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IMPACT OF SUB-LETHAL CONCENTRATION OF DIMETHOATE (ROGOR) PESTICIDE ON ALKALINE PHOSPHATASE ACTIVITY IN GILLS OF FRESHWATER FISH, *CATLA CATLA*

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ABSTRACT

The effect of pesticides on phosphatase activity is very much limited in fishes. Acid and alkaline phosphatases are known as inducible enzymes whose activity in animal tissues goes up when there is a toxic impact and the enzymes begin to counteract. The enzymes activity may begin to drop either as a result of having partly or fully countered the toxin and cells also damaged. Alkaline phosphatase activity was found in the gills decreased in experimental fishes, but in control fishes, its value was maximum. Enzymes activities were reduced. Detailed results are summarized in the present paper.

Figure : 01 References : 24 Table : 01

KEY WORDS : Alkaline phosphatase,Dimethoate, Freshwater fish *Catla catla.*

Introduction

Large scale use of pesticides in agriculture is the primary origin of pollutant in the environment. They may also arise as effluents from manufacturing and formulating plants[17]. Some pesticides are quite toxic to fish at very low concentrations and aquatic animal at even low concentration. Gills are the characteristic respiratory organs of aquatic animals. Intakes of the pesticides into a fish are largely through the gills[12, 22]. Many water and fat soluble substances including organophasphorus pesticides freely pass across the gills causing irreversible damage. It can be chemically variables influence toxicity by affecting respiratory rate and thereby the amount accumulate and absorbed in the gills. Gills are the first organ to face any foreign molecules that is carried through the blood circulation in the gill epithelium. It acts as an excretory organ[6, 15]. Exposure to toxicants causes changes in size, quality, membrane liability and lysosomes stability. The membrane prevents indiscriminate cell autophagy depending on the property of lysosome enzyme*. Lysosome enzyme release is a sensitive indicator of environmental stress on invertebrates and fish[5, 21]. Therefore they often serve as the most sensitive index of environmental alterations in the presence of toxic materials[4, 10].Hence, the present investigation has been undertaken to assess the toxic impact of dimethoate (Rogor) on alkaline phosphatase activity from the gills of a freshwater fish, *Catla catla.*

Material and Methods

The freshwater fish *Catla catla* were collected from Benitura reservoir, Murum, Dist-Osmanabad (M.S) India. The animals were acclimatized in laboratory conditions for three weeks under natural photoperiods and they were fed on alternative days. The healthy fishes were kept in 100 liters plastic tank. The fish specimens were

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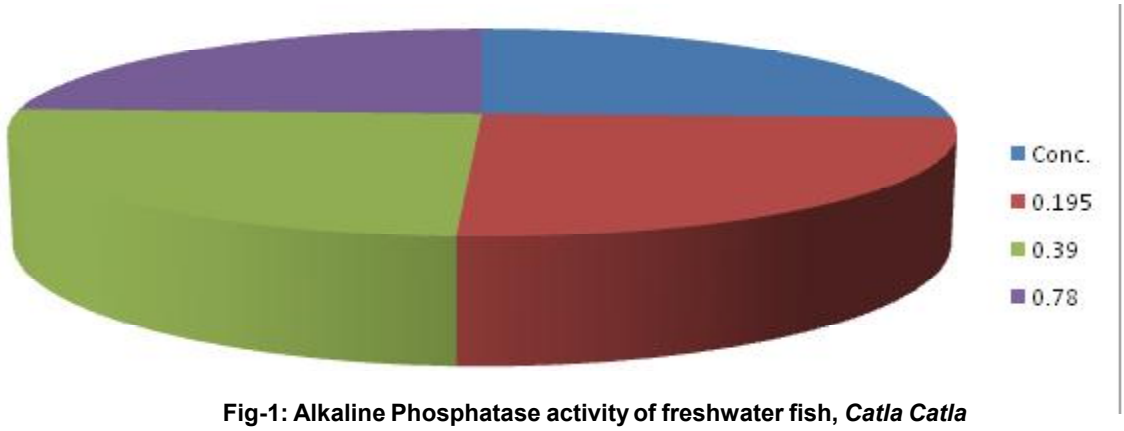

Fig-1: Alkaline Phosphatase activity of freshwater fish, *Catla Catla*

divided into two groups. The five fishes in each group kept on control and other as experimental were subsequently exposed to sub-lethal concentration of dimethoate (Rogor) 0.195ml/ltr, 0.39ml/ltr and 0.78ml/ltr for a period of 7th, 14th and 21st days. After 7th, 14th and 21st days of exposure the fishes were sacrificed and the gills organ were quickly dissected out and washed in saline and blotted on a filter paper. After clearing, a known amount of tissue was homogenized at 4°C. It was centrifuged at 10,000rpm. The supernatant was used for enzyme assay. Alkaline phosphatase was assayed following standard method[3].

Results and Discussion

The results obtained indicate the Mean ± SEM of alkaline phosphatase activities in the gills of fresh water fish *Catla catla* exposed to the three sub-lethal concentrations of dimethoate (Rogor) are shown in Table- 1 and represented graphically in Fig.1. There was a significant decrease of alkaline phosphatase activity in 0.195ml/ltr ($P<0.001$), 0.39ml/ltr ($P<0.001$) and 0.78ml/ltr ($P<0.001$) when compared to control.

In the present investigation on freshwater fish *Catla catla* treated with different sub-lethal concentrations (0.195ml/ltr) of dimethoate (Rogor) a perceptible decrease in the gills has been observed on 7th day (2.825±0.0003*), while control fishes alkaline phosphatase activity was more maximum. The 14th day experimental fishes, sub-lethal concentration (0.39ml/ltr) alkaline phosphatase activity show (2.821±0.0003*) gradual decreasing in the gills, while control fishes alkaline phosphatase activity was moderate. And 21st day experimental fishes, sub-lethal concentration (0.78ml/ltr) alkaline phosphatase activity (2.727±0.0005*) also decreased while control fishes alkaline phosphatase activity was minimized.

The results show both significant alkaline phosphatase are hydrolytic lysosome enzymes and are released by the lysosome for the hydrolysis of foreign material and activation alkaline phosphatase activities were observed in the gills tissue [1, 11,23]. Similar findings have been reported with other pesticides[22]. Lysosome hydrolysis are thought to contribute to the degradation of damaged cells and hence to facilitate their replacement by normal tissue[8,16]. The reported gill form a major site of accumulation of foreign substances. The inhibition of alkaline phosphatase activity observed 0.195 ml/ltr and 0.39 ml/ltr might be due to the toxic effect of dimethoate that damage cells. The enzyme might diffuse into the cell by treatment of toxicants and get utilized for the digestion of cellular organelles, which are responsible for its secretion, resulting in the decrease of alkaline phosphatase activity. The most probable reason for the decrease in the activity of acid phosphatase could be uncoupling of oxidative phosphorylation[7,13].

Alkaline phosphatase has also been shown to be involved in active transport , glycogen metabolism, protein synthesis, secretary activity and in synthesis of certain enzymes[14,18,20]. In the present investigation on the alkaline phosphatase activity, gills showed a significant decrease with remarkable fluctuation. Gills showed a gradual decrease in alkaline phosphatase activity depending upon the concentrations of

TABLE-1: Alkaline phosphatase activity in the gills of freshwaterfish *Catla catla* in control and exposed to sub-lethal concentration of dimethoate (Rogor).

Sr. No	Tissue	Biochemical constituents	Period for Days	Exposed in conc. ml/l	Control Groups	Experimental Groups
1	Gills	Alkaline phosphatase	7	0.195ml/l	2.870±0.0005	2.825±0.0003*
2			14	0.39 ml/l		2.821±0.0003*
3			21	0.78 ml/l		2.727±0.0005*

Values are expressed as mg/100mg tissue.
Each value is mean ± SEM (n=5).
*Significance at p<0.001

dimethoate[19]. Decrease in alkaline phosphatase activity could be due to the alteration of the fluidity nature of the membrane which is responsible for the functioning of the membrane bound enzymes. The behavior of phosphatase activity observed in the gills in the present study may be due to the toxic effect of the pesticide by which the cellular membrane and lysosome membrane might have been ruptured or due to tissue inflammatory reaction of toxin [2, 9, 24].It is concluded that in all sub-lethal concentration of dimethoate (Rogor) on the alkaline phosphatase activities is found to be gradually decreased and after that 21st days to experimental groups highly decreased in alkaline phosphatase activity in the gills.

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