ISSN: 2277-5536 (Print); 2277-5641 (Online)

BIOCHEMICAL ALTERATIONS IN PROTEIN CONTENTS OF FRESHWATER BIVALVE, *LAMELLIDENS MARGINALIS* AFTER EXPOSURE TO THIAMETHOXAM AND TRIAZOPHOS.

Rane Minakshi, Mahajan A.Y. and Zambare S. P.
Department of Zoology, D. N. College, Faizpur, Tal.-Yawal, Dist –Jalgaon-425503, (M.S), India.
Department of Zoology, Dr.Babasahe Ambedkar Marathwada University, Aurangabad-431004, (M.S), India.
(E-mail: minakshirane1@gmail.com; mahajan.ay@gmail.com)

ABSTRACT
Freshwater bivalves, *Lamellidens marginalis* were exposed to acute and chronic doses of thiamethoxam and triazophos.The aim of investigation was to evaluate the effect of pesticides on the protein contents in different tissues of *L. marginalis.* The effects were studied and observed into two groups as control and experimental. The experimental groups were exposed to different concentrations of thiamethoxam and triazophos as 24 hrs to 96 hrs. for acute and 7 day's to21 days for chronic dose. Tissues like foot, mantle, gills, gonads, digestive gland and whole body were removed and dried at 80^{o}C and the dry powders were used for protein estimation. The results are reported in mg/100 mg dry weight of tissue. In present investigation, the protein contents were found to be significantly decreased. Among the exposed group, triazophos was found to be more toxic with maximum decrease in protein contents as compared to control and thiamethoxam. From the results, it is also observed that there was decrease in protein contents with increase in period of exposure.

KEY WORDS: acute, chronic, *Lamellidens marginalis*, proteins, thiamethoxam, triazophos.

INTRODUCTION

Environmental pollution caused by pesticides, brings numerous hazardous effects on the life processes of the organisms. These environmental pollutants bring about damage to different organs or disturb the physiological and biochemical processes within the organism. With rapid industrialization and increase in human population, the pollution of water bodies has become a universal phenomenon in the present day world (Bela Prasad, 2008). The important sources of water pollution are industrial effluent, domestic sewage, drainage and pesticides, which pollute the river and major water sources (Marathanayagam and Sharmila, 2004). The higher concentration of toxicants bring the adverse effects on aquatic organisms, at cellular level or molecular level and ultimately lead to disorder in biochemical composition which is useful in determining different toxicants and protective mechanism of the body to resist the toxic effects of the substances (Patil *et al.*, 1989; Jain, 2000). Any change in the environment of an organism adversely affects the protein turnover and disturb the internal milieu. Interaction occurring during protein metabolism in protein, amino acids, enzymes and co-enzymes were studied by Harper *et al.*, (1978). Proteins are one of the proximate constituents of the body. Protein content in the tissue of animal is an important organic constituent which play a vital role in cellular metabolism. Proteins are among the most abundant biological macromolecules and are also extremely versatile in their function. The study of total protein alteration in different tissues of freshwater bivalves, *Parreysiacylindrica* after cypermethrin exposure (Waykar and Lomte *et al.*, 2001). The analysis and comparative protein profiles is different in different tissues namely gills, foot and mantle of two freshwater bivalves, *Lamellidens marginalis* and *Lamellidens corrianus* and found protein markers which helps to study the molluscan taxonomy (Kulkarni *et al.*, 2005). Keshvan *et al.*, (2005) studied total protein content in freshwater crab, *Barytelphusa guerini* on exposure to Hildan. Study on biochemical changes in the protein in the tissues like gills, hepatopancreas, gonads, gonads, muscle, mantle and foot of freshwater bivalve (Kamble *et al.*, 2010). Siddiqui *et al.*, (2010) studied copper sulphate and its effect on protein in some vital organs of freshwater crab, *Barytelphusa gureini.* Shelke (2010) studied the effect of cadmium chloride on total protein alterations in liver and gonads of freshwater fish, *Amblypharyngodon mola.* Proteins are the most important and abundant macromolecules in living beings which play a vital role in architecture and physiology of the cell and in cellular metabolism (Mommsen and Walsh, 1992).

MATERIALS AND METHODS

The bivalves *Lamellidensmarginalis* were collected from the Hatnur dam situated on Tapi River near Hatnur nearly 35 kms away from Bhusawal, Maharashtra, India. The bivalves were acclimatized to laboratory conditions for 5-6 days prior to subjecting them to experiments. Only healthy and active bivalves were chosen for experiments. Two groups of healthy and active bivalves were formed. One of the two groups was considered as experimental and another was kept as control. The experimental group was exposed to the grades of pesticides i.e.Thiamethoxam and Triazophos for 24, 48, 72 and 96 hours for acute exposure and 7, 14 and 21 days for chronic exposure. The control group was treated without pollutants. $LC_{50/2}$ values of 96 hours were taken for acute exposure and $LC_{50/10}$ of 96 hours were taken for chronic exposure of each pollutant. The bivalves were dissected and their tissues like foot, mantle, gills and digestive gland were excised and whole body mass of remaining animals was taken. All tissues were dried at 80^{0}C in an oven till

constant weight was obtained. The dried powders of different tissues of control and experimental animals were used for estimations of Protein. Protein content of the tissues was estimated by Lowry's method (Lowry *et al.,* 1951).

RESULTS

Table 1. depicts the change in protein level in different tissues of bivalve, *Lamellidens marginalis* after acute exposure of thiamethoxam and triazophos. Protein contents were reduced in *L. marginalis* in almost all tissues with increase in exposure period. Maximum decrease was observed in the tissues like mantle and whole body after acute exposure. Among the two pesticide treated bivalves, maximum decrease in protein contents was observed in triazophos treated animals than thiamethoxam treated animals as compared to control. Table 2 depicts the change in protein level in different tissues of freshwater bivalve, *L. marginalis* after chronic exposure. There was a decrease in protein contents of different tissues of *L. marginalis* with increase in exposure period. Maximum decrease was observed in mantle and whole body tissues in thiamethoxam treated bivalves while in triazophos treated bivalves, maximum decrease was observed in tissues such as mantle and digestive gland followed by gills.

Table 1. Protein contents in different tissues of fresh water bivalve, *Lamellidens marginalis* after Acute Exposure to Thiamethoxam and Triazophos (values are in mg/100mg dry weight).

Sr. No.	Tissues	Control		Thiamethoxam (12.89 PPM)		Triazophos (3.67 PPM)	
		24 hrs.	96 hrs.	24 hrs.	96 hrs.	24 hrs.	96 hrs.
1	Gills	67.58±1.45	67.35±3.12	56.13±4.31** (-16.794)	45.89±2.57** (-31.863)	55.89±3.69** (-17.298)	48.59±3.59** (-27.854)
2	Gonads	74.56±2.01	73.12±2.43	64.18±3.24** (-13.921)	49.69±3.98** (-32.043)	66.98±4.89* (-10.166)	54.87±5.29** (-24.958)
3	Digestive gland	66.21±3.68	65.19±3.98	56.23±2.03** (-15.073)	47.89±2.89** (-26.537)	57.30±5.12* (-13.457)	47.69±4.12** (-26.844)
4	Foot	74.98±5.47	74.2±4.98	66.23±4.19* (-11.669)	61.59±4.31** (-16.994)	67.98±5.89** (-9.335)	60.6±4.37** (-18.328)
5	Mantle	41.58±2.04	40.98±3.31	34.59±3.13** (-16.810)	30.49±3.84** (-25.597)	35.84±5.49NS (-13.804)	31.94±3.41** (-22.059)
6	Whole body	55.21±5.19	54.79±4.45	49.56±4.21* (-10.234)	44.03±4.18** (-19.639)	48.61±4.98** (-11.954)	43.57±3.84** (-20.478)

1.Values are expressed as mg/100 mg of dry weight.
2. ± indicates S. D. of five observations.
3. NS – Non significant, * - P < 0.005, ** - P < 0.01
4. (+) / (-) indicate % variation over control.

Table 2. Protein contents in different tissues of fresh water bivalve, *Lamellidens marginalis* after chronicExposureto Thiamethoxam and Triazophos (values are in mg/100mg dry weight)

Sr. No.	Tissue	Control			Thiamethoxam (2.579ppm)			Triazophos (0.734ppm)		
		7 days	14 days	21 days	7 days	14 days	21 days	7 days	14 days	21 days
1	Gills	68.215±1.12	67.12 ±3.12	66. ±1.89	56.56±3.15** (-17.085)	48.23±4.06** (-28.143)	44.56±3.26* (-33.243)	52.36±2.01** (-23.242)	41.25±2.13** (-38.542)	38.96±2.34** (-41.632)
2	Gonads	78.16 ±2.68	73.402 ±2.25	70.24 ±3.12	71.7±2.58** (-8.265)	64.566±3.33** (-12.037)	52.34±4.23** (-25.484)	62.23±4.51** (-20.381)	54.69±4.52** (-25.492)	46.37±3.86** (-33.983)
3	Digestive glands	66.544±3.45	65.42 ±3.156	62.568 ±3.23	57.89±3.2** (-13.004)	51.23±2.23** (-21.690)	45.48±2.89** (-27.311)	48.45±4.56** (-27.191)	44.34±2.25** (-32.222)	37.86±3.32** (-39.489)
4	Foot	75.26 ±3.45	75.12 ±3.89	74.76 ±3.12	70.232±3.21** (-6.680)	68.52±3.12** (-8.785)	64.6±4.56** (-13.590)	71.46±2.89* (-5.049)	67.53±3.02** (-10.103)	63.12±4.58** (-15.569)
5	Mantle	42.265±2.45	41.561 ±2.8	41.126 ±3.21	38.64±2.06** (-8.576)	35.67±3.45** (-14.174)	31.59±2.84** (-23.187)	37.64±1.25* (-10.942)	36.94±3.1** (-11.118)	32.54±4.13** (-20.877)
6	Whole body	55.45 ±4.87	55.12 ±4.23	54.36 ±5.12	52.16±3.4^{NS} (-5.933)	47.64±5.1* (-13.570)	44.69±4.65* (-17.788)	52.69±3.49^{NS} (-4.977)	45.68±3.47** (-17.126)	43.94±4.81** (-19.168)

1. Values are expressed as mg/100 mg of dry weight.
2. ± indicates S. D. of five observations.
3. NS – Non significant, * - P < 0.05, ** - P < 0.01,
4. (+) / (-) indicate % variation over control.

ISSN: 2277-5536 (Print); 2277-5641 (Online)

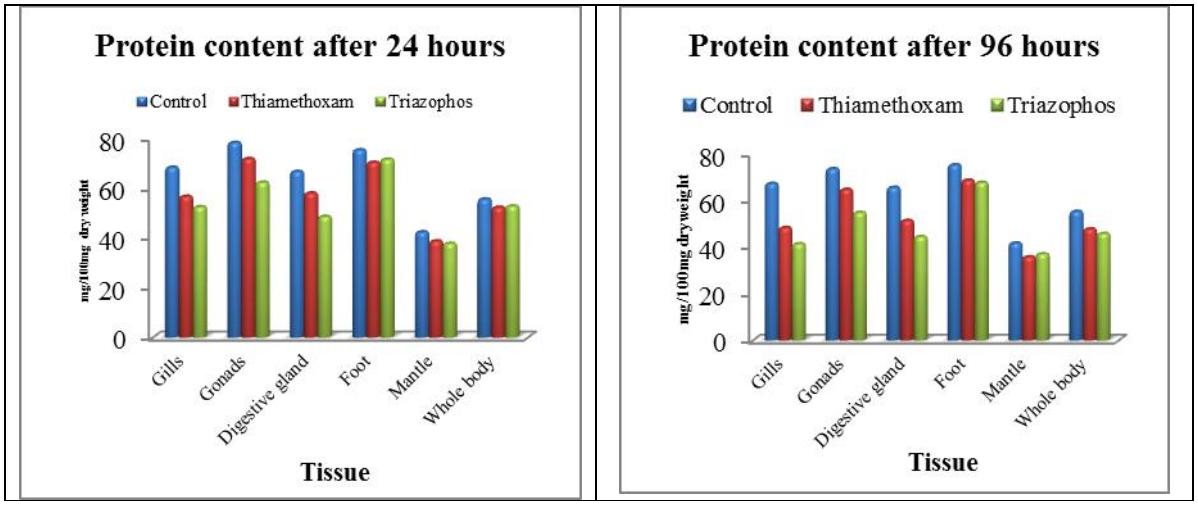

Figure-1: Protein contents in different tissues of fresh water bivalve, *Lamellidens marginalis* after acute exposure to Thiamethoxam and Triazophos (values are in mg/100mg dry weight)

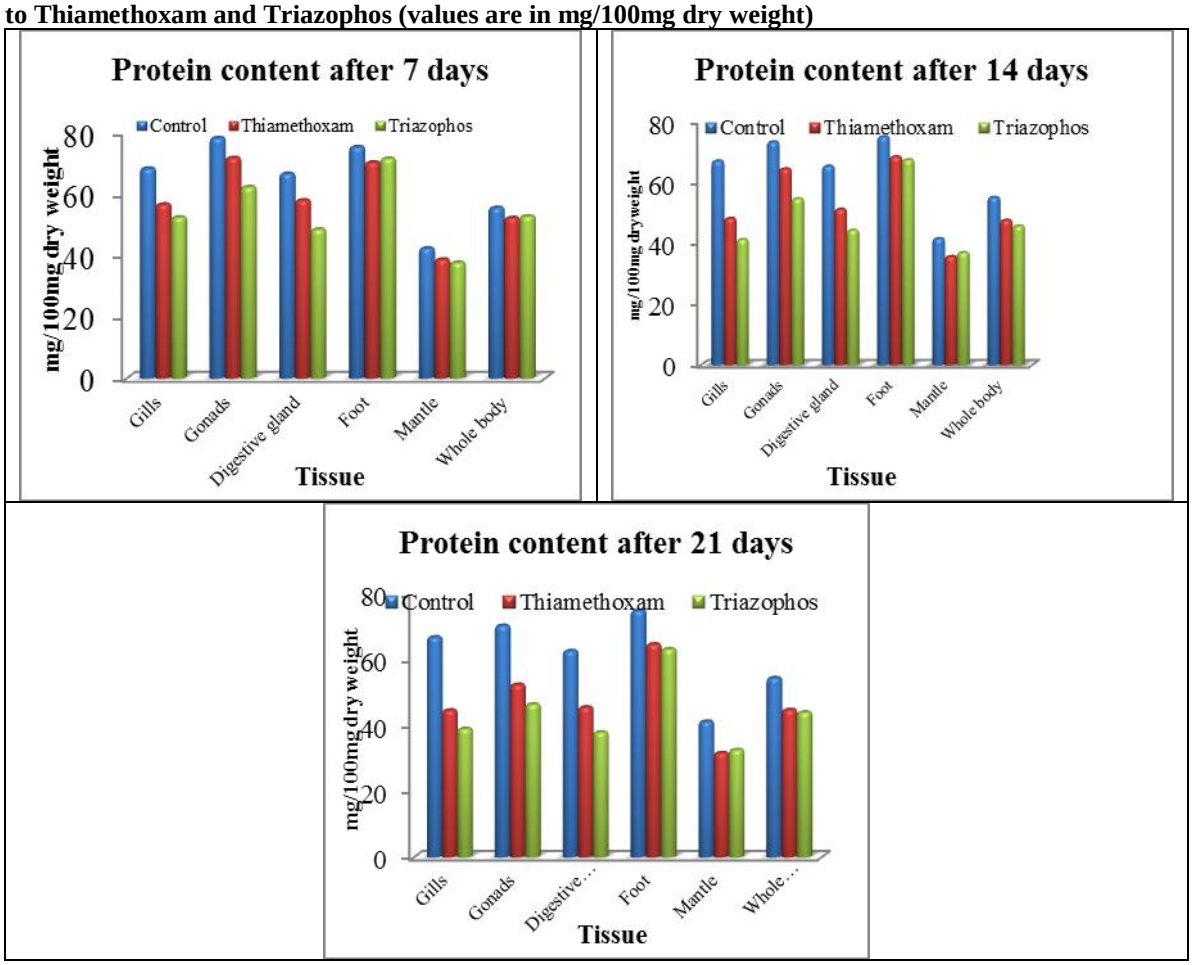

Figure-2:Protein contents in different tissues of fresh water bivalve, *Lamellidens marginalis* after chronic exposure to Thiamethoxam and Triazophos (values are in mg/100mg dry weight)

DISCUSSION

The discharge of agricultural runoff, sewage to the aquatic environment as well as the occasional failing of sewage treatment plants to eliminate some chemicals has raised concerns about the future water quality in rivers, lakes, estuaries and ocean. These environmental pollutants bring about damage to different organs and disrupt the physiological and biochemical processes in the organisms. Many of the toxic substances remained persistent and non-

biodegradable with their residues lasting in our environment. Pesticides due to their potential toxicity produce biochemical changes in the tissues and organs of exposed animals (Shastry and Sharma, 1979; Kumar and Singh, 2000; Tilak *et al.,* 2003; Mathivanan, 2004; Shrivastava and Singh, 2004). Acute poisoning by pesticides certainly represents stress (Matton and La Ham, 1969). Proteins being an important constituent of animal tissue have a main role in cell metabolism. It is the most fundamental and abundant biochemical constituent present in the animal body and the estimation of protein is considered to be important (Ravichandran *et al.,* 1994). The protein content is thus, a key substance to show effect of stress, several man-made activities cause a critical situation for the aquatic as per the surrounding changes, the proteins respond for better survival by either increasing or decreasing their contents. Therefore, the assessment of the protein content can be considered as a diagnostic tool to determine the physiological responses of the cells and organs. According to Nelson and Cox (2005), and Satyanarayana (2005),the physiological activity of animal was indicated by the metabolic status of proteins. Jagateshwari (2005) studied the biochemical changes induced by pesticide, phosphalone in *Cyprinus carpio* at different concentrations and found significant depletion in protein content in different tissues. Senthilkumar *et al.,* (2007) showed that when *Spirolotelphusa hydrodroma* treated with chloropyriphos, the protein content decreased in gills.

Patil (2011) observed maximum depletion of protein content in digestive glands than in mantle, gills, foot and whole body tissue and concluded that the pesticidal stress might have increased the proteolysis activities in the cells. 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. The digestive gland is the site of action of pollutants in the body of bivalves or digestive gland seems to be the main site of degradation and detoxification of pesticides and hence has the largest demand of energy for the metabolic processes resulting in to increasing utilization of protein in digestive gland provided better indication of the extent of toxicity. A marked fall in the protein level in all the tissues indicates a rapid initiation of breakdown of protein. To meet energy demands during toxic stress mobilization of protein might have taken place (Lomte and Alam, 1982). The depletion of protein tissue was due to diversification of energy, to meet the impending energy demand under toxic stress (Vincent et al., 1995). The significant decrease in total protein content in foot, hepatopancreas and gills of the freshwater mussel, *Lamellidens corrianus* on exposure to organochlorine insecticide, hildan (Kulkarni *et al.,* 2005). The decrease in the protein level recorded during study was an indicative of increased proteolysis resulting to shift in nitrogen metabolism. Inhibition of ribosomal activity result in protein degradation is also one of the possible reasons for protein synthesis (Shelke, 2010).

REFERENCES

Bela Z. and Prasad R. (2008). Impact of pollution on fresh and marine water resources. *J. Pollution Res.* **273**: 461-466.

Harper H.A. 1978. Harper's Review of Biochemistry.

Jain M. and Kulshreshta K. (2000). Effect of pesticides on fishes. A review of recent studies in India. *J. Nation.* **7** (2): 14-18.

Kamble J.R., Chandgade C.A. and Raut P.D. (2010). Paper presented in 97th Indian Science congress.

Keshavan R., Kamble S.M., Kulkarni A.N. and Deshmukh, P B. (2005). Impact of sevin on acid and alkaline phosphatase activities of the freshwater mussel, *Lamellidens marginalis* (Lamarck). *J. Aqua. Biol.* **20**(1): 108 – 110.

Kulkarni AN., Kamble S.M. and Keshavan R. (2005). Studies on impact of Hildan on biochemical constituents in the freshwater mussel, *Lamellidens corrianus*. *J. Aqua. Biol.* **20** (1): 101 – 104.

Kumar S. and Singh M. (2000). Toxicity of dimethoatebto a freshwater teleost *Catlacatla*. *J. Exp. Zool. India.* **3**(1): 83-88.

Lomte VS. and Alam S. (1982). Changes in the biochemical components of the prosobranch, *Bellamia* (Viviparous) *bengalensis* on exposure to malathion. Proc. Symp. Physiol. Resp. Ani. Pollutants.MarathwadaUniversity, Aurangabad, India.

Lowry O.H., Rosebrough N.J., and Farr N Land Randall R.J. (1951). Protein measurement with thw Folin Phenol Reagent. *J. Biochem.* **193**: 265-275.

Mathivanan R. (2004). Effects of sublethal concentration of quinalphos on selected respiratory and biochemical parameters in the freshwater fish, *Oreochromis mossambicus*. *J. Ecotoxicol. Environ. Monit.* **14**: 57-64.

Matton and La ham. (1969). Effect of organophosphate dylola on rainbow trout larvae.J.Fish Bd. Can. **26**: 500-504.

Mommsen T.P. and Walsh P.J. (1992). Biochemical and environmental perspectives on nitrogen metabolism in fishes. *Experentia.* **48**: 583-593.

Nelson DL. and Cox MM. (2005). Lehninger Principles of Biochemistry. 3rd edition, Macmillam worth Publishers.

Patil PN and Lomte VS (1989). Effect of pesticidal stress on the metabolic enzymes arginase, acid and alkaline phosphatases of the army worm, *Mythima* (Pseubaletia) separate. *Proc. Natl. Symp. Ecotoxicol.* 85-90.

Patil A.G. (2011). Protein changes in different tissues of freshwater bivalve,*Parreysia cylindrica* after exposed to Indoxacarb.

Ravichandran (1994). Impact of phenol metabolism in the freshwater fish, *Oreochromis mossaambicus*. *J. Ecotoxicol. Environ. Monit.* **4**(1): 33-37.
Satyanarayana U. (2005). Biochemistry book and allied (P) Ltd. 8/1 Chintamani Das Lane Kolkata 700009 India.
Senthilkumar P., Samyappan K., Jayakumar S. And Decarman M. (2007). Effect of Chlorpyrifos on the nutritive value in a freshwater field crab, *Spirotelphusa hydrodroma*. *Res. J. Agri. Biol. Sci.* **3**: 760-766.
Shastry KV, and Sharma K. (1979). Toxic effect of endrin on liver and kidney of the freshwater teleost fish. *Proc. Symp. Environ. Biol.* 337-342.
Shelke A.D. (2010). Effect of cadmium chloride on total protein alterations in liver and gonads of freshwater teleost fish, *Amblypharyngodon mola*. *J. Aqua. Biol.* **25**(1): 155-158.
Shrivastava S and Singh S. (2004). Changes in protein content in the muscle of Heteropneustes fossilis exposed to carbaryl. *J. Ecotoxicol. Environ. Monit.* **14**: 119-122.
Siddiqui AA., Lhingneilam J., Keishing M., Nabi T. and Shaikh S.A. (2010). Copper sulphate and its effect on protein in some vital organs of freshwater crab, *Barylelphusa gureini*. *J. Aqua. Biol.* **25**(1): 171-176.
Tilak K.S., Satyavardhan K. and Thathaji P.B. (2003). Biochemical changes induced by Fenvalerate in the freshwater fish, *Channa punctatus*. *J. Ecotoxicol. Environ. Monit.* **13**: 261-270.
Vincent S., Ambhore T., Kumar L. C. A. and Selvanayagam M. (1995). Biochemical response of the Indian major carp, *Catlacatla* (Ham) to Chromium toxicity. *Indian J. Environ. Health.* **37**(3): 190-196.
Waykar B., Lomte V.S. and Zambare S.P. (2001). Effect of cypermethrin on ascorbic acid content in the mantle, foot, gill, digestive gland and whole body tissues of freshwater bivalve, *Parreysia cylindrical. J. Aqua. Biol.* **16**: 57-61.