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Effect of an Organochlorine and Three Organophosphate Pesticides on Glucose, Glycogen, Lipid, and Protein Contents in Tissues of the Freshwater Snail *Bellamya Dissimilis* (Müller)

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The extensive use of pesticides on crops and forests in recent years for the control of agricultural pests is causing serious problems on non-target organisms leading to a number of pathological and disturbed biochemical processes (Rashatwar and Ilyas 1984). Though there is information on alteration of enzyme systems during pesticide exposure the possible impact of pesticides on organic constituents is yet to be understood. Since normal organic constituents act as the key substrates for intermediary metabolism, a study of these components is essential to understand the changes brought about by the treatment with pesticides (Ahamad et al. (1979).

In the present investigation the effect of Endosulfan, Methyl parathion, Quinalphos and Nuvan (DDVP) on glucose, glycogen, lipid and protein contents of the viscera, mantle and foot at the end of 24h, 96h LC_{50}, and sublethal concentrations on the freshwater snail, Bellamya dissimilis (Müller) was studied.

MATERIAL AND METHODS

Short term tests of acute toxicity were performed over a period of 96h following flow-through bioassay on snail Bellamya dissimilis. The shell height ranged from 1.6 cm-2.3cm. Different concentrations of Endosulfan 35% EC (6,7,8,9,10,10-hexachloro-1,5,5a,6,6,9,9a-hexahydro 6,9-methano-2,4,3-benzo(e)dioxothiepin-3-oxide-supplied by M/s. A.P. Agro-Industries Development Corporation, Kurnool, India), Methyl Parathion (Metacid-50% EC-

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Dimethyl Phosphonitrophenyl Thiophosphate, supplied by M/s. Bayer India Ltd, Bombay), Quinalphos 25% EC (O,O-dimethyl O-quinaxolin-2yl phosphate - supplied by M/s.Premier Pesticides Private Ltd, Cochin, India), and Nuvan 76% EC (DDVP-2,2-dichloroethenyl O-O-dimethyl Phosphoric acid- ester-supplied by M/s. Hindustan Ciba Geigi Ltd, Bombay) were used. The recommendations for exposure given by USEPA (1975) were followed. The snails were exposed to 96h LC_{50} concentrations of Endosulfan, Methyl Parathion, Quinalphos, and Nuvan (DDVP). (96h LC_{50} are $1.8x10^{-5}$ g/l, $4.7x10^{-3}$ g/l, $1.9x10^{-3}$ g/l and $2.089x10^{-2}$g/l and sublethal concentrations (96h LC_{50} /10) respectively, as described earlier (Padmaja et al. 1988). The snails that survived at the end of 24h and 96h were shelled and dissected to separate viscera, mantle and foot. Controls (without pesticides) were also run simultaneously. Stock solutions of the active ingredients of endosulfan, and quinalphos were prepared in acetone, and that of metacid and nuvan were prepared in water. The desired concentrations of the insecticides in water were prepared by adding suitable aliquots of stock solutions to water in the reservoirs. Acetone was added to controls in an amount equal to the largest aliquot of the stock used in the test series in case of pesticides prepared in acetone. (Padmaja et al. 1988).

The biochemical constituents (glucose & glycogen) were determined in all the three major tissues by the colorimetric method of Kemp et al. and Mendel et al. (1954) respectively, the total lipid content by Pandey et al. (1963) and the total protein content by Lowry et al. (1951). Each group contained at least five animals and the results were expressed as arithmetic averages. The values were derived directly from a standard graph prepared with known concentrations of glycogen, lipid, and bovine serum albumen. The results were expressed as percentage values. The Students' 't' test was employed to compare the control and treatment means (Bailey 1959).

RESULTS AND DISCUSSION

The biochemical parameters (glucose & glycogen), total lipid and total protein contents decreased in all the three tissues in the pesticide exposed snails. This decrease was noticed at 24h exposed animals and was highest at 96h LC_{50} concentrations (Table 1). Similar trend was observed during exposure to sublethal concentrations, but the decrease was less when compared to LC_{50}concentrations (Table 2). In general, endosulfan, an

Table 1 The percentage decrease of glucose, glycogen, lipid and protein contents in the viscera, mantle and foot of B. disimilis exposed to 24 and 96h to 96h LC_{50} concentrations of endosulfan, methyl parathion, quinalphos and nuvan (DDVP) (n = 5).

Pesticide	T	Glucose 24 (h)	Glucose 96 (h)	Glycogen 24 (h)	Glycogen 96 (h)	Lipid 24 (h)	Lipid 96 (h)	Protein 24 (h)	Protein 96 (h)
	V	64.6 *	88.5 *	67.3 *	90.3 *	40.9 *	59.3 *	25.6 *	55.9 *
Endosulfan	M	55.5 *	85.4 *	52.5 *	76.8 *	28.8 *	49.6 *	24.0 *	61.6 *
	F	43.5 *	36.8 *	33.2 *	96.2 *	34.8 *	49.1 *	41.1 *	60.1 *
Methyl-	V	45.6 **	71.9 *	54.4 *	86.9 *	20.3 **	86.7 *	28.4 *	36.4 *
parathion	M	41.2 **	40.7 *	31.2 *	63.9 *	31.7 *	50.4 *	12.8 **	29.6 *
	F	38.8 *	73.6 *	31.2 *	49.3 *	19.6 *	70.9 *	19.7 *	31.6 *
	V	68.7 *	90.1 *	63.7 *	90.3 *	29.7 *	55.1 *	28.1 *	52.7 *
Quinalphos	M	54.2 *	86.9 *	55.4 *	71.2 *	26.0 *	44.3 *	42.6 *	55.6 *
	F	52.9 *	82.3 *	17.7 *	84.5 *	23.2 *	31.8 *	57.9 *	71.5 *
	V	37.4 *	63.7 *	55.6 *	62.9 ""	37.8 *	48.9 *	32.4 *	51.1 *
Nuvan	M	28.1 **	70.7 *	35.5 *	47.1 *	25.4 *	50.4 *	19.6 **	32.9 *
	F	22.2 **	52.9 *	39.4 *	61.9 *	34.1 *	50.0 *	36.2 *	57.3 *

T=tissue; V=viscera; M=mantle; F=foot.

* = $P<0.01$; ** = $P<0.05$; "" = $P>0.01$.

Table 2 The percentage decrease of glucose, glycogen, lipid and protein contents in the viscera, mantle and foot of *B.dissimilis* exposed to sublethal concentrations of endosulfan, methyl parathion, quinalphos and nuvan (DDVP) for 24 and 96h (n = 5).

		Glucose		Glycogen		Lipid		Protein	
Pesticide	T	24 (h)	96	24 (h)	96	24 (h)	96	24 (h)	96
Endosulfan	V	44.2 *	80.2 *	56.7 *	82.3 *	23.5 *	29.7 *	10.9 **	17.6 **
	M	43.8 *	69.1 *	41.7 *	63.9 *	18.3 *	24.8 *	16.7 *	20.2 *
	F	22.4 **	55.9 *	16.9 *	30.5 *	17.4 *	27.3 *	9.4 "	10.9 **
Methyl-parathion	V	15.6 "	43.8 **	38.0 *	62.9 *	17.0 "	37.2 *	5.5 "	7.9 "
	M	17.6 **	47.9 *	9.8 *	28.6 *	17.6 **	43.4 *	0.6 "	8.4 "
	F	10.6 "	35.3 **	9.1 *	34.7 *	10.9 "	32.7 *	12.2 **	16.1 **
Quinalphos	V	37.4 **	75.2 *	60.2 *	80.7 *	27.7 *	29.6 *	11.2 "	13.6 "
	M	43.8 *	64.2 *	37.7 *	61.3 *	15.5 *	20.4 *	22.4 *	29.9 *
	F	8.3 "	44.1 *	3.7 "	64.8 *	10.9 **	17.2 *	10.3 "	21.8 *
Nuvan	V	18.4 "	22.3 **	46.2 *	53.2 *	21.8 **	18.9 *	28.9 *	29.8 *
	M	34.6 *	38.2 **	52.5 *	53.1 *	11.3 "	23.9 *	16.0 *	23.2 *
	F	8.3 "	29.4 **	28.9 *	36.2 *	11.6 "	16.4 **	32.4 *	37.6 *

T = tissue; V = viscera; M = mantle; F = foot.

" = P>0.05; "" = P>0.01 * = P<0.01; ** = P<0.05.

organochlorine pesticide has maximum effect on biochemical constituents followed by quinalphos, an organophosphate pesticide.

Depletion of glucose and glycogen may be due to direct utilizartion of these compounds for energy generation, a demand caused by pesticide induced hypoxia. Earlier studies have shown a decrease in the oxygen consumption during pesticide stress in B. dissimilis (Padmaja and Rao 1991) and fish (Singh and Srivastava 1981). However, other mechanisms such as decreased glycogenesis and mobilization to other tissues cannot be ruled out. Formation of mucus film and changes in tissues responsible for gaseous exchange might have lead to hypoxic or anoxic stress resulting in anaerobic metabolism in the snail during pesticide exposure. (Padmaja K* (presently *RJ) thesis submitted for Ph.D. Dept. of zoology, Nagarjuna University, Guntur, A.P. India).

Decrease in tissue lipid and proteins under pesticide stress could be due to several mechanisms. These include a)formation of lipoproteins which are utilized for repair of damaged cell and tissue organelles b) direct utilization by cells for energy requirements and c)increased lypolyses (Ghosh and Chatterjee 1989). Damage to cellular organization has been noticed in B.dissimilis exposed to pesticides (Padmaja, Unpublished data 1991). However, more work needs to be done to understand which of these mechanisms is operating in the present system. Further inter and intra species variations should be taken into consideration for a proper understanding of the overall effect of environmental stress on biochemical alterations. (Eisler 1970).

Molluscs are important as not only vectors of helminth parasites but also rich sources of protein food to man as well as animals. They form an important link in the food chain of the aquatic systems. It is pertinent to mention here that the snail, Bellamya dissimilis is an economically important mollusc (used to feed ducks in Kolleru lake area A.P. India). It is also reported to be an important food item of some commercially important fishes Pangasius pangasius (David 1963) Tor tor (Desai 1970) and Puntius sarana (Sinha 1972). During recent years, due to increased agricultural activity in the area adjoining the lake, pesticide residue levels in the Kolleru lake had increased, particularly organochlorine residues (Padmaja, RJ., Unpublished data).

The present study shows as result of exposure to the pesticides the biochemical constituents were reduced. As a result of decrease in biochemical constituents growth and reproduction will be affected. Thus even low level of concentrations of pesticide residues in the biota would result in decrease of snail population which would inturn deprive the nutrition of aquatic fauna.

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