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A Study on the Effect of Rogor on Liver, Kidney and Intestine of Freshwater Catfish *Clarius magur*

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Abstract—*Insecticides are substances used to kill insects. These are claimed to be a major factor behind the increase in the 20th-century's agricultural productivity. Rogor is an organophosphate (OP) insecticide providing quick knockdown used to manage insect pests such as bug, stem borer, shoot fly, aphids, thrips, beetles etc. It controls many biting, rasping and sucking pests in fruit and vegetable crops, cotton, oil seed crops etc. Among aquatic fauna, fishes are very sensitive to wide variety of toxicants especially pesticides, which cause deleterious effects through accumulation; and thus its histological study can provide us valuable knowledge for assessing the health and conditions of aquatic fishes, that it can be correlate with the health of human because a major part of the world's food is being supplied from fish source. Keeping this in mind we decided to trace the impact of rogor on the liver, kidney and intestine of freshwater catfish Clarius magur. Based on the lethal doses information, we took two sub-lethal doses of rogor (6.5 mg/L and 4.34 mg/L) for 7 days; which is 1/10 th and 1/15th part of the LC_{50} value, to carry out our experiment. In our experiment, histopathological examination of the liver with 6.5mg/L rogor showed dissociated hepatocytes, hydropic changes and infiltration; liver tissues of fishes exposed to 4.34 mg/L of rogor showed rupture in blood capillary and blood was spilled in comparison with the control fishes. Kidney tubules with widened lumen was observed in fishes exposed to 6.5mg/L of rogor, whereas the fishes exposed to 4.34mg/L rogorshowed normal structure of kidney tubules as in control. In the fishes exposed to 6.5mg/L of rogor we observed vacuolization in serous membrane of the intestine; whereas fishes exposed to 4.34mg/L of rogor showed normal architecture of intestine as in control.*

Keywords*: Rogor, Insecticide, Liver, Kidney, Intestine, Clarius magur.*

1. INTRODUCTION

Insecticides are substances used to kill insects[1]. These are claimed to be a major factor behind the increase in the 20th-century's agricultural productivity[2].Insecticides are formulated to kill, harm, repel or mitigate one or more species of insect. Insecticides work in different ways - some disrupt the nervous system, whereas others may damage their exoskeletons, repel them or control them by some other means[3]. Rogor is an organophosphate (OP) insecticide providing quick knockdown used to manage insect pests such as bug, stem borer, shoot fly, aphids, thrips, beetles etc. It controls many biting, rasping and sucking pests in fruit and vegetable crops, cotton, oil seed crops etc.[4].Each insecticide can pose a different level of risk to non-targetinsects, people, pets and the environment. Responses to OP insecticides by aquatic organism, not only depends on the quality and quantity of the chemical, but also depends on the exposure time, quality of water and species of organism[5, 6]. Among aquatic fauna, fish are very sensitive to wide variety of toxicants especially pesticides, which cause deleterious effects through accumulation[7]. Histological study can provide us valuable knowledge for assessing the health and conditions of aquatic fishes, and it can be correlate with the health of human because a major part of the world's food is being supplied from fish source. Thus it is essential to secure the health of fishes. There are many reports available related to toxicity of insecticides on different fish species[8,9]. Ruptured gill lamellae and damaged connective tissue cells in *Catla catla*was observed after treated with sub lethal doses (0.195, 0,39, and 0.78 ml/ltr) of rogor[10]. Keeping all this information in mind we decided to trace the impact of rogor on the liver, kidney and intestine of freshwater catfish *Clarius magur*.

2. MATERIALS AND METHODS

Collection of experimental fishes and their maintenance

Healthy freshwater catfish, *Clarias magur* with average body weight of 86±6 g was selected for the purpose of present study. Fishes were collected from the local fish markets. Disease free and healthy fishes were selected to carry out the experiment. Immediately after bringing into laboratory, they were treated with 0.01% $KMnO_4$ solution for 5 minutes and then transferred to earthen pots of 50 l capacity containing non-chlorinated water where they were kept for 15 days for acclimatization. The water was aerated continuously and change every day and fishes were fed daily with commercial fish food, natural food like chironomus larva etc. The physicochemical characteristics of the experimental water were measured every alternate day using standard methods[11], the ranges of which were are as follows:

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pH : (7.2±0.3), Temperature: (25^0C ±3), Dissolved oxygen: (8.3mg/L±0.3).

Test chemical

Rogor is one of the most widely used insecticides in the world. Chemically it is known as Dimethoate (IUPAC Name- O, o dimethyl S- [2 (methylamino)-2-oxoethyl] dithiophosphate) which is an organophosphate available in the market by the trade name of rogor or rogodan. It was first patented and introduced in the 1950s by American Cyanamid.

Experimental design

Three groups of fishes were maintained for a period of 7 days. Group (I) was kept as control and the groups (II) and (III) were exposed to two different doses of experimental chemical - Rogor. Based on the lethal doses information [9], we took two sub-lethal doses of rogor (6.5 mg/L and 4.34 mg/L); which is 1/10 th and 1/15 th part of the LC_{50} value of the chemical to carry out our experiment. Treatments were carried out for 7 consecutive days. The exposure medium was changed every alternate day to maintain the desired concentration of Rogor. At the same time, the water in control group was also changed. On completion of 7 days of exposure, fishes were sacrificed and processed for histological observation.

Histopathological study

For histological observation, liver, kidney and intestine of the controlled and treated fishes were removed aseptically and preserved in 10% buffered formalin solution. After 48 hrs of preservation, tissues were washed under running tap water for 24 hrs to remove formalin.Washed tissues were dehydrated, cleared with xylene, embedded in paraffin blocks, and were cut at 5µ thickness by using rotatory microtome.For histopathological examination, sections were stained using routine Hematoxylin andEosin staining procedure[12]. Stained sections were examined under microscope, photographed and interpreted.

3. RESULTS

Histological studies revealed that the liver sections of control fishes showed normal histoarchitecture which was characterized by polygonal shaped hepatocytes arranged in well-organized hepatic cords(Fig.1a);Liver of the fishes exposed with 6.5mg/L rogor showed hydropic changes (Fig.1b) and infiltration (Fig.1c); liver tissues of fishes exposed to 4.34 mg/L of rogor showed rupture in blood capillary and blood was spilled.

Histological studies of the kidney sections revealed that the control fishes showed normal histoarchitecture of uriniferous tubules and glomerulus with clear Bowman's capsule (Fig.2a). Among the treated groups, kidney tubules with widened lumen was observed in fishes exposed to 6.5mg/L of rogor (Fig.2b), whereas the fishes exposed to 4.34mg/L rogor showed normal structure of kidney tubules as in control.

Histological studies of the intestine sections revealed that the control fishes showed normal histoarchitecture of intestine in control (Fig.3a). In the fishes exposed to 6.5mg/L of rogor, we observed vacuolization in serous membrane of the intestine; whereas fishes exposed to 4.34mg/L of rogor showed normal histoarchitecture as in control(Fig.3b).

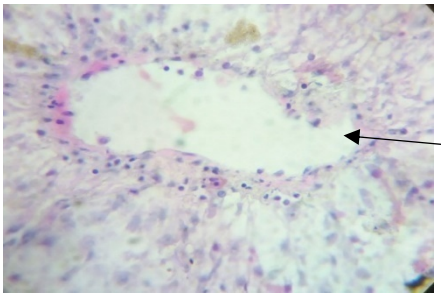

Fig.1a: Section of liver of control fish,*Clarias magur* showing normalhepatocytes architecture withnormal central vein (H&E X100).

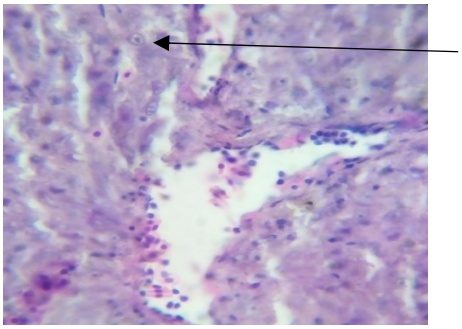

Fig.1b: photomicrograph of the liver sections (H&E ×100) of *Clarias magur* after 7 days exposure to 6.5 mg/L of rogor showing hydropic changes.

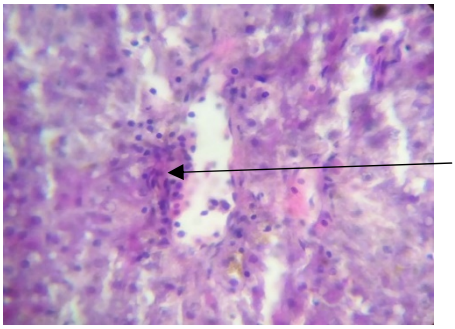

Fig.1c: photomicrograph of liversection (H&E × 100) treated with 6.5 mg/L of rogor showing infiltration of lymphocytes in portal vein.

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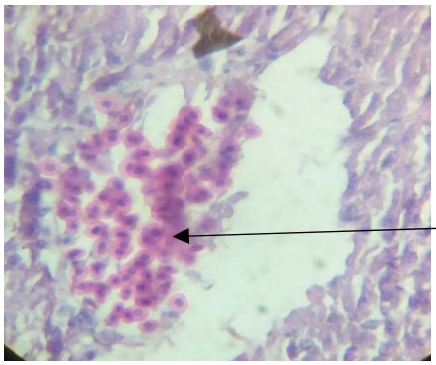

Fig.1d:Photomicrograph of liver section (H&E ×100) of *Clarias magur*after 7 days exposure to 4.34 mg/Lof rogor showing blood spilling.

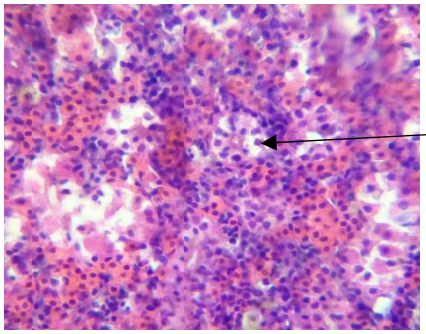

Fig.2a. Photomicrograph of controlkidney (H&E ×100) of *Clarias magur*showing normal architecture of Glomerulus and Bowman's capsule.

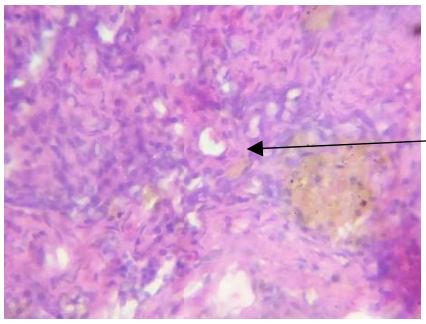

Fig.2b: photomicrograph of kidney section (H&E ×100) of *Clarias magur* after 7 days exposure to 6.5mg/L of rogor showing tubules with widened lumen.

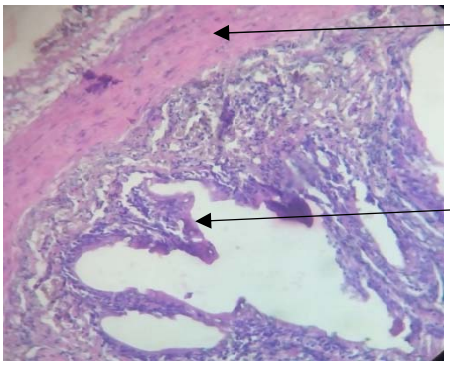

Fig.3a: Photomicrograph of controlintestine (H&E ×400) of *Clarias magur* showing normal structure of serous membrane, submucosa and villi.

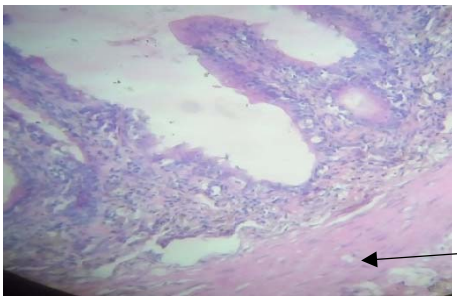

Fig.3b: Photomicrograph of intestinesection (H&E X400) of *Clarias magur* after 7 days exposure to 6.5mg/L of rogor showing vacuolization in serous membrane.

4. DISCUSSION

Histopathological changes have been widely used as biomarkers in the evaluation of the health of fish exposed to contaminants, both in the laboratory [13,14]and field studies [15]. Dimethoate exposure induced marked abnormalities in the liver, gills, kidney and muscles and on also some organs[16]. Liver is one of the major organ which is affected by various contaminants present in water. Liver contains the highest pesticides concentration because it is an organ of storage and detoxification of pesticides. The present study is supported by the study of Deka and mahanta [17] who observed hepatocytes degeneration, blood spilled, acute and extensive necrosis of liver cells of *Heteropneustes fossilis* Malathion.

Kidney is one of the first organ to be affected by contaminants in the water[14]. The result of the present study is also in consistent with the findings of Anand, et. al., [18], who observed shrinkage of glomerulus, pycnotic nuclei and widened lumen of kidney tubules in *Clarias magur*after exposed to Cypermethrin.

Irritation and destruction of the mucosa membrane of the intestine hamper absorption [19]. Our present study are in agreement with those observed by many investigators about the effects of different toxicants on fish intestine[20] .

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5. CONCLUSION

Pesticides have been recognized as serious pollutants of aquatic environment. Fishes are able to accumulate pesticides and other pollutants from their environment. Pesticides affect the specific vital organs such as liver, gill and kidney. The accumulation of pesticides in the tissues of fishes can result in chronic illness and cause potential damage of fish population that may affect the other biota including human. Practicing Integrated Pest Management can significantly reduce the amount of insecticides needed to control many insect problems.

6. ACKNOWLEDGEMENT

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