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EFFECT OF AN INSECTICIDE (MONOCROTOPHOS) ON SOME BIOCHEMICAL CONSTITUENTS OF THE FISH *TILAPIA MOSSAMBICA*

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ABSTRACT

The effects of an insecticide monocrotophos on some biochemical parameters of the fish, *Tilapia mossambica* at 24, 48, 72 and 96 hrs of exposures were studied. Median lethal concentration (LC50) of monocrotophos to the fish for 24 hour exposure was determined during bioassay study. The protein contents were found to be declined in all the samples analyzed during all the exposure periods. The reduction of protein may be due to proteolysis and increased metabolism under toxicant stress. The carbohydrate levels were found to be elevated in the samples of gill, muscle and kidney in all the exposure periods. This may be due to the stress induced by the insecticide as physiology of organism with the help of corticosteroids. The cholesterol contents of gill, muscle and kidney were found to be declined in all the treatment periods of experimental fish compared to control. This may be due to utilization of fatty deposits instead of glucose for energy purpose.

KEY WORDS: Water pollution, Biochemical parameters, *Tilapia mossambica.*

INTRODUCTION

Pesticides leave residues in water and soil even after several days of the spray in the crop fields. The uses of organophosphorus pesticide in crop field are highly toxic to the aquatic organisms including fish (Sreenivasan and Swaminathan, 1967). Extensive use of pesticides pollutes the aquatic environment. Such pollution disorders the metabolic activities and alters physiological state thereby changing the biochemical constituents of fishes (Anon, 1975). In aquatic toxicology the traditional LC_{50} test is often used to measure the potential risk of a chemical (Jach de Bruijin *et al.*, 1991). Palanichamy *et al.* (1986) have reported that the sublethal effects of malathion, thiodon and ekalux on protein, carbohydrate and lipid content of muscle and liver of *Oreochromis mossambicus*.

Khanee *et al.* (1992) observed depletion in protein contents of various tissues of fish *Oreochromis mossambicus* during the exposure of deltamethrin. Begum and Vijayaraghavan (1995) have recorded an increase of glucose level in branchial tissue of an air breathing fish, *Clarias batrachus* treated with rogor. Anusha *et al.* (1996) studied the sublethal effects of organophosphorous pesticides quinalphos in the tissues of the fish *Cirrhinus mrigala.*

Tilak *et al.* (2003) have studied the biochemical changes induced by fenvalerate in the freshwater fish *Channa punctatus.* Proteins are important organic substance required by organisms in tissue building and play an important role in energy metabolism (Yeragi *et al.*, 2003). Mishra *et al.* (2004) studied the effect of malathion on lipid content of liver and muscles of *Anabas testudineus.* The present study has been aimed to know the effect of monocrotophos on some biochemical constituents in certain tissues of the fish *Tilapia mossambica.*

MATERIALS AND METHODS

In the present study, fish *Tilapia mossambica* were exposed to different concentrations of an insecticide and the biochemical constituents of the fish were studied. Technical grade insecticide, monocrotophos manufactured and supplied by TUCAS limited, Tamil Nadu, India, was taken for the present study.

The bulk sample of the freshwater fish, *Tilapia mossambica* (Ranging in weight 14gm to 17 gm and in length from 7 cm to 10 cm) was procured from the Periyakulam pond at Ukkadam and transported to

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the laboratory in well aerated polythene bag and acclimated to the ambient laboratory temperature (28 ± 0.2) in large glass aquarium. During the period of acclimation, they were fed every day with oil cake mixed with rice flour. The period of acclimation lasted for 2 weeks. After acclimation healthy fish were selected from stock and transferred to another glass tank. Feeding was stopped one day before the commencement of the experiment.

The median lethal concentration (LC_{50}) of monocrotophos to the freshwater fish *Tilapia mossambica* for 24 hr. exposure was determined. The effect of monocrotophos on the biochemical constituents like protein, carbohydrate and cholesterol under sublethal toxicity were analysed in the tissues gill, muscle and kidney by using the following standard procedures.

The total Protein concentration was estimated by the method of Lowry *et al.* (1951), and the quantitative estimation of carbohydrate in the tissue was done by the method described by Hedges and Hofreiter (1962). The cholesterol level was estimated based on enzymatic method using cholesterol esterase, cholesterol oxidase and peroxidase (Richmond, 1973).

RESULTS AND DISCUSSION

The changes in the biochemical constituents in the gill, muscle and kidney of the fish *Tilapia mossambica* exposed to sublethal concentration of monocrotophos at different exposure periods were observed in the present study. The physical and chemical characteristics of the water used for the study

Table 1: Showing the protein, carbohydrate and cholesterol level (mg/gm) of various tissues of *Tilapia mossambica* exposed to varying periods of sublethal monocrotophos toxicity.

Tissues	Exposure periods (hrs)	Protein		Carbohydrate		Cholesterol	
		Control	Experiment	Control	Experiment	Control	Experiment
Gill	24hr	14.40 ±0.14	14.00 ±0.15	3.442 ±0.287	8.210 ±0.332	41.032 ±1.117	30.716 ±1.247
	48hr	14.41 ±0.14	12.72 ±0.19	3.306 ±0.217	8.720 ±0.781	40.342 ±0.899	26.846 ±1.170
	72hr	14.25 ±0.27	11.66 ±0.11	3.204 ± 0.222	8.968 ±0.348	39.470 ±0.764	23.604 ±1.402
	96hr	13.81 ±0.41	11.32 ±0.24	3.084 ±0.082	11.336 ±0.835	38.058 ±1.278	23.268 ±2.111
Muscle	24hr	14.296 ±0.842	11.912 ±1.226	4.350 ±0.349	17.160 ±0.896	48.970 ±0.381	29.736 ±0.409
	48hr	14.120 ±0.523	10.892 ±0.815	4.248 ±0.329	15.886 ±0.831	47.618 ±0.734	29.292 ±0.565
	72hr	12.860 ±1.303	6.932 ±0.473	4.000 ±0.158	26.452 ±0.841	46.934 ±0.540	29.956 ±0.305
	96hr	12.740 ±1.574	6.228 ±0.255	4.020 ±0.357	24.572 ±1.771	45.668 ±1.412	23.720 ±0.541
Kidney	24hr	35.460 ±0.523	17.376 ±0.948	15.812 ±0.337	45.150 ±2.407	65.71 ±0.197	39.998 ±0.858
	48hr	35.320 ±0.682	15.980 ±0.845	15.912 ±0.231	46.466 ±1.512	67.515 ±0.446	39.080 ±0.843
	72hr	33.164 ±0.751	14.480 ±1.214	14.192 ±1.390	50.684 ±1.382	67.265 ±0.415	37.793 ±0.482
	96hr	33.140 ±0.847	11.376 ±0.783	13.652 ±0.788	61.670 ±1.739	65.498 ±1.193	30.818 ±1.123

Values are means of SD of five individual observations.

Values are significant at 5% level

showed the permissible values which were always within the admissible limit of APHA (1998).

The median lethal concentration (LC_{50}) of monocrotophos for 24 hr exposure of the fish *Tilapia mossambica* was 2 ppm. The mortality of the fish *Tilapia mossambica* exposed to different concentrations of monocrotophos was observed and it showed that the monocrotophos is very toxic to fish even at very low concentration. Maheswari *et al.* (2001) have observed the median lethal concentration of Triazophos to the fish, *Clarias batrachus* and reported that organophosphate was more toxic among other insecticides. In the present study, protein content of gill, muscle and kidney were found to be declined during all the exposure periods of 24hr, 48hr, 76hr and 96hr (Table 1) as observed by Venkataraman *et al.* (2006) who studied for metabolic dysfunction to malathion toxicity in fish *Glossogobius giuris.*

Lynch *et al.* (1969) and Dalela *et al.* (1981) observed a decrease in protein content in *Mystus vittatus* under pesticide exposure and reported that the depletion of protein may be due to the excretion of proteins by kidney due to kidney failure or impaired protein synthesis as a result of liver disorders. Dubhat and Bapat (1984) and Patel and Parmar (1993) observed maximum decrease in protein contents in the liver of *Channa orientalis* and *Baleopthalmus dussumieri.*

The carbohydrate level was found to be increased in the present investigation as observed by Srivastava and Srivastava (1995) in liver and muscle tissue of *Heteropneustes fossilis* and *Barcus ticto* exposed to Chlordecone. Koundinya and Ramamurthi (1979) and Srivastava and Singh (1981) reported that sublethal concentration of certain organophosphate pesticides caused glycogenolysis which produced hyperglycemia in the African food fish *Tilapia mossambica* and the Indian catfish, *Heteropneustes fossilis* respectively. Elevated carbohydrate level in the liver or the fish *Heteropneustes fossilis* was observed by Narendra Singh and Anil Srivastava (1982) during the exposure of formathion toxicity.

The cholesterol level was found to be decreased in the exposure periods. Such a trend has also been reported by Palanichamy *et al.* (1986) in *Oreochromis mossambicus* on exposure to 3 different periods. The reduced cholesterol level may be due to the inhibition of cholesterol biosynthesis in the liver or due to reduced absorption of dietry cholesterol as reported by Jayantha Rao *et al.* (1984) and Kanagaraj *et al.* (1993). Shakoori *et al.* (1996) reported that the cholesterol decrease may be due to utilization of fatty deposits instead of glucose for energy purpose.

A toxicant induce its effect at cellular or even at molecular level, but ultimately cause physiological, pathological and biochemical alterations. It is therefore necessary to focus attention on changes in biochemical composition of marine organisms, which are under pollutant threat.

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