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RESEARCH ARTICLE

HISTOPATHOLOGICAL LESIONS INDUCED BY ENDOSULFAN IN THE LIVER OF FISH, TILAPIA MOSSAMBICA

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ABSTRACT

Freshwater fish, *Tilapia mossambica* is an important species in Tamil Nadu region having good nutritional values. Fishes living in close association with may accumulate pesticides. In the present study, the toxic effects of the endosulfan LC_{50} 5 µg/L. The most common changes were observed in both 10% and 30% sublethal concentrations of endosulfan in liver of *Tilapia mossambica* for different exposure period. In 5 days treated fish in 10% sublethal concentration of the liver tissue changes observed in *Tilapia mossambica* was affected nucleus congestion, unequal size of nucleus, increase of vaculation, disintegrated of nucleus mild vacuoles and less number of nucleus. The present work on histological observation was carried out to know lesions in liver that had resulted from sublethal exposure of the fish *Tilapia mossambica* to pesticide endosulfan.

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INTRODUCTION

Nowadays fishes are important sources of proteins and lipids for humans and domestic animals, so health of fishes is very important for human beings. Recently, many studies have been conducted to determine the mechanisms of insecticides in fishes, with the ultimate goal of monitoring, controlling and possibly intervening in xenobiotics exposure and its effects on the aquatic ecosystem. Endosulfan, an organochlorine pesticide, is used to control insects and mites infesting crops including vegetables, fruits, tea, coffee, cotton, rice and grains (Thangavel *et al*., 2010). Endosulfan is partially degraded into endosulfan sulfate, which often enters the water bodies via surface runoff of contaminated soil. Endosulfan sulfate is highly toxic (Leonard *et al*., 1999). This endosulfan is though banned on many Western countries, yet this pesticide is used in India and in tropical and subtropical regions (EFSA, 2005). Due to its acute toxicity, potential for bioaccumulation, and role as an endocrine disruptor endosulfan became a highly controversial agrichemical in recent days. Petri *et al*., (Gurr, 1959) reported that endosulfan is highly toxic to fish and shellfishes. The mainly effected organ in endosulfan toxicity is liver. Swollen and pale livers commonly seen in this toxicity at the gross examination even in subacute poisoning (Mor and Ozmen, 2003; Mor and Ozmen, 2010a).

At necropsy, hemorrhages can be seen in livers in acute poisoning in cattle (Mor and Ozmen, 2003). Liver histology of rabbits suffers from endosulfan toxication characterized by loss of radial cellular arrangement, hypertrophy of hepatocytes, significant increase of Kupffer cells, circulatory disturbances, focal necrosis, fatty degeneration, nuclear pyknosis, narrowing of sinusoids and bile duct hyperplasia. Hemorrhages and infiltration of inflammatory cells that localized around the central vein and portal space can be seen. Interlobular mononuclear inflammatory cells among vacuolated hepatic cells and dilated congested sinusoids are reported. Apoptotic activity in liver cells increased in livers by endosufan exposure (Mor and Ozmen, 2010a). The present study reports histopathological changes in the liver as a result of exposing *Tilapia mossambica* is to sublethal concentration of endosulfan.

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MATERIALS AND METHODS

The fish, *Tilapia mossambica* were collected from Ariyalur area and were brought to the laboratory in large plastic troughs and acclimatized for one week. Healthy, carp fish having equal size (length 10 to 12 cm) and weight (20 to 25 g) were used for experimentation. Stock solution of endosulfan was prepared by dissolving appropriate amount of salt in distilled water. The physico-chemical characteristic of test water have analyzed regularly during the test periods following the standard method describe by APHA (APHA, 1998). Batches of 10 healthy fishes were exposed to different concentrations of insecticide endosulfan to calculate the medium lethal concentration LC_{50} value (5 µg/L) using probit analysis Finney method (Finney, 1971). The fishes (Four groups) were exposed to the two sub lethal concentrations ($1/10^{th}$ and $1/30^{th}$ mg/L) of endosulfan for 10, 20 and 30 days respectively. Another group was maintained as control. At the end of each exposure period, fishes were sacrificed and liver tissue was dissected, removed and fixed in 10% formalin on the spot. After 24 hours the fixed tissues were taken for histological technique followed by Gurr (Gurr, 1959). For histological analysis section were cut at 5-6µm thickness and stained with Haematoxylin and Eosin. After stained the slides were examined under light microscope and photographed (Labomed).

RESULT

Histopathological changes in liver

Control fish

Normal histological structure was observed in the liver of the control fish. The structural details of the liver of control *Tilapia mossambica*. The most common no changes like prominent Nucleus bile, Canalticuli and normal heptocytes (Plate 1).

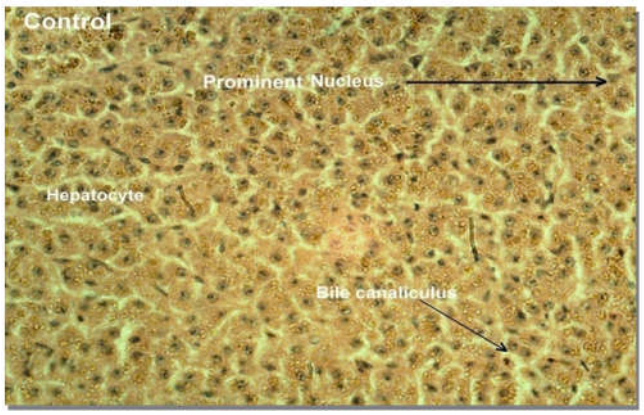

Plate 1. Photomorphograph the control liver of fish *Tilapia mossambica*

Treated fish

The most common changes were observed in both 10% and 30% sublethal concentrations of endosulfan in liver of *Tilapia mossambica* for different exposure period. In 5 days treated fish in 10% sublethal concentration of the liver tissue changes observed in *Tilapia mossambica* was affected nucleus congestion, unequal size of nucleus and increase of vaculation (Plate 2). In 5 days treated fish 30% sublethal concentration of liver tissue were observed disintegrated of nucleus and the number of nucleus less, nucleus congesion, mild vacuoles and less number of nucleus (Plate 3).

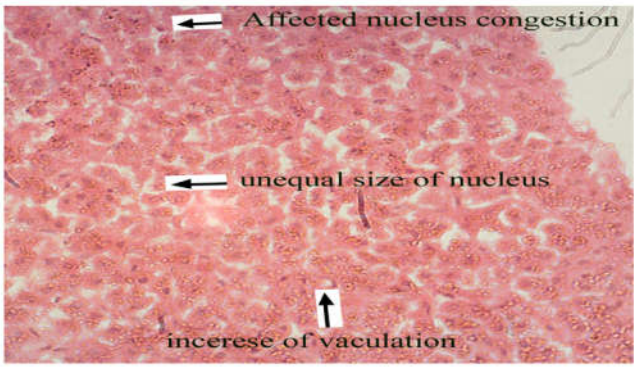

Plate 2. Effect of 10% endosulfan on the liver histology of *Tilapia mossambica* exposed to 5 days

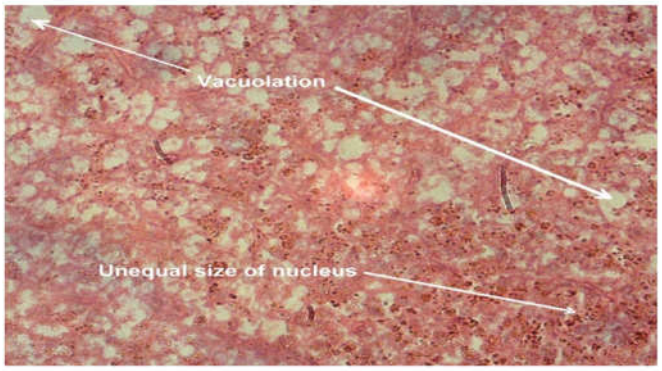

Plate 3. Effect of 30% endosulfan on the liver histology of *Tilapia mossambica* exposed to 5 Days

DISCUSSION

In the present study LC_{50} values of endosulfan of fish *Tilapia mossambica* at 96 hours was 5 µg/L and sub lethal concentrations namely 10% and 30% values were selected, studying their effects on histological aspects. This study, normal structure was observed in the liver of the control fish *Tilapia mossambica*. The most common no changes like prominent Nucleus bile, Canalticuli and Heptocytes. In the 10% sublethal concentration of the 5 days exposure liver tissues affected nucleus congestion was observed. The 30% sublethal concentration of liver tissues were observed disintegrated of nucleus and the number of nucleus less, nucleus congesion, mild vacuoles, less number of nucleus, degenerated vacuoles and changed the appearance of blood streaks. Similar finds was earlier reported (Babu Velmurugan, 2009). According to Osman *et al.* (2009). Recorded congestion and hemorrhage in the hepatic sinusoids with dilation vessels, vacuolization and degeneration of hepatic cells with fatty changes with atrophy of pancreatic acini, in liver of the *Oreochromis niloticus* exposed to the polluted water containing heavy metal salts.

Antonio *et al.* (2007) studied histopathological changes in liver of Nile tilapia, *Oreochromis niloticus* exposed to water borne copper and observed vacuolization and necrosis of the liver parenchyma. The liver cord disarray, cell vacuolation and cell necrosis were observed in this study which was also repoted by Shastry and Sharma, (1979) in Endrin treated liver of Indian fish. As per report, extensive damage to periphery hepatocyes, resulting in loss of their polygonal appearance. Similar type of result was also reported by Prasada *et al*. (1990) under heptachlor intoxication. Sarma *et al*. (2012) observed marked necrosis,vacuolation and loss of hepatocytes.

Fish liver has the ability to detoxify pesticides but high concentrations of these compounds can alter hepatic enzyme activities that can result in damage of hepatocytes (Brusle *et al*., 1996 and Paris-Palacios *et al*., 2000). The liver histology in flying barb showed that endosulfan caused some alterations of the hepatocytes like vacuolization and necrosis. These alterations are often associated with a degenerative necrotic condition (Myers *et al*., 1987). In *Channa punctata*, endosulfan caused lipid peroxidation and disrupted antioxidant enzymes in liver (Pandey *et al*., 2001) which in turn might lead to hepatic dysfunction. Besides, it appears that the degree of structural heterogeneity is enhanced with increasing concentration of the toxicant [9]. As seen in the present study, the liver histological changes observed were more evident in fish exposed to higher dose of endosulfan. Similar hepatic histopathological effects were observed in fish due to other chlorinated pesticides such as hexachlorocyclohexane (Das and Mukherjee, 2000) and lindane (Ortiz, 2003). The histological lesions indicate that endosulfan are very hazardous pollutant. Moreover, the above mentioned severe alterations indicate that the fish, *Tilapia mossambica* is an appropriate species to act as a biological marker of water pollution.

Conclusion

The present study revealed that the pesticide endosulfan is potent to cause toxic responses, even structural alterations, in aquatic organism like fish. Evidences of toxicity manifested significantly in the damages caused to the liver studied. It is also recommended that before using endosulfan in any aquaculture processes, the estimated safe and dischargeable concentrations should be considered important to protect living organisms as well as fish.

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