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Toxicological Impact Of Newtech Biopesticides On The Hepatic Tissue Of *Danio Aequipinnatus*

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Abstract: Biopesticides are eco-friendly alternatives to chemical pesticides, but their potential toxicological impacts on non-target aquatic organisms remain a concern. This study aimed to evaluate the toxic effects of Newtech biopesticides on the liver of *Danio aequipinnatus* (Ham Buch), a freshwater fish species widely distributed in the region of Navapur taluka of Nandurbar District. Specimens were exposed to varying concentrations of the biopesticide over 21 days, followed by histological examination of the liver tissues. The results showed significant dose-dependent alterations, including vacuolation, hepatocyte necrosis, and congestion of blood sinusoids. These findings suggest that although Newtech biopesticides are designed to minimize environmental damage, they may pose risks to aquatic organisms at higher concentrations as well as prolonged exposure. This study highlights the need for further research to assess the ecological safety and potential sublethal effects of biopesticides on aquatic ecosystems.

Index Terms - Toxicology, effect New tech, Liver *Danio aequipinnatus.*

I. INTRODUCTION

Aquatic biota is increasingly polluted by number of organic and inorganic pesticides, which are widely used in agriculture and pest control to protect agricultural crops and reduce disease-carrying pathogens. However, the runoff from agricultural fields, industrial discharges, and urban activities introduces these toxic chemicals into rivers, lakes, and oceans, posing serious issue to aquatic life. Chemical Pesticides affect not only target pests but also non-target species such as fish, crustaceans, amphibians, and aquatic invertebrates. Begum (2004) stated that such rivers and the adjacent aquaculture ponds are likely to be contaminated by pesticides. Fishes are particularly sensitive to a wide variety of pesticide chemicals, toxic concentrations may rise not only from spillage of agricultural practices if their use is excessive but also from several other sources (Mariyadasu and Kusuma, 2017. Biopesticides offer a sustainable and eco-

friendly alternative to chemical pesticides. The pesticides derived from natural materials like microorganisms (bacteria, fungi, and viruses), plant extracts, certain minerals and biopesticides are designed to target specific pests with minimal impact on non-target species, including humans, beneficial insects, and aquatic organisms. The New tech is agro-biopesticide which is widely used in agriculture of Navapur region. This biopesticide is prepared by plant alkaloids and microbial enzymes. It acts as a stomach poison to the crop pest. New tech is recommended for the control of mealy bugs, hence called as mealy bug Insecticide.Various species of the fishes are found in the Navapur region, *Danio aequipinnatus* (Ham Buch), commonly known as the giant danio, is a freshwater fish species that is sensitive to changes in water quality, making it an ideal model for Eco toxicological studies. The advantages of histopathology as a biomarker lie in its intermediate location concerning the level of biological organisation (Binukumari and Vacanthi, 2014). Ortiz *et, al*., 2003, stated that *the* liver the organ primarily meant for detoxifying, glycogen storage and release of glucose to the blood, and synthesis of several components of blood plasma, shows histopathological changes in fish upon exposure to contaminants. The liver is a vital organ for detoxification and metabolism, is particularly vulnerable to the effects of toxic substances, including pesticides. Histological changes in the organism exposed to the contaminant have been considered the best tools for evaluating the toxic effects both in laboratory and field studies (Shah and Parveen, 2020). Histopathological analysis of the liver can provide early indications of sublethal toxicity and reveal potential risks to aquatic organisms. This study aims to investigate the histopathological effects of Newtech biopesticides on the liver of *Danio aequipinnatus* by exposing the fish to various concentrations of the biopesticide over an extended period. By histological examination, the study seeks to evaluate the extent of liver damage and identify specific pathological alterations. The findings will contribute to understanding the potential ecological impact of biopesticides on non-target aquatic species and inform guidelines for their safe use in integrated pest management systems.

II. RESEARCH METHODOLOGY

Due to the sensitivity to environmental pollutants, the *Danio aequipinnatus* (Ham Buch) was selected as the experimental animal. Healthy and live *Danio aequipinnatus* of uniform size (5-7 cm in length) were obtained from the Rangavali River of Navapur Tahsil Dist. Nandurbar. Fishes were brought by local fishermen from the Rangavali River of Navapur Tahsil of Nandurbar District. Collected specimens were brought into the laboratory for further experimentation using a plastic container filled with reservoir water to avoid mortality. Fishes were acclimatized for 8 days in laboratory conditions in glass aquaria containing dechlorinated water. The aquaria water was continuously supplied with oxygen by mechanical devices. During the period of the experiment, the fish were fed commercial fish food twice daily, and the water was renewed daily to maintain optimal water quality. For further investigation, matured adult fishes were exposed to Newtech at a sub-lethal concentration (LC50/10) of 0.1554 ppm for 7,14,21 days respectively. Three replicates of ten fish for every concentration of the pesticides were used. Each experiment was accompanied by its control.

1. **Collection and Maintenance of Fish:** Fishes were brought by local fishermen from the Rangavali River of Navapur Tahsil of Nandurbar District. Collected specimens were brought into the laboratory for further experimentation using a plastic container filled with reservoir water to avoid mortality. Fishes were acclimatized for 8 days in laboratory conditions in glass aquaria containing dechlorinated water.

2. Dose Preparation

Newtech biopesticides, a commercial formulation used in agricultural pest control, were obtained from a certified distributor. Different concentrations of the biopesticide were prepared by diluting it in dechlorinated water. The test concentrations were selected based on preliminary range-finding tests to determine sublethal exposure levels for the fish.

3. Experimental Design

Fish were divided into four groups (n=10 per group), corresponding to the control (0.0 ppm) and three biopesticide concentrations (0.21 ppm,). Each group was maintained in a separate glass aquarium containing 10 litres of test solution. The biopesticide exposure lasted for 7,14 and 21 days respectively. The water and biopesticide concentrations were renewed every 48 hours to maintain consistent exposure levels. Fish behaviour and mortality were monitored daily throughout the experiment.

4. Histopathological Analysis

At the end of the exposure period, fish were removed and dissected for further study. The liver of each fish was carefully removed and fixed in 10% neutral buffered formalin for 48 hours. Following fixation, the liver tissues were dehydrated through a graded series of ethanol, cleared in xylene, and embedded in paraffin wax. Thin sections (5-6 µm) of the liver tissue were cut using a rotary microtome and mounted on glass slides.

5. Staining Procedure

The tissue sections were stained with haematoxylin and eosin (H&E) to assess general histopathological changes. Stained slides were observed under a light microscope at different magnifications (10x, 40x, and 100x) for histopathological analysis. Specific pathological features, such as vacuolation, hepatocyte necrosis, congestion of blood sinusoids, and other cellular alterations, were documented.

6. Histopathological Scoring

Histopathological changes in the liver were scored based on the severity and extent of damage observed. A semi-quantitative scoring system was used, where: 0 days: no lesions, 07 days of treatment: mild changes, 14 days of treatment: moderate lesions, 21 days of treatment: severe lesions The study was conducted from June 2020 to December 2020.

III. RESULTS AND DISCUSSION

The liver is an important organ of the body, it plays vital functions like homeostasis and detoxification like biochemical transformations of contaminants like pollutants and toxicants from the surrounding media. Histopathological examination is a sensitive bio-monitoring method for determining the impact of toxicants

on fish (Vieira *et al.*, 2019). Pesticides-exposed fish undergo significant structural changes (Kaur and Mishra, 2019). Current investigation found that after Newtech exposure, the liver of the *Danio aequipinnatus* exhibited cytoplasmic vacuolation, increased space in sinusoids, hypertrophy in hepatocytes, nuclear degeneration with a pyknotic nucleus, degeneration of bile duct, cellular degeneration and enlargement of the middle vein were noticed at the end of 7th, 14th and 21st days treatment which are comparable to those shown in previous on other fish subjected to different toxicants. Magar and Shaikh (2013), stated that when malathion was exposed to C*hanna punctatus* some liver abnormalities like cytoplasm degeneration, sinusoidal space and vacuolisation. In the present investigation, morphological and structural changes in the liver of *Danio aequipinnatus* showed necrosis, hypertrophy, sinusoidal space, and vacuolation were recorded The Newtech at lethal concentration induced significant changes in the liver.

IV. CONCLUSION

The study on the histopathological effects of Newtech biopesticides on the liver of *Danio aequipinnatus* **(**Ham Buch**)** provides critical visions into the latent effects of modern biopesticides on aquatic organisms**.** The study indicates that exposure to Newtech biopesticides can lead to significant liver abnormalities, including hepatocyte degeneration, vacuolation, and inflammatory responses**.** These alterations suggest that while biopesticides are often promoted as safer alternatives to conventional pesticides, their effects on non-target organisms warrant careful consideration**.** The observed histopathological changes highlight the need for further research into the long-term implications of biopesticide use in aquatic ecosystems**.** Continuous monitoring and assessment of these compounds are essential to ensure the health of aquatic species and the overall integrity of aquatic environments**.** In the present investigation, it is suggested that, implementing rigorous safety evaluations before application**.**

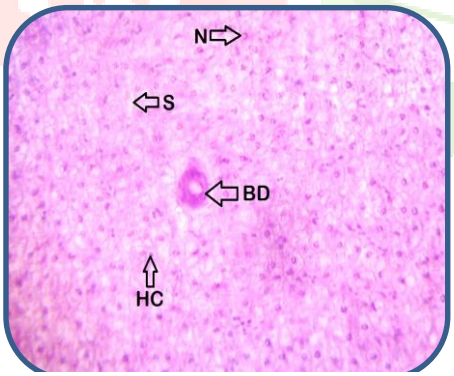

Fig. 1. (a) Control/ Liver/ *Danio aequipinnatus*

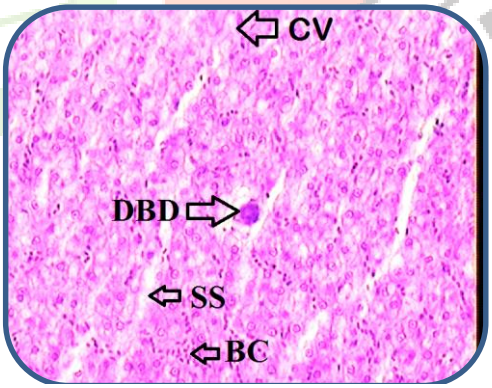

Fig. 1. (b) 7 Days/ Newtech / Liver/ *Danio aequipinnatus*

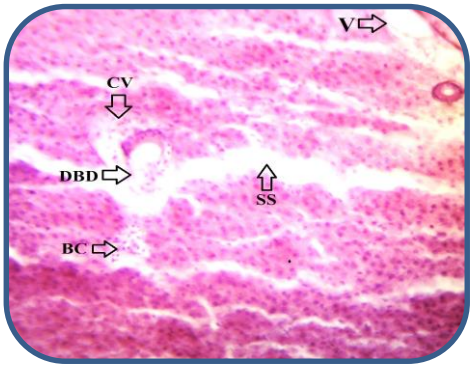

Fig. 1. (c) 14 Days/ Newtech / Liver/ *Danio aequipinnatus*

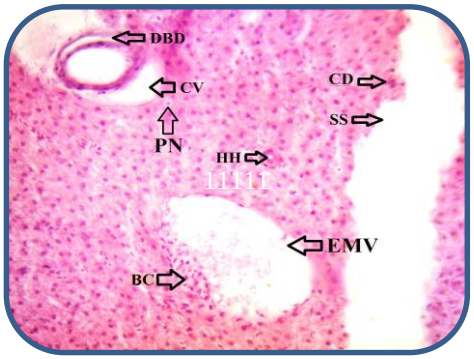

Fig. 1. (d) 21 Days/ Newtech / Liver/ *Danio aequipinnatus*

I. **Figure:** Photomicrographs of Liver of *Danio aequipinnatus* control group showed Normal structure of N (Nucleus), S (Sinusoids), BD (Bile Duct), while after 7 days, 14 days and 21 days' exposure to Newtech showed- CV (Cytoplasmic Vacuolation), DBD (Degeneration of Bile Duct), SS (Sinusoidal Space), BC (Blood Congestion), V (Vacuolation), PN (Pyknotic Nucleus), EMV (Enlargement of Middle Vein), HH (Hypertrophy of Hepatocytes)

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