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EFFECT OF EKALUX (25 % EC) ON HISTOPATHOLOGICAL CHANGES IN LIVER OF FRESHWATER FISH *CHANNA GACHUA* (HAMILTON, 1822)

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ABSTRACT

Alteration in behavioral patterns and histopathology of liver were studied in Channa gachua, after exposure to Ekalux (25 % EC). The 96 hour LC_{50} of Ekalux was determined to be 1.473 ppm. The exposed fish exhibitedirregular, erratic and darting swimming and became lethargic due to inhibition of AchE activity.The liver showed rupture of sinusoids, loosening of hepatic tissue,vacuolation between hepatocytes, degeneration and vacuole formation in islets ofLangerhans, shrinkage of central vein and necrosis in hepatocytes. The result of the present study revealed that Ekalux toxicity affects the liver.

Keywords: Ekalux, *Channa gachua*, liver.

INTRODUCTION

Growth in human population led to the need of increase in crop and food production, for this secure food production chemical pest control was developed. The use of pesticides had a very positiveimpact in the overall increase in food production; the risks associated with thisinclude deterioration of human health, water contamination, livestock animalpoisoning and death of beneficial insects, wildlife endangerment and pesticidetolerance (Gupta, 2004 and Zhang *et. al*., 2004).The agricultural runoff fromtreated areas enters the rivers and posed a threat on survival of fish and other aquatic organism. Such rivers and the adjacent aquaculture ponds are likely to be contaminated by pesticides (Begum,2004). The use of such chemical pesticides in agriculture is a problem to ecosystem it is resulting in the environmental pollution (Barbieri, 2008) and toxicity risk to the non-target organisms including human health (Calvert *et al*., 2001; Snodgrass 2001) and cause a major public health problem. Agricultural pesticides are also found in areas not adjacent to agricultural land (Hoffman *et al*., 2000).

Organophosphates insecticides represent the largest group of insecticides and it is most commonly preferred due to its effectiveness. Organophosphates are esters of phosphoric acid, which include aliphatic, phenyl and heterocyclic derivatives. Organophosphate can exert significant adverse effects in non-target species including humans (Lucio, 2006). Organophosphate lack target specificity and can cause severe, long-lasting population effects on terrestrial and aquatic nontarget species, especially the fish (Fulton and Key, 2001).

Fishes have greater sensitivity to changes in the aquatic environment (Vinodhini and Narayanan, 2008). Freshwater fish *Channa gachua* is a common and abundantly available species which comes in exposure of this pesticide. Fishes serve as a biomarkers of environmental pollution (Winger *et al.,* 1990).

Hence, this work was undertaken to assess the toxicity of Ekalux (25 % EC) to *Channa gachua* determining the LC_{50} and evaluate its effects on liver through the identification of histopathological changes.

MATERIAL AND METHODS

In the present study, the freshwater fish *Channa gachua*(length 18 $\pm$ 1.0 cm and weight 40 $\pm$ 5.0 g) irrespective of their sex, was procuredfrom Godavari River, Kaigaon Toka near Aurangabad (19°37'26.3"N 75°01'18.6"E), have been chosen as the testorganism. Fishes were acclimatized for seven days in order to recover from the capture and transportation stress. All the precautions laid down by APHA (2005) were followed.

Experiments were conducted to determine the toxicity of Ekalux (25% EC) in various concentrations and exposure. The dead fish were removed immediately. Finney's probit analysis (Finney, 1971) was followed to calculate the LC_{50}values for 96 h and used $1/10^{th}$ of LC_{50} for 10 days.

The liver were isolated from normal and pesticide treated fish. Physiological saline solution (0.85% NaCl) was used to rinse and clean the tissue. They were fixed in aqueous Bouin's solution for 48 h processed through graded series of alcohols cleared in xylene and

embedded in paraffin wax. Sections were cut of 6 µ (Microns) thickness; stained with Ehrlich hematoxilin and Eosin (dissolved in 70% alcohol) (Humason, 1972) and were mounted.

RESULT AND DISCUSSION

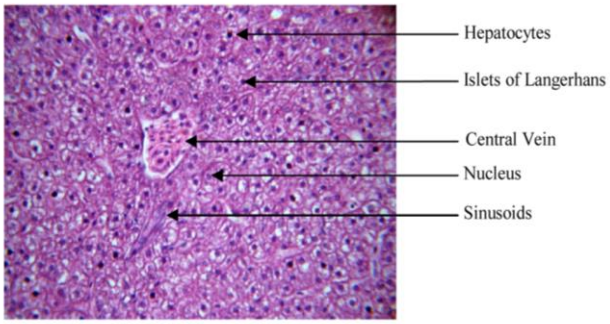


Fig. A (Control)

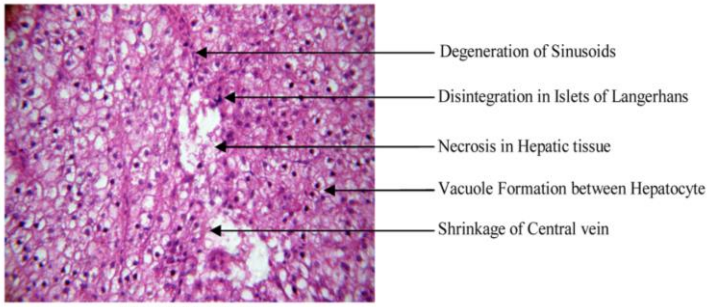


Fig. B (Lethal)

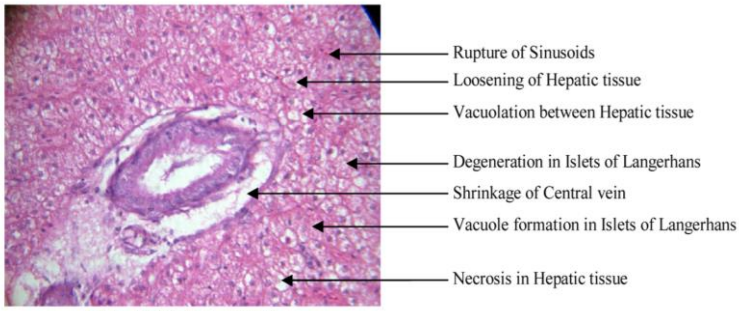


Fig. C (Sub-Lethal)

The present results revealed that the water used for experiment was not contaminated. Initialy no any mortality found in control group. Test fish *Channa gachua* was exposed to the 1.473 ppm for 96 h exposure and 1/10th of 96 h concentration (0.147 ppm) were studied in the term of behaviour and hitopathological changes.

Normal behaviour was observed for control group throughout the entire experimental period. The fishes were show active well co-ordinate movements, normal swimming, schooling behaviour and respiratory behaviour like rate of opercular movement.

The abnormal behaviour of fish was observed in exposure group, where fish felt suffocation and they came to the water surface to gasp air, it shows the surfacing phenomenon, the gulping air at the surface (surfacing phenomenon) i.e. the significant preference of upper

layers in the exposed group might be the result of the need for higher oxygen levels during the exposure period (Katja, *et al*., 2005); errecgular schooling behaviour, abrupt erratic and jerky swimming, it may be due to the inhibition of AchE in the brain and neuromuscular junction (Rao *et al*., 2005 and Agrhari *et al*., 2006); mucous secretion from skin and respiration through gill were increased, the mucus forms a barrier between the toxic media and body and reduces contact with the toxicant so as to minimize its effect (Marigoudar, *et al*., 2009); and the rates of opercular movement intialy incresead, the increased opercular gill movement may possibly compensate for increased physiological activity under stressful conditions (Shivkumar and David, 2004); and later it slowed down, although they tried to stay at the upper water surface, the loss of body equilibrium was pronounced. Finally, all the body activity decreased and fishes settled down at the base of the aquaria and died.

The fish behaviour in laboratory can be sensate marker of toxicantinduced stress (Rand and Petrocelli, 1985). Behaviour represents the integration of underlying physiological processes with the environmental stimuli that trigger them and the evolutionary forces that have and continue to shape them (Grue, *et al*., 2002). Alterations in the chemical composition of the natural environment usually lead to cause effects on behavioural and physiological systems of the inhabitants, particularly of the fish (O'Brien, 1967; Edwards, 1973).

Liver is a main metabolic vital organ and digestive gland composed of hepatocytes and lattice cells, it is indirectly affected by toxicants with the blood. Hepatic cells of liver have a distinct central nucleus with densely stained chromatin margin and a prominent nucleolus. The sinusoids are located irregularly between the hepatocytes and are lined by endothelial cells with prominent nuclei (Fig. A).

The acute effect of quinalphos on freshwater fish *Channa gachua*showed marked pathological alterations in liver as degeneration of sinusoids, disintegration in islets of langerhans, necrosis in hepatic tissue, vacuole formation between hepatocytes and shrinkage of central vein (Fig. B) and alteration in chronic exposure period viz. sub-lethal concentration effect, rupture of sinusoids, loosening of hepatic tissue, vacuolation between hepatocytes, degeneration and vacuole formation in islets of langerhans, shrinkage of central vein and

necrosis in hepatocytes (Fig. C). Results of the present study revealed that the quinalphos changes the microstructure of liver.

Liver is the primary organ of detoxification of xenobiotics (Metelev *et al*., 1971) and it is essential for both the metabolism and the excretion of toxic substances in the fish body (Salamat and Zarie, 2012). Liver is the target organ due to its large blood supply, which causes noticeable toxicant exposure (Mohamed, 2009) it is also one of the organs most affected by contaminants in water (Rodrigues and Fanta, 1998). Changes in the liver are used as an important biomarker of environmental pollution, this pathological alteration serve as a model for studying the interactions between the environmental pollutant and hepatic structure and function.

Quinalphos pesticide depicted severe critical impact on behaviour of the fish *C. gachua*. These behavioural changes appear to be manifestation of its toxicity and reflect in direct effect on nervous system of test fishes.

The extent damage to the liver tissue in the exposure of quinalphos which may alters the physiological and behavioural function of fish which may be due to the reduction in enzyme synthesis associated with glycogen, protein and nucleic acid synthesis and reduces the functional ability of the liver which directly affects all metabolic activities of the test fish *Channa gachua*.

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