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Phosphomidon induced biochemical changes in fresh water snail, *Viviparous bengalensis* from darana river of Nasik district

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Pesticides have unique position among crop protecting chemicals. The phosphomidon an organophosphate pesticide has an ample application on account of its efficiency against a wide variety of insect pest which enters into aquatic bodies through runoff water. Blind use of pesticide bound to affect the non target organism like *Viviparus bengalensis*. The present research paper deals with the study of toxic potential of pesticide *i.e.* phosphomidon against fresh water snail, *Viviparus bengalensis.* The average LC_{50} values were determined up to the period of 96 hrs. The glycogen and protein contents were found to be depleted while lipid content was inclined. The results can be correlated with the increased consumption of reserve food in the hepatopancreas, mantle, foot and whole body tissues of the fresh water snail *Viviparus bengalensis.*

Key words : Bioassay**,** *Viviparus, Bengalensis*, Phosphomidon

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INTRODUCTION

The pollution of aquatic environment with pesticides has become a menace to the aquatic flora and fauna and is a problem of immediate concern. These pollutants contaminate the water and they are let out into the aquatic biota from industrial and agricultural areas. The level these pollutants are highly persistent which reaches to life fastly by threatening in terms of both space and time (Brack *et al.*, 2002; Diez *et al.*, 2002). The recent development of biomarkers whose study is based on the toxicology related to pollutants has provided essential tools for vigilant contamination monitoring (Korami *et al.*, 2000).

The excess use of pesticides in the soil mixes with water during rainy season by agricultural runoff. The excess pesticides cause mortality at non target organisms and also get accumulated in their tissues. 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. The present investigation tried to full fill the gap on the study on sub lethal effect of phosphomidon on aquatic animal *i.e.* freshwater snail, *Viviparus bengalensis.*

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. Carbohydrates are one of the important building blocks which provide energy on oxidation to body tissues. This energy is utilized for metabolic activities of a living being. They are the first among organic nutrients to be utilized to generate required energy. They serve as precursors for dispensable amino acids and some nutrients, which are metabolic intermediates necessary for growth. Lipids are diverse group of compounds also serves as an important sources of metabolic energy. They play a vital role in terms of general nutrition. Lipids found in foodstuffs and in fat deposits of many animals in the form of triglycerides which

are esters of fatty acids and glycerol. Carbohydrates, proteins and lipids constituent play an important role in energy metabolism (Lehninger, 1964; NRC, 1993; Heath, 1987; Jauncey, 1988; McDonald *et al.*, 1989).

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 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 before experimentation. The healthy snail's approximately same size and weight selected for the present study. The fresh water snails *Viviparus bengalensis* were exposed to median lethal concentration of phosphomidon. The results were compared with control set. The snails were sacrificed for collection of tissue and used further for biochemical estimations of total glycogen, protein and lipid content. The tissues from dissected snails such as foot, mantle, hepatopancreas and whole body were collected separately for biochemical analysis. The separated 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's *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 phosphomidon was assessed by acute static bioassay. The average LC_{50} values were determined 61.97 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.

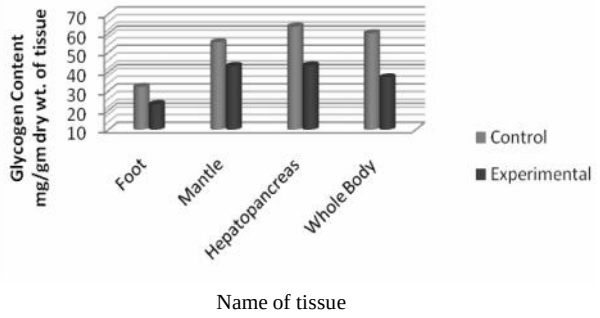

Fig. 1: Effect of pesticide on glycogen content in fresh water snail, *Viviparous bengalensis* at 96 hours period of exposure

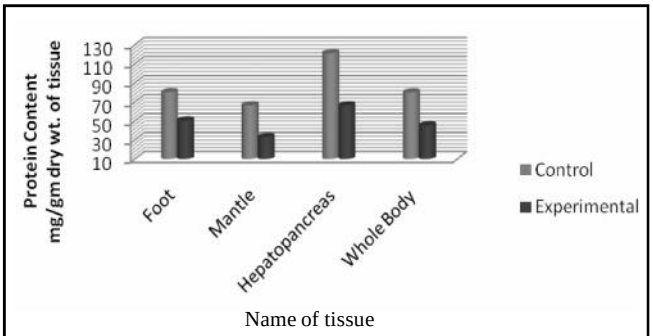

Fig. 2: Effect of pesticide on protein content in fresh water snail, *Viviparous bengalensis* at 96 hours period of exposure

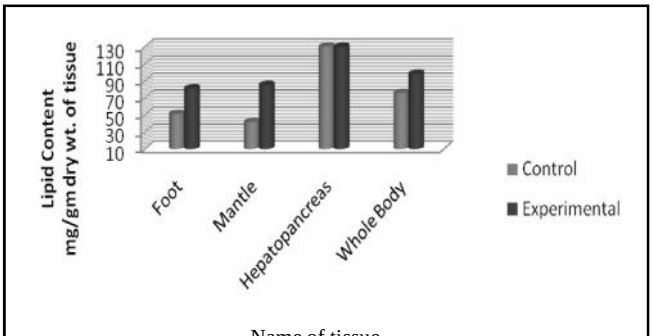

Fig. 3: Effect of pesticide on lipid content in fresh water snail, *Viviparous bengalensis* at 96 hours period of exposure

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	23.318± 0.341	-27.481	80.293± 0.334	50.647± 0.326	-36.921	51.267± 0.311	81.164± 0.316	58.314
Mantle	55.39± 0.389	43.116± 0.368	-23.964	66.443± 0.205	33.226± 0.582	-49.993	41.644± 0.211	85.219± 0.180	94.663
Hepato pancrease	63.483± 0.431	43.446± 0.505	-31.561	121.22± 0.555	66.283± 0.124	-45.319	135.27± 0.276	191.012± 0.168	41.212
Whole body	60.071± 0.171	37.162± 0.350	-38.135	80.094± 0.338	45.472± 0.169	-43.227	75.685± 0.232	98.224± 0.130	29.778

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

The glycogen content in foot of *Viviparus bengalensis* was found to be decreased from 32.159 to 23.318 mg/g dry wt. The glycogen content of mantle was decreased from 55.390 to 43.116 mg/g dry wt. The glycogen content in hepatopancreas was also found to be depleted from 63.483 to 43.446 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 to37.162 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 50.647 mg/g dry wt. In mantle it was depleted form 66.443 to 33.226 mg/g dry wt. In hepatopancreas the total protein content was decreased from 121.22 to 66.283 mg/g dry wt. and that of whole body it was found to be decreased from 80.094 to 45.472 mg /g dry wt.

In foot of treated snail lipid content was found to increase from 51.267 to 81.164 mg /g dry wt. The lipid content of mantle was increased from 41.644 to 85.219 mg/g dry wt. In hepatopancreas lipid increased from 135.27 to 191.012 mg /g dry wt. While in whole body lipid increased from 75.685 to 98.224 mg /g dry wt. Pesticidal stress caused overall increased in lipid level in test tissue. Lipid content in control group was very high in hepatopancreas.

The 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 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 the glycogen content of the hepatopancreas suggest greater glycolytic activity during pesticidal stress. 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 Ramamurthi (1978) the decrease in glycogen level in the hepatopancreas induced glycolysis and glycogenolysis. The decrease in glycogen level of foot and mantle was observed less as compared to hepatopancreas. Reddy (1987) and Ramanrao and Ramamurthi (1987) studied the effect of phosphomidon pesticide on glucose metabolism in different tissues and found decrease in total carbohydrate. Reddy (1987) observed decreased glycogen level in prawn *Metapenaeus monocerous* after exposure to phosphomidon, DDT, fenervalate. Chaudhari (1990) observed the effect of pesticide on snail *Bellamiya bengalensis* and found decreased in glycogen content. Similar results were reported by other workers (Chaudhari and Lomte, 1990; Mane *et al.*, 1986).

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). Vijaymohan and Nair (2000) observed significant decrease in protein content of muscle and liver of *Oreochromis mossambicus* exposed to titanium dioxide factory effluent. Vijay Kumar and Kannpundi, (1989) studied the effect of phosphomidon of the mangrove crab *Sesarma andersion* (larvae) and found the decreased protein content after treatment. Chaudhari (1990) and Sontakke and Llomte (1992) studied the biochemical variation in *Bellamiya benganlensis* and *Thira lineate*. The decrease in protein content in all tissues of the present paper indicates the process of proteolysis occurred 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.

Lipid content was found to be increased significantly in test tissue of *Viviparus bengalensis* due to exposure of pesticide. According to Gobbat (1976) 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 increased in lipid content alter by pesticide treatment was supported by many workers. In *Viviparus bengalensis* the pesticidal stress have inhibited the action of enzyme of lipid metabolism which caused by increased in total lipid content (Chaudhari and Lomte, 1990; Bhamare, 1994; Shandilya, 2009).

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