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Research Article

BEHAVIORAL CHANGES IN FRESH WATER BIVALVE, LAMELLIDENS MARGINALIS DUE TO ACUTE TOXIC EFFECT OF ORGANOTIN TRIBUTYLTIN CHLORIDE IN SUMMER SEASON

*[1]J.T. Jagtap, [2]S.B. Ubarhande and [3]K.B. Shejule

[1]Department of Zoology, Swami Vivekanand Senior College, Mantha (MH) - 431504, India
[2]Department of Zoology, Rajashri Shahu Arts, Commerce and Science College, Pathri (MH) - 431111, India
[3]Department of Zoology Dr. BAMU Aurangabad (MH) - 431 004, India

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ABSTRACT

The bivalves have been used for many years to determine the pollution status of water. When freshwater bivalve, *Lamellidens marginalis* exposed to 3.55 ppm, 2.42 ppm, 1.79 ppm and 0.98 ppm LC_{50} concentration at 24 to 96 hrs of periods of intervals. Showed Different physiological and morphologically changes were observed in tributyltin chloride exposed groups. There is no any kind of change observed in control groups of bivalves. From this study we concluded that toxicity of TBTCL was responsible for behavioral changes in *L. marginalis.*

Keywords: *Lamellidens marginalis,* Tributyltin chloride, Behavioral change, Acute toxicity, Summer Season.

INTRODUCTION

Several reviews on the tributyltin compound, which cover the production, use, chemistry, toxicity, fate and hazards of TBT in the aquatic environment (Batley, 1996; Clark *et al*., 1988; Ronald Eisler, 1989; Gibbs, 1996; Laughlin *et al*., 1996; WHO, 1990). Toxicity to aquatic organisms generally increases as the number of organic components increases from one to three and decreases with the incorporation of a fourth, making triorganotins more toxic than other forms (Wu *et al*., 2014). The evaluation of acute toxicity is essential for determination of sensitivity of animals to the toxicants and also useful for evaluating the degree of damage to the target organs and the consequent physiological and behavioral disorders, (Arome & Chinedu, 2013). Animal behavior depends on the fluctuations of environmental conditions and their capacity of animal body (Kamble & Kamble, 2014). Some biotic as well as a biotic factors play very important role to change activities and behavior of the animals. The toxicological nature of surrounding environment was assessed with the help of behavior and metabolic changes in animals. The behavioral modification in animals can be taken as the most sensitive indicators of environmental stress (Roo Eisler, 1979).Various researchers showed the behavioral changes due to the effect of toxicant (Muley and Mane, 1988), indicated that the behavioral changes were influenced by the toxic compounds of mercury salts in *Viviparus bengalensis* (Mane & Muley, 1984), presented behavioral alterations in bivalve mollusks, *Lamellidens marginalis* due to fluoride and endosulfan. Behavioral assessment of heavy metal on freshwater crab was studied by Andhale *et al*. (2011). Mohd Lliyas (2012) demonstrated nickel chloride brings some changes in physiochemical properties of water and it affects the metabolic rate leading to death of freshwater bivalve *L. marginalis*. Sharma (2019) and Vasanthi *et al*. (2019) studied behavioural fluctuations in fishes due to chemical stress and mercury expose.

Tributyltin chloride is known to be harmful to many non-target aquatic organisms, particularly molluscs, (Horiguchi *et al*., 1997). Some of the scientists worked on and showing TBT might be cause behavioural disorders. Fent & Meier (1992) and Triebskorn *et al*. (1994) worked on TBTO and concluded TBTO may affect the nervous system and alter behavior. Compare to marine very little work about TBT had to be done on freshwater animals. Some of the workers, (Humbe, 2016; Mohate 2013; Nikam

*Corresponding Author: Dr. J.T. Jagtap, Department of Zoology, Swami Vivekanand Senior College, Mantha (MH) - 431504, India, Email: jitendrajagtap28@yahoo.com, Mobile: +91 9637854020

& Shejule, 2015; Shejule *et al*., 2006) focusing and showing behavioural variations observed in different animals. Molluscs have been used extensively as bioindicators of heavy metal pollution in aquatic system, (Azizi *et al*., 2018). They are more sensitive than the fish species from the middle and the inferior parts of the rivers. When the mussels disappear, it means that the river is seriously affected, (Fuller, 1974), leading to a decreasing in the life support capacity of the ecosystem, induced also by the elimination of these important filtering. Hence present study can undertake to investigate the acute toxic effect of tributyltin chloride on behavioural patterns of freshwater bivalve molluscs, *Lamellidens marginalis*.

MATERIALS AND METHOD

The freshwater bivalves, *L. marginalis* were collected from the Godavaririver, at Paithan, 45 km away from Aurangabad city. The bivalves were brought to the laboratory and acclimatize to the laboratory conditions. Pilot experiments were conducted to find out the range of the toxicity of the toxicant used tributyltin chloride. Acute toxicity tests were conducted over 96 hrs. The experimental troughs containing 5 litres dechlorinated water were used to keep the animals. For each experiment ten bivalves, *L.marginalis* of approximately similar size (50-55 mm in shell length) were exposed to different concentrations of tributyltin chloride. After every 12 hours the polluted water was changed by the fresh solution of the same concentration. The behaviour and mortality of the bivalves were recorded as per the intoxication and time of exposure.

RESULTS AND DISCUSSION

Control bivalves were very quick in their protective response. Frequently extension of siphons and foot out of the valves occurred. Filtration of water occurred through visceral body. Movement of foot was fast it is tightly attached to the trough. Ample amount of mucus was secreted by foot. Bivalves close their shell valves at the time of immersion in water upon the valve and protruded siphons for all the time during the experimental period. The excreta of feaces with little mucous appeared all the time in this group. Behavior changes in freshwater bivalve *L.marginalis* against Tributyltin chloride intoxication at different exposure periods at 24 hrs the most of the bivalves in the entire test concentrations opened the shell valve and protruded the foot and pallial edges conditions. Tolerate toxicity with the help of operculum. Little mucus secretion observed over shell. To avoid pollutant, the shell of bivalves observed to be closed for longer time. Their movements were restricted and excreta were eliminated over large amount. After 48 hrs of intoxication, bivalve discharged more amounts of excreta into the trough. Movement was goes down, with less response to external stimuli. Size and shape of the foot was reduced. Bivalves open their shell valves but not properly. Mucous secretion of foot was increased. The bivalve showed less response to pin touch or vibrations. Bivalves lost protective behavior after 72 hrs. Some bivalves opening shell valves some keeping tightly pack. Large amount of mucus and excreta was found in trough. The bivalves give very poor response to mechanical stimuli. Foot shape and size observed to be reduced. After 96 hrs of tributyltin chloride intoxication, bivalves remained in same position under toxic chemical stress. Bivalves shell loss their connection with adductor muscles was to be noted. Foot movement not seen and the bivalves do not respond to mechanical stimulus. White, thick gelatinous mucus secretion observed into the trough. Excreta reduced. Criteria for selection of dead bivalves were used by observing the experimental animals, with open shell valves and shrunken foot.

Table 1. Relative Toxicity of TBTCL to the freshwater bivalve, *Lamellidens marginalis* in summer.

Time of exposure (Hrs.)	Regression equation $Y=\bar{y}+(X-\bar{x})$	LC50 ppm.	Variance	Chi-square	Fiducial limits m1	m2	LD 111.7368	Safe conc.ppm
24	Y=13.9590X -2.686	3.553	0.00017093	0.09511119	0.51701658	0.568267	85.2768	0.2245
48	Y=8.7563X +1.639	2.42	0.00042949	0.14310022	0.33653968	0.417778	116.16	
72	Y=4.8998X +3.761	1.790	0.0014463	0.00430609	0.12260716	0.271685	128.8944	
96	Y=9.1523 +2.279	0.982	0.0004779	0.2026317	-0.206948	0.292641	94.3584	

The behavioural changes were recorded in the freshwater bivalve, *L. marginalis* when LC_{50} concentration of TBTCL (3.55, 2.42, 1.79 and 0.98 ppm) at 24, 48, 72 and 96 hrs exposed periods. In the present study, *L. marginalis* when exposed to tributyltin chloride, at various concentrations, test animals showed behavioral changes such as closing of shell, secretion of mucus and as exposure period increases, foot comes out from the shell indicated death of the animal. Shell closing mechanism might be the protective device against the toxicant and provides good tolerance in the mollusks (Chaudhari *et al.*,1988; Joshy *et al.*, 2018) reported many behavioral changes in pesticide exposed snail, *Bellamya bengalensis* like sudden withdrawal of foot inside the shell, closing of operculum and mucus secretion. Mucus secretion was also observed in *Corbiculas triatella* on exposure to pesticides, (Jadhav, 1993)and in *Parreysia favidens* against heavy metal exposure, (Bhamre *et al*., 1996). It has been suggested that, mucus isolates particulates and soluble parts of pollutant from solution (Brooks & Rumsby, 1967; Romeril, 1971) with withdrawal of body into shell or closure of siphons. (Waldock & Thain, 1983) exposed *C. gigas* to TBT oxide (TBTO) for 56 d; they reported that exposed to 0.15 µg/L TBTO did not grow as well as controls and had pronounced thickening of the upper shell, and that spat exposed to 1.6 µg/L TBTO were severely inhibited in terms of growth. (Kharat *et al*., 2009) showed the LC_{50} for 48 hrs of organotin tributyltin chloride on the rate of oxygen consumption of freshwater prawn, *Macrobrachium kistnensis* has been determined. Increases in oxygen consumption in 1 and 2 hrs indicated immediate response to the toxic environment and initial elevation in the rate of oxygen consumption showed a compensatory phase to enhance the physiological activity, but the steady decrease may be due to the failure of respiratory metabolism in *M. kistnensis*. By the experiments conducted by Holwerda & Herwig, (1986) it was found that the freshwater clam *Anodonta anatine* could not survive exposure to tributyltin oxide in a concentration equivalent to 5 µg Sn/L for longer than 6 weeks. Kamble & Kamble (2014) observed physiological and morphological changes induced due to LC 50 concentration of copper sulphate (0.56) and reported that the toxicity of copper sulphate is responsible for behavioral changes in freshwater snail, *B. bengalensis*. Ansari & Singh (2014) reported that the toxicity of mercuric chloride was responsible for the behavioral changes in freshwater bivalve, *L. marginalis*. It includes protective response, foot movements and its secretion, response to external stimuli, mucus secretion of gills and diapedesis were observed in experimental animals.

CONCLUSION

In the present study the behavioural alterations recorded due to stress of Tributyltin chloride. The rise in temperature, low oxygen content and low food availability in the water body inhabiting the animals in the summer are mainly accounting for the physiological demand to the survival of the species. Addition of tributyltin chloride stress increased the demand and thereby the animal becomes sensitive to the tributyltin chloride stress. The effect of tributyltin chloride on freshwater organisms is quite insufficient compare to marine organisms, so in the present work it is attempted to study the effect of tributyltin chloride on survival of freshwater bivalve, *L. marginalis*.

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