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Effect of Fenvalerate Synthetic Pyrethroid on a Certain Haematological Parameters of Freshwater Fish *Channa marulius* (Ham-Bach)

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ABSTRACT- The present investigation was carried out to the effect of Fenvalerate on haematological parameters in freshwater fish *Channa marulius* using standard methods. Fish was exposed to (1/4th LC₅₀) sub lethal concentration of Fenvalerate (0.086ppm) for 96h. The blood sample was obtained from both, control and experimental fishes and assayed haematological parameters (Total Erythrocyte count, TEC; Total Leucocytes count, TLC; Haemoglobin, Hb; Packed cell volume, PCV; Mean corpuscular volume, MCV; Mean Corpuscular Haemoglobin and Mean Corpuscular Haemoglobin Concentration; MCHC). The result revealed that TEC, Hb percentage, PCV and MCHC counts were significantly decreased, whereas TLC, MCV and MCH increased slightly in experimental fish. The study has thus indicated marked changes in blood of *C. marulius* after exposure to Fenvalerate.

Key-Words: Fenvalerate, Hematology, *Channa marulius*, Haemoglobin, Sub lethal

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INTRODUCTION

The blood parameters in fishes are influenced by many factors viz. quality of water, temperature, the sex, size, season and age of fishes are directly reflected haematological parameters of the fishes (Bhagat *et al.*, 1986). The study of fish blood parameters are important for determining factors related to its physiological capacity (Affonso, 2001; Wells *et al.*, 2005).

Blood parameters are considered path physiological indicators of the whole body and therefore are important in diagnosis the structural and functional status of fish exposed to toxicants (Adhikari *et al.*, 2004). A number of hematological parameters such as RBC, WBC, and haemoglobin content and so on, are used to assess the functional status of the oxygen carrying capacity of the blood. Pollution of aquatic ecosystem by chemicals used in industry and agriculture is increasing day by day.

Due to injudicious and indiscriminate use of agrochemicals, fertilizers, pesticides, and insecticides boost crop production with the sole aim of getting more yields. Water bodies like ponds, lakes and rivers are continuously getting polluted normally these pesticides reaches an aquatic environment through surface runoff and sediment transport from treated effluents (Bauman, 1981).

Direct application of pesticides to water bodies to control the inhabiting pests. Spray drift from normal agricultural operation and through heavy rainfall. In all cases these chemicals may directly toxic as well as deteriorate the water quality by changing its physicochemical nature and cause ecological imbalance leading to health hazards to different types of aquatic organisms in general and fishes in particular (Tripathi, 1992). The herbicide can cause death of fishes either directly or due to saturation by destruction of food chain many herbicides have shown to affect the growth and reproduction of fishes with evidence of tissue damage (Dhasarathan *et al.*, 2000). The present study was undertaken to analyze the impact of 1/4th sub lethal concentration of Fenvalerate on haematological parameters of fresh water fish *C. marulius* (Ham Buch).

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MATERIALS AND METHODS

The fresh water fish *C. marulius* weighing (15±5 g) and length (10±3 cm) were collected from Kan and Panzara river of Sakri Taluka (Dhule). Live fishes were brought to the laboratory and thoroughly washed under tap water and acclimatized in laboratory conditions for 15 days. They were fed with standard fish diet (Tokyu grows certified company). Water in the tank was changed after 2 days of interval. Technical grade Fenvalerate (ISAGRO ASIA), 20% emulsifiable concentration (EC) was purchased from Sushil Agricultural pesticide and fertilizer Agency, Sakri for the present study.

The fishes were divided into a group, each group of ten healthy fishes were transferred to plastic tough having capacity of 10 litres and they exposed to 1/4th sub lethal concentration of Fenvalerate (0.086 ppm). One group was kept as control. At the end of exposure period the blood was collected in glass tube by cutting the caudal peduncle, using EDTA as an anticoagulant. Maximum 2 ml blood was taken for haematological studies. The haematological parameters such as RBC, WBC, and Hb, packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were estimated by using the methods described by Swarup *et al.*, (2002).

The RBC and WBC were counted by haemocytometer, Hb was determined by Sahil's haemoglobinometer and PCV was measured by using Wintrobe's tube. The Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration were calculated by equation.

$$\text{MCV (Cubic micron)} = \frac{\text{PCV}}{\text{RBC (million /cu.mm)}} \times 10$$

$$\text{MCH (Pg)} = \frac{\text{Hb in g (\%)}}{\text{RBC (million/cu.mm)}} \times 10$$

$$\text{MCHC (g/dl)} = \frac{\text{Hb in g (\%)}}{\text{PCV}} \times 100$$

Result were expressed±S.E. three replicates and differences between mean were considered to significance when p<0.05 (Bansal *et al.*, 2004).

RESULTS AND DISCUSSION

In the present investigation, the effect of insecticide like Fenvalerate 1/4th (0.086 ppm) on haematological parameters such as RBC, WBC, Hb, PCV, MCV, MCH and MCHC in the fresh water fish *C. marulius* is shown in Table 1.

Effect on RBC

The amount of RBC present in the blood of fish after exposed to different hours in the 0.086 ppm concentration

of Fenvalerate .The blood of fishes exposed to 0.086 ppm Fenvalerate for 24 h, 48 h, 72 h and 96 h were found to contain 1.98, 1.7, 1.42, 1.32 mm³, respectively and mean control was 2.51 mm³. The R BC values were significantly decreased than the control.

Lowering of RBC amount might be due to the damaging action of insecticides on peripheral cell due to which viability of the cell was affected. Anemia could be due to effects of insecticide on haemopoiesis or the attraction of the cell membrane and hydrolysis of acetyl chloride in body fluid by chlorine esterase of erythrocytes may be secondary result from a primary action of the insecticides on the erythropoetic tissue due to which there was a failure in the red cell production.

Effect on WBC

The amount of WBC present in the blood of fish after exposed to sub lethal concentration of 1/4th (0.086 ppm) 24 h, 48 h, 72 h and 96 h were found to contain 3.80, 4.69, 5.11, and 6.38 mm³ respectively and mean control was observed 4.25 mm³.

In the present investigation, the WBC values showed significantly higher in 48 h, 72 h and 96 h than the mean control value, while it was less in 24 h. An increase in lymphocytes suggested that the immune mechanism of fish get stimulated and become adapted under insecticide stress to fight against the pollutants in the environment. Higher white blood cell count indicates damage due to infection of body tissue may be physical stress and leukemia. Increased in the in the number of leucocytes occurs due to immunological response. Similarly, increased in total leucocytes counts have been observed by Kumari *et al.*, (2010). This significantly increased in total leucocytes count might be due to immunological reactions to produce more antibodies to cope with the stress induced by these toxicants. Increase in the number of WBC of *C. marulius* reflects impairment of the defense mechanism and manifested in to leucocytosis to cope with such a situation. Similar results were reported in *teleost* by Tyagi *et al.* (1989); Dutta, *et al.*, (1992); Kalair, et al (1993) and Ramesh and Saravan (2008) on, exposure to different pesticide. Lymphocytes are numerically predominant white blood cells in fish (Kumar *et al.*, 1999). Lymphocytes of fish have been regarded as immune-competent. Thus, they are responsible for the production of antibodies (Eills *et al.*, 1978).

Effect on haemoglobin

The amount of hemoglobin content in the blood of fish after exposed to sub lethal concentration of 1/4th (0.86 ppm) of Fenvalerate for 24 h, 48 h, 72 h and 96 h were found to contain 9.2, 8.41, 7.02, 5.42 g/dl respectively and mean control was recorded as 10.22 g/dl. The hemoglobin level in all exposure period was significantly decreased over the control. Our work was supported by Thomas Nithyanandam *et al.* (2007). He was reported in *C. carpio* on, exposed to pesticide, the reduction of hemoglobin might be due to blood coagulation. Similarly Gill *et al.*, (1992) reported reduction in RBC and Hb in *Barbus con-*

chohitus exposed to Endosulfan, *Catla catla* exposed to ekalux (Mustak and Natrajan, 1992), *Cyprinus carpio* exposed to Dimethoate (Chauhan, *et al.* 1994). Ramesh and Manvalara Manujan, (1992) reported decrease in Hb, TEC in Malathion exposed fresh water carp *Cyprinus carpio* and sumithion exposed to *Clarias batrachus* respectively. Anaemia induced stress may also be due to blood cell injury and disrupted hemoglobin synthesis (Binna Kumari

and Subhisha, 2010). The causes of depletion in the Hb content in *Puntius conchoni* are supposed to degeneration, depression and the destruction of the blood forming material by the piscicidal compound (Patole and Bhoi, 2013).

Table 1: Haematological parameters of fresh water fish *C. marulius* exposed to 1/4th sub lethal concentration of Fenvalerate (0.086 ppm) insecticide

Parameters	Exposure periods				
	Control	24 hrs	48 hrs	72 hrs	96 hrs
RBC ($\times 10^6/\text{mm}^3$)	2.51 \pm 0.3	1.98 \pm 0.22 (-26.76) **	1.71 \pm 0.29 (-46.78) **	1.42 \pm 0.02 (-76.76) **	1.32 \pm 0.14 (-90.15) ***
WBC ($\times 10^3/\text{mm}^3$)	4.25 \pm 0.65	3.80 \pm 0.18 (-11.84) *	4.69 \pm 0.3 (9.38) *	5.11 \pm 0.09 (16.15) *	6.38 \pm 0.52 (33.38) **
Hb (g %)	10.22 \pm 0.98	9.2 \pm 1.3 (-11.08) *	8.41 \pm 0.69 (-21.52) *	7.02 \pm 0.48 (-45.58) **	5.42 \pm 0.58 (-46.96) **
PCV (%)	30.9 \pm 4.1	33.3 \pm 2.7 (7.20) *	28.3 \pm 1.2 (-9.18) NS	26.25 \pm 0.75 (-17.71) *	23.93 \pm 2.57 (-29.12) **
MCV(μm^3)	122 \pm 3.0	163 \pm 8 (-25.15) *	165 \pm 10 (26.06) *	172.4 \pm 16.6 (29.23) **	184.4 \pm 24 (33.69) **
MCH(Pg)	42.1 \pm 3.5	45.2 \pm 3.3 (6.85) NS	41.3 \pm 21 (-1.93) NS	50.2 \pm 2.6 (16.13) *	43.36 \pm 6.64 (2.90) NS
MCHC(g /dl)	34.1 \pm 2.3	28.4 \pm 1.6 (-20.07) *	29.6 \pm 1.0 (-15.20) *	27.04 \pm 0.66 (-26.10) *	23.53 \pm 1.77 (-44.92) **

Mean \pm S.D. values differ significantly ($p < 0.05$) within same columns.

*Significant value: $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. NS= Non-Significant ($p > 0.05$). Values in the parenthesis are percentage change over control treated as 100 percent

Effect on PCV

The amount of PCV of exposed *C. marulius* after the 24 h, 48 h, 72 h and 96 h exposure were 33.3, 28.3, 26.25, 23.93% and mean control was 30.9%. It was increased in 24 h, whereas at 48 h, 72 h and 96 h was significantly decreased from exposure period to control over.

Effect on MCV

The amount of MCV of the fish exposed to sub lethal concentration of Fenvalerate after the 24 h, 48 h, 72 h and 96 h exposed period revealed 163, 165, 172, 184 μm^3 respectively and mean control was 122 μm^3 , respectively. The MCV contain in exposure period was significantly increased over control.

Effect on MCH

The amount of MCH in the blood of the fishes exposed to 1/4th sub lethal concentration (0.086 ppm) of Fenvalerate for 24 h, 48 h, 72 h and 96 h were found to contain 45.2,

41.3, 50.2 and 43.36 pg, respectively and mean control was 42.1 pg. The values were decreased at 48 h. While the values are increased in 24 h, 72 h and 96 h than over control.

Effect on MCHC

The amount of MCHC in the blood of the fish recorded as 28.4, 29.6, 27.04, 23.53 g/dl respectively and means control value was 34.1 g/dl was to be found. The MCHC was decreased from control to exposure period. Atamanalp *et al.*, (2003), Atmanalp and Yanik, (2003) found a significant increase in the level of RBC and significant decrease in MCH, MCHC, thrombocytes count and erythrocyte sedimentation rate in rainbow trout (*Oncorhynchus mykess*) following Cypermethrin and Mancozeb acute exposure. A decrease in important blood parameters has been reported during exposure to various pesticides in fish (Saxena and Seth, 2002).

The decrease in the above parameters indicates stage of fish caused due to decreased erythropoetic activity or increased destruction of red blood cells further support in favors of this comes from the decrease noted PCV. Decrease in Hb indicates poor O₂ transport by blood caused by damage or due to increased accumulation of CO₂ in blood. In the present investigation significant change was recorded in the RBC, WBC, Hb, MCV, PCV and MCHC. The reduction in this value might be due to spleen concentration after have been detected in fish. Cells released from spleen which is an erythropoetic organ would have lowered those values.

CONCLUSION

The present investigation was shown that Fenvalerate caused decrease in the haematological parameter in *C. marulius*, which suggest that the Fenvalerate (synthetic pyrethroids) may weak the immune system and result in severe physiological problem ultimately to the death of fish. Fenvalerate is a synthetic pyrethroid used to protect many fruits, vegetables and field crops against disease, hence farmer comes direct contact it and may impair their health.

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