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Effect of endosulphan on biochemical parameters of fresh water snail *Viviparous bengalensis*

SOPAN LAXMAN ERANDE[1] AND SANJAY SHAMRAO NANWARE[2]

[1]Department of Zoology, K.S.K.W Arts Science and Commerce College, CIDCO, NASHIK (M.S.) INDIA
[2]Department of Zoology, Yeshwant Mahavidyalaya, NANDED (M.S.) INDIA
Email : slerande@rediffmail.com

Pesticides have unique position among crop protecting chemicals. The endosulfan an organochloride pesticide has ample application on account of its efficiency against a wide variety of insect pest. However, on its entry into aquatic bodies through runoff water, possibilities of gross alterations in physico-chemical profile of water cannot be ruled out. Blind used of pesticide bound to affect the non target organism like *Viviparus bengalensis.* In present study the toxic potential of endosulfan was assessed by acute static bioassay. The average LC_{50} values were determined for 24 hrs, 48 hrs, 72 hrs and 96 hrs. The glycogen and protein contain were depleted and lipids was found increased. The results were correlated with the increased consumption of reserve food in the foot, mantle, hepatopancreas and whole body tissues of the snail *Viviparus bengalensis.*

Key words : Bioassay**,** *Viviparous bengalensis*, Endosulfan

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INTRODUCTION

The primary source of pollution is waste waters containing toxic substances in the form of pesticide residue, heavy metal salts, oils etc. Modern civilization with its rapidly growing industrial units and an increase in the population, has lead to an accelerate degradation of the freshwater resources. The excess uses of pesticides which persistent in the soil and mixes with water during rainy season by agricultural runoff cause mortality at non-target organisms and also get accumulated in their tissues. These pollutants are likely to affect the biological systems in different ways according to their chemical properties. The sum of physiological changes created particular pollutants is likely to be characteristics of these pollutants. It might be possible to establish specific responses of that pollutant. From this it is easy to identify a pollutant on the basis of its physiological effect pattern (Sastry *et al.,* 1979; Jagtap *et al.,* 2009). It results in its biomagnifications. Most information of effect of pollutants on aquatic animals has been obtained from mortality study. Often very little is known about damage to different internal organs or about disturbed physiological and biochemical process within the organism following exposure to pollutants. A better understanding about mode of action of toxicant and cause of death poisoned aquatic animals we want to predict the potential harmfulness of various means of investigating sublethal effect of pollutants on aquatic animals which are used.

The toxic chemical causes stress to organism. The biochemical changes occurring in the body is the first indication of stress. To overcome the stress organism needs more energy. It is taken from reserved food material (glycogen, protein and lipid). If stress is mild only stored glycogen is used as a source of energy but when stress is strong then the energy stored in the form of protein and lipid may be utilized. Proteins are "building blocks of life" found everywhere in an organism (Lehninger, 1964). Carbohydrates are one of the important building blocks of the biosphere; they provide energy on oxidation to body tissues which is utilized for metabolic activities of a living being. Carbohydrates are considered to be the first among organic nutrients to be utilized to generate required energy (Heath, 1987). They serve as precursors for dispensable amino acids and some nutrients, which are metabolic intermediates necessary for growth (NRC, 1993). Lipids are diverse group of compounds many of which function as important sources of metabolic energy. They are simple glycerol based fats and oils play a vital role in terms of general nutrition (Jauncey, 1998). Lipids found in

foodstuffs and in fat deposits of many animals in the form of triglycerides which are esters of fatty acids and glycerol (McDonald *et al.*, 1989). Carbohydrates, proteins and lipids constituent play an important role in energy metabolism.

The frequency of changes in the composition of biochemical constituents of any organism varies with the fluctuations of pesticidal stress. Biochemical studies are good parameters which help to see the effect of pesticide on biochemical composition of vital tissue of freshwater snail. Hence, attempt has been made to find out biochemical changes such as glycogen, protein and lipid content in tissues like foot, mantle, hepatopancreas and whole body of freshwater snail, *Viviparus bengalensis.*

RESEARCH METHODOLOGY

The fresh water snails, *Viviparus bengalensis* were collected from Darna River at Nashik (M. S). The snails were acclimatized to the laboratory condition for two days prior to experimentation. The healthy snail's approximately same size and weight were selected for present investigation. The fresh water snails *Viviparus bengalensis* were exposed to median lethal concentration for acute treatment. The acclimatized snails were treated with median lethal concentration of endosulfan. The results were compared with control set. The snails were sacrificed for collection of tissue and used further for biochemical analysis. The snails were dissected and tissues *viz.*, foot, mantle, hepatopancreas and whole body were collected separately. The tissues were dried and powdered. The powder was used for biochemical analysis. The glycogen in the tissues was estimated by standard Anthrone method (Seifer *et al.*, 1950). The total protein content was estimated by Lowry's method (Lowry *et al.*, 1951) while the lipid content was estimated by vaniline reagent method (Barnes and BlackStoch, 1973).

RESEARCH FINDINGS AND ANALYSIS

The toxic potential of pesticide endosulfan was assessed by acute static bioassay. The average LC_{50} values were determined 3.5 ppm for 96 hours. The obtained results of total protein, glycogen and lipid content in fresh water snail, *Viviparus bengalensis* along with control set for 96 hours period of exposure is shown in Table 1 and Fig. 1, 2 and 3. The total protein, glycogen and lipid content in fresh water snail, *Viviparus bengalensis* is expressed in terms of unit mg/g dry wt.

The glycogen content in foot of *Viviparus bengalensis*

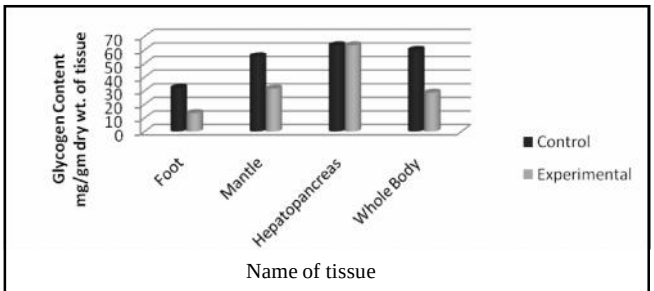

Fig. 1: Effect of pesticide on glycogen content in freshwater snail, *Viviparous bengalensis* at 96 hours period of exposure

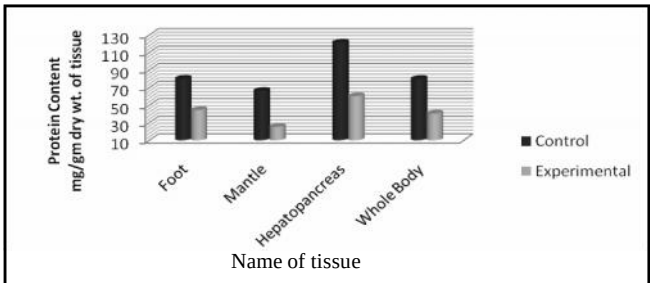

Fig. 2: Effect of pesticide on protein content in fresh water snail, *Viviparous bengalensis* at 96 hours period of exposure

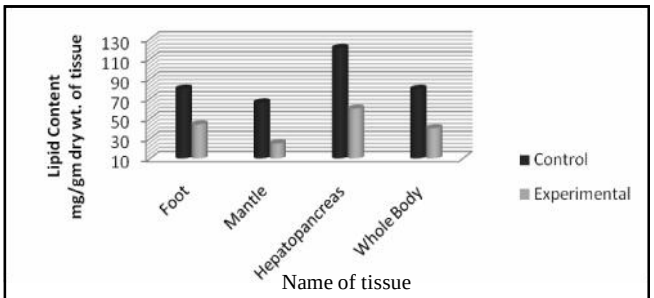

Fig. 3: Effect of pesticide on lipid content in fresh water snail, *Viviparous bengalensis* at 96 hours period of exposure

Table 1: The amount of glycogen, protein, lipid content in freshwater snail, *Viviparous bengalensis*

Biochemical content → / tissue ↓	Glycogen			Protein			Lipid		
Organ	Control	96 Hrs	%	Control	96 Hrs	%	Control	96 Hrs	%
Foot	32.16±0.577	13.633±0.247	-27.515	80.293±0.334	44.436±0.192	-44.664	51.267±0.311	88.369±0.111	72.368
Mantle	55.39±0.389	31.617±0.712	-42.918	66.443±0.205	25.303±0.098	-61.917	41.644±0.211	92.195±0.149	121.386
Hepato-pancreas	63.483±0.431	33.991±0.678	-46.456	121.22±0.555	60.278±0.137	-50.273	135.27±0.276	192.744±0.223	42.492
Whole body	60.071±0.171	28.621±0.196	-52.353	80.094±0.338	40.477±0.233	-49.462	75.685±0.232	112.418±0.224	48.532

(Each value is mean of three readings ± Standard Deviation)

was found to be decreased from 32.16 to 13.633 mg/g dry wt. The glycogen content of mantle was decreased from 55.390 to 31.617 mg/g dry wt. The glycogen content in hepatopancreas was also found to be depleted from 63.483 to 33.991 mg/g dry wt. The same decreasing trend was observed in whole body tissue of fresh water snail, *Viviparus bengalensis* as compared to control set. The observed values were from 60.071 to 28.621 mg/g dry wt. for acute treatment.

The total protein content in fresh water snail was also found to be variable in different tissues of *Viviparus bengalensis*. The total protein content in foot was found to be depleted from 80.293 to 44.436 mg/g dry wt. In mantle it was depleted form 66.443 to 25.303 mg/g dry wt. In hepatopancreas the total protein content was decreased from 121.22 to 60.278 mg/g dry wt. and that of whole body it was found to be decreased from 80.094 to 40.477 mg /g dry wt.

In foot of treated snail lipid content was found to increase from 51.267 to 88.369 mg/g dry wt. The lipid content of mantle was increased from 41.644 to 92.195 mg/g dry wt. In hepatopancreas lipid increased from 135.27 to 192.744 mg/g dry wt. While in whole body lipid increased from 75.685 to 112.418 mg/g dry wt. Pesticidal stress caused overall increased in lipid level of foot, mantle, hepatopancreas and whole body. Lipid content in control group was very high in hepatopancreas.

Change in the biochemical composition of tissue due to pesticide reflects in the utilization of their biochemical energy to counteract the toxic stress. The observed biochemical changes in the snail may be due to pathological effects of pesticide to the animal by changing its metabolic processes to overcome the toxic effect as a protective measure. Stored glycogen is immediate source of energy when required and in fresh water snail *Viviparus bengalensis* was altered indicating the stress of pesticide. The decrease in glycogen content was greater in hepatopancreas as compared to foot and mantle. This indicate that hepatopancreas is the principal metabolic center for various metabolic activities during stress. Significant decreases in the glycogen content of the hepatopancreas suggest greater glycolytic activity in the hepatopancreas than foot and mantle.

The decrease in glycogen content indicates shifting towards anaerobic metabolism. Carbohydrates are the first nutrient to be deputed and degraded in stress conditions imposed on animal (Clerk, 1975). According to Koundinya and Ramamurthy (1978) the decrease in glycogen may be due to enhanced break down to glucose through glycolysis. The decrease in glycogen level in the hepatopancreas induced glycolysis and glycogenolysis. The decreasing trend of glycogen level in foot and mantle was observed less as compared to hepatopancreas. Reddy (1987) and Ramanrao and Ramamurthy (1987) studied the effect of phosphomidon pesticide on glucose metabolism in different tissues and found decrease in total carbohydrate. Their significant utility to meet high energy demand and concluded both lethal and sub lethal concentration of phosphomidon increased in the oxidation of glucose through TCA cycle and enhanced both glycolysis and hexose monophosphate pathway to yield more number of ATP and NADPH molecule for detoxification. Reddy (1987) observed decreased glycogen level in prawn *Metapenaeus monocerous* after exposure to phophomidon, DDT, fenervalate. Chaudhari (1990) studied the effect of pesticide on biochemical composition of the snail *Bellamiya bengalensis* and found decreased in glycogen content.

Protein is an essential organic constituent of an animal tissue and plays an significant role in cellular metabolism, Cell membrane protein regulate the extra and intracellular media. All enzymes, co-enzymes intermediate proteins, amino acids are protein and are involved in metabolism. The protein content in foot, mantle hepatopancreas and whole body of snail *Viviparus bengalensis* shows significant decrease after pesticidal exposure. The impairment in protein synthesis, the decrease in total average protein content of tissue alter treatment suggest enhancement of proteolysis to meet the high energy demand under pesticidal stress (Kabeer, 1978). The fall in protein level during pollutant exposure may be due to increased in protein catabolism and decreased anabolism of protein. Ramanrao and Ramamurthy (1987) studied the protein content in the tissue of *Pila globosa* after exposing to sumithion. Shariff (1987) studied the effect of detergent on biochemical constituent and found decline of protein content and concluded that the decline may be due to increased activity of proteolytic enzymes. Vijay Kumar and Kannapundi (1989) studied the effect of phosphomidon of the mangrove crab *Sesarma andersion* (larvae) and found the decreased protein content after treatment. Chaudhari and Lomte (1990) and Sontakke and Lomte (1992) studied the biochemical variation in *Bellamiya benganlensis* and *Thira lineate*.

A marked fall of protein content in all tissue of snail indicates rapid breakdown of protein to meet the enzyme demand during pesticidal stress. The higher decrease in hepatopancreas was found as compared to foot and mantle due to high metabolic potency and efficiency of hepatopancreas. The literature cited in the text agreed with the present investigation for the decrease in protein content of pesticidal treated snail *Viviparus bengalensis.*

Lipid content was significantly increased in various tissues of *Viviparus bengalensis* due to exposure at acute treatment of phosphomidon. According to Gobbat (1978) in Lamellibranch molluscs the conversion of glycogen into fatty acid reserve via triose phosphate pathway in glycolytic sequence for the production of pentose sugar for nucleic acid synthesis as well as necessary intermediate for lipogensis. Swami (1993) suggested that shift in

carbohydrate and protein metabolism into lipid synthesis in fresh water mussel exposed to flodit and metacid.

The degradation of amino acid given to ketoacid provides the acetate units for lipogenesis. The acetyl Co-A condensate with existing fatty acid which may continue to increase the chain length of fatty acid and also consequent of esterification with glycerol results in the formation of lipid hence, possible mechanism of elevation of lipid might be due to increased the lipid synthesis including transformation of glycogen and protein into lipids, inhibition of lipase activity may be presumed to occur in the tissue of snail and this may account for increased level of total lipid in tissue of snail. The increased in lipid content alter by pesticide treatment was supported by Chaudhari (1990), Bhamre (1994), Shandilya (2009) and Vijaymohan and Nair (2000). In *Viviparus bengalensis* the pesticidal stress have inhibited the action of enzyme of lipid metabolism which causes the increase in total lipid content in tissues of freshwater snail, *Viviparus bengalensis*.

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