Advances in Bioresearch
Adv. Biores., Special Issue 1 -2025: 19-21
©2025 Society of Education, India
Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL: http://www.soeagra.com/abr.html
CODEN: ABRDC3
DOI: 10.15515/abr.0976-4585.SPL1.1921

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Comparative Evaluation of Acute Toxicity of Profenofos and Quinalphos to a Freshwater Bivalve *Lamellidens consobrinus*

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ABSTRACT
The aim of this study was to evaluate acute toxicity effect of commercial formulation of organophosphate pesticides such as Profenofos (50% Emulsifiable concentration) and Quinalphos (25% Emulsifiable concentration) on freshwater bivalve Lamellidens consobrinus. The experimental groups were collected from "Darana River, Chehedi, Nashik, Maharashtra, India". The bivalves were acclimatized to laboratory environmental conditions. The Experimental groups were exposed to different grades of concentrations of Profenofos and Quinalphos for acute dose. Resulting mortality was recorded in the range of 10% to 90% for each concentration when exposed to 24, 48, 72 and 96 hours. Parallel controls were also maintained on "Control group" i.e. without use (without spiking) of Profenofos and Quinalphos. Accordingly, behavioural changes also recorded for experimental groups and for control group. Based on study, it was observed that, there was no mortality observed in case of "Control group" of Lamellidens consobrinus. Probit analysis was used for the estimation of LC_{50} value. The resulting LC_{50} values obtained for 24, 48, 72 and 96 hours were 50.36, 24.51, 9.71, 5.90 ppm for Profenofos and 23.21, 10.56, 6.66, 4.12 for Quinalphos respectively. Analysis of results indicates that Quinalphos is more toxic than Profenofos.
Keywords: *Lamellidens consobrinus, Profenofos, Quinalphos, Acute toxicity.*

Received 24.09.2024 Revised 21.10.2024 Accepted 11.01.2025

How to cite this article:
Pratibha B. Khapre, Sanjay M. Nikam, Vikram R. Kakulte, Mayura S. Patil . Comparative Evaluation of Acute Toxicity of Profenofos and Quinalphos to a Freshwater Bivalve *Lamellidens consobrinus*. Adv. Biores., Special Issue 1 -2025: 19-21

INTRODUCTION

Indiscriminate use of pesticides in agricultural field to control various pests resulted in the contamination of aquatic environments. These pesticides affect the non-target organisms found in water bodies where they accumulate in their bodies and disturbs various physiological processes by creating toxicity stress. Organophosphate pesticides such as Profenofos and Quinalphos are widely used in the agricultural field. The use these pesticides showed impact on various organisms. Acute toxicity of triazophos, Profenofos, Quinalphos, Carbofuran & Carbonyl pesticides on *Cirrhinus mrigala* showed that Profenofos was highly toxic as compared to the other pesticides as per their established LC_{50} values [6]. Quinalphos is also highly toxic and had profound impact on *Cyprinus Carpio* [5]. Quinalphos found genotoxic and caused lipid peroxidation and oxidative stress in the liver culture of Zebrafish [3]. Mollusca are important as food stuff. Molluscans like freshwater bivalve are the richest source of Vitamin B12. Many species of bivalve molluscans are abundantly found in water sources of India. They can be helpful to sustain regular and very productive fisheries in India particularly in Maharashtra state. Several studies proved impact of various pesticides on freshwater bivalve *Lamellidens marginalis*. Studies on impact of heavy metals like mercury, cadmium and zinc over *Lamellidens consobrinus* was also carried out [1]. The present investigation was carried out to found toxicity effect of Profenofos and Quinalphos on freshwater bivalve *Lamellidens consobrinus.*

MATERIAL AND METHODS

Freshwater bivalve *Lamellidens consobrinus* were collected from Darna River, Chehedi, district-Nashik, State Maharashtra, India. These bivalves brought to laboratory and acclimatized to laboratory environmental conditions in aged tap water for the period of four days. During this period, they were fed to green algae. Healthy active bivalve of same sizes and weight were selected for toxicity study & testing irrespective of consideration of their sex. Organophosphate pesticides such as Profenofos (50% Emulsifiable concentration) and Quinalphos (25% Emulsifiable concentration) were used for experimental testing of toxicity. Stock solutions of both (Profenofos and Quinalphos) were prepared by dissolving 1ml of original stock solution in to 1 litre (1000ml) of double distilled water. From this stock solution, 15 to 20 different concentration solutions were prepared by serial dilutions, so as to set them in the final experiments. Out of these, 10 animals were exposed to each concentration in 5 litres (5000ml) of toxicant water. Similarly, parallel controls were also maintained on "Control group" i.e. without use (without spiking) of Profenofos and Quinalphos. The experimental concertation solution was renewed (substituted) each after 24 hours by aged tap water as a diluent medium. During toxicity testing, feeding to bivalve was discontinued. Observations were carried out on regular basis. Accordingly, behavioural changes & mortality also recorded for experimental groups and for control group each after 24 hours. Probit Analysis was carried out so as to compute 24, 48, 72 and 96 hours LC_{50} values for both Profenofos and Quinalphos. Based on study, it was observed that, there was no mortality observed in case of "Control group" of *Lamellidens consobrinus*. The resulting LC_{50} values obtained for 24, 48, 72 and 96 hours were 50.36, 24.51, 9.71, 5.90 ppm for Profenofos and 23.21, 10.56, 6.66, 4.12 for Quinalphos respectively.

RESULTS AND DISCUSSION

Toxicity studies are helpful to measure a response of an organism to a biologically active substance like pesticide. The LC_{50} values for Profenofos and quinalphos pesticides to *Lamellidens consobrinus* for 24, 48, 72 and 96 hrs. were calculated. *The resulting LC_{50} values obtained for 24, 48, 72 and 96 hours were 50.36, 24.51, 9.71, 5.90 ppm for Profenofos and 23.21, 10.56, 6.66, 4.12 for Quinalphos respectively.* The relative toxicity of pesticides, probit regression equation, LC_{50} and LC_{10} values, variance, Chi square, LC_{50} fiducial limits, lethal dose and safe concentration are summarized in table-1. During the toxicity testing experiments, the bivalve showed response to pesticides by excessive mucus secretion. It is proved from the results (Tab.-1) that the freshwater bivalve *Lamellidens consobrinus* was more sensitive to the Quinalphos than Profenofos. Analysis of results indicates that Quinalphos is more toxic than Profenofos. Similar observations have been reported by various workers by using various pesticides on different test animals. There are wide variations found in the sensitivity of different species to different chemicals. Sensitivity depends upon age, sex, weight and physical state of the animal [8]. Gills are most important organs in aquatic animals. Damage to gills by various chemicals and heavy metals was reported by number of workers. Mercury chloride damages the gills of *Lamellidens marginalis* [9]. Pesticides like Profenofos and lambda-cyhalothrin creates toxicity, damages to the gills and digestive gland as well as alteration in level of biochemicals like proteins, lipids and glycogen of *Lamellidens corrianus* [10]. Effect of quinalphos and thiodan was also demonstrated over freshwater bivalve *Parreysia corrugata*. They found severe impact over biochemical parameters along with enzymes like alkaline phosphatase and acid phosphatase of the bivalve. Damages to the gills, gonads and digestive glands was also recorded [12]. Profenofos also created histopathological alterations of liver in freshwater fish *Channa gachua* [7]. Impact of Profenofos was also found on freshwater fish *Notopterus notopterus* causing histopathological changes in their kidney. Kidney showed haemorrhage, oedema, fragmented glomeruli and elongated kidney tubules in experimental fish [11]. Histopathological changes in gills, liver and brain of *Cyprinus carpio* on exposure to quinalphos were also noted. Increasing duration of exposure caused severe damages [4]. Results of present study (Tab.-1) clearly indicates that rate of mortality for fixed time increases with increase in the concentration of pesticide as well as for a particular concentration mortality increases with increase in exposure time. Accumulation of pesticide occurs in the body of animals leading into damages of various physiological aspects leading to the death.

CONCLUSION

Thus, from the present study it can be concluded that the toxicity of tested pesticides Profenofos and Quinalphos to *Lamellidens consobrinus* affects respiratory and nervous system of the animal resulting into death. The present study also confirms that Quinalphos is more toxic than Profenofos.

Table-1-Relative Toxicity of Different Pesticides Against *Lamellidens consobrinus*

Sr. No	Name of Pesticide	Time of exposur Hrs.	Regression equation	LC50 value ppm	LC10 value ppm	Variance 'V'	Chi square (X^2)	Fiducial limit M_1	Fiducial limit M_2	Lethal dose ppm	Safe concentration 'C' ppm
1	**Profenofos**	24	Y=3.62906x-1.77028	50.36	32.54	0.0020266	0.386892	1.613851	1.790321	1208.64	1.741726
		48	Y=3.51533x+0.11612	24.51	10.59	0.0021416	0.157913	1.298639	1.480047	1176.48	
		72	Y= 2.99156x+2.04692	9.71	3.62	0.0041725	0.552901	0.860613	1.113825	699.12	
		96	Y= 2.90058x+2.76470	5.9	2.13	0.0044119	0.290808	0.640665	0.901039	566.4	
2	**Quinalphos**	24	Y= 4.38917x-0.99404	23.21	11.85	0.0014775	1.063678	1.290336	1.441014	557.04	0.655787
		48	Y= 2.19359x+2.75489	10.56	2.75	0.0053861	1.056208	0.879819	1.167508	506.88	
		72	Y= 2.27573x+3.12596	6.66	1.82	0.0068201	0.122219	0.661609	0.985339	479.52	
		96	Y=2.83785x+3.25612	4.12	1.46	0.0047163	0.419721	0.480294	0.749501	395.52	

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