



EFFECT OF SEVIN ON THE GLYCOGEN CONTENT OF FRESH WATER SNAIL, *THIARA LINEATA*

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Abstract

Aquatic contamination by pesticides, arising as a result of their extensive use in agriculture and public health program. Carbamates are now a day increasingly used due to their biodegradable nature and less persistence in the environment. However, indiscriminate use of these pesticides for crop protection causes much damage to the aquatic fauna. The carbamate, Sevin, caused severe alterations in biological steps of aquatic snail, Thiara lineata. The snail is economically important which serves as an intermediate host of various trematod parasites, which causes severe diseases to human being as well as domestic animals. The gastropod mollusc, T. lineata is a filter feeder at secondary level of fresh water ecosystem. Hence, it felt necessary to study alteration in the levels of glycogen. The acclimatized, healthy, active and same sized mature adult animals were considered for an experiment. The three groups of ten snails each were exposed to sub-lethal concentration (0.913 ppm) of Sevin for 1, 7 and 14 days, simultaneously controls were run. The first group was sacrificed and different parts of the body, viz., gonad, hepatopancreas and foot were separated. From second group, reproductive tract and visceral organs (rest of the body) and from third group whole body was separated and total glycogen was estimated. The results were statistically analyzed and were found to be significant.

Keywords: *Thiara lineata, Sevin, Glycogen.*

Introduction:

Agricultural pesticide pollution is the greatest and most problematic source of pollution. Once pesticides are released in the environment certain pesticides are metabolised in short time where as other persists over longer period and can accumulate in the soil, water and ultimately reach to the tissue of the organisms. The present investigation has been undertaken to find out the effects of sub-lethal concentrations of Sevin on cellular metabolism in selected tissues, viz., whole body, gonad, hepatopancreas, foot, reproductive tract and rest of the body of a fresh water snail, *Thiara lineata* for 1, 7, and 14 days of exposure. the chemical changes occurring in the body give first indication of stress (Mayes, 1977). A number of changes in biochemical parameters of aquatic organisms due to pesticide toxicity have been noted by several investigators (Ramana Rao and Ramamurthi, 1978; Mule and Mane, 1989; Chaudhari and Lomte, 1992, Jadhav *et al.*, 1995; Lomte and Wakar, 2000; Ahirrao *et al.*, 2004; Ahirrao and Kulkarni, 2005; Ahirrao and Khedkar, 2012; Borale and Ahirrao, 2013)

MATERIALS AND METHODS

The active and healthy snails, *T. lineata* were collected from 'Bori' river at Tamaswadi (Taluka Parola, District Jalgaon, MS, India). The snails were brought to the laboratory and acclimated for four days. The snails were exposed to sub-lethal ($1/5^{\text{th}}$ of LC_{50} , 0.913 ppm) dose of sevin for 1, 7 and 14 day (Ahirrao and Khedkar, 2012) . All the experiments were conducted in day light rhythm. A concurrent control was maintained and the all experimental and control snails were fed once in a day. After specific exposure periods, the animals were sacrificed and different organs like whole body, reproductive tract, gonads, hepatopancreas, foot and rest of the body were separated. The separated tissue of organs made into dry powders by dehydrating in hot air oven at 58-60 °C for 72 hours. The tissue powders were homogenized in the respective media. Enough care was taken to prevent heat generation during homogenization by placing the homogenizing container in freezing mixture to estimate Glycogen by the method of Kemp *et al.* (1954). The physico-chemical parameters of the water were studied by method of APHA(1981).

Each observation was confirmed by taking three replicates. All values were expressed as mg/gm dry weight and subjected to statistically analysis according to Bailey(1965).

RESULTS.

The physico-chemical parameters of water used for holding the animal had temperature between 26-28 °C, pH 7.1 to 7.3, total hardness 140 to 150 ppm and DO of 5.6 to 7 ml/lit. The glycogen content in all the tissues under investigation was found decreased, which was statistically significant at 1, 7 and 14th day of exposure span.

On the 1st day of exposure, maximum depletion was observed in the whole body (-67.35%; P<0.001) followed by hepatopancreas (-44.2%; P<0.01), gonad (-33.50%; P, 0.01), reproductive tract (-6.053%; P<0.05), rest of the body (-3.161%; P<0.05) and foot (-2.985%; P<0.05).

After 7th day of exposure, a significant decline in the glycogen content was observed in all the tissues, the percent depletion as compared to the controls ranges from -19.988% to -68.02%. The maximum reduction in the glycogen level was observed in whole body (-68.02%; P<0.001) followed by hepatopancreas (-58.424%; P<0.001), gonad (-47.175%; P<0.001), foot (-29.91%; P<0.01), rest of the body (-27.116%; P<0.001) and the reproductive tract (-19.988%; P<0.01).

On the 14th day of exposure to toxicant maximum reduction being in the whole body (-78.68%; P<0.001) followed by foot (-68.222; P<0.001), hepatopancreas (-65.963%; P<0.001), reproductive tract (-65.962; P<0.001), gonad (-50.112%; P<0.001) and rest of the body (-42.092; P<0.001). All result were found to be statistically significant, as shown in the table 1

The order of decrease in glycogen content in all the tissue was:

After 1st day:

Whole boly > Hepatopancease > Gonad > Reproductive tract > Rest of the body > Foot.

After 7th days:

Whole boly > Hepatopancease > Gonad > Foot > Rest of the body > Reproductive tract

After 14th days:

Whole boly > Foot > Hepatopancease > Reproductive tract > Gonad > Rest of the body

DISCUSSION

Glycogen, is perhaps the first organic constituent to be utilized under stress conditions, is found to drastically decrease during the entire exposure span indicating its utilization during exposure to Sevin (Rao and Rao, 1979). The disturbance in glycogen profile was considered as one of the most outstanding biochemical lesions was due to the action of pesticides (De Bruin, 1976). The result shows that the glycogen is very sensitive indicator of Sevin toxicity, in the sense that even one day an exposure to Sevin, considerable decrease in its content was noticed in all the tissues. Quite surprisingly glycogen depletion in the whole body for one day exposure was found to be maximum as compared to hepatopancreas. The decrease in glycogen content suggests its mobilization to meet the energy demand warranted by toxic environment (Wassermann *et al.*, 1970). Pesticides are known to impose hypoxic conditions in organisms (Siva Prasada Rao, 1980), which may contribute to the acceleration of anaerobic glycolysis, thereby resulting in depletion in glycogen reserves. Decrease in hepatopancreas glycogen could be due to the decreased synthesis or an increased utilization through glycogenolysis.

The gradual depletion of glycogen in these tissues reflects that a certain amount of resistance is offered during Sevin toxicosis and as a result the time dependent decrease in the metabolite was being observed. The overall trend of glycogen depletion in tissues also reflects the complex role of the tissue in the elimination of toxic waste products during pesticide intoxication. Under Sevin pesticide toxicity the aerobic respiration in the tissues is impaired and energy is derived from anaerobic respiration resulting in rapid glycogen utilization leading to its depletion in tissues. Depletion of the glycogen in the present study could also be attributed to the onset of hypoxic or anoxic conditions in the snail. Under hypoxic conditions, the animal derives its energy from the anaerobic breakdown of glucose, which is available to the cells by the increased glycogenolysis.

The cause for disturbance in glycogen profiles is one of the most outstanding biochemical lesions due to the action of many pesticides. Earlier studies in heptachlor exposed fish (Konar, 1970) support to the present investigations. Glycogen depletion could also be attributed to the failure of hormonal release and the activation and inactivation of hormonal mediated enzymes concerned with glycogenolysis and glycogenesis.

The general decrease in the glycogen level as observed in the present investigation and recorded by other workers in different species may be due to the onset of hypoxic condition either at the organism level or in the vicinity of organ systems, as observed in copper toxicity (Balavenkatasubbaiah *et al.*, 1984) in *Tilapia mossambica* as well as in Aldrin exposed *Channa punctatus* (Sastry *et al.*, 1992); Endrin intoxication in *Cerassius auratus* (Grant and Mehrle, 1970); Endosulfan toxicity in *Barytelphusa guerini*(Reddy *et al.*,1991) and *Channa Punctatus*(Sastry and Siddiqui, 1982); Lindane intoxication in *Heteropneustes fossilis* (Srinivastava and Mistra, 1982) observed decreased glycogen content. Ramana Rao and Ramamurthi (1978) also found the decrease glycogen content in Sumithion exposed apple snail, *Pila globosa*. Similar results have observed by Patil *et al.*,(1993,1995) in *Thiara lineata* when exposed to Zolon, Endocel and Sevin; Chaudhari *et al.*,(1999) in *Thiara lineata* exposed to Rogar, Rao *et al.*, (1995)in *Indoplanorbis exustus* exposed to Decis (Deltamethrin); Lomte and Waykar (2000) observed disturbance in glycogen profile was considered as one of the most remarkable biochemical change due to action of pesticide in the bivalve *Parreyssia cylendrica*.

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Table 1: Glycogen content in the tissues of *T. lineata* exposed to sublethal dose of sevin

Tissue	Control	Experimental (Exposure span in Days)		
		1	7	14
Whole body	197.00 ± 29.69	64.32 ± 12.94 (-67.350) ***	63.00 ± 13.43 (-68.020) ***	42.00 ± 15.22 (-78.680) ***
Reproductive tract	210.12 ± 23.99	197.4 ± 13.44	168.12 ± 10.44	71.52 ± 15.76

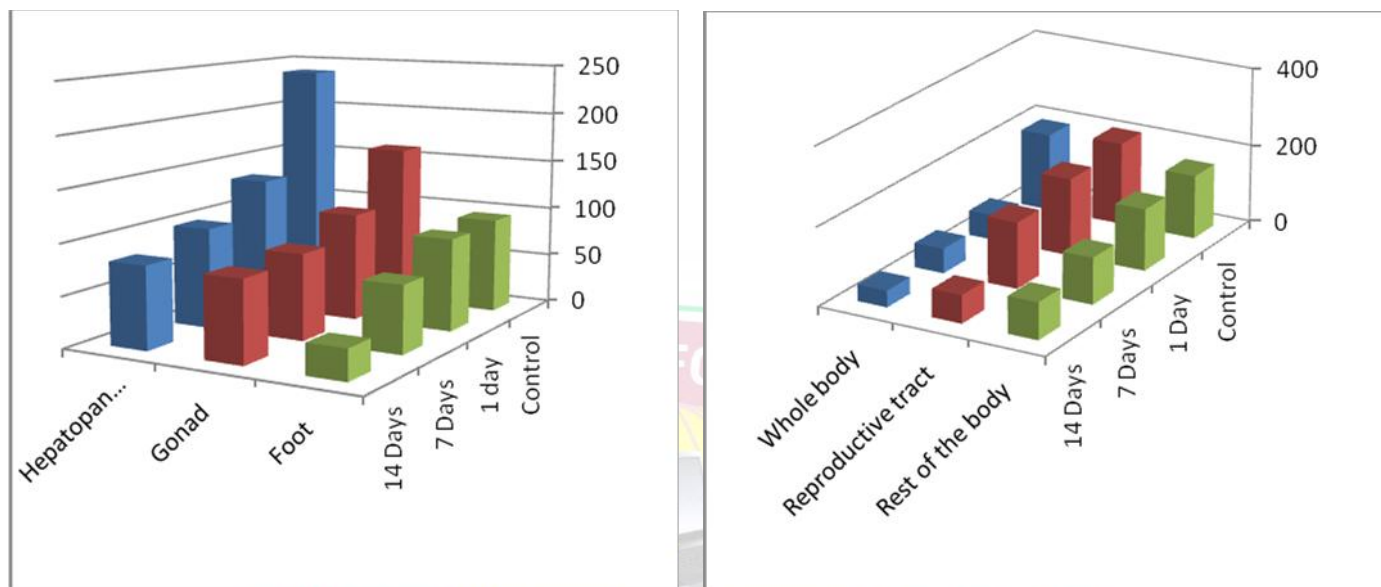
		(-6.053) *	(-19.988) **	(-65.962) ***
Hepatopancreas	238.12 ± 32.12	132.87 ± 13.56 (-44.200) **	99.00 ± 13.56 (-58.424) ***	81.05 ± 14.20 (-65.963) ***
Gonad	160.00 ± 14.42	106.4 ± 10.22 (-33.50) **	84.52 ± 11.12 (-47.175) ***	79.82 ± 9.988 (-50.112) ***
Foot	94.28 ± 10.26	91.46 ± 2.12 (-2.985) *	66.08 ± 5.41 (-29.910) **	29.96 ± 8.64 (-68.222) ***
Rest of the body	162.26 ± 12.33	157.13 ± 11.22 (-3.161) *	118.26 ± 9.66 (-27.116) ***	93.96 ± 10.22 (-42.092) ***

Values Expressed as mg/gram dry weight of the tissue. Each value is a mean of three observations ±

Value indicated in parenthesis is present changes over control; (+) and (-) indicate percent increase and decrease respectively.

Values are significant at ; *=P<0.05, **=P<0.01 and ***=P<0.001

Fig. 1 Graphs showing changes in the glycogen content of the snail, *Thiara lineata* due to the impact of Sevin.



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