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A study on the effect of an insecticide malathion on the hematology of the freshwater fish *"Catla catla"*

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A B S T R A C T

Pollution of aquatic eco-systems is a major global problem since the past two decades. Rapid urbanization and industrialization has led to increased disposal of pollutants such as heavy metals, radio nuclides and various types of organics and inorganics into the aquatic environment. Fishes are the simple and reliable biomarkers of pollution of aquatic bodies. The blood parameters have been used as a sensitive indicator of stress in fish exposed to different water pollutants, toxicants and effluents etc. The acute and sublethal toxicity of the insecticide Malathion on the fish *Catla catla* was evaluated to determine its effect on the haematological values. Malathion is an organophosphorous insecticide widely used in agricultural and non agricultural purposes in India, creates a serious threat to the environment as well as target and non target organisms. LC50 value for 96 hours was calculated following probit analysis methods. Catla catla was exposed to sublethal concentration of malathion (0.8 ppm). The study revealed a declining trend of RBC, Haemoglobin and increasing trend of WBC indicated toxic effect of malathion on Catla catla.

Keywords: Malathion, *Catla catla*, Haematological parameters

A R T I C L E I N F O

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1. Introduction

Water pollution problems related to agrochemicals have been taken categorically into consideration and it has been found that use of agrochemicals in the crop fields is liable to change the abiotic and biotic characters of the aquatic media, leading hazards to the aquatic flora and fauna. Fish can serve as bio indicators of environmental pollution and therefore can be used for the assessment of the quality of aquatic environment since they are directly exposed to chemicals resulting from agricultural production via surface runoff of water or indirectly through the food chain of ecosystem (Ateeq et al., 2002). One of the difficulties in assessing the state of health of natural fish population has been the paucity of reliable references of the normal condition. physiologists have turned to studies of haematology, probably because it has proved a valuable diagnostic tool in evaluating human health. Indiscriminate use of insecticides on crops causes serious environmental hazards affecting aquatic and land dwelling animals. Unfortunately, most of the insecticides are not biodegradable and tend to persist for years together in soil and water. There are many reports available related to toxicity of insecticides on different fish species. Malathion is commonly used organophosphorous pesticide. Once malathion is introduced into the environment, it may cause serious intimidation to aquatic organisms and is notorious to cause severe metabolic disturbances in non target species like fish and freshwater mussels. The present study was carried out on some hematological parameters of fresh water fish Catla catla treated with insecticide Malathion.

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 rice bran and oil cake in the ratio 1:1. Feeding was stopped two days prior to the experiment in order to keep the animal more or less in the same state of metabolic requirement. The toxicant Malathion has been used for the study. Batches of 10 healthy fishes were exposed to different concentrations of Encounter to calculate the LC50 value. One more set of fishes are maintained as control in tap water.To find the wide range of concentration 1 to 8 ml of malathion were chosen and the number of dead or affected fish in each set up was counted 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 ppm 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. Four groups of fishes were exposed to 0.8 ppm(sub lethal concentration of 96 hours LC50 value)concentration of the Malathion for 24, 48, 72 and 96 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 hematological parameters such as HB, RBC, WBC, MCV, MCH, MCHC and PCV were analyzed. The hemoglobin content was estimated by acid hematin method (T. Sahli 1962). Total RBC count and WBC count were counted using an improved Neubaur haemocytometer (S.L. Shah, and A. Altindag 2004). The mean corpuscular volume was calculated by using values of PCV% and the red blood cell counts expressed in µm-3 (D. Anderson, and G.W. Klontz, 1965). The mean corpuscular haemoglobin content was calculated by using the value of haemoglobin content and the red blood cell counts and expressed in pg (D.Anderson, and G.W. Klontz, 1965). The percentage of mean corpuscular hemoglobin concentration was calculated by using the values of haemoglobin content and the PCV% (D. Anderson, and G.W. Klontz, 1965). The PCV percentage was calculated employing standard method and formulae (G.S. Sandhu 1990).

3. Results and Discussion

The amount of RBC in the blood of the fishes exposed to 0.8 ppm of Malathion for 24,48,72 and 96hrs was found to contain 1.66,1.36,1.05,0.80 x 106/mm3 and mean control was found to be 1.89 x 106/mm3.The amount of WBC were found to be increased from the control. The values were10.00, 12.00, 17.00, 18.00, 22.00 x 10^6/mm^3 in control,24, 48, 72 and 96hrs respectively. The level of hemoglobin in the fish *Catla catla* on exposed to 24, 48, 72 and 96hrs was found to contain 4.2, 3.6, 0.01, 2.8% and mean control was found to be 5.00 g%. The value of MCV in fishes exposed to 0.8 ppm Encounter for 24, 48, 72 and 96hrs was found to contain 31.0, 35.0, 20.6, 18.1 µm3 and mean control was found to be 45.5µm3. The amount of MCH in the blood of the fishes exposed to 0.8 ppm Encounter was recorded as 17.0, 16.0, 13.0, 10.0 and the control was found to be 21.0 Pg. The amount of MCHC recorded as 18.2, 16.2, 10.2, 8.2, 6.2 g/dL in control, 24, 48, 72 and 96hrs exposures respectively. The amount of PCV in the blood of the fishes exposed to 0.8 ppm herbal plant extract for 24, 48, 72 and 96hrs was found to contain 12.2, 10.2, 10.07, 0.82% and mean control was found to be 15.2%. To get an insight into nature of changes that are taking place in the blood parameters in an organism as a result of insecticidal pollution Malathion, hematological studies were carried out in the fish, *Catla catla*. Decrease in RBC may be due to the disruptive action of the pesticides on peripheral cell due to which viability of the cells was affected. Anaemia could be due to the effect of insecticide on haemopoisis or attraction of cell membrane. Similar reports have been given by (S. Binukumari, and M.C. Subisha 2010). An increase in lymphocytes suggests that the immune mechanism of fish gets stimulated and becomes adapted under pesticide stress to fight against the pollutants in the environment. This significant increase in total leucocyte count might be due to immunological reactions to produce more antibodies to cope with the stress induced by these toxicants (K.Shanthi, et al 2009)

The reduction in Hb content can be related to decrease in RBC number, which indicates haemolysis, haemorrhage

and reduced erythropoiesis in fishes on exposure to insecticides. In the present study, MCV and MCH was found to increase and then decrease gradually in all exposure periods. Decrease in MCV values may be considered as an index of RBC destruction. Decrease in MCH also indicates endosmosis where involves passage of solvent from concentration solution to more concentration solution. Decrease in MCHC reveals that loss of Hb is comparatively at higher rate than that of the PCV. Decrease in PCV due to haemolysis of RBC leads to fish anaemia and Increase in PCV shows the magnitude of shrinking of cell size (A.R.Shakoori, et al 1996). (Abdul RAUF and Naeemuddin ARAIN 2013) reported that the acute exposure to LC50 values of diazinon induced haematological alterations in Indian carp and offers a tool to evaluate toxicity derived alterations.

Table 1: Effect of Malathion on haematological parameters in blood of the fish *Catla catla*

Parameters	Exposue concentation 0.8ppm	Exposure periods				
		Control	24Hrs	48 Hrs	72 Hrs	96 Hrs
RBC (106/mm3)	Mean±SD %	1.89±0.56a	1.66±0.46 ab 11.55↓	1.36±0.31ab 26.63↓	1.05±0.32b 43.21↓	0.80±0.17b 54.77↓
WBC (106/mm3)	Mean±SD %	10.00±1.58d	12.00±2.0 5c 18.18↑	17.00±1.69b 63.63↑	18.00±1.15b 72.72↑	22.00±1.37a 109.09↑
Haemoglobin (gm %)	Mean±SD %	5.00±1.03a	4.2±0.097 b 14.34↓	3.6±0.72b 26.29↓	0.01±0.001d 99.60↓	2.8±0.63c 44.23↓
MCV (µm3)	Mean±SD %	45.5±3.26a	31.0±4.49 b 30.96↓	35.0±3.26c 22.36↓	20.6±1.62d 53.54↓	18.1±1.05e 58.92↓
MCH (pg)	Mean±SD %	21.0±2.17a	17.0±1.82 b 18.18↓	16.0±1.35c 22.72↓	13.0±1.74d 36.36↓	10.0±1.18e 54.54↓
MCHC (g/dL)	Mean±SD %	18.2±1.82a	16.2±1.54 b 10.41↓	10.2±0.97c 41.66↓	8.2±1.39d 52.08↓	6.2±0.95e 62.50↓
PCV (%)	Mean±SD %	15.2±1.36a	12.2±0.98 b 18.51↓	10.2±0.85c 37.03↓	10.07±1.55c 37.77↓	0.82±0.14d 94.32↓

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.

4. Conclusion

The hematological 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 Malathion .So we should create awareness among people to use biocides instead of pesticides and herbicides.

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