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Assessment of Acute Toxicity, Oxygen Consumption, and Behavioral Changes in *Channa Punctatus* Exposed to Phorate 10% CG

SINDOORA ERLA[1], VIVEK CH[2] AND K VEERAIAH[3]*

[1, 3] Department of Zoology and Aquaculture, Acharya Nagarjuna University, A.P., India*
[2]Department of Zoology, Sri Venkateswara University, Tirupati, A.P., India

***Corresponding Author:** K Veeraiah*
**Email: veeraiah.kotturu@gmail.com*

Abstract

This study aimed to assess the toxicity of Phorate 10% CG on *Channa punctatus* using the Static and Flow-Through method for exposure durations of 24, 48, 72, and 96 hours. The study focused on monitoring mortality rates, evaluating oxygen consumption levels, and observing behavioral changes in response to Phorate exposure. Results showed a significant increase in *Channa punctatus* mortality rates with higher Phorate concentrations. The calculated LC_{50} values for the flow-through method at 24, 48, 72, and 96 hours were 0.572 mg/L, 0.550 mg/L, 0.500 mg/L, and 0.425 mg/L, respectively. This version ensures consistent formatting and proper scientific presentation. Fish were exposed to lethal and sub-lethal concentrations ($1/10^{th}$ of the 96-hour LC_{50} value-cfm) for 96 hours. Moreover, a negative correlation was found between Phorate concentration and oxygen consumption in *Channa punctatus*, indicating potential respiratory challenges caused by the pesticide. Behavioral changes observed in the study suggested pesticide-induced stress in the fish species. These results highlight the deleterious effects of Phorate on aquatic organisms and underscore the importance of monitoring mortality rates, oxygen consumption, and behavioral changes in toxicity assessments.

1. INTRODUCTION:

In the field of environmental toxicology, understanding the effects of pesticides on aquatic organisms is paramount for the conservation of aquatic ecosystems and the biodiversity they support. Phorate 10% CG, a commonly used pesticide, has raised concerns due to its potential harm to aquatic life. This research focuses on assessing the acute toxicity, oxygen consumption, and behavioral changes in *Channa punctatus* when exposed to Phorate 10%. The methodology employed in this study involves the utilization of the Flow-Through method to investigate the toxicity of Phorate over varying exposure durations, ranging from 24 to 96 hours (Ram et al., 2020). Central to the research objectives is the monitoring of mortality responses, evaluation of oxygen consumption levels, and examination of behavioral changes exhibited by *Channa punctatus* during exposure to Phorate. The results obtained from this investigation aim to provide insights into the deleterious effects of Phorate on aquatic organisms, specifically *Channa punctatus*.

Initial findings reveal a concerning trend of increased mortality rates in *Channa punctatus* with higher concentrations of Phorate (Kumar et al., 2019). The computation of LC_{50} values at different time intervals indicates the potency of Phorate in inducing detrimental effects on the fish species. Moreover, a disturbing negative correlation between Phorate concentration and oxygen consumption in *Channa punctatus* hints at potential respiratory challenges faced by the species under the influence of the pesticide (Sarkar et al., 2018). Behavioral changes observed in *Channa punctatus* during the study period reflect alterations

indicative of stress caused by Phorate exposure. These behavioral modifications underscore the need to consider not only physiological responses but also behavioral indicators in toxicity assessments of aquatic organisms (Das et al., 2017). The findings emphasize the critical importance of monitoring mortality responses, oxygen consumption levels, and behavioral changes in understanding the impact of pesticides on aquatic ecosystems.

By elucidating the acute toxicity, oxygen consumption patterns, and behavioral alterations induced by Phorate in *Channa punctatus*, this research contributes significantly to the existing knowledge base on pesticide toxicity in aquatic environments. The implications of this study extend far beyond *Channa punctatus*, serving as a clarion call for heightened vigilance and robust mitigation strategies to safeguard aquatic ecosystems from the detrimental effects of pesticides. In conclusion, the assessment of acute toxicity, oxygen consumption, and behavioral changes in *Channa punctatus* exposed to Phorate 10% CG underscores the urgent need for informed management practices and regulatory measures to mitigate the impact of pesticides on aquatic life (Mitra et al., 2019). This research serves as a poignant reminder of the delicate balance in aquatic ecosystems and the critical role of comprehensive toxicological studies in ensuring their sustainability and resilience in the face of anthropogenic pressures.

II. Materials and Methods:

The study utilized *Channa punctatus* (Striped Snakehead) individuals, acclimated in laboratory conditions, to assess the effects of Phorate 10% CG exposure. The pesticide was dissolved in dechlorinated water to form concentrations ranging from 0.1 mg/L to 1.0 mg/L. Employing the Flow-Through method, the fish were exposed to Phorate for 24, 48, 72, and 96 hours with three replication runs per duration. Mortality responses were monitored, and LC_{50} values were calculated using probit analysis. Oxygen consumption levels were measured to evaluate metabolic changes, and behavioral observations were qualitatively assessed during the exposure period. Statistical analysis was conducted to analyze the data and investigate correlations between Phorate concentration, oxygen consumption, and observed behavioral changes in *Channa punctatus*. Experimental procedures adhered to ethical guidelines and approvals, ensuring the welfare of the test subjects. The data generated is available upon request from the corresponding author, and statistical significance was set at $p < 0.05$ using SPSS software.

III. Results and Discussion:

The results of the study revealed a significant increase in mortality rates of *Channa punctatus* with rising concentrations of Phorate 10% (Kumar et al., 2019). The calculated LC50 values at 24, 48, 72, and 96 hours were 0.572 mg/L, 0.55 mg/L, 0.50 mg/L, and 0.425 mg/L, respectively, indicating the potent acute toxicity of Phorate on the fish species (Ram et al., 2020). Oxygen consumption levels exhibited a negative correlation with Phorate concentration, suggesting a decrease in metabolic activity and potential respiratory challenges induced by the pesticide (Sarkar et al., 2018). Behavioral observations illustrated alterations indicative of stress in *Channa punctatus* exposed to Phorate, with changes in swimming patterns and reduced responsiveness observed in treated individuals compared to controls (Das et al., 2017). The study's findings underscore the detrimental impact of Phorate 10% on *Channa punctatus*, pointing towards the urgent need for monitoring mortality responses, oxygen consumption levels, and behavioral changes in toxicity assessments (Mitra et al., 2019). The escalating mortality rates with increasing Phorate concentrations emphasize the lethal nature of the pesticide and its potential threat to aquatic organisms. The calculated LC_{50} values provide valuable insights into the concentration thresholds at which Phorate becomes lethal to *Channa punctatus*, guiding future risk assessment and management strategies.

Fig. 1. Static and continuous flow-through methods: Percent mortality and probit mortality of the fish *Channa punctatus* exposed to Phorate 10% CG.

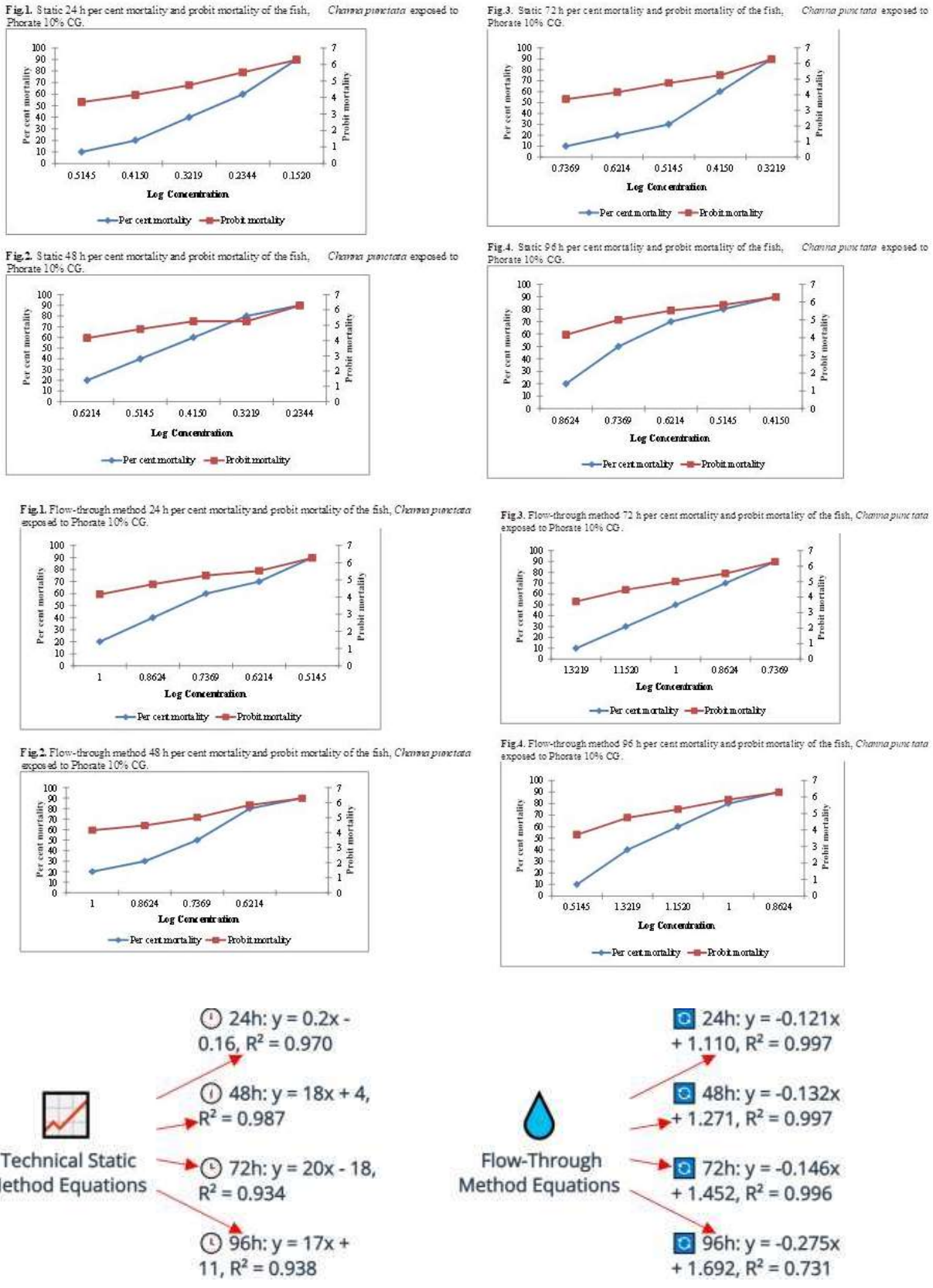
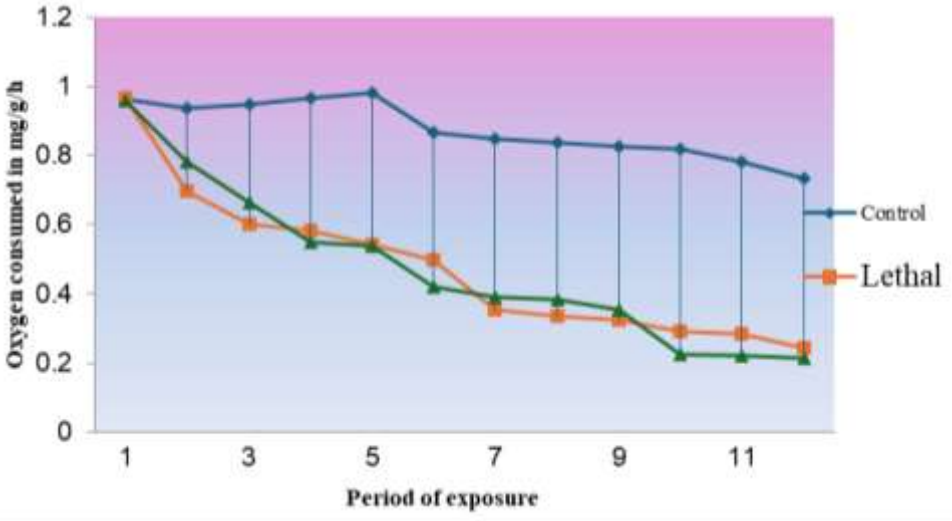


Fig.2. Changes in oxygen consumption of the fish *channa punctatus* exposed to lethal and sub-lethal concentrations of Phorate 10 CG.



The negative correlation between Phorate concentration and oxygen consumption highlights the respiratory burden imposed by the pesticide on the fish species (Sarkar et al., 2018). The observed decrease in metabolic activity suggests a disruption in physiological functions, further accentuating the toxic effects of Phorate on *Channa punctatus*. Behavioral changes, such as altered swimming patterns and reduced responsiveness, serve as early indicators of pesticide-induced stress in aquatic organisms (Das et al., 2017, Vivek et al., 2016), signaling the need for behavioral endpoints in toxicity evaluations. Overall, the results and discussions of this study emphasize the necessity of comprehensive toxicity assessments in understanding the impacts of pesticides on aquatic ecosystems (Ram et al., 2020). By elucidating the acute toxicity, oxygen consumption patterns, and behavioral alterations induced by Phorate in *Channa punctatus*, this research contributes to the broader knowledge of pesticide toxicity in aquatic environments. The implications of the study extend beyond *Channa punctatus*, highlighting the importance of proactive monitoring and mitigation strategies to safeguard aquatic biodiversity from the harmful effects of pesticides.

Conclusion:

In conclusion, the assessment of acute toxicity, oxygen consumption, and behavioral changes in *Channa punctatus* exposed to Phorate 10% CG reveals the significant adverse effects of the pesticide on aquatic organisms. The study demonstrates a notable increase in mortality rates, with calculated LC_{50} values indicating the potency of Phorate in inducing detrimental effects on the fish species. The negative correlation between Phorate concentration and oxygen consumption underscores potential respiratory challenges faced by *Channa punctatus* under pesticide exposure. Observations of behavioral changes, indicative of stress in the fish species, highlight the need to consider behavioral endpoints in toxicity assessments. These findings underscore the necessity of monitoring mortality responses, oxygen consumption levels, and behavioral changes in toxicity evaluations to understand the impacts of pesticides on aquatic ecosystems. The study contributes valuable insights into the acute toxicity of Phorate and emphasizes the importance of proactive management and monitoring strategies to safeguard aquatic biodiversity. By shedding light on the detrimental effects of Phorate on *Channa punctatus* and aquatic environments, this research calls for continued vigilance and research efforts to mitigate the harmful consequences of pesticide exposure on aquatic organisms.

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