

CONSEQUENCE OF ORGANOPHOSPHATE DIMETHOATE PESTICIDE ON ACID PHOSPHATASE ACTIVITY IN GILLS OF FRESHWATER FISH, *CATLA CATLA*

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ABSTRACT

The freshwater fish, *Catla catla* were exposed in various doses of 0.195, 0.39 and 0.78 ml/lit of dimethoate (Rogor) pesticide for 7, 14 and 21 days duration. The effect of dimethoate pesticide on the gills was observed. The gills showed damaged and ruptured. Acid phosphatase are known as inducible enzyme whose activity in animal tissues goes up when there is a toxic effect and enzymes begin to counteract. The effect of dimethoate on gills significantly changed the cell and fish activities were reduced in experimental, but in control fishes value was maximum. It was in turn an indication of toxic effect of dimethoate on acid phosphatase activities was shortened. Detailed results are summarized in the present paper.

Figure : 01

References : 20

Table : 01

KEY WORDS : Acid phosphatase, Dimethoate, Freshwater fish-*Catla catla***Introduction**

There are three major groups of synthetic pesticides namely, organophosphates, organochlorines and carbonates. Organophosphates represent one of the main categories of synthetic organic pesticides since their introduction into the agrochemical market. These are used as insecticides and highly effective in the toxin. Water being essence of life is polluted with various chemicals coming through industrial effluents, domestic sewage and agricultural runoff. The constant flow of agricultural effluent discharge into water bodies often leads to a variety of pollutant accumulation, which becomes apparent when considering toxic pollution. Environment becomes continuously polluted due to continued use of toxicants²⁰. There are various ways through which the pesticides add with the environment either by

direct or indirect applications. A heavy amount of pesticides are directly applied to agricultural field mostly to control pests and improve crop yield. These pesticides finally find their way into water reservoirs and cause harm to aquatic flora and fauna. These contaminants can negatively affect nontarget organisms like fishes^{1, 12, 19}. Fish being in direct contact with aquatic environment is susceptible to any change that may occur in it. Further, changes are expected to be reflected in the osmoregulation, carbohydrate, metabolism, general body physiology, hematology and reproductive activities of fishes¹⁵. Exposure to toxicants causes changes in size, quality, membrane liability and lysosomes stability. Acid phosphatase has been shown that purified alkaline phosphatase from number of sources can also hydrolyze creative phosphate, inorganic pyrophosphates and number of polyphosphates

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and metaphosphatase of average chain length. Many workers have observed disturbances in the gill of fishes ^{2,3,12}. Hence, the present study is an attempt to deal with the consequence of dimethoate (Rogor) pesticide on acid phosphatase activities in gills of 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 divided into two groups. The five fishes of each group kept on control and other as experimental were subsequently exposed to various 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 4⁰c. It was centrifuged at 10,000 rpm for 10 minutes. The supernatant was used for enzyme assay. Acid phosphatase was assayed following the modified method^{4, 18}.

Results and Discussion

The results obtained indicate the mean \pm SEM of acid phosphatase activities in the gills of freshwater 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 acid phosphatase activity in 0.195ml/ltr ($P < 0.001$), 0.39ml/ltr ($P < 0.001$) and 0.78ml/ltr ($P < 0.01$) when compared to control.

In the present investigation on freshwater fish *Catla catla* treated with different sub-lethal concentration (0.195ml/ltr) of dimethoate (Rogor) a perceptible decrease in the gills has been observed in 7 days ($0.0138 \pm 0.0001^{**}$), while control fishes acid phosphatase activity is more. The 14th day's experimental fishes, sub-lethal concentration (0.39ml/ltr) acid phosphatase activity show ($0.0145 \pm 0.0001^{**}$) gradual reducing in the gills, while control fishes acid phosphatase activity is temperate. And 21st day's experimental fishes, sub-lethal concentration (0.78ml/ltr) acid phosphatase activity ($0.0174 \pm 0.0001^*$) also rose when compared to control.

The results show both significant acid phosphatases serve as diagnostic tool to assess toxicity stress of chemicals in the living organism. Acid phosphatase is hydrolytic lysosome enzymes and is released by the lysosome for the hydrolysis of foreign material. It is also a role in certain detoxification functions⁸. Acid phosphatase activities were observed in the gills tissue. Similar findings have been reported with other pesticides. Lysosomes hydrolases are thought to contribute to the degradation of damaged cells and hence to facilitate their replacement by normal tissue ^{6, 9, 16}. Acid phosphatase is an enzyme of lysosomes origin, which hydrolyses the phosphorous ester in acidic medium, moreover helps in autolysis of the cell after its death. The decrease, fluctuation and increase of acid phosphatase activity encountered

TABLE-1: Acid phosphatase activity in the gills of freshwater fish, *Catla catla* in control and exposed to various sub-lethal concentration of dimethoate (Rogor).

Sr.No	Tissue	Biochemical constituents	Period for Days	Exposed in conc. ml/ltr	Control Groups	Experimental Groups
1	Gills	Acid phosphatase	7	0.195ml/ltr	0.0167 \pm 0.0001	0.0138 \pm 0.0001 ^{**}
2			14	0.39 ml/ltr		0.0145 \pm 0.0001 ^{**}
3			21	0.78 ml/ltr		0.0174 \pm 0.0001 [*]

Values are expressed as mg/100mg tissue.

Each value is Mean \pm SEM (n=5).

Significance ^{**}p<0.001 and ^{*} p<0.01

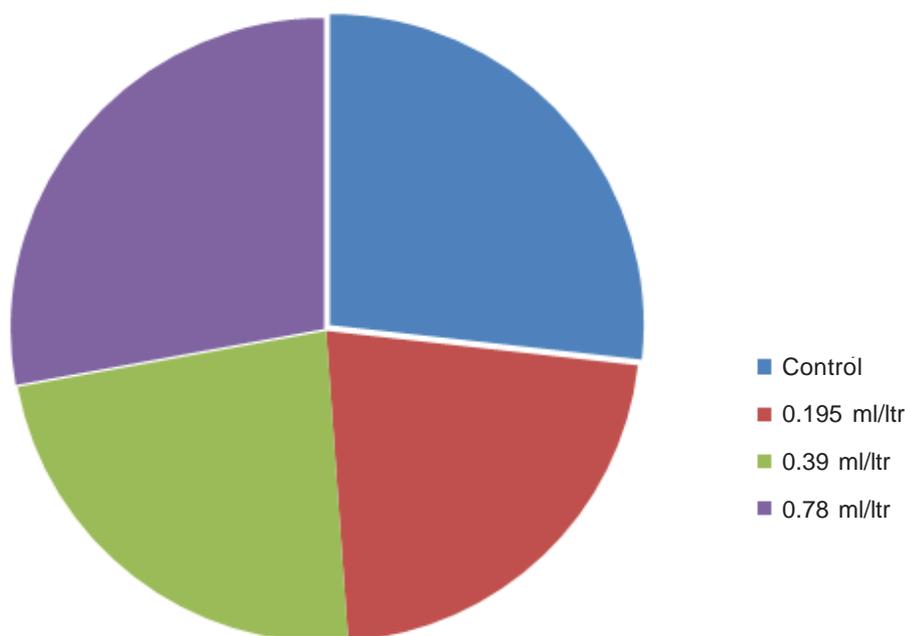


Fig.1 : Acid Phosphatase activity of freshwater fish, *Catla catla*

in 0.195, 0.39 and 0.78ml/ltr to expose fishes. In the gill tissue of freshwater fish, *Tilapia mossambicus* (Peters) treated with Gamma lidane in various tissues of fish *puntiusconchonus* treated with mercury⁷. Similar observations in the air breathing catfish *Clarias batrachus* exposed to a sub-lethal concentration of carbofuran in ambient water for 30 days¹¹. Gills form a major site of accumulation of foreign substances. The inhibition of acid phosphatase activity observed in 0.195 and 0.39 might be due to the toxic effect of dimethoate of toxicants and get utilized for the digestion of cellular organelles, which are responsible for its secretion, resulting in the decrease in the activity if acid phosphatase could be uncoupling of oxidative phosphorylation^{5, 13}.

Increase in the activity level of acid phosphatase in 0.78 ml/ltr during the studies was

most probably due to rapid destruction of lysosome and thereby excessive release of acid phosphatase. Increase or decrease in the lysosome enzyme activity depend upon the concentrations of pesticide^{9, 16}. The enhanced activity may be indicative of an adaptive rise in enzyme activity to the persistent stress and can be taken as a meaningful biochemical index of dimethoate toxicity to assess pesticide pollution of the aquatic environment. There werer similar observations of increase in acid phosphatase activity in gills exposed to pesticide Rogor in *Heteropneustes fossilis* and increase in acid phosphatase activity in gill lysosome of *Oreochromishor norum* exposed to lead^{10, 14, 17}. It is concluded that results show both significant inhibition at lower concentration and stimulation at the higher concentration.

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