

# Estimation of LC<sub>10</sub> and LC<sub>50</sub> of Chlorpyrifos in *Lamellidens marginalis* by Probit Analysis

## Abstract

The present study was executed to estimate the toxicity of chlorpyrifos (20%EC) on fresh water bivalve *Lamellidens marginalis* (Lamarck, 1989). By using the probit analysis statistical method the toxicity test were evaluated. The LC<sub>10</sub> and LC<sub>50</sub> values after 24, 48, 72 and 96 hrs were 17.3, 7.0, 3.6 and 1.9 ppm and 21.3, 10.1, 8.5 and 3.6 ppm respectively. Chlorpyrifos is an organophosphate pesticide used to kill variety of pests together with insects and worms. This pollutant obtains from agricultural and household excess water that come into aquatic environment and have adverse effect on organisms which were lives in it. From many years bivalves have been used to find out the polluting condition of water.

**Keywords:** Agriculture, Household, Chlorpyrifos, Probit.

## Introduction

Detrimental changes in physical, chemical or biological characteristics of our biosphere occur due to pollution which is destructive for entire human being and their related environment. As compare to developed countries use of pesticides is tremendous in developing and undeveloped countries. All pesticides are particularly deliberate for destroy for harmful animals. These pesticides runoff into water reservoirs and shows affect on non-targeted aquatic biota (Chopra *et al.*, 2011). An estimated values shown 200 toxic chemicals are used in various parts of the world, Mishra and Bohidar (2005). According to (WHO, 2003), only in developing countries 25% pesticides are used in the world. Inclined state of Aquatic pollution has led to steady decreasing in number of aquatic organisms.

Among these pesticides organophosphates (OP) used throughout the world because of their biodegradability, elevated efficiency and low resolution, Fulton and Key, (2001). According to research temperature is directly proportional to toxicity of Organophosphate pesticides, Pandey *et al.* (2008). Due to their high morbidity use of OP restricted in developed countries but in developing countries like India, the application of OP is still common (Balaram, 2003). In India near about 90,000 tons of technical grader pesticides consume per annum.

Chlorpyrifos is a broad-spectrum, chlorinated organophosphate (OP) white crystalline strong odorous insecticide applied on farms for eradication of pest and within the houses, it is used for to control termites, cockroaches and fleas as acaricide and nematicide. Chlorpyrifos is the common name for 0,0-diethyl 0-(3,5,6-trichloro-2-pyridinyl)-phosphorothioate. It is highly effective, longer residual control and shown triple action formula: stomach, contact and fumigation.

The fresh water bivalve *Lamellidens marginalis* is widely distributed in pond, lakes perennial large water bodies in Indian sub continents and accepted as food overall places of India (Subba Rao, 1989). These are the soft bodied organisms provided chance to make use of variety of food products, pharmaceuticals and for neutraceutical applications (Haldar *et al.*, 2018).

## Aim of the Study

1. To Study physico- chemical of Jamda dam.
2. To Stimate the toxicity of Chlorpyrifos on fresh water bivalve *Lamellidens marginalis*

## Material and Methods

Approximately similar sized (50-55 mm) fresh water bivalve, *Lamellidens marginalis* collected from Jamda dam, situated 20° 30' N and



**S. Y. Patil**

Research Scholar, Dept. of Zoology, S.S.V.P. S's L. K. Ghogare Science College, Dhule, Maharashtra, India

**R. D. Patil**

Research Guide, Dept. of Zoology, S.S.V.P. S's L. K. Ghogare Science College, Dhule, Maharashtra, India

**M. U. Patil**

Assistant Professor, Dept. of Zoology, V. U. Patil Arts, and Late Dr. B. S. Desale Science College, Sakri, Dhule, Maharashtra, India

25° 45' N latitude and 75° 0' E longitude 30 km away from Chalisgaon city, Dist.-Jalgaon, Maharashtra, India. They were brought to the laboratory and cleaned thoroughly to remove debris. Animals were kept in plastic trough having dechlorinated water for 5 to 6 days to acclimatizing. Bivalves were not fed during experiment.

Estimation of the physico-chemical characteristics of water like pH, Air temperature, water temperature, Dissolved oxygen, free CO<sub>2</sub>, Bicarbonates, Total alkalinity, Total dissolved solids, Acidity, Salinity, Nitrate, Calcium and Magnesium by Wrinkle's method and APHA, 1985. Ten to fifteen different concentrations of the pesticide chlorpyrifos (20% E.C.) added in troughs having ten liters capacity. Collected data analyzed statically by probit method on convert toxicity curve to different exposure (% mortality vs. concentration). Series of static bioassay test were conducted to obtain LC<sub>10</sub> and LC<sub>50</sub> values for the duration of 24, 48, 72 and 96 hrs (Finney, 1971), as acute exposure resultant mortality was recorded in 10% to 100% ranged for concentration for the 24, 48, 72 and 96 hrs. Simultaneously control was maintained. To obtain constant results each experiment repeated for six times. Animal behavior was also observed.

#### Result and Discussion

The physico-chemical properties of the water used for acclimatizing for experimental animals as pesticide diluents were examined. Temperature also affect the average values for physico-chemical parameters of exposure water in troughs was pH 7.35 ± 0.1221, Air temperature 27°C ± 2.1937, Water temperature 23°C ± 2.2254, Dissolved Oxygen 2.090 ± 0.935, Free CO<sub>2</sub>, Bicarbonates 64 ± 9, Total Alkalinity 64.247 ± 12.86, Total Dissolved Solids 42, Acidity 3.978 ± 2.264, Salinity 0.2024, Chloride 48.22 ± 1.69, Nitrate 0.004 ± 0.001, Calcium 1.37 ± 0.89, Magnesium 42.1 ± 0.86. Physico-chemical parameters display effect on concentration of pesticides hence estimation of water parameters were done. Temperature is critical determinant of biogeography affects in straight line on physiological and behavioral characteristics on the experimental animals, Kumar *et al.* (2013).

In the present study the fresh water bivalve, *Lamellidens marginalis* exposed to chlorpyrifos. The LC<sub>10</sub> and LC<sub>50</sub> values were calculated by Finney's method for acute exposure. The values of 10% and 50% lethal concentration were obtained 17.3, 7.0, 3.6 and 1.9 ppm and 21.3, 10.1, 8.5 and 3.6 ppm for 24, 48, 72 and 96 hrs respectively. The LC<sub>10</sub> and LC<sub>50</sub> values, regression results, variance, 95% Fiducial limits, lethal and safe concentration Chi square test of Chlorpyrifos were calculated for 24, 48, 72 and 96 hrs and shown in Table no.-1. and graphical representation expressed in fig.-1. From the above findings indicated that, *Lamellidens marginalis* was highly sensitive to Chlorpyrifos pesticide and safe concentration of Chlorpyrifos is (0.6928 ppm). When increasing the period of exposure the LC<sub>50</sub> value decreases because lowest value 3.6 ppm observed at 96 hrs period of exposure. According to Bandopadhyay and Aditya (2006) various chemical

substances, pesticides and xenobiotics accrue in natural aquatic territories, resulting toxic effect on aquatic biota. 50% lethal concentrations of different pesticides exposure on *Lamellidens marginalis* obtained by several workers, Stalin *et al.* (2017); Amanullah *et al.* (2010) stated effect of chlorpyrifos on *Lamellidens marginalis*. (Rane and Mahajan 2012) reported acute toxicity of Thiamethoxam and Trizophos on *Lamellidens marginalis*. Nandurkar (2015) studies effect of chemotherapeutant on *Lamellidens cirrianus* and *Parreysia cyllindrica*.

#### Behavior of *Lamellidens Marginalis* Exposure to Pesticide Chlorpyrifos

Observations recorded in 2 groups

##### Behavior of bivalve-Control group

1. The bivalve engrossed in the water retracted their body inside the shell and closed the shell valves.
2. Few minutes later, open the shell valve and extended their foot and pallial edges in addition to the siphons outside the valve.
3. Extended organs kipped in side instantly if mechanical stimulus was made.
4. Consistently excreta were accumulated and no mucus secretion at all.
5. Foot was pulling in and shell valve was opened in case of dead animals. Gentle mechanical stimulus had affectless.

##### Behavior of bivalve-Treated group with pesticide Chlorpyrifos:

1. When pesticide Chlorpyrifos immersed in water of trough included experimental bivalves, without any delay they retracted the foot and closed shell valve.
2. Later than some time, the bivalves slightly opened the shell valves and obtrude the foot slightly together with the pallial edges and siphons exterior the shell valve.
3. Firstly bivalve opened the shell valves rapted the slight inflamed between the shell and stay behind closed to avoid extra incursion of the pesticides within the body.
4. Abundant mucus secretion was observed in the bivalves those exposed with pesticide.
5. Shrinked foot was seeing in bivalves.
6. Siphons over hanged at the border of shell valve in some cases.
7. Development of eggs and embryos at different stages were released and summarized in jellylike mass.
8. Siphons opening time was also condensed with the time of exposure of the pesticide.
9. Shrunken foot and opened shell valve are the symptoms of dead bivalves because they had no effect to any mechanical stimulus.

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**Table- 1, Relative Toxicity of pesticides Chlorpyrifos against *Lamellidens Marginalis***

Sr. No.	Time Expo. In hrs	Regression equation	LC <sub>10</sub> Value	LC <sub>50</sub> Value	Variance 'V'	Fiducial limits		Lethal dose	Safe conc. 'C'	f <sup>2</sup>
						M <sub>1</sub>	M <sub>2</sub>	ppm		
1	24	Y = 13.814X+13.4105	17.37	21.3810	0.008980	1.27108	1.38852	312.88	0.6928	2.2422
2	48	Y = 1.5156X+4.4803	7.0332	10.1788	0.0037405	2.7830	4.7982	248.58		1.1866
3	72	Y = 3.0787X+1.9881	3.6475	8.5126	0.003628	0.8602	1.0962	184.90		0.9954
4	96	Y = 15.9975X+8.5218	1.9961	3.6599	0.001521	0.1958	0.2441	59.35		0.7495

**Fig.-1, Graphical Representation of Toxicity of Chlorpyrifos against *Lamellidens Marginalis***

