EFFECTS OF PROFENOFOS (AN ORGANOPHOSPHATE) ON THE HAEMATOLOGICAL CHANGES IN LABEO ROHITA (Rohu).

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ABSTRACT

Pesticide hazards have been accentuated by the sharp rise in their agricultural, industrial and in domestic use. These pesticides cause significant variation in structural, haematological, histological and biochemical changes in the aquatic animal, particularly in fish.

The rohu (*Labeo rohita*) is an important freshwater fish. The rohu occurs throughout in South Asia and is an important aquaculture freshwater species. Rohu is one of the major carp, being cultivated in small aquatic water bodies as well as in artificial tanks in rural area of darbhanga, Bihar, India. Profenofos (an organophosphate insecticide) is being used on a variety of crops including wheat, cotton, maize, potato and sugar beet. Extensive use of this pesticide has increased its content in the soil and also in aquatic bodies such as rivers, ponds and lacks in rural areas of India. Our study investigated the lethal effects of profenofos on rohu fish, being cultivated in and around Darbhanga and various changes in the fish hematology. The in vitro study will come up with knowledge of toxic values of the pesticide and will help the fish cultivators of the rural area of darbhanga.

Keywords: *Profenofos, Haematology,Labeo rohita*

INTRODUCTION

The environmental pollution is one of the major serious problems that face mankind in this century. There are many types of pollutants that interfere with our-life both directly and indirectly. Furthermore, potential future hazards to human health and wildlife can be created by residues from some long-lived pesticides that may build up in the food chain and cause widespread contamination of the environment (El-Sebae, 1993; Zaahkouk *et al.,* 2000). Fisheries in India are a very important economic activity and a flourishing sector with varied resources and potentials

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. In India, utilization of pesticides is about 3% of the total world consumption and is increasing at the rate of 2-5% per annum (Bhadbhade *et al.,* 2002). Fish is good indicator of aquatic contamination because, its biochemical stress responses are quite similar to those found in mammals (Mishra and Shukla, 2003).

In rural areas, the carp culture is mainly done in natural ponds as well as in artificial ponds made in the agricultural fields. Intensive uses of pesticides and insecticides in agriculture has shown its side effects as the agricultural runoff or the water from the fields, that drains into the water bodies or aquaculture ponds is polluting the water with excessive amounts of pesticides and insecticides. The higher levels of such pollutants make the water unsuitable for aquaculture as well as for other recreational purposes (Dunier and Siwicki, 1993).

The organophosphate insecticides have been shown to exert lethal effects on some species of fishes and other aquatic fauna (Bacchetta *et al*., 2014) Profenofos is an organophosphate insecticide, largely used against Cotton MealyBug, cabbage caterpillar, Plutella xylostella and asparagus caterpillars, as well as against wheat and cabbage aphids (US EPA, 2015).

Profenofos is an organophosphate pesticide and is highly toxic to freshwater fish. Fish have to play an important role in the food chain therefore, investigation of the effects of pesticides (Profenofos) significance in evaluation of negative effects of pesticides to human health.

Nowadays, the hazards of pesticides have been accentuated by the sharp rise in their use by farmers, industrialists and householders alike. Pesticide poisoning resulting in death occurs mainly in developing countries where the consumption of these products is high (Banerjee *et al*., 1999). Organophosphate (OP) compounds are the most toxic pesticides causing environmental pollution and potential health hazards (Agdi *et al.,* 2000).

The objective of the study is to analyze and comprehend the acute toxic effects in lethal Concentration50 (LC50) of commercial grade organophosphate pesticide Profenofos on haematological alteration of freshwater fish *labeo rohita* in laboratory condition.

MATERIALS AND METHODS

The test fishes (*L. rohita*) were collected from local aquaculture pond in the city of Darbhanga. Living and healthy *Labeo rohita* of body size of 11 ± 1 cm and body weight of 28 ± 2 g were chosen for the study. The fishes were kept in glass aquaria containing 40 L of ground water, with continuous aeration through aquaria pumps. Fishes were treated with 0.01% potassium permanganate solution to obviate dermal infections. The fishes were fed with commercially available fish food and acclimatized for 15 days before starting the experiment.

For the experiments on exposure of profenofos pesticides, the method of Jhingran (2007) was adopted. Profenofos 98% was purchased from the local market of Darbhanga, manufactured by Excel Crop Care Ltd, Mumbai. The fishes were divided in to five groups, having 10 fishes in each group. The first group served as a control and received no insecticide. The other groups received different concentrations of propenofos. The fingerlings of *Labeo rohita* were exposed to the 4 concentrations of profenofos i.e., 0.6, 0.8, 1.0 and 1.2 µg L -1 (Ghazala *et al*., 2016, Singh and Alam, 2016). Fish were fed daily with commercial diet at the rate of 3 % of their body weight in two fractions at an interval of 8 hours. The fish blood was collected at 96 hrs for the haematological experiments.

The fish collected every 24 hours was immediately processed for the determination of vital haematological parameters such as haemoglobin (Hb), RBC count, WBC count and haemtocrit (Hct) using standard haematological procedures.

RESULTS AND DISCUSSION

The haematological parameters were tested for the fishes survived 72 hours or more under influence of various dosages of profenofos. At least 3 fishes were used for the haematological analysis using standard methods. Table 1 showed that the haemoglobin percentage decreased from 11.2 ± 1.10 to 7.8 ± 0.86*. The dosage of 0.6 (µg L-1) and higher showed significant differences in haemoglobin concentration in test fishes. Similar effects were shown by RBC count as well as haematocrit (PCV). The RBC count reduced from 3.48 ± 0.54 to 2.04 ± 0.32* x 106 cells µl-1 while haematocrit was reduced to 26.8 ± 1.10 to 21.8 ± 0.28*. The WBC count was also affected by increasing concentrations of Profenofos. The WBC count increased from 4.74 ± 0.31 to 6.21 ± 0.58* x 103 cells µl-1. Again, the profenofos concentration higher than 0.6 µg l-1 produced significant increases in WBC count as shown by one way ANOVA test in comparison to control.

Table.1 Haematological parameters of *Labio rohita* exposed to different concentrations of profenofos under in vitro conditions.

Concentration of profenofos (µg L-1)	**Haematological parameters (mean ± SD)**			
	Haemoglobin (%)	RBC count (x106 cells µl-1)	Haematocrit (%)	WBC Count (x103 cells µl-1)
Control	11.2 ± 1.10	3.48 ± 0.54	26.8 ± 1.10	4.74 ± 0.31
0.6	9.3 ± 1.02*	2.72 ± 0.32*	25.7 ± 0.66*	5.23 ± 0.38*
0.8	8.6 ± 0.93*	2.69 ± 0.37*	24.5 ± 0.54*	5.32 ± 0.56*
1	8.2 ± 0.55*	2.44 ± 0.28*	23.2 ± 0.48*	5.74 ± 0.62*
1.2	7.8 ± 0.86*	2.04 ± 0.32*	21.8 ± 0.28*	6.21 ± 0.58*

Fig-1 The data are presented as mean ± standard deviation (n=3). The values marked with asterisk are significantly different from control using one way ANOVA (p>0.05)

The organophosphates, i.e. profenofos are modern synthetic insecticide and are potent neurotoxic molecules (Lundbaye *et al.,* 1997). The environmental risk assessment of any given pesticide/insecticide depends on its toxicity to the fish and other organisms. Profenofos is one of the organophosphates pesticides that are widely used in India for the agricultural purposes. The 50% lethal concentration (LC50) is the parameter that shows the toxicity and is considered to be the preliminary step for studies into the extent of acute or chronic toxicity.

The work of organophosphates was reviewed and gave a thought that the pesticides do effect the biochemical changes in the blood and also parameters of the blood change. Reduction in RBC and hemoglobin values in Labeo rohita exposed to profenofos in this study is similar to the observations conducted by (Vijaya kumar *et al*., 2015). Our results showed a 96 hour LC50 value of 0.62 µg L-1 for Labio rohita fingerlings. Singh and Ansari (2016), showed a 96-h LC50 value of profenofos for zebrafish as 0.388 L-1 respectively. The results are close and the differences could be due to the greater body size of L. rohita and in vitro conditions of the experiments. At 96 h, median lethal concentrations of profenophos were 0.31 mg/L (0.26-0.38) in another major carp *Catla catla* (Ghazala *et al.,* 2014).

The present study showed remarkable toxic effects of profenofos on L. rohita, which may be one of the reasons of fish mortality due to higher concentrations of the insecticide. Shrafeldin *et al*., (2015) showed highly significant increase in WBCs counts during both the acute and chronic exposure to profenofos on Nile tilapia (*Oreochromis niloticus*). Highly significant decrease in RBCs counts, Hb content and Hct % was noticed during experimental periods on Nile tilapia. Similar observations were mentioned after exposure of Nile tilapia to organophosphate pesticides (Ibrahim *et al*., 2005; El-Sayed *et al*., 2007; El-Sayed and Saad, 2008). Such increase in leucocyte counts is believed to be the alteration in defense mechanism. Oppositely, leucopenia was observed in common carp, Cyprinus carpio exposed to sublethal concentration of profenofos which was explained as the malfunction of the hematopoietic system caused by toxicant stress (Marie *et al*., 1998). It seems that tilapia may be more resistant than carp. It can be concluded that profenofos is highly toxic to the aquacultured carps and exert severe haematological changes in fishes.

CONCLUSION

Thus, profenofos in the aquatic medium is a major factor responsible for drastic changes in the fish blood. Perhaps, it would be more rational to state that a rise or fall in RBC and WBC count, Hb content and hematocrit concentration in toxicant exposed fish provide important information on the overall haematology of fish under investigation. The rural area of Darbhanga, which regularly culture rohu, as an edible carp should be aware of the uses of profenofos in their fields as well as the fields nearby the aquaculture ponds. Awareness on restricting the uses of organophosphate insecticide will be helpful in aquaculture practices.

ACKNOWLEDGEMENT

The authors are thankful to Department of Zoology, K. S. College, Laheriasarai, Darbhanga, for providing laboratory facilities and Instrumentation. And also thank's to Dr. A. C. Jha and Dr. R. P. Sinha for encouragement me.

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