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Short communication

Lipid Peroxidation Induced by Insecticide Emamectin Benzoate in Liver and Brain Tissues of Freshwater Fish *Labeo rohita*

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ABSTRACT
Pesticide application has pernicious impacts on non- target aquatic flora and fauna. Emamectin Benzoate (EB) is an insecticide developed to control lepidopteroninsects. Many insecticides have been reported to create oxidative stress via generating free radicals. Current research is directed towards evaluation of potential of EB on lipid peroxidation (LPO) in fingerlings of *Labeo rohita.* For the present study, fingerlings were divided into three groups, Control, LC_0 and LC_{50} group and were exposed to predetermined concentration of EB for 96 hrs. Results revealed increase in Malondialdehyde (MDA) level in LC_0 and LC_{50} group indicating EB has potential to induce oxidative stress.

Key words: *Labeo rohita,* Insecticide, Emamectin, Malondialdehyde.

INTRODUCTION

The world's growing population will demand for its needs. More will be the population; more will be its demands for food, shelter, water and other resources. To execute these needs especially to feed such a large population is a big challenge in front of the farmers (Battaglin Fairchild 2002). Thus, use of agrochemicals like fertilizers and insecticides to increase the farm yield and to decrease the growth of unwanted insect pests has become a necessity. However, increased application of pesticides, sequel their inrush into aquatic resources. This is one of the reasons for environmental pollution and also many of the pesticides have pernicious impacts on the non-target aquatic flora and fauna (Sharbidre et al. 2011, Gulliya et al. 2020).

Emamectin Benzoate (EB) is a newer insecticide, benzoate salt of avermectin B1 (Abamectin). Basically, it is a foliar insecticide for vegetables. The mechanism of action of EB involves stimulation of high affinity GABA receptors and a consequent increase in membrane chloride ion permeability (Xu et al. 2016). EB is a broad spectrum, semi-synthetic drug isolated from soil dwelling actinomycetes (*Streptomycin avermitilis*) (Kumar et al. 2022)

Lipid peroxidation (LPO) is a process in polyunsaturated lipid rich membranes, involving formation of lipid radicals, utilization of oxygen, breaking down of double bond of unsaturated lipids and causing destruction of membrane lipids (Kumar et al. 2017). Many investigators have reported that pesticides can cause lipid peroxidation and it can be considered as an important biomarker to study toxicity in various fish species (Peebua et al. 2007, Farombi et al. 2008, Köprücü et al. 2008, Chandra 2011). Various insecticides induce oxidative stress via generating free radicals. These free radicals damage lipid molecules of cell membrane and lead to production of Malondialdehyde (MDA) which reflects oxidative stress (Pawar et al. 2019). Disproportion between production and assemblage of reactive oxygen species in cells brings out oxidative damage in cells. Every organism is still provided with a biological system that strives to detox the formed reactive oxygen species (Helen et al. 2018).

Labeo rohita is a freshwater fish belonging to Cypirinidae family. They are mostly found in rivers and lakes and also can be reared in man-made aquatic habitats like ponds, dams etc. Since its flesh is delicious has good food value, forming common man's food. Although, a lot of work has been carried out on different insecticides and their toxicity, a very little work has been done on toxicity consequences of Emamectin Benzoate on fish. Therefore, the intent

of the present study was to assess the toxicity of pre-determined concentrations of insecticide EB on fingerlings of freshwater fish *Labeo rohita* and to discover whether the insecticide EB is efficient enough to cause oxidative stress or not, specifying its toxicity potential in fish.

MATERIALS AND METHODS

Experimental fish and chemicals

Fingerlings of freshwater fish *Labeo rohita* were procured from fish seed rearing site, Kale, Kolhapur, Maharashtra. They were brought to the laboratory and treated with 0.1% $KMnO_4$ solution so as to avoid infections. Fish were then acclimatized to laboratory conditions for 15 days in glass aquarium and were fed daily with floating fish feed. The waste material formed was siphoned off daily from bottom of aquarium so as to reduce ammonia content in water. The physico-chemical parameters of water holding the fingerlings were analyzed as per the standard procedures of APHA (1998) the pesticide was bought from the market.

Determination of LC_0 and LC_{50} concentrations

Acute toxicity test-96 hrs was conducted by exposing the test organisms to concentrations of test material i.e. EB. Two controls were concurrently carried out in which organisms were exposed to all similar conditions but without test chemical (control group). The least concentration at which no death response is observed was considered as LC_0 concentration (LC_0 group) whereas, the concentration which caused a 50% live- death response was considered as LC_{50} concentration (LC_{50} group). Healthy fish measuring 8±2 cm and weighing 9±2 g were used for the present study. Thus, fishes from control group were not exposed to insecticide EB, whereasLC_0 and LC_{50}were exposed to 0.583 and 0.833 ppm of EB, respectively. Ten fish were released in a container with twenty liters of de-chlorinated tap water. After completion of 96 hrs, the oxidative stress marker that is lipid peroxidation was studied.

Lipid peroxidation activity

After insecticide exposure of 96 hrs, fish from each group were sacrificed and their brain and liver tissue were pooled out. The pooled tissues were used for analysis of lipid peroxidation by method suggested by Wills (1966). The end product of total lipid peroxidation is malondialdehyde (MDA) and itsabsorption was measured at 532nm.

Statistical analysis

The observed data from each group were expressed in arithmetic mean ± Standard deviation. The data was statistically analysed by One Way ANOVA method.

RESULTS AND DISCUSSION

MDA level in LC_0 and LC_{50} group increased as compared to Control group after acute exposure to insecticide EB. Both liver and brain tissue of control group showed MDA level 2.53 ± 1.32 and 5.07 ± 1.49 nMoles of MDA/ mg tissue, respectively (Fig. 1). MDA level in liver and brain tissues of LC_0 group were 7.49 ± 0.91 and 10.95 ± 0.91 nMoles of MDA/ mg tissue, respectively, and of those under LC_{50} treatment 22.38 ± 1.11 and 25.95 ± 0.91 nMoles of MDA/mg tissue, respectively. Lipid peroxidation is a metabolic process that causes oxidative deterioration of lipids via generating reactive oxygen species. This process ultimately degrades lipids present in cell membrane causing cell damage and eventually cell death. The final product of lipid peroxidation is Malondialdehyde. Amount of MDA is equivalent to lipid peroxidation activity. Some researchers have reported that lipid peroxidation brings out damage to cell membrane (Wong et al. 2007). In the current study, toxic effects of insecticide EB were manifested on freshwater fish *L.rohita*. Various investigators have reported that numerous pesticides evoke lipid peroxidation (Köprücü et al. 2008, Peebua et al. 2007, Farombi et al. 2008). Nwani et al. (2010) observed elevated level of lipid peroxidation in the liver of *Channa punctatus* in response to exposure to Atrazine. In the present study, it is observed that the acute exposure of EB to LC_0 group and LC_{50} group induced lipid peroxidation. There is significant increase of LPO in LC_0 and LC_{50} group when compared with the LPO level in control group. Thus EB might be potent enough to evoke lipid peroxidation in fish.

CONCLUSION

The study revealed that MDA level increased

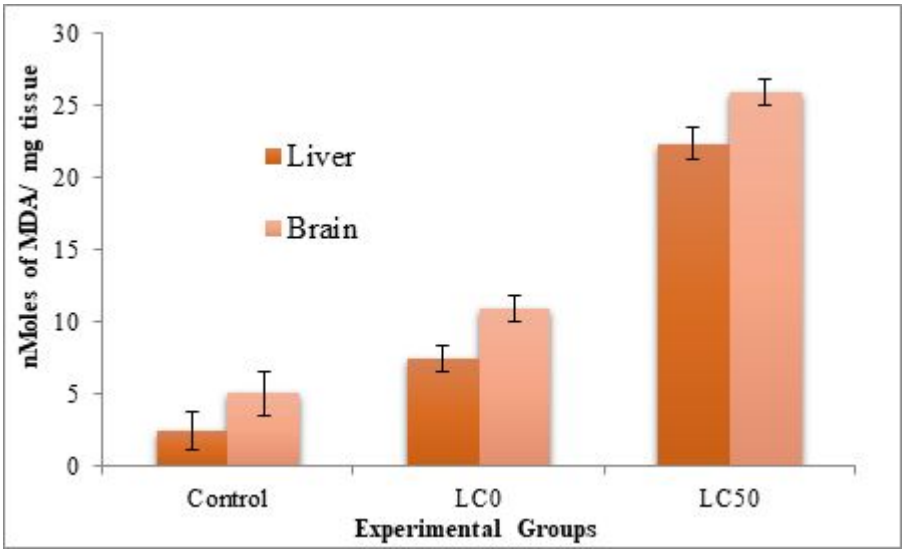

Figure 1. Lipid peroxidation activity in liver and brain tissues of *Labeo rohita* fish fingerlings after acute exposure (96 hrs) to insecticide EB

significantly in LC_0 group and LC_{50} group in liver and brain tissue of the fish as compared to the Control group. The acute exposure of EB proved moderately toxic to fish which effects on LPO in vital organs like liver and brain.Therefore utmost care should be taken to prevent its drainage into the water bodies.

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