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EFFECT OF SODIUM PENTACHLOROPHENATE ON PROTEIN METABOLISM OF THE GASTROPOD, *INDOPLANORBIS EXUSTUS*

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Widely used herbicide, sodium pentachlorophenate has hazardous effects on the non - target animal species. During the present study freshwater gastropod, *Indoplanorbis exustus* is subjected to LC10 and LC50 concentrations for the periods of 24, 48, 72 and 96 hours. It is noted that protein level is depleted while protease activity shown initial increase and then there appeared a marked decrease. The amino acid reserves are found to be decreased and then increased after later periods of exposure. The herbicide stress induced effects are discussed in the light of available literature.

INTRODUCTION

Massive use of herbicides and pesticides in agriculture and public health have resulted in pollution of freshwater bodies, as these non-degradable chemicals are washed away and get accumulated in aquatic bodies. They also interfere with the soil and water causing major threat to the inhabitants. The toxicology of pesticides, therefore, related to both injurious effects directly upon man or animals and their long term effects in the environment, which are essential to maintain the ecological balance, needs to be studied (Holden, 1973).

Freshwater gastropods are detritous feeders which form food link at primary consumer level in aquatic ecosystem. Sodium pentachlorophenate is a broad spectrum herbicide and is widely used in the industrial, agricultural and domestic fields. By studying biochemistry and physiology one can assess the extent of pollution caused by this herbicide to the non-target organisms. Protein metabolism involves interaction between proteins, amion acids, several enzymes and co-enzymes (Harper *et al.*, 1978). Chaudhari *et al.*, (1988) have studied the effect of Basalin (herbicide) on the freshwater gastropod, *Bellamya bengalensis*. Gayanath & Sarojini (1982) have studied the effect of sodium pentachlorophenate of freshwater prawn, *Microbrachium lamerri*. Lomte & Patil (1989) have given an elaborative account of the effect of some common pesticides on digestive enzymes of the army worm, *Mythimna pseudalatia separata*. During the present investigation the impact of sodium pentachlorophenate on the protein metabolism of the freshwater gatropod, *Indoplanorbis* exustus is studied.

MATERIALS AND METHODS

The snails, *Indoplanorbis exustus* were collected from Panzara river which is flowing through Dhule city and were maintained to the laboratory conditions for a week. Acute toxicity studied were done by using sodium pentachlorophenate and LC 10 and LC 50 values for 24, 48, 72 and 96 hours of exposure were calculated by the method of probit analysis (Finney, 1971). After each exposure period ten animals from each group were sacrificed and dry powder was obtained for biochemical analysis. For enzyme assay the acetone dried powder was used. A concurrent control was maintained in dechlorinated water. Total body proteins were estimated by Folin phenol method (Lowry *et al.*, 1951), free amino acids by Ninhydrin method (Moore & Stein, 1954) and activity of protease enzymes was assessed by the method considering the amount

of free amino acids liberated from the protein substrate as a measure of proteolytic activity (Prosser & Vanwell, 1958). Statistical analysis for significance using students 't' test were also done (Bailey, 1965).

RESULTS AND DISCUSSION

The physico-chemical characters of water used for holding gastropods and as diluent were-temperature 27°C - 30°C, pH 7.1 - 7.3, total carbonates 155 - 160 ppm and oxygen content 4.3 -4.6 ml/litre. The result of acute toxicity studies by using sodium pentachlorophenate on the freshwater gastropod, *Indoplanorbis exustus* are given in Table I.

Table I : Study of acute toxicity of sodium pentachlorophenate on the freshwater gastropod *Indoplanorbis exustus.*

Sr. No.	Period of exposure	Regression equation	LC 10 ppm	LC 50 ppm
1.	24 hours	Y = 0.4062 x - 0.345	1.463	4.841
2.	48 hours	Y = 0.3842 x - 0.693	0.546	1.691
3.	72 hours	Y = 0.1422 x - 0.232	0.193	0.875
4.	96 hours	Y = 0.0372 x - 0.734	0.074	0.083

Table II: Impact of sodium pentachlorophenate on the level of protein (mg / gm), amino- acid (mg / gm) and protease activity (mg of amino-acid / gm protein / hr at 37°C) of the gastropod, *Indoplanorbis exustus.*

Bio-chemical content	Control group	PERIOD OF EXPOSURE							
		24 hours		48 hours		72 hours		96 hours	
		LC 10	LC 50	LC 10	LC 50	LC 10	LC 50	LC 10	LC 50
Protein		*	*	*	*	*	*	*	*
	215.77	140.5	134.37	164.39	171.20	171.51	161.30	156.04	146.75
	± 6.60 %	± 4.10	± 3.80	± 5.30	± 5.90	± 3.80	± 5.60	± 4.90	± 4.10
	(Variation)	-34.85	-37.32	-23.81	-20.65	-20.51	-25.24	-26.68	-31.99
Amino acid		NS	*	*	*	*	*	**	**
	10.92	10.50	8.18	20.72	13.75	22.17	19.28	9.63	9.53
	± 1.13 %	± 1.2	± 1.00	± 02.3	± 1.2	± 2.5	± 1.8	± 1.2	± 1.1
	(Variation)	-3.82	-25.12	-89.65	-25.9	102.91	76.51	-11.85	-12.75
Protease		*	**	NS	*	**	*	*	*
	0.14	0.25	0.17	0.15	0.10	0.12	0.09	0.07	0.05
	± 0.02%	± 0.04	± 0.01	± 0.02	± 0.01	± 0.01	± .005	± 0.005	± .002
	(Variation)	80.98	21.42	7.14	-28.57	-14.28	-35.71	-50.0	-64.28

Stastistical significance : * = $p < 0.01$; ** = $p < 0.05$; NS = Not significance.

The total body proteins of the snail, *I. exustus* due to LC 10 and LC 50 doses of the herbicide was found to be decreased after all exposure period. The total amino acid level of the snail, *I. exustus* reacted differently with different expoure periods. The content initially decreased, after 24 hours of exposure and then there was a steady increase upto 48 and 72 hours of exposures. But after 96 hours of exposure the content again decreased from both the groups. The protease activity was found to be increased after 24 hours of exposures but after 48, 72 and 96 hours of exposure the enzyme activity was found to be decreased. The result of the metabolities are summarized in Table II.

Proteins are the important organic cellular constituent forming a major part of the cell boundaries alongwith lipids. Amino acids are the building blocks of the proteins and their inter convertibility from other organic reserves through acetyl - co - A has primary importance. During stress conditions the protein synthesis and interconversion between amino acids, glucose and fatty acids to liberate energy get affected (Mane *et al.*, 1986). Reddy *et al.* (1991) have studied the effect of endosulfan on the protein metabolism of the freshwater crab, *Barytelphusa guerini* and they have noted the depletion of the proteins followed by a progressive accumulation of free amino acids. In the present study, the protein content showed depletion and amino acid level showed an increased pattern after 72 hours of exposure due to sodium pentachlorophenate stress in *I. exustus*. The depletion in the protein content might have stimulated proteolysis in the tissue by activating protease enzyme.

This depletion may constitute as a physiological mechanism and play a comprehensive role under pesticidal stress, to provide intermediates to Kreb's cycle or enhance osmolality, by retaining free amino acid content in the body fluid, to compensate osmoregulatory problems encountered due to leakages of ions and other essential molecules during stress conditions.

Under proteolysis, enhanced breakdown dominates over synthesis, while in the case of anabolic process, increase protein synthesis dominates the protein breakdown. Fluctuation in protein and amino acids levels due to herbicide stress is time dependent. Higher level of content may be attributed to decreased utilization of amino acids (Sheshagiri Rao *et al.*, 1987) and also in successive catabolism of protein or transamination of keto-acid (Shakoori *et al.*, 1976). In the present study, it was observed that the protease activity decreased after herbicide treatment. It is suggested that this decrease in the enzyme activity might be due to changes in the activity of phosphatases, rapid chemical bindings of enzymes with herbicides, decreased synthesis of protease, uncoupling of phosphorylation and increase in the metabolic activity during stress condition (Birk *et al.*, 1962; Swami *et al.*, 1983). Extension of these studies under chronic exposure would reveal the nature of dearrangement as possible indicators of herbicide toxicity.

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