IMPACT OF SHORT-TERM EKALUX EXPOSURE IN THE LIVER TISSUES OF FRESH WATER TILAPIA (*Tilapia mossambica)*

BEENA S KURUP, SREEJAI. R, NEENA SUZZAN JOSHUA
Zoology Research Centre, St. Stephen's College, Pathanapuram,

Abstract

Ekalux is an organophosphate class of pesticide commonly used as an insecticide in the agricultural field of Kerala. The present study is focused on the effects of sub lethal (1ppm) and lethal (2.5ppm) concentrations of ekalux toxicity in the liver of fresh water fish *Tilapia mossambica* for seven days of exposure with parallel untreated control fish. The present experiment revealed that there is dose dependent alterations like degenerations of hepatic cells (DHC), necrotic areas (NC), pycnotic nuclei, dispersed nuclei (DN), granular cytoplasm, destructed erythrocytes etc. were observed in the liver cells. The study affirms the view that histopathological analysis is a suitable method in toxicological studies to understand the pathological conditions of tissues under stress.

Keywords: Ekalux, *Tilapia mossambica*, Histopathology, Toxicity.

Introduction

Pesticides have been a boon to the human welfare owing to their importance in modern agriculture to protect standing crops and stored grains, and protecting human belongings from pests. The extensive use of these pesticides has resulted in the almost ubiquitous presence of these chemicals, their metabolites and break-down products in the biotic and abiotic environment including soil and water. Ekalux belongs to organophosphate class of pesticide commonly used as an insecticide in the agricultural field's throughout Kerala. These Pesticides after application eventually reach the aquatic ecosystem in considerable amounts through agricultural runoff from land, and atmospheric fall out through rain, affecting non-target species and amongst them fish are the worst victims. The effects may be on their survival, growth and development, depending upon several factors like physical and chemical properties as well as the concentration of the pesticides or their transformed by-products in aquatic ecosystem, duration and kind of exposure – acute or chronic, intermittent or continuous and ability of fish to metabolize the pesticide absorbed.

Materials and methods

The commercial grade ekalux purchased from local pesticide shop is used for the present study. The required concentration of the pesticide was prepared in chlorine free tap water. Studies were conducted on the freshwater fish *Tilapia mossambicus*. They were obtained from a local water body which has no previous record of water pollution. The acclimation and maintenance of fish was done using standard procedures. Fresh water acclimated fish having a size of 10–14 cm and 15–20 g wet weight were used. The 96 h LC50 value was calculated using probit analysis and it is 2.5ppm. The fish were grouped into four, each consisting of ten individuals. First group served as control and the remaining as experimental. The fish were exposed to sub lethal concentrations 1ppm and lethal concentration of 2.5ppm of the toxicant. Controls received similar treatment except the addition of ekalux. The fish were fed with standard food pellets throughout the experiment, but feeding was stopped 24h prior to each sampling day. Samples were collected at the end of 7^{th}, days of exposure. The liver tissues of both control and exposed fish were

dissected out, gently rinsed with the physiological saline solution (0.9% NaCl) to remove blood and adhering debris and fixed in Bouin's fluid. The fixed tissues were then processed by a routine histological method (Gurr, 1962). Photomicrographs of the sections were taken in Olympus BX-51 trinocular fluorescent research microscope and the images were analysed by Olympus micro image software.

Result and Discussion

Tissue histology is considered as an indicator of exposure to pollutants, represents a useful tool to assess the degree of pollution, particularly for sublethal to chronic effects (Cengiz and Unlu 2003). The liver is the main organ for detoxification that suffers serious morphological alterations in fish exposed to pesticides and other toxic substances. The present investigation revealed that no histopathological changes in the liver of the control fish. The structural details of the gill of control *Tilapia mossambica* is shown in plate 1. Control fish liver shows normal architecture with hepatocytes which where polygonal in shape, each with a centrally placed rounded nucleus with distinct nucleolus filled with fine and clear cytoplasm. The hepatic cells are arranged in normal configuration. Kupffer cells were present in the luminal surface of sinusoid endothelium and fat storing cells such as macrophages, pericytes are seen in normal. The parenchymatous hepatic tissue in teleost has many important physiological functions and also detoxification of waste products as well as externally derived toxins, drugs, chemicals, heavy metals and pesticides as suggested by Roberts and Rodger (2001). The exposure of pesticide cause noticeable changes in lethal and sub lethal concentrations. After the seven days of exposure, the fish exposed to sub lethal concentration of ekalux displayed histopathological changes such as the blood capillaries, arteries and veins were filled with erythrocytes (RBC) and degeneration of hepatocytes (DHC). Other histological lesions like brownish pigmentation (BP) and dispersed nuclei (DN) were also found in these liver tissues (Plate II). In the lethal concentration pesticide exposure, the histopathological changes like conspicuous cloudy swelling of hepatocytes (CPE), absence of prominent cell differentiation (PC) and necrotic (NC) areas started appearing in the tissue. The development of necrosis appeared to be a serious consequence of Ekalux poisoning in the fish. In consonance with the present findings, necrosis in hepatic tissue has been observed earlier by Tilak *et al.*,(2005) and Kunjamma *et al.*, (2008) in freshwater fish (*Catla catla*) and (*Oreochromis mossambicus*) treated with chlorpyrifos. The present results were more or less in agreement with other studies in which necrosis and lipidosis vacuolization, an increase of macrophage aggregates and eosinophilic granular cells were recorded in fish treated with insecticides malathion and paraquat, respectively Figueiredo-Fernandes *et al.*, (2006), Elezaby *et al.*, (2001). Changes in the liver were time and concentration dependent. Histological changes in the liver could be attributed to the fact that, the liver is the major site of detoxification, it is expected that the toxicant insecticide would reach there in abundance for detoxification and disposal Al-Jahdali *et al.*, (2007).

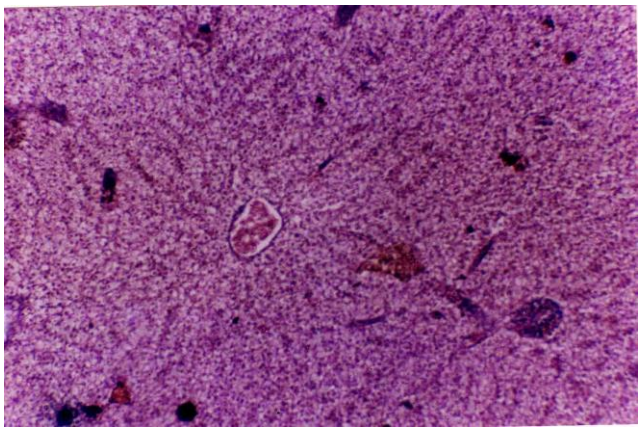

Plate I: Control Liver Tissue

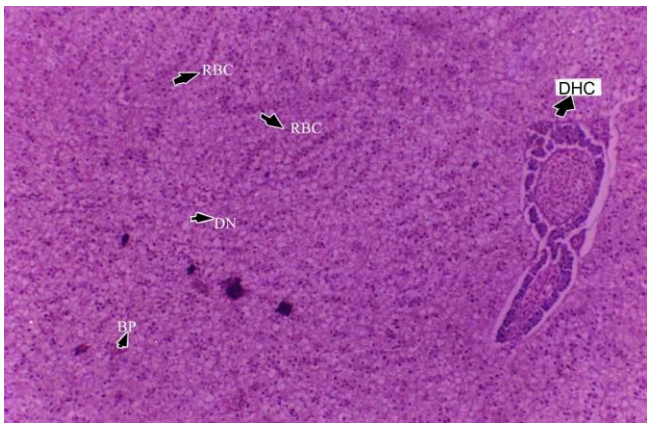

Plate II: Liver Tissue exposed Sublethal Concentration of Ekalux: DHC, RBC, DN,BP

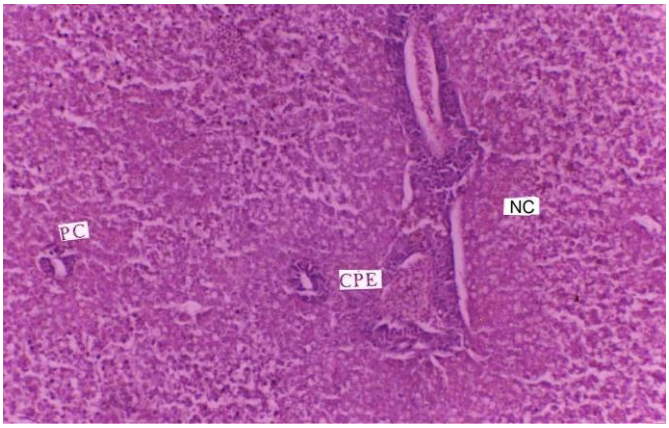

Plate III: Liver exposed to Lethal
Concentration of Ekalux : CPE, PC, NC

Conclusion

The results of the present study clearly indicated that pesticides have a direct impact on histological alterations in *Tilapia mossambicua*. Ekalux is known to impair the metabolic and the physiological activities of the organism. The results emerging from the present study also points out to the fact that through repeated exposure the pesticides tend to accumulate in tissues of animals even at sub lethal concentration. The alteration in the histology of liver tissue seen in the present study is indicative of the fact that unlike bioaccumulation in terrestrial animals which is less relevant, in aquatic environment the impact is manifold. It is evident from the studies that Ekalux exposure cause marked changes in the liver tissue, the damage increased as the concentration of the pesticide increased. The changes observed were denervation of hepatocytes pycnotic nuclei, appearance of binucliated and multinucleated condition. Reethamma and Valsala Joseph (2016) suggested that the extent of damage to the liver tissue is dependent on the dose and duration of pesticide exposure.

Reference

1. Al-Jahdali MO, Bin Bisher AS, Abu zeid IM, (2007) Physiological and histological alterations in rats liver induced by SumithionR an insecticide used in dengue fever vector control in Jeddah. Saudi Arabia. Saudi J Biol Sci; 14(1):43-51.
2. Cengiz E, Unlu E. (2003) Histopathology of gills in mosquitofish, Gambusia affinis after long-term exposure to sub-lethal concentrations of malathion. J Environ Sci Healt B; 38(5):581-589.
3. Elezaby M, El-Serafy S, Heckmann R, Sharf-Eldeen K, Seddek M. (2001) Effect of some toxicants on the fresh water fish Oreochromis niloticus. J Egypt Ger Soc Zool; 36:407- 344.
4. Figueiredo-Fernandes A, Fontainhas-Fernandes RE, (2006) Reis- Henriques MA. Effects of Paraquat on Hepatic EROD activity, liver and gonadal Histology in male and female Nile Tilapia, Oreochromis niloticus exposed to different temperatures. Arch Environ Contam Toxicol; 51(4):626-632.
5. Gurr E (1962) Staining animal tissues: practical and theoretical, Leonard Hills Ltd, London.

6. Kunjamma A, Philip B, Bhanu S, Jose J. (2008) Histopathological effects on Oreochromis mossambicus (Tilapia) exposed to chlorpyrifos. J E R D; 2(4):553-559.
7. Reethamma O V and Valsala Joseph SMT (2016) Histopathological Studies on the Gill and Liver Tissue of Etroplus maculatus Exposed to Fluben Diamide. International Journal of Science Technology and Engineering : 3 (4) 147-152.
8. Roberts RJ, Rodger HD. (2001) The pathophysiology and systematic pathology (ED. Ronald J. Robert, S) Fish pathology, 3 edn. Harcourt publishers limited; 88.
9. Tilak K, Rao K, Veeraiah K. (2005) Effects of Chlorpyrifos on histopathology of the fish Catla catla. J Ecotoxicol Environ Monit;15 (2):127-140.