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Impact of Pesticide "Alderin" on the Haematology of the Freshwater Fish, "*Cirrhinus Mrigala*"

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A B S T R A C T

The pesticides are one of the most potentially harmful chemicals introduced into the environment. Through they have contributed considerable to human welfare their adverse effects of non target organisms are significant. Haematological parameters are being used as indicators in the measurement of health conditions and toxicological symptoms of organisms. The acute and sublethal toxicity of the pesticide "Alderin" on the fingerlings of *Cirrhinus mrigala* was evaluated to determine its effect on the haematological values. The fish was exposed to varying levels of the toxicant concentrations using static bioassay to determine the median lethal concentration. The LC_{50} value is 0.74 ppm. The fish was exposed to different hours (24, 48, 72 and 96hrs) in sublethal concentration 0.074 ppm and parameters like RBC, WBC, Hb, MCV, MCH, MCHC, PCV has been analyzed. All haematological parameters except WBC were found to be decreased from control and the WBC was increased in all exposure periods. The values were statistically analyzed and most values were found to be significant at 5% level.

Keywords: Haematological, Pesticide, toxicity, sublethal, *Cirrhinus mrigala.*

A R T I C L E I N F O

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1. Introduction

Measurement of haematological parameters are important in diagnosing the structural and functional status of the animal exposed to toxicant because blood parameters are highly sensitive to environmental or physiological changes and health conditions. The analysis of haematological parameters in fish can contribute to the assessment of the animals health and also the habitat conditions. Haematological parameters such as haemato crit (Hcl), haemglobin (Hb), Red blood cells (RBCs), White blood cells (WBCs) are used to assess the functional status of oxygen carrying capacity of the blood stream and have been used also indicate secondary responses of an organism to irritants.

2. Materials and Methods

Fishes were maintained in a large tank and acclimatized to laboratory conditions for 21 days. Water was changed daily to maintain the oxygen content and to remove the excreta of fishes. Fishes were maintained at room temperature and fed with ad libitum daily at least one hour prior to the replacement of the tank water. Feeding was stopped one day prior to the experiment in order to keep the animal more or less in the same state of metabolic requirement. The pesticide Alderin has been used for the study. Alderin is a broad spectrum organophosphate pesticide. which is effecting in controlling cardamom thrips, yellow stem borer of paddy, mealy bug, brown plant hopper, green leaf hopper, corn root worms, Cockroaches, grubs, fleas, beetels, flies, termites, fire ants and lice. Alderin primarily as a contact poison with some action as a stomach poison. Batches of 10 healthy fishes were exposed to different concentrations of Alderin to calculate the LC_{50} value. One more set of fishes are maintained as control in tap water. To find the wide range of concentration 10 to 50 ml of Alderin were chosen and the number of dead or affected fish in each set up was counted at regular intervals upto 24 hours. The level of the dissolved oxygen, pH, alkalinity and hardness were monitored and maintained constant.

The tanks were continuously aerated with electrically operated aerator. Appropriate narrow range of concentration 1-5 ml was used to find the median lethal concentration using a minimum of 6 fishes for each concentration and the mortality was recorded for every 24 hours upto 96 hours. It was found as 0.74 ppm for 96 hours. For this stock solution various sub lethal concentrations were prepared for bioassay study. Four groups of fishes were exposed to 0.074 ppm (sub lethal concentration of 96 hours LC_{50} value) concentration of the Alderin for 24, 48 and 72 hours respectively. Another group was maintained as control at the end of each exposure period. The blood was collected from gills using syringe and anticoagulants (ammonium oxalate, EDTA) were added and the haematological parameters such as Hb, RBC, WBC, MCV, MCH, MCHC and PCV were analyzed. The haemoglobin content was estimated by acid haematin method [1]. Total RBC count and WBC count were counted using an improved Neubaurhaemocytometer [2]. The mean corpuscular volume was calculated by using values of PCV% and the red blood cell counts expressed in µm-3 [3]. The mean corpuscular haemoglobin content was calculated by using the value of haemoglobin content and the red blood cell counts and expressed in pg [3]. The percentage of mean corpuscular haemoglobin concentration was calculated by using the values of haemoglobin content and the PCV% [3]. The PCV percentage was calculated employing standard method and formulae [4].

3. Results and Discussion

The amount of RBC in the blood of the fishes exposed to 0.074 ppm pesticide Alderin for 24, 48, 72 and 96 hrs was found to contain 1.86, 1.75, 1.60, 1.45 x 106/$mm^3$and mean control was found to be 1.90 x 106/mm^3.The amount of WBC were found to be increased from the control. The values were 3.75, 4.50, 4.90, 5.50 and 6.75 x 106/mm^3 in control 24, 48, 72 and 96hrs respectively. The level of haemoglobin in the fish, *Cirrhinus mrigala* on exposed to 24, 48, 72 and 96hrs was found to contain 2.79, 2.45, 2.30, 2.00 gm% and mean control was found to be 2.90gm %. The value of MCV in fishes exposed to 0.074 ppm Alderin for 24, 48, 72 and 96 hrs was found to contain 20.00, 19.00, 18.50, 17.00 μm^3 and mean control was found to be 22.00 μm^3.

The amount of MCH in the blood of the fishes exposed to 0.074 ppm Alderin was recorded as 14.20, 13.00, 12.30, 11.00 and the control was found to be 15.00 Pg. The amount of MCHC recorded as 13.70, 12.00, 10.00, 9.50 and 8.00 gm/dL in control 24, 48, 72 and 96hrs exposures respectively. The amount of PCV in the blood of the fishes exposed to 0.074 ml Alderin for 24, 48, 72 and 96hrs was found to contain 8.70, 7.50, 6.00 and 5.20 % and mean control was found to be 9.00 %.

Binu kumari and Anbazhagan [5] have observed that decrease in RBC may be due to the disruptive action of the herbicide water on peripheral cell due to which viability of the cells was affected. Anaemia could be drug to the effect of herbicide toxicant water on haemopoisis. Low haemoglobin level according to [6, 7] might decrease the ability of fish to enhance its activity in order to meet occasional demands. According to increase of WBC may be attributed as an adaptive value in the fish, *Catla Catla* exposed to malathion stress, which may be directly propotional to the severity of the causative stress condition.

The significant reduction of Hb could be indication of severe anemia caused by destruction of erythrocytes [8]. The low value of PCV in fish exposed to stress was attributed to a reduction in red blood cell volume caused by osmotic changes [9].

4. Conclusion

The haematological parameters except WBC were found to be decreased from control and the WBC has increased in all exposure periods. From the above investigation it can be inferred that the aquatic animals are affected by the Alderin. So we should create awareness among people to use biocides instead of pesticides.

Table 1: Impact of Alderin on haematological parameters in blood of the fish *Cirrhinus mrigala*.

Parameters	Exposure Periods				
	Control	**24 hrs**	**48 hrs**	**72 hrs**	**96 hrs**
RBC (106/mm3)	1.90±0.056[a]	1.86±0.1[ab] 2.01↓	1.75±0.08[ab] 7.9↓	1.60±0.07[b] 15.79↓	1.45±0.06[b] 23.68↓
WBC (106/mm3)	3.75±0.11[d]	4.50±0.12[c] 20.00↑	4.90±0.1[b]31.7 30.67↑	5.50±0.08[b] 46.67↑	6.75±0.04[a] 80.01↑
Haemoglobin (gm %)	2.90±0.10[a]	2.79±0.05[b] 20.69↓	2.45±0.09[b] 15.52↓	2.30±0.07[d] 3.79↓	2.00±0.03[c] 31.03↓
MCV (µm3)	22.00±0.09[a]	20.00±0.10[b] 9.9↓	19.00±0.07[c] 13.64↓	18.20±0.09[d] 17.27↓	17.00±0.12[e] 22.73↓
MCH (pg)	15.00±0.10[a]	14.20±0.08[b] 5.33↓	13.00±0.13[c] 13.33↓	12.30±0.07[d] 18.00↓	11.00±0.08[e] 26.67↓
MCHC (g/dL)	13.70±1.82[a]	12.00±1.54[b] 12.41↓	10.00±0.97c 27.01↓	9.50±1.39d 30.66↓	8.00±0.95[e] 41.61↓
PCV (%)	9.00±0.10[a]	8.70±0.[12b] 3.33↓	7.50±0.11[c] 16.67↓	6.00±0.13[c] 33.33↓	5.20±0.09[d] 42.22↓

Results are mean (±SD) of 5 observations

% = Parenthesis denotes percentage increase/decrease over control.

In a column, means followed by a common letter or not significant at 1% level by using DMRT.

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