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Organophosphate-Pesticide exposure and Hematological changes in Freshwater Fish *Channa punctatus* (Bloch)

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ABSTRACT

The freshwater fish, Channa punctatus (Bloch) was exposed to the organophosphate pesticide malathion and 2.0ppm, 3.0ppm and 4.5ppm were determined as sub-lethal, median lethal and lethal concentrations at 96 hr of exposure. These LC_{50} values indicate that the Malathion is highly toxic to fish. The fish were exposed to sub-lethal concentration for 4 days and the changes in the biochemical constituents were studied. Significant changes in Respiratory, hematological, biochemical and enzymological parameters in fish were observed. Several behavioral changes during the period of exposure were also observed and noted. The results obtained were discussed at length with the available literature.

Keywords: Bloch, Pesticide, Malathion, Fish.

INTRODUCTION

Pesticides are widely used in modern agriculture to enhance the productivity of crops. However, some pesticides have the potential to cause serious health and environmental damage. When such pesticide drains into aquatic environment than the fishes are exposed to low concentration over a long period seem to produce many physiological and biochemical changes in fish. Fish have been valued for many years as excellent indicators of water quality. High usage of pesticide in the field, affects both biotic and abiotic environment.

Stresses and pollutants generally cause relatively rapid changes in Blood parameters of fish (Deshmukh, 2016). A reduction in hemoglobin content and erythrocyte population resulting in anaemia have also been suggested as reason for drop in Oxygen uptake in fish *Channa punctatus* exposed to lethal Concentration of Deltamethrin (Jayaprakash and Shettu, 2013). Though, the biochemical, Physiological and enzymatic parameters are the common biomarkers of exposed fish to toxicity of pollutant.

Since blood glucose level is an important parameter to assess the stress condition of fish by pesticides. Enzymes play a significant role in food utilization and metabolism. The toxic effects of organophosphorous compounds on the activity of alkaline phosphatase in various tissues of fishes have been worked out by various workers. Dubey et al., (2014) reported significant inhibition of alkaline Phosphatase in liver, intestine and muscle tissues of *Clarias batrachus* when exposed to Dimethoate. The effect of Rogor on the activity of alkaline phosphatase was studied by Borah and Yadav (1996).

In this study, the effects of pesticide on hematological and biochemical parameters in *Channa punctatus* (Bloch) evaluated under laboratory conditions.

MATERIALS AND METHODS

The edible fresh water fish *Channa punctatus* used in this experiment. There twenty fishes with length and weight ranged between 10-15 cm and 20-25 g, respectively, were acclimatized to laboratory conditions for 10 days and separated into control and exposed groups. During the acclimatized period fishes were fed ad-libitum with rice bran (or) powdered oil cakes. The median lethal concentration (LC50) and sub lethal concentrations were found out by exposing the fish to different concentrations of Malathion (2.0, 3.0 and 4.5 PPM) for 4 days and control group was also maintained separately. Malathion ($C_{12}H_{15}ClNO_4PS_2$) is a broad spectrum organophosphate pesticide widely used to control pests in agricultural crops. It is commercially available organophosphate pesticide and is more toxic to living beings.

Blood sample was collected from the control and experimental fishes by cardinal vein puncture using an insulin syringe containing 0.1ml of 0.2% EDTA of each group at 1st, 2nd, 3rd and 4th day of experiment. Hemoglobin was estimated by Darbkin's method (Suganthi et al. 2015). The blood sugar was estimated by O -toludine method. The alkaline phosphatase was estimated by using the method of Bergmeyer (1963) as modified by Butterworth and Probert (1970).

RESULTS AND DISCUSSION

The mortality of fish did not occur at 1.5 PPM concentration of Malathion for 96 h exposure, but increased with excess concentration as revealed in Figure 1. The sub-lethal concentration is 2.0 PPM, median lethal concentration (LC_{50}) is 3.0 PPM and the lethal concentration is 4.5 PPM for 96 hrs exposure.

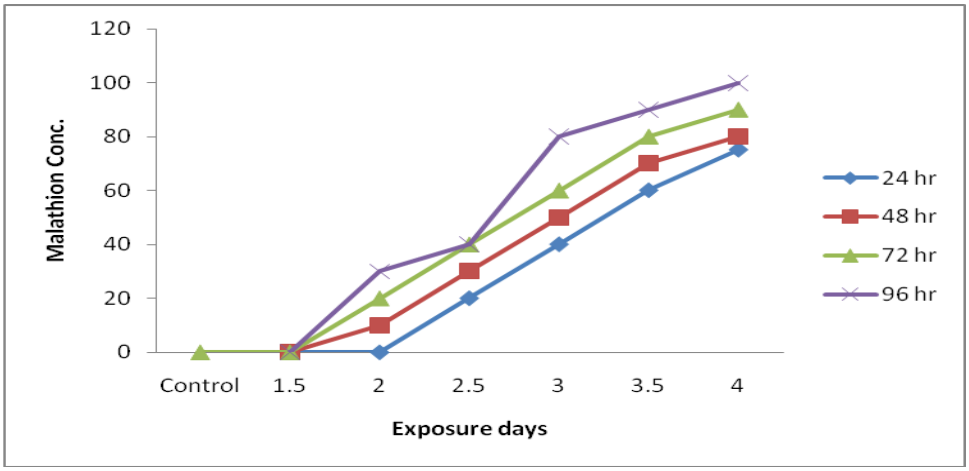

Figure 1: Mortality of Channa punctatus exposed to different concentrations of Malathion at different exposure periods.

Table 1: Statistical analysis (Log-dose/Probit regression line of the LC_{50} value of Malathion on *Channa punctatus* for 96 hours.

Conc. ppm	Log Conc. (X)	No. of fishes (n)	Mortality Rate (r)	P	Exp Y	W	X	Y

2.00	0.3010	100	30	0.2980	4.4056	0.5590	0.3010	4.3994
2.50	0.3979	100	50	0.4986	5.1524	0.6310	0.3979	5.1445
3.00	0.4771	100	80	0.7980	5.7626	0.5134	0.4771	5.7530
3.50	0.5441	100	90	0.8990	6.2785	0.3436	0.5941	6.2074

The LC_{50} value differs from species to species for the same pesticide as well as for different pesticides due to their mode of action on fish. Durairaj and Selvarajan (1991) have estimated LC_{50} value for Quinolphos and Phenthoate and were found to be 7.5 PPM and 2.5 PPM respectively for 96 hours of exposure in *Channa punctatus*. Malathion was found to be highly toxic to minnows (LC50 8.6 ppm) and murrels (LC50 5.93ppm) as summarized by Durkin (2008). The present findings is in agreement with the work of Anoop et al., (2010) who also recorded LC_{50} values of Dimethoate in *Heteropeunistis fossilis*. The median lethal concentration (LC_{50}) was calculated by means of probit analysis (Finney 1981) (Table 1).

Hemoglobin (Hb) content was estimated in the blood of *Channa punctatus* exposed to LC_{50} value of Malathion concentration and presented in table 2. The Hb content of blood was 8.75 g/dl in control fish and it was decreased (6.30 g/dl) when exposed to LC_{50} concentration of Malathion. The Hb content was gradually reducing with increasing exposure period. The decreased hemoglobin concentration represents that the fish power to supply adequate oxygen to the tissues is limited considerably and this will result in decline of physical activities (Nussey et al., 1995). The reduced level of hemoglobin content may be affecting the Oxygen consumption of the fish by way of reduced transportation of Oxygen and this fact can be confirmed in the present study also.

The total blood sugar content increased with increasing concentrations of Malathion. The blood sugar level which was 54.50 mg/ml in control fish significantly increased to 74.50 mg/ml in LC_{50} of Malathion at 96 hrs exposure period (Table 2).

Table 2: Effect of LC_{50} Malathion on Hemoglobin and Blood glucose level of *Channa punctatus* at different periods of exposure.

Exposure Time (hr)	Hemoglobin content (g/dl)		Blood sugar level (mg/ml)	
	Control	Exptl. LC_{50}	Control	Exptl. LC_{50}
24	8.78±0.005	8.00±0..006	55.10±0.18	61.50±0.43
48	8.75±0.007	7.45±0.007	55.25±0.17	65.25±0.19
72	8.70±0.005	6.85±0.005	54.75±0.16	69.75±0.15
96	8.75±0.006	6.30±0.007	54.50±0.16	74.50±0.30

The percentage (36.70) of blood sugar level increase is, as a function of exposure period. Such increase in blood sugar has been probably due to increased rate of utilization of blood sugar to meet the excess energy demands imposed by the severe stress of pesticide on the physiological activity of fish. This increase of blood sugar level may be due to conversion of stored glycogen into blood glucose by the inducement of adrenal hormones namely glycocorticoids and Catacolamines by pesticides. Christobher et al. (2016) reported increased level of blood sugar when exposed to 1ppm concentration of Phosphamidon treated *Labeo rohita* fishes at 15 days intervals. The present findings were support from the work of Mohammad Illiyas et al., (2015) in Dimethoate- treated *Catla catla* under insecticide toxicity.

CONCLUSION

This study concludes that the exposure of various concentrations of Malathion pesticide is toxic to aquatic organisms and severely affects the function of respiratory system, blood tissues, Liver and intestinal tissue of freshwater fish *Channa punctatus* which seriously affects the survival of fish in its habitat. Therefore, it is concluded that Malathion at sub-lethal concentration, can cause considerable deterioration to fish health. For this reason, Malathion use must be regulated otherwise contaminated runoff from agricultural fields can deteriorate fish health and significantly reduce fish and aquatic organisms productivity of water bodies.

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