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HAEMATOTOXICITY OF PHORATE, AN ORGANOPHOSPHOROUS PESTICIDE ON A FRESHWATER FISH, *CHANNA PUNCTATUS* (BLOCH)

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ABSTRACT

The present investigation has been designed to study the effect of sublethal concentrations of phorate, on the haematological parametes of *Channa punctatus* (Bloch) after exposure to 15 days. The present study shows the alternation in haematological parameter such as significant decrease in RBC counts, Hb %, thrombocytes, PCV %, MCHC, MCH, MCV, monocytes%, eosinophil% and basophil% and where as significant increase in WBC count, ESR, lymphocytes% and neutrophil% in photate exposed fish. The response of the fish towards toxicity of phorate was grossly dependent on concentration and duration of exposure. Thus, this paper gives an overview of the manipulation of fish, Channa punctatus as a biomarker of organophosphates pesticides through alternation in haematological parameters.

Keywords: *Channa punctatus*, Haematological parameters, Phorate.

INTRODUCTION

The widespread use of pesticides not only brought adverse influence on agro ecosystems but also caused alteration in physiological processes of non-target organisms. Balanced ecosystem is necessary for survival of living organisms (Ashok, 2018a). These pesticides through surface runoff reach to the unrestricted areas like ponds and rivers which alter the physicochemical properties of water and influence the agriculture (Ashok, 2018b). Such pesticide is toxic to aquatic organism and cause deleterious effect or even death to the aquatic animals. The toxicity study is essential to find out toxicants limit and safe concentration, so that there will be minimum harm to aquatic fauna in the near future. Among the several aspects of toxicity studies, the estimation of haematological parameters is one of the most commonly used methods in aquatic environmental studies with suitable organisms like fishes. Pesticides play havoc to fish production as well as quality; it is widely used in agriculture and is commonly detected in surface water and ground water.

Organophosphates are some of the most widely used pesticides in the world. They are used in agriculture, homes, gardens, and veterinary practices. In general, they are not persistent in the environment as they break down quickly. Because of their relatively fast rate of degradation, they have been a suitable replacement for the more persistent organochlorine (Frederick,2005). Organophosphorous insecticide used against pod borers, fruit borers, stem borers, leaf miners, defoliating caterpillars, sucking pests, termites etc and in other settings, to kill a number of pests, including insects and worms (Prakash and Verma, 2014). Organophosphates are highly toxic to fish and non-target aquatic organisms and are powerful nerve poisons, since they inhibit AChE activity (Klaverkamp and Hobden, 1980).

Phorate ($C_7H_{17}O_2PS_3$) is an organophosphorous pesticides used against insect especially chewing insect, leafhoppers, leaf miners, mites and nematodes. It is a systemic

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insecticide that acts by inhibiting cholinesterases. Phorate is of moderate persistent in most of the soil and slightly soluble in water. Phorate itself is not persistent in plants but plants metabolize phorate to very potent anticholinesterase agents such as the sulfoxide. Phorate is toxic to fishes and other animals (Singh *et al*., 2010).

Several studies have been conducted in assessing the toxicity of organophosphorous insecticides on different fish species (Frederick, 2005, Singh *et al*., 2010 and Prahash and Verma, 2014,).Perusal of literature reveals paucity of information on acute toxicity of phorate on the haematological parameters of freshwater edible fishes. Hence the present study was undertaken to examine the toxic effects of phorate on the haematological parameters of freshwater snake headed fish, *Channa punctatus*.

MATERIALS AND METHODS

The healthy *Channa punctatus* ranging from 8.5-9.5 cm in length and 9.0-10.0 g in weight were collected from local fish ponds and washed with 1% solution of $KMnO_4$ for five minute and then transferred to the plastic jar containing 50L dechlorinated tap water for acclimatization. Fishes were acclimated to laboratory conditions for 10 days at room temperature. The LC_{50} values of phorate at 96 hours of exposure were estimated to be 0.30mg/L for air breathing snake headed fish, *Channa punctatus* (Singh *et al*., 2010). Based on 96 LC_{50}, fishes were exposed to sublethal concentrations (0.05mg/L and 0.10mg/L) for the period of 15 days. A control group was maintained in an identical environment. The fishes were regularly fed with commercial food and the medium was changed daily to remove faeces and food remnants. Five fishes from each set were sacrificed for the collection of blood. Blood samples of these fishes were collected from caudal vein in the glass tubes. Blood parameters like RBC count, WBC count, Thrombocytes, Hb, PCV,ESR, MCHC, MCH and MCV were calculated following the methods of Dacie and Lewis (1977).

RESULTS AND DISCUSSION

Table 1: Effects of sublethal concentration of Phorate on haematological parameters of *Channa punctatus* after 15 days exposure (n=5).

Parameters	Control(Mean±SE)	0.05mg/L(Mean±SE)	0.10mg/L(Mean±SE)
RBC (106/mm3)	1.63±0.14	1.40±0.05*	1.28±0.9*
WBC(103/mm3)	7.56±0.09	8.35±0.05	8.68±0.12**
Thrombocytes (103/mm3)	29.04±0.05	24.52±0.38	22.73±0.03*
Hb (g/dl)	14.21±0.84	8.92±0.08	8.42±0.67**
PCV (%)	37.4±0.84	30.8±0.95*	24.7±0.68**
ESR (mm/h)	22.01±1.10	23.14±1.25	27.84±2.87*
MCHC (%)	35.44±4.87	31.24±4.14	33.62±4.12
MCH(pg)	94.24±9.28	74.10±17.12	68.31±5.46*
MCV (µg)	241.10±28.12	230.29±23.14	210.84±18.24
Lymphocytes %	76.5±2.11	78.5±1.78	80.3±1.67*
Neutrophil %	11.8±1.11	12.7±1.02	13.1±0.98*
Monocytes %	7.9±0.78	6.4±0.84*	5.1±0.73**
Eosinophil %	3.4±0.32	2.2±0.28	1.4±0.21*
Basophil %	0.4±011	0.2±0.14	0.1±0.11*

*= significance at 0.05level; ** = significance at 0.01 level.

In the present study significant alterations was found in haematological parameters of phorate exposed freshwater fish, *Channa punctatus*. The significant decreases in RBC count, Thrombocytes, Hb%, PCV, MCHC, MCH and MCV where as significant increase in WBC count & ESR in *Channa punctatus* were found after 15 days exposure to sublethal concentration of phorate. The results obtained in this study showed significant reduction in RBC counts and Hb levels in phorate exposed *Channa punctatus*. Similar reductions in RBC counts and Hb contents in different fish

species had been also reported after exposure to organophosphorous pesticides (Svoboda *et al*., 2001; Ramesh and Saravanan, 2008). The significant decrease in the Hb contents may also be due to either an increase in the rate at which the Hb is destroyed or to a decrease in the rate of Hb synthesis (Reddy and Bashamohideen, 1989). The observed depiction in the haemoglobin and PCV in the phorate exposed fish could also be attributed to the lysing of erythrocytes. Similar reductions have been reported by Musa and Omoregie (1999). Thus the significant reduction in these parameters is an indication of severe anaemia caused by exposure of phorate in experimental fish.

In the present study, WBC count increased significantly in *Channa punctatus* after exposure to sub lethal concentration of phorate. The increases in WBC counts (leucocytosis) were reported in fishes exposed to organophosphorous pesticides (Ramesh and Saravanan, 2008; Prakash and Verma, 2014). Increases in WBC count establish leucocytosis which is considered to be of an adaptive value for the tissue under chemical stress. Presence of foreign substances or under pathological conditions leucocytosis in fish may be the consequence of direct stimulation of immunological defense (Marti *et al*, 1996). The increase in WBC count can be correlated with an increase in antibody production which helps in survival and recovery of the fish exposed to lindane and malathion (Joshi and Deep, 2002).

In the present study significant reduction in thrombocyte counts with the exposure of the fish to phorate was observed. The increases in thrombocytes was also observed in fish, *Heteropneteutes fossilis* exposed to pesticide chlorpyrifos (Prakash and Verma, 2014). The decrease in thrombocytes may be related to decreased thrombocyte production or increased destruction of thrombocytes.

In the present study significant increase in erythrocyte sedimentation rate (ESR) in phorate exposed experimental fish was observed. The increases in ESR may be attributed to the swelling of RBC. Flos *et al* (1987) reported that the swelling of the RBCs may be due to an increase in protein and carbondioxide in the blood.

In the present study lymphocytes and Neutrophil percentage has significantly increased in fishes exposed to sub lethal concentration of phorate. Percentage of eosinophils, monocytes and basiphils decreased in phorate exposed fishes. The similar result has been observed in the fish, *Heteropneteutes fossilis* exposed to pesticide chlorpyrifos (Prakash and Verma, 2014). Thakur and Pandey (1990) and Srivastava *et al*. (2007) also reported increase in percentage of lymphocytes and decrease in neutrophils and eosinophils in *Clarias batrachus* after exposure to BHC and distillery effluent, respectively. Thus lymphocytosis as evidences in the present investigation might be due to immunological reaction to produce more antibodies to cope with the stress induced by the toxicant.

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In conclusion, the changes in the haematological parameters indicate that they can be used as indicators of organophosphates pesticides related stress in fish on exposure to elevated pesticides levels in the water.

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REFERENCES

1. **Ashok, K.V.** (2018a). Ecological Balance: An Indispensable Need for Human Survival. *Journal of Experimental Zoology*, India. 21 (1): 407-409.
2. **Ashok, K.V.** (2018b). Unsustainable Agriculture, Environmental Ethics and Ecological Balance. *HortFlora Research Spectrum*. 7 (3): 239-241.
3. **Daci, J.V., and Lewis, SM** (1977). *Practical Hematology*. Elsevier 653.
4. **Flos, R. Tort, L. and Balacch, J.** (1987). Effect of zinc sulphate on haematological parameters in the dog fish(Scyliohinus canicula) and influence off MS 222. *Mar. Environ. Res*.21: 289-298.
5. **Frederick M.F.** (2005). One of a series of the pesticides. Information Office, Florida Cooperative Extension service, Institute of Food and Agricultural Sciences, University of Florida.
6. **Joshi, P.S. and Deepa, H.** (2002). Effect of lindane and malathion exposure to certain blood parameters in

a freshwater teleost fish Clarias batrachus. *Pollution Research*, 21(1): 55-57.

7. **Klaverkamp, J.F. and Hobden, B.R.** (1980). Brain–acetyl cholinesterase inhibition and hepatic activation of acephote and Fenitrothion in rainbow trout (*Salmo gairdneri*). *Canadian Journal of Fisheries and Aquatic Sciences*, 37:1450-1453.
8. **Marti H H, Wenger R H and Rivas L A** (1996). Erythropoietin gene expression in human, monkey and murine brain. *Euro. J. Neurosci*. 8, 666-676.
9. **Musa, S.O. and Omoregie, E.** (1999). Haematological changes in the mudfish, Clarias griepinus (Burchell) exposed to malachite green. *J. Aqual. Sci*.14:37-42.
10. **Prakash, S. and Verma, A.K.** (2014). Effect of Organophosphorus Pesticide (Chlorpyrifos)on the Haematology of *Heteropnetues fossilis* (Bloch). *International Journal of Fauna and Biological Studies*. 1(5):95-98.
11. **Ramesh M. and Saravanan, M.** (2008). Haematological and biochemical responses in a freshwater fish *Cyprinus carpio* exposed to chlorpyrifos. *International Journal of Integrative Biology*, 3(1): 80-83.
12. **Reddy, M.P. and Bashamohideen, M.** (1989). Fenvalerate and cypermethrin induced changes in the haematological parameters of *Cyprinus carpio*. *Acta Hydrochimica et Hydrobiologica*, 17: 101-107.
13. **Singh, A.P., Singh, S., Bhartiya, P. and Yadav, K.** (2010). Toxic effect of Phorate on the Serum Biochemical Parameters of Snake Headed Fish, *Channa punctatus* (Bloch). *Advances in Bioresearch*. 1(1): 178-182.
14. **Srivastava, N.K. and Prakash, S.** (2018). Morphological, Behavioural and Haematological alterations in catfish, *Clarias batrachus* (Linn.) after Acute Zinc Toxicity. *International Journal on Biological Sciences*, 9(1): 72-78 (Special issue).
15. **Srivastava, S.K., Singh, D. Prakash, S. and Ansari, K.K.** (2007). Effect of sublethal concentration of distillery effluent on the haematological and biochemical parameters of *Clarias batrachus* (Linn.). *Ecol. Env. & Cons*. 13(3):511-514.
16. **Svoboda, M., Luskova, V., Drastichova, J. and Zlabek, V.** (2001). The effect of diazinon on hematological indices of common carp (*Cyprinus carpio* L.), *Acta Vet. Brno*. 70 : 457-465.
17. **Thakur, G.K. and Pandey, P.K.** (1990). BHC (Gammaxene)poisoning effect on Leucocytes of an air breathing fish, *Clarias batrachus*(Linn.). *J.Environ. Biol*.11(2):105-110.