Biochemical Alterations in Glycogen Content of Freshwater Snail, *Bellamya bengalensis* due to Cypermethrin Intoxication

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ABSTRACTS

Effect of sub lethal concentration of pyrethroid pesticides Cypermethrin on ovary of aquatic snail, *Bellamya bengalensis* was evaluated. The histochemical and biochemical analysis for 15 days exposed snail was made in the present work. The amount of biochemical components was greatly influenced in the range of 9.31% to 53.69% by Cypermethrin which causes depletion in glycogen level. The maximum depletion of glycogen content observed during the pre-reproductive period after 15 days of exposure span.

Key words: Cypermethrin, Bellamya bengalensis, Ovary, Glycogen.

INTRODUCTION

Cypermethrin, a synthetic pyrethroid, used extensively in households, industrial and agriculture fields for the control of several insect pests (Tiwari et.al., 2012). Due to overuse use, cypermethrin makes their entrance into natural water bodies through agriculture run-off and ultimately affects the several non target aquatic organisms and inhibits growth and several metabolic activities (Li et.al., 2005).

Due to the pesticidal stress biochemical changes are occurring in the body, to overcome the stress body requires extra energy. The different anthropogenic activities toxicants were added in the water which changes composition of biomolecules (Nandurkar and Zambre, 2011).

Carbohydrates are the major source of energy for vital activities of organism. Glycogen is the stored food material in animal tissue which is used as an immediate source of energy when required and is an essential feature of the normal organism metabolism (Thunberg and Manchaster, 1972.)

Wolansky et.al, (2006) and Singh et.al., (2008) observed high mortality at lower doses of synthetic pyrethroids and are less toxic to non-target animals, especially mammals (Shafer et.al., 2005). Although considerable data on insecticidal activity of pyrethroids are available, yet there is lack of information on the molluscicidal activity of pyrethroids. The effect of pyrethroids cypermethrin and deltamethrin on the snail *Lymnaea acuminate* was observed by Singh et al., 2010.

The structure and function of the reproductive tract of snails and slugs have been studied with increasing interest in recent years. The functions of different reproductive organs have also been investigated (Lavioletta 1954; Arionidae and Quattizini 1967; Plesch *et al*. 1971; Nanaware 1975; Bhatlawande 1989;

Ahirrao and Kulkarni, 2011; Jagtap et.al. 2011; Ahirrao and Phand, 2013; Ahirrao and Borale, 2014, Ahirrao and Phand (2015 and 2017) and Ahirrao (2018).

The biochemical and physiological effects of the Pyrethroid compounds are not fully understood in molluscs from the metabolic point of view. Considering from all possible angles present study attempt has been made to investigate the change in glycogen level in the ovary of freshwater snail, *Bellamya bengalensis* exposed to sub lethal concentration of Cypermethrin.

MATERIALS AND METHODS

The freshwater prosobranch snail, *Bellamya bengalensis* were collected from Aner Dam near Shirpur, Dist. Dhule, Maharashtra (India) and maintained in the laboratory condition for acclimation. LC_{50} values for 24 hr were determined by exposing the snails to pesticides cypermethrin during breeding season. A group of 25 animals were released into 0.0011 ppm cypermethrin concentration in water. After treatment the animals were sacrificed after 1, 7 and 15 days of exposure during pre-reproductive, reproductive and post-reproductive periods. The snails were subjected to pyrethroid, cypermethrin at 9.00 a.m. every time and were sacrificed only during morning hours between 8 to 9 a.m. in order to avoid changes in the concerned parameters due to circadian rhythms (Shankaraiah, 1978).

The tissues were subjected into alcoholic Bouin's fluid for detection of glycogen. For Histochemical detection of glycogen Best's Carmine method (Glick, 1949) was used as described by Pearse (1961). For biochemical estimations dry powder was used and its weight was kept practically constant through the experimental work. Glycogen was estimated by Kemp et.al. (1954). Experimental data was analyzed statistically by adopting statistical method (Pillai and Sinha, 1968). Each value given here is the mean and standard deviation of three different preparations and each preparation was assayed three times. A variation was considered significant at 5% level of probability.

RESULTS AND DISCUSSION

The freshwater snail, *Bellamya bengalensis* show the marked histochemical changes after 1, 7 and 15 days of exposure during pre-reproductive, reproductive and post-reproductive periods. The biochemical estimation of glycogen in the ovary after 1 day exposure a considerable depletion in glycogen content was observed during ore and post-reproductive period where as in reproductive period significant increased was observed. After 7 and 15 days of exposure, significant decrease was found to be noticed.

The percent depletion of glycogen amount as compared to control during investigation was found in the range of 9.31 % to 53.69 %. The maximum decrease was found during the pre-reproductive period upon 15 days of exposure (53.69 %, $P<0.001$).

The different cell types of reproductive tract store excess food in the form of glycogen. This food is required during adverse conditions of the nature. The glycogen is the most suitable reserve carbohydrate in invertebrate. Stellen and Stellen, (1956) observed the nutrible glycogen percentage in the whole body of *Siphanaria japonica* and they was found to be high. Glycogen is the prime source of energy for carrying out various life activities but due to the pesticide stress, the prime energy source is affected severely, and it was a negative effect on various processes in the clam's body (Sanjay and Deepak (2003). The glycogen was being more during pre-reproductive period in *Bellamya bengalensis*, as the stored glycogen might be

utilized for the formation of reproductive components and due to this the decrease in concentration during post reproductive period. The stored glycogen was the ultimate source of energy during reproductive period. Similar results were obtained by Kulkarni and Shinde (1992); Ahirrao and Kulkarni (2011); Ahirrao and Phand (2013); Ahirrao and Borale (2014); Ahirrao and Phand (2015 and 2017); Ahirrao (2018) and Sonawane and Sonawane (2018).

The above results show that the glycogen is very sensitive marker of pyrethroid toxicity, in the sense that within one day of exposure considerable decrease in glycogen was noticed. Quite surprisingly during reproductive period an initial increase and then gradual decrease in level of glycogen was observed in ovary. This initial increase may be due to stress condition to obtain more glucose from food stuff and further decrease in the content is being longer exposure to toxicant. The decrease in glycogen content suggests its utilization to meet energy demands caused by toxic conditions.

The present investigation shows that the glycogen is very sensitive toxicity marker for cypermethrin, in the sense that within one day of exposure considerable decrease in glycogen was noticed. The depletion in glycogen content suggests its utilization to meet energy demands caused by toxic conditions.

Period	Control	1 Day	7 Day	15 Day
Pre-Reproductive	11.38 ± 1.30	10.32 ± 1.48 – 9.31 *	9.80 ± 1.40 – 13.88 *	5.27 ± 1.54 – 53.69 * * *
Reproductive	16.48 ± 1.28	19.00 ± 1.37 + 15.29 *	14.30 ± 1.19 – 13.23 *	10.67 ± 1.18 – 35.25 * * *
Post-Reproductive	19.88 ± 1.24	17.91 ± 1.63 – 9.90 *	16.87 ± 1.42 – 15.14 *	11.51 ± 1.34 – 42.10 * * *

***P < 0.05, **P < 0.01 and ***P < 0.001**

Table : Effect of Cypermethrin on Glycogen contents of Ovary in freshwater snail, *Bellamya bengalensis* in mg %.

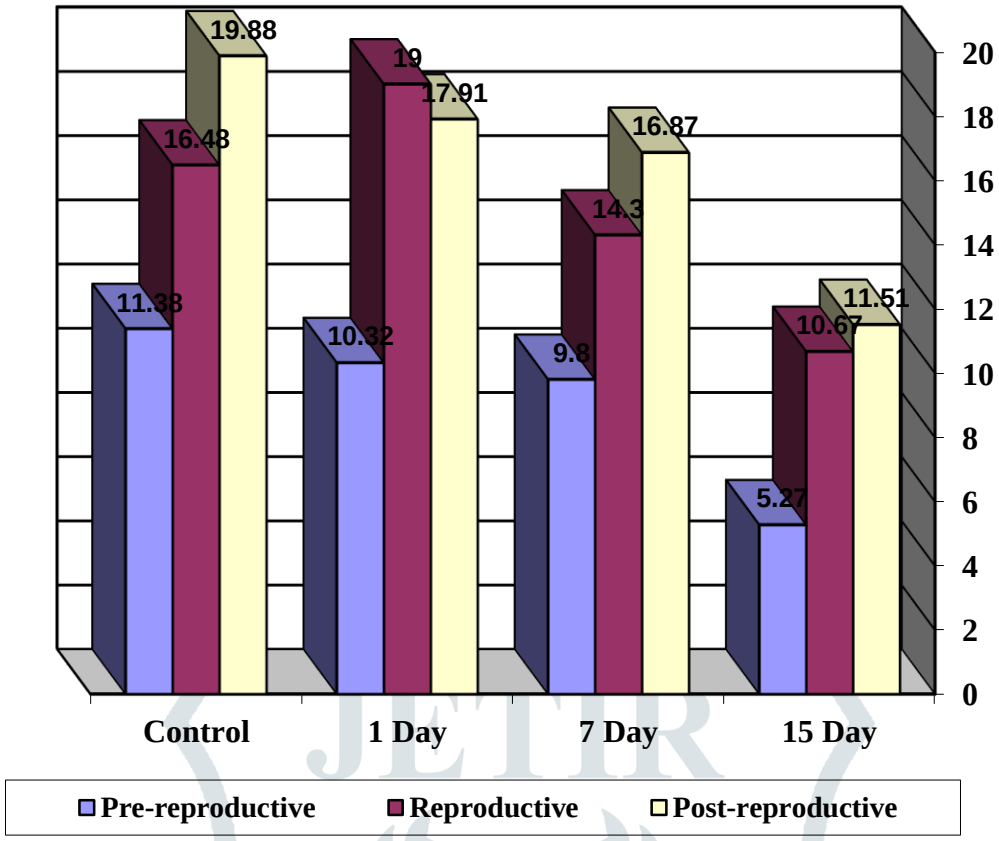

Fig. : Effect of Cypermethrin on Glycogen contents of Ovary in freshwater snail, *Bellamya bengalensis* in mg %.

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