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Effect of Glyphosate on Behavioral Changes in a Fresh Water Fish, Labeio Rohita in Sarju River of Gonda, Uttar Pradesh

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Abstract: ***The present study showed that the glyphosate is toxic and causes behavioral changes in Labeio rohita. The LC_{50}, values of glyphosate conducted to be as 0.018 ml/l; 0.015; m1/1; 0.012 m1/1 and 0.010 m1/1 at 24, 48, 72 and 96 hours. A thick coat of mucus over the body and loss of stability noticed may be due to none functioning of the brain. The colors of the tested fishes appeared little pale as compared to the normal fishes. Hyper excitability followed by lethargy was observed by the jerky and random movement of fishes just after the addition of toxicants. Due to the low rate of oxygen uptake, fishes came to the surface to engulf air frequently. Herbicides, commonly employed to control unwanted vegetation in crops, can enter water bodies through runoff, leading to unintended consequences for aquatic ecosystems.***

Keyword: Glyphosate, Labeo rohita, LC50, Behavioral changes, Hyper excitability, Aquatic ecosystems, Herbicide runoff, oxygen uptake, mucus coat.

I. INTRODUCTION

The use of herbicides in agricultural practices has raised significant environmental concerns, particularly regarding their impact on aquatic ecosystems (Applebyet *al* 2001). Glyphosate, one of the most widely used herbicides globally(Guyton *et al*., 2015, Myers *et al*., 2016), has been a focal point of research due to its potential effects on non-target organisms, including fish (Lopes *et al* 2022). This study investigates the behavioral changes in the freshwater fish *Labeo rohita*, commonly known as rohu, in the Sarju River of Gonda, Uttar Pradesh, following exposure to glyphosate. (Vivian and Cláudia, 2008). Freshwater ecosystems, such as rivers and lakes, play a critical role in maintaining biodiversity and supporting local livelihoods. However, increasing agricultural runoff has led to elevated levels of chemical pollutants, which can disrupt the delicate balance of these ecosystems (). *Labeo rohita* is not only an economically important species in Indian aquaculture but also serves as an indicator of environmental health. Understanding how glyphosate affects its behaviour can provide insights into the broader ecological implications of herbicide use. Behavioural alterations in fish can serve as early warning signals of environmental stress and toxicity. Changes in swimming patterns, feeding behaviour, and predator avoidance can significantly affect the survival and reproduction of fish populations (Percilia *et a*l 2017; Melissa *et al* 2021). This study aims to assess the extent of behavioural changes in *Labeo rohita* exposed to varying concentrations of glyphosate, contributing to our understanding of the herbicide's ecological risks in freshwater environments. By investigating the effects of glyphosate on *Labeo rohita* in the Sarju River, this research highlights the urgent need for effective management practices to mitigate agricultural runoff and protect aquatic life. The findings will not only inform local conservation efforts but also contribute to the global discourse on sustainable agricultural practices and their impacts on freshwater ecosystems.

II. MATERIAL AND METHOD

Live and healthy specimens of *Labeio rohita* (wt. 150 ± 10 gram) were collected from local fish market. The collected fishes were kept in 0.2% KMno4 solution for few seconds in order to check microbial infection and acclimatized in standard laboratory conditions for 7-10 days at Temperature 27° ± 4°C and pH 7.2.After acclimatization, two exploratory and one definitive test were conducted. In Ist exploratory test two selected concentrations of glyphosate (lower and higher) were added in Ist and IInd Jars containing five fishes each to estimate supposed mortality between 0% to 100%. In second exploratory test four concentrations were taken to get narrow range of glyphosate and 5 fishes were exposed to each concentration. After that 7 concentrations were selected in definitive bio-assay test and 10 fishes were introduced in each concentration. Mortality was recorded after a period of 24, 48, 72 and 96 hrs and LC50 was calculated by plotting a graph between percent mortality and concentrations of glyphosate. During this experiment reporting the Behavioral characteristics of *Labeio rohita*.

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III. RESULTS

The behavioral response of the fishes, *Labeio rohita* were recorded by exposing them to acute concentrations of glyphosate for 24, 48, 72and 96 hrs. The colors of the tested fishes appeared little pale as compared to the normal fishes. Acute exposure of glyphosate caused frequent surfacing, swimming and aggressive behavior initially; but after some time reduction in aggressive behavior and loss of balance in locomotion was noticed. Hyper excitability followed by sluggishness was also observed just after the addition of toxicants. Excessive secretion of mucus through general body surface was also observed. Due to the low rate of oxygen uptake, fishes came to the surface to engulf air frequently.

IV. DISCUSSION

The topic of glyphosate effect on behavioral changes in freshwater fish, specifically *Labeo rohita* in the Sarju River of Gonda, Uttar Pradesh, is both timely and critical, given the increasing use of glyphosate as a herbicide in agriculture and its potential environmental impacts.

A. Background

Glyphosate is a widely used herbicide, primarily for weed control in agricultural practices (Guyton et al., 2015, Myers et al., 2016), Its presence in aquatic ecosystems raises concerns due to its potential toxic effects on non-target organisms, including fish. *Labeo rohita*, commonly known as rohu, is an important species in freshwater fisheries and aquaculture in India, making it a suitable model for studying the effects of pollutants.

B. Behavioural Changes

1) *Swimming Patterns:* Studies have shown that exposure to glyphosate can alter the swimming behaviour of fish (Kellner *et al*., 2016),(Maximino *et a*l., 2012). Changes might include erratic swimming, increased or decreased activity levels, or altered social interactions. These behavior can affect feeding, mating, and predator avoidance, leading to broader ecological implications (Gordon and Hen, 2004, Moratalla et al., 2017).
2) *Feeding Behaviour:* Glyphosate exposure could influence the foraging behaviour of *Labeo rohita*. Fish may exhibit reduced appetite or altered preferences for certain food types, which can affect growth rates and survival. (La *et al* 2013).
3) *Stress Responses:* Behavioral stress responses, such as increased surface activity or abnormal responses to stimuli can indicate physiological stress caused by glyphosate exposure. Chronic stress can lead to immune suppression, making fish more susceptible to diseases (Aitbali et al., 2018, Motta et al., 2018, Pu et al., 2020).

V. CONCLUSION

The study of glyphosate's effects on *Labeo rohita* in the Sarju River is vital for understanding the broader implications of chemical use in agriculture on freshwater ecosystems. The observed behavioural changes can serve as indicators of ecological health and underscore the need for integrated approaches to water management and agricultural practices. Addressing these issues is essential for preserving biodiversity and ensuring the sustainability of local fisheries.

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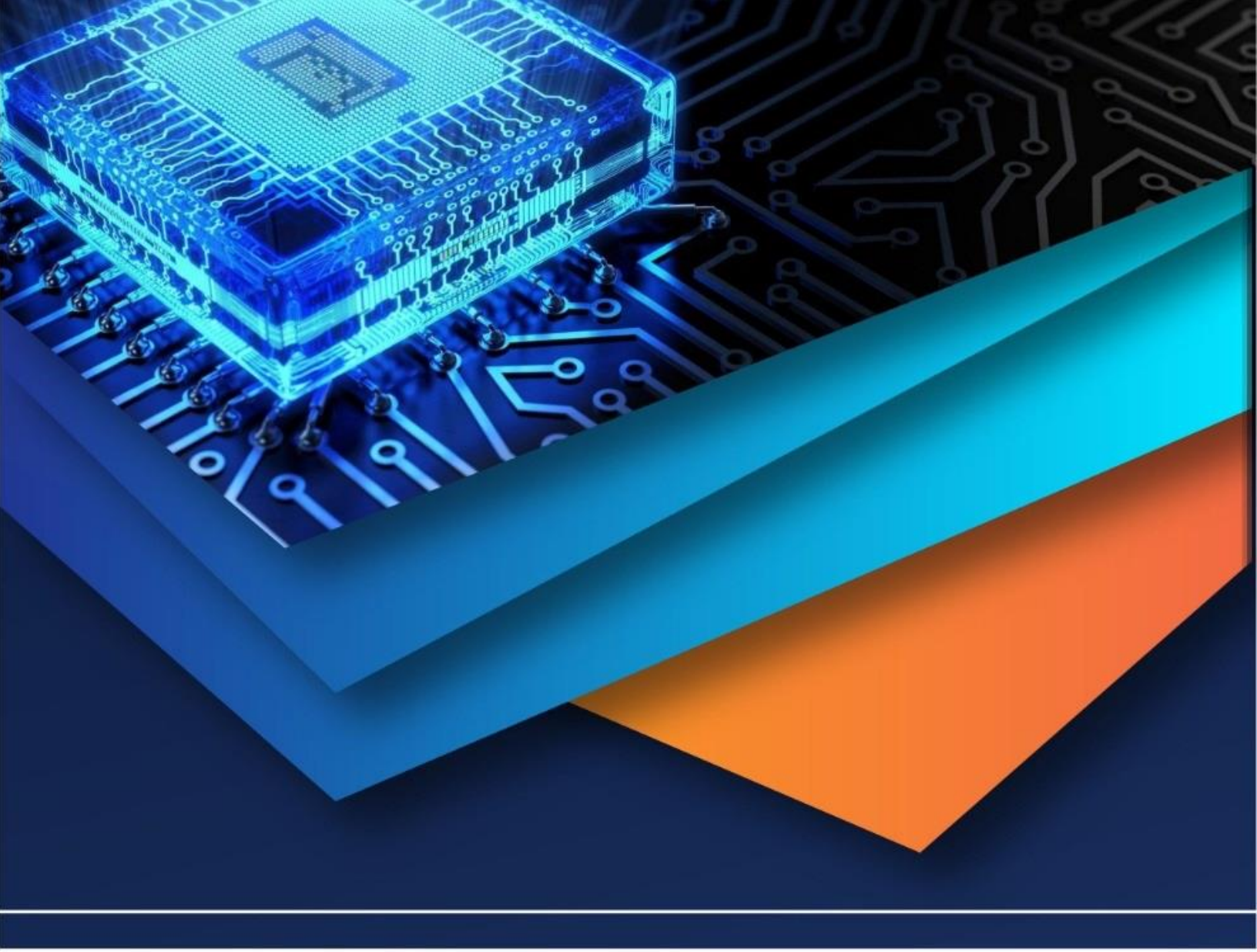

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