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Research Article

A Study of lambdacyalothrin intoxication on protein content of fresh water bivalve *Lamellidens marginallis (Lamarck)*

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ABSTRACT

The effect of L-ascorbic acid in the detoxification due to lambdacyalothrin intoxication in the protein content in gills, gonads, digestive gland tissues of fresh water bivalve *Lamellidens marginallis* (lamarck) has been studied. These bivalves were exposed to acute (24 and 96 hours) and chronic (4, 7, 14 and 21 days) dose of lambdacyalothrin with and without ascorbic acid. Protein content from gills, gonads, digestive gland of control and experimental bivalves from different group were estimated after 4, 7, 14 and 21 days. After 4, 7, 14 and 21 days lambdacyalothrin treated bivalves were allowed to recover in normal water with and without ascorbic acid and protein content was estimated. Protein content was found to be more in different tissues exposed to lambdacyalothrin with ascorbic acid as compared to lambda cyalothrin without ascorbic acid. Bivalves showed fast recovery with ascorbic acid in comparison to normal water recovery.

Key words: Bivalve, *Lamellidens marginalis,* lambdacyalothrin, L- Ascorbic acid, Protein.

INTRODUCTION

Agricultural and Industrial revolution is taking place in today's world to fulfil the needs of the rising population. The demand of synthetic chemicals such as pesticides, fertilizers, biocides and many industrial by products are increasing as population is increasing and creating pollution problems. Therefore marine and freshwater organisms are affected by anthropogenic activities. Based on the target species the pesticides are classified as insecticides, rodenticides, molluscicides, herbicides, fungicides, nematocides etc. The pesticides on the basis of chemical composition are divided into four groups as organophosphorous pesticide, organochlorine pesticide, carbamates and synthetic pyrethoids. In the present study, the pesticide lambdacyalothrin, a synthetic pyrethoid is used to study its effect on the biochemical changes in the body of Molluscs. Molluscs are the soft bodied aquatic animals. About 1,12,000 species of the molluscs are known to the mankind. They belong to class Lamellibranchiata. These are the most abundantly found in fresh water of India. The Indian freshwater forms of mussels include the genera such as *Lamellidens*, *Indonaia*, *Pseudodon*, *Parreysia*, *Balwantia*, *Corbicula*, *Physunio*, *Unio* etc. Sessile lifestyle, resistance to stress, filter feeding mechanism, high accumulation potential of a wide range of contaminants, and suitability as a model for toxicity testing are useful characteristics of fresh water bivalves for biomonitoring studies[2] . These bivalves are the source of food for human beings in various parts of the world such as China, Japan, Malaya, Europe and America. These are also having economical importance as these are used in the production of toys, ornaments and utility articles. Such economically and commercially important bivalves have been continuously exposed to Pesticides like lambdacyalothrin, methomyl etc. These pesticides are very toxic to the living organisms as they accumulate in the tissues, get biomagnified, and modify their composition, patterns of distribution, biological cycles and alter the physiological responses of

individual species. Pesticides also have significant impact on unicellular organisms like planktons being consumed by aquatic invertebrates like bivalves and fishes, the residues of pesticides and in the food chain. The toxic effect of pesticides on physiological and biochemical aspects of gastropod molluscs have been studied time to time but adequate attention is not provided to pesticide effect on economically important species of freshwater bivalves such as *Lamellidens*. Waykar and Pulate observed the physiological disturbances arising in animals after exposure to pesticides exhibits trends towards normalization and this rate of recovery from pesticide induced damage is faster on exposure to L-ascorbic acid indicating the preventive and curative property of the L-ascorbic acid against the pesticide induced damage. Thus similar results have been observed in the present study also. Thus it is evident that vitamin C not only confirm protection against pesticide toxicity but can also perform therapeutic role against pesticide toxicity in molluscs.

MATERIALS AND METHOD

Experimental Design: Set- I

1. Group 'A' was maintained as control.
2. Group 'B' animals were exposed to subacute treatment (LC 50/2 values of 96 hrs) of lambda-cyalothrin (0.75 PPM) upto 96 hrs
3. Group 'C' animals were exposed to subacute treatment of lambda-cyalothrin (0.75 PPM) along with 50 mg / litre L ascorbic acid upto 96 hours.
4. Group 'D' animals were exposed to subacute treatment of lambda-cyalothrin (0.75 PPM) along with 100 mg/ litre L ascorbic acid upto 96 hours.

Experimental design for recovery: Set- II

1. Group 'B' animals exposed to lambda-cyalothrin for 96 hours from set divided into three groups for recovery study
2. Group 'E' animals pre-exposed to lambda-cyalothrin were allowed to cure self normally in untreated fresh water up to 21 days.
3. Group 'F' animals pre-exposed to lambda-cyalothrin, were allowed to cure in 50 mg /litre ascorbic acid in fresh water up to 21days.
4. Group 'G' animals pre-exposed to lambda-cyalothrin were allowed to cure in 100 mg/litre ascorbic acid in fresh water up to 21days.

During experimentation animals were fed on fresh water algae. After every 7th,14th and 21st days interval, animals from set-I and set-II were, dissected and tissues such as gills, gonads and digestive gland were dried at 80ºC in an oven till constant weights were obtained. The total protein levels in dried powders of gills, gonads and digestive gland of control and experimental animals were estimated by the method of Lowry et.al., 1951.The amount of total protein content was expressed in terms of mg of protein/100mg of dry weight of tissue. Each observation was confirmed by taking at least three replicates[1].

RESULTS AND DISCUSSION

The present work was designed to find out the effect of pesticide lambdacyalothrin on protein content from gill, gonad and digestive gland of the freshwater bivalve *Lamellidens marginallis*. The protein content of gill, gonad and digestive gland of the freshwater bivalve *Lamellidens marginallis* were found to be decreased after exposure to lambdacyalothrin. The results have been shown in the Table 1. Proteins play a significant role in cellular metabolism, because as a constituent of cell membrane proteins regulate the process of interaction between intra and extra cellular media. As enzymes, proteins participate in the intricately balanced subcellular functions. Protein metabolism, which involves interaction concerning proteins, amino acids and many enzymes and coenzymes have been extensively studied in many animal systems[3]. Ramanarao and Ramamurthi studied the protein contents in the tissues of *Pila globosa* after exposing it to sumithion. Mule studied the alterations in protein content after exposure to monocrotophos, cypermethrin and some heavy metals. In the present study the higher depletion of protein in the digestive gland might be due to high metabolic potency and efficiency of the gland when compared to other tissues like gills and gonads tissue of the bivalve. A marked fall in the protein level in all tissues indicates a rapid initiation of breakdown of protein. To meet energy demands during toxic stress, mobilization of protein might have taken place[6]. It is possible that in tissues exposed to pesticide a high demand of energy for maintenance of osmotic balance which have resulted in decreased level protein was observed in Lamellidens marginalis[9]. The same observation was observed in total protein content of all tissue of fresh water bivalve, Parreysia cylindrica after cypermethrin exposure[21]. The acute and chronic exposure to tetracycline and chloramphenicol, L.corrianus showed decrease in protein levels, in proportion with the period of exposure[11]. The decrease in average total protein content of tissue after treatment suggests enhancement of proteolysis to meet the high energy demands under heavy metal or other stress. The percent decrease in protein after acute and chronic exposure of pesticides might be due to over exertion or activity of muscle under pesticide stress. The increased protease activity in fresh water bivalve, Parreysia cylindrica after pesticide treatment[18].

Table No. 1
Protein content in selected tissues of *Lamellidans margianlis* after acute exposure to Lambda cyalothrin without and with Ascorbic acid during recovery (Value represent percentage in dry weight)

Treatment		Tissue	24 hrs	96 hrs	Recovery			
					4 days	7 days	14 days	21 days
Control		Gill	59.59 ± 0.61	59.29 ± 0.97				
		Gonad	52.69 ± 1.02	51.85 ± 0.96				
		D.gland	54.53 ± 0.89	53.89 ± 0.45				
Lambda cyalothrin		Gill	50.37 ± 1.07 -15.45	34.85 ± 0.85 -41.22				
		Gonad	45.45 ± 0.67 -13.74	32.94 ± 0.54 -36.46				
		D.gland	43.72 ± 0.75 -19.83	29.49 ± 0.82 -45.27				
Lambda cyalothrin 50 mg/L A.A.		Gill	53.64 ± 0.93 -9.98	41.42 ± 0.64 -30.14				
		Gonad	48.94 ± 0.97 -7.11	37.12 ± 0.67 -28.40				
		D.gland	46.90 ± 0.72 -14.00	36.91 ± 0.42 -32.09				
Lambda cyalothrin 100 mg/L A.A.		Gill	55.89 ± 0.89 -6.19	43.34 ± 0.81 -23.90				
		Gonad	50.08 ± 0.62 -4.95	39.04 ± 1.01 -24.70				
		D.gland	48.68 ± 0.78 -10.73	38.64 ± 0.42 -28.30				
After 96 hrs exposure to Acute Lambda cyalothrin	Normal water	Gill			36.51 ± 0.84 +25.02	39.39 ± 0.86 +13.02	43.24 ± 0.72 +24.06	49.96 ± 0.05 +43.36
		Gonad			35.74 ± 0.86 +23.74	37.37 ± 0.04 +13.44	39.84 ± 0.10 +20.93	46.04 ± 1.09 +39.74
		D.gland			33.67 ± 0.85 +15.09	36.42 ± 0.02 +23.48	38.76 ± 0.12 +31.42	45.16 ± 0.20 +53.11
	Normal water ±50mg/ L AA	Gill			39.95 ± 0.93 +33.02	46.62 ± 0.13 +33.77	50.80 ± 0.03 +45.77	59.19 ± 1.05 +69.84
		Gonad			40.38 ± 0.78 +45.05	42.79 ± 1.02 +36.57	48.43 ± 0.88 +47.00	51.20 ± 1.03 +55.40
		D.gland			43.59 ± 0.58 + 53.42	47.79 ± 1.71 + 62.04	51.08 ± 2.00 + 73.20	53.77 ± 0.98 + 82.31
	Normal water ±100mg / L AA	Gill			48.69 ± 0.62 + 48.62	54.76 ± 1.00 + 57.13	59.18 ± 2.00 + 69.66	57.58 ± 1.00 + 65.22
		Gonad			45.39 ± 0.86 + 39.85	48.34 ±0.94 + 46.71	51.67 ± 1.02 + 56.84	52.74 ± 2.0 + 60.09
		D.gland			49.46 ± 1.05 + 68.56	51.34 ± 1.04 + 74.06	52.95 ± 0.99 + 79.51	54.97 ± 0.87 + 86.38

1. Values expressed as mg/100 mg dry wt. of tissue.
2. (+) or (-) indicate percent variation over control.
3. ± indicate Standard deviation of three observations.
4. Values are significant at *=P<0.05;**=P<0.01;***=P<0.001; NS= Not Significant.

The proteolytic activity seems to be high due to increased transaminase activity[16] by which amino acids can be catalysed in the TCA cycle as keto acids[4]. A marked fall in the protein level in all tissues indicates a rapid initiation of breakdown of protein. The significant decrease in total protein content in foot, hepatopancreas and gills of the fresh water mussel, Lamellidens corrianus on exposure to organochlorine insecticide, hildan[5]. Pandit SV and Mundhe AY also observed the same results. Decrease in protein content was possibly due to stress conditions caused by toxicity of indoxacarb on protein metaboloism or due to enhanced proteolytic activity as a consequence of increased metabolic demands following exposure to the toxic stress of indoxacarb[13]. The same trend of reduction in protein content was observed which suggests an increase in the proteolytic activity and possible utilization of its products for metabolic purpose[10,15,17,24.] Fall in the protein level during exposure may be attributed to increased catabolism and decreased anabolism of protein due to toxic stress of monocrotophos[13]. In the present study, there was a significant decrease in the protein content in various tissues of experimental freshwater bivalves as compared to control fresh water bivalves. The protein content was more in pesticides with ascorbic acid exposed bivalves as compared to those exposed only to pesticide

lambdacyalothrin. The bivalves showed fast recovery of tissue protein in presence of ascorbic acid than those allowed to cure naturally as shown in table 1.

CONCLUSION

It may be concluded that the physiological disturbances arising in animals after exposure to pesticides exhibit trends towards normalization and this rate of recovery from pesticide induced damage is faster on exposure to L-ascorbic acid indicating the antioxidant property of ascorbic acid in curing the damage caused to bivalve due to exposure to pesticide. Thus the results obtained in the present study indicate severe disturbances in the protein metabolism of the bivalve, Lamellidens marginallis exposed to lamdacyalothrin and fast recovery in the presence of ascorbic acid.

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