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EFFECT OF INSECTICIDE ROGOR ON HISTOLOGY OF GILL AND LIVER TISSUES OF FRESHWATER FISH, *CIRRHINUS MRIGALA*

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ABSTRACT
Human population growth and industrial development have been the major causes of water contamination around the world during recent years. The ecological effects of pollutants in aquatic ecosystems and their bioavailability and toxicity are closely related to species distribution, both in the solid and the liquid phase of the aquatic ecosystem. The poisoning by pesticides from agricultural fields is a serious water pollution problem and its environmental long-term effect may result in the incidence of poisoning of fish and other aquatic life forms. Histopathology is the microscopic examination of tissue in order to study the manifestation of disease. The LC_{50} value was determined when the fish was exposed to insecticide. To assess the sublethal effects of the insecticide for long term exposure on the histopathology of the freshwater fish, *Cirrhinus mrigala.* Histological changes noticed tissue of *Cirrhinus mrigala* compared with control group.

KEYWORDS: Insecticide, *Cirrhinus mrigala*, Histopathology.

INTRODUCTION
India is primarily an agro-based country with more than 60–70% of its population dependent on agriculture. However, 30% of its agricultural produce is lost owing to pest infestation. In the absence of a better alternative, deployment of pesticides becomes inevitable despite their known hazardous effects. Utilization of pesticides in India is about 3% of the total world consumption and is increasing at the rate of 2–5% per annum (Bhadbhade *et al*., 2002). Pesticides are finding increasing use in recent years since they are biodegradable and therefore persist in the environment only for a short time. Because of their low persistence, repeated applications of these pesticides are being practiced for the control of pests in agricultural fields and thereby large quantities find their way into water bodies.

Pesticides are one of the most potentially harmful chemicals introduced into the environment. Though they have contributed considerably to human welfare, their adverse effects on non-target organisms are significant. Studies concerning with the effect of pesticides on fishes have their own importance in relation with the factors increasing ecological problems and toxicity in organisms. Studies on various organs of fishes affected by pesticides used to control insect pest population are made by many researchers and they found positive results regarding toxicity of these pesticides in fishes.

Fish is good indicator of aquatic contamination because its biochemical stress responses are quite similar to those found in mammals (Mishra and Shukla, 2003). Fishes are one of the most widely distributed organisms in an aquatic environment and being susceptible to environmental contamination may reflect the extent of the biological effects of environmental pollution in waters. The assessment of the ecotoxicological risks caused by pesticides to ecosystems is based on data on the toxicity and effects of pesticide preparations to non-target organisms. Fishes are among the group of non-target aquatic organisms.

Histological changes provide a rapid method to detect effects of irritants, especially chronic ones, in various tissues and organs. Histological studies on fish have revealed that various toxicants have produced pathological changes in the tissues such as macrobiotic changes in the liver, tubular damage of kidneys, gill and lamellar abnormalities. Histopathological biomarkers in the gills may be valuable as indicators of the general health of the fish and mirror effects of exposure to a variety of anthropogenic pollutants (Wijeyaratne and Pathiratne, 2006).

MATERIALS AND METHODS

Cirrhinus mrigala is also known as the mrigal and the white carp. It is a species of ray finned fish in the carp family. Native to the streams and rivers in India, the only surviving wild population is in the Cauvery river, leading to its IUCN rating as vulnerable. Mrigal is popular as a food fish and an important aquacultured fresh water species throughout South Asia. The Indian carps are considered as a delicacy compared to other exotic carp species also cultured in Asia and sell for higher prices. The procured bulk samples of *Cirrhinus mrigala* were transported to the laboratory in well aerated polythene bag and acclimatized to the laboratory conditions. During this period fish were fed with mixture of oilcake and rice bran. Feeding was stopped one day prior to the start of the experiment.The LC_{50} values were determined for 96 hours by probit Analysis (Finney,1971). $1/10^{th}$ of 96 hour LC_{50} value was taken as sublethal concentration for Rogor. Fishes were divided into groups; each group consisted of 10-15 fishes. After the stipulated period of exposure, fishes of all the groups were sacrificed and tissues gill and liver were isolated and used for the histopathological studies.

RESULTS AND DISCUSSION

GILL HISTOLOGY

CONTROL

Histological changes noticed at gill tissue of *Cirrhinus mrigala* compared with control group. The gills of control fish showed a row of long thin filaments, the primary lamellae, projecting from the gill arch like the teeth of a comb. On its distal and ventral surface were the secondary lamellae. Secondary lamellae consist of an envelope of epithelial cells, usually one layer thick, supported and separated by pillar cells arranged in rows.

LONG TERM EXPOSURE

Gills of *Cirrhinus mrigala* exposed for 10 days shows desquamation of the epithelial lining of primary and secondary lamellae after 20 days of exposure necrosis, fusion of the secondary lamellae and absence of lamellar spaces were also observed. After 30 days of exposure degradation of primary and secondary lamellae.

Shandha sathyanarayan *et al.*,(2012) studied the histopathological effect of pesticide on *Cyprinus carpio* which showed severe damage with shrinkage of the tips of secondary lamellae. He also observed lesions such as epithelial hyperplasia and curling of secondary lamellae on the gills,swelling and thrombosis of the tips of several secondary lamellae and club shaped secondary lamellae.

LIVER HISTOLOGY

CONTROL

Histological changes noticed at liver tissue of *Cirrhinus mrigala* compared with control group. Liver of control fish composed of large number of polyhedral hepatic cells containing a granular cytoplasm. Nuclei of the liver cells are vesicular with a large nucleolus, numerous bile ductules, blood capillaries and sinusoides. The sinusoides were filled with erythrocytes. Sinusoides were irregularly distributed between polygonal hepatocytes and lined by endothelial cells with very prominent.

LONG TERM EXPOSURE

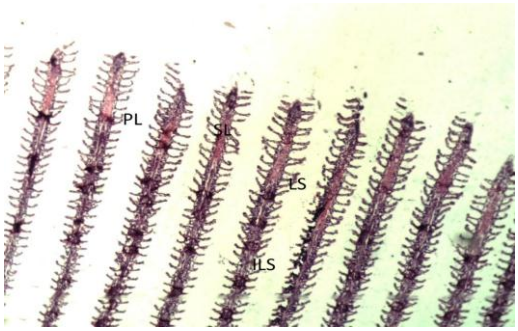
Liver of *Cirrhinus mrigala* exposed for 10 days shows Inflammation of the liver cells, after 20 days of exposed liver shows very severe diffuse vacuolation of hepatocytes, After 30 days of exposure, liver shows Necrosis of the hepatic cells rupture of sinusoids with hemorrhages at several point. The pesticide treated gills and liver of fish *Cirrhinus mrigala* showed the damage to varying extent depending on the exposure period. As the exposure time increased the degree of damage also increased. The pesticides applied on land eventually find their way to the aquatic environment, thus contaminating soil and water for several years and subsequently get accumulated in aquatic organisms (Mathivanan, 2004).

Tilak *et al.* (2001) reported on the effects of pesticide on the liver of *Ctenopharyngodon idellus* and found degeneration of hepatocytes, formation of vacuoles, rupture in blood vessels, necrosis and disappearance of the hepatic cords. Pesticide exposure causes severe alterations in the tissue biochemistry of fishes. Radhaiah and Jayantha Rao, (1992) reported moderate cytoplasmic degeneration in hepatocytes, formation of vacuoles, rupture in blood vessels and appearance of blood cells among hepatocytes, formation of vacuoles, picnotic nuclei in the liver of *Tilapia mossambica* exposed to fenvalerate. Swelling of the hepatocytes with diffuse necrosis and marked swelling of blood vessels were observed in the liver tissue by Das and Mukherjee, (2000**)** when *Labeo rohita* was exposed to hexachlorocyclohexane.

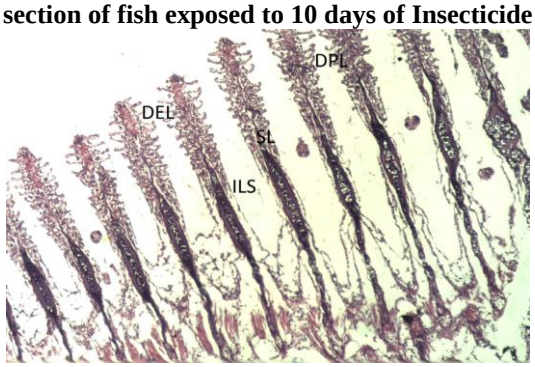
All the histopathological observation indicated that exposure to sub-lethal concentrations of rogor caused destructive effect in the liver tissue of *Cirrhinus mrigala*. Liver histopathological alterations, such as those observed in this study and findings from previous studies, may result in severe physiological problems, ultimately leading to the death of fish. As a conclusion, the findings of the present histological investigations demonstrate a direct correlation between pesticide exposure and histopathological disorders observed in several tissues.

HISTOPATHOLOGY OF GILL OF *CIRRHINUS MRIGALA*

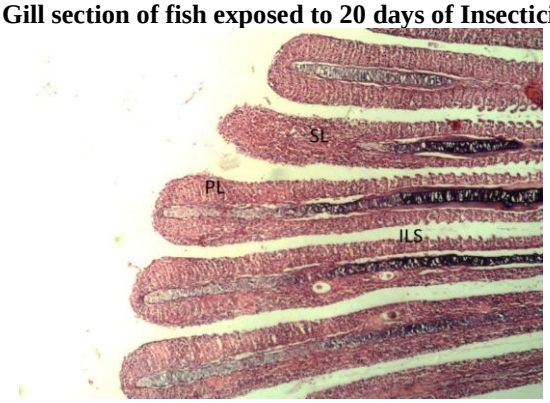
Control gill section of fish



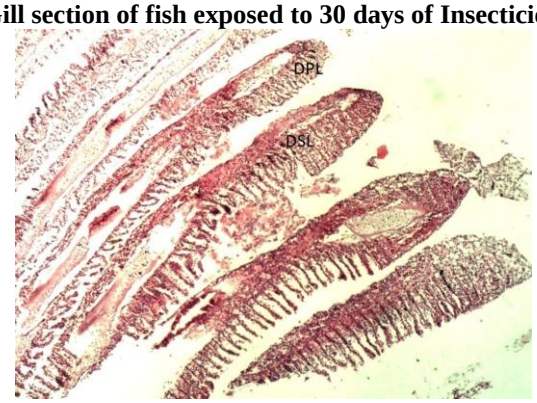
Gill section of fish exposed to 10 days of Insecticide



Gill section of fish exposed to 20 days of Insecticide



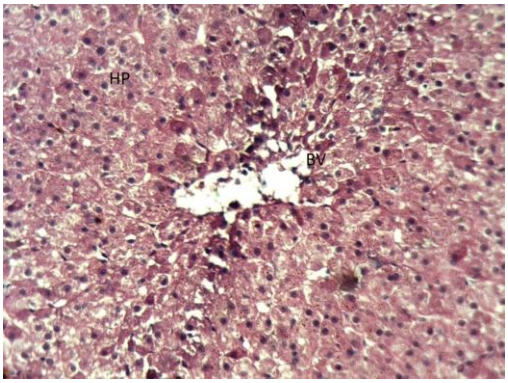
Gill section of fish exposed to 30 days of Insecticide



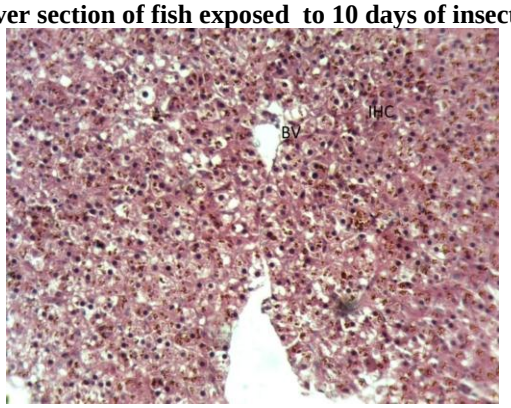
PL-primary lamellae, SL-secondary lamellae, IL-lamellar spaces, DEL-degeneration of epithelial lining, DPL-degradation of primary lamellae, ILS-inter lamellar space, DSL-degradation of secondary lamellae

HISTOPATHOLOGY OF LIVER OF *CIRRHINUS MRIGALA*

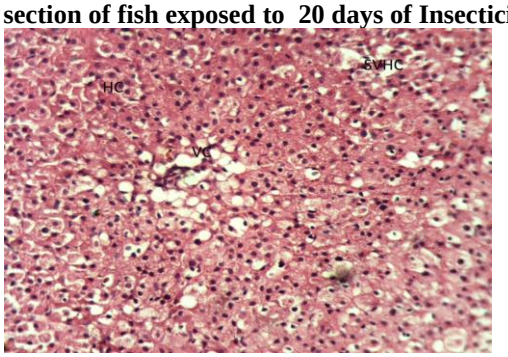
Control liver section of fish



Liver section of fish exposed to 10 days of insecticide



Liver section of fish exposed to 20 days of Insecticide



Liver section of fish exposed to 30 days of Insecticide

HC-hepatocyte cells, BV-blood vessel, VC- vacuoles, SVHC-severe vacuolation of hepatocyte cells, DHC-degradation of hepatocyte cells, RS- rupture of sinusoids.

CONCLUSION

The studied alteration in histological status of the pesticide treated fish showed various severe alterations in gill and liver. Histological alterations could be used as meaningful indicators of pesticide pollution and usage of the pesticide should be restricted to have a healthy ecology. Replacing of the chemical pesticides by biopesticides are cause no harm to our environment. Practices that prevent erosion and runoff are key in preventing pesticides from reaching surface water and eliminating negative environmental.

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