream. *Neotropical Icthyology,* 5(3): 327-336.
6. Nish, C. and S.C. Joshi, (2003). Effect of short term endosulfan on hematology and serum analysis of male rat. *Indian Journal of Toxicology,* 9(2):83-87.

* * *

Prajapati Rakesh/ Research Scholar/ Department of Aquatic Biology/
Veer Narmad South Gujarat University/Surat/ Gujarat/India.
Gadhia Mohini/ Prof. and Head/ Department of Aquatic Biology/
Veer Narmad South Gujarat University/Surat/ Gujarat/India.