



# TOXIC EFFECT OF CHLORPYRIPHOS And CYPERMETHRIN ON BEHAVIOUR OF FRESHWATER SNAIL *Lymnaea Stagnalis*

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## Abstract

Several recent studies have demonstrated the effect of pesticides on freshwater gastropods. Freshwater snails provides valuable system for studying the effect of water pollution on aquatic life. Several behavioral changes were recorded in the freshwater pulmonate snail *Lymnaea stagnalis* when subjected to mean LC50 concentrations (0.66 ppm) of chlorpyrifos (50%) and cypermethrin (5%). Acute (72 h) exposure to chlorpyrifos (50%) and cypermethrin (5%) inhibited several behavior activities including feeding, locomotion and response to external stimulation rates were reduced, potentially impacting courtship behavior and mucous secretion. It also correlate with the shell deposition and aquatic respiration of snail *Lymnaea stagnalis*. These results provide initial information needed to assess the potential hazards to chlorpyrifos and cypermethrin on behavioral toxicology of *Lymnaea stagnalis*. The objective of the current study was to evaluate the exceeding sensitivity of *Lymnaea stagnalis* to chlorpyrifos (50%) and cypermethrin (5%) and evaluate probable hazards to aquatic animals and ecosystems.

**Keywords:-**Chlorpyrifos (50%), cypermethrin (5%), *Lymnaea stagnalis*, behavioral toxicology.

## Introduction:

*Lymnaea stagnalis* is an aquatic pulmonate snail(D.Eisenhardt,2008).*Lymnaea stagnalis* is used as ecotoxicological model and bioindicator of aquatic contaminants.*Lymnaea stagnalis* also referred to as great or common pond snail,is an abundant and widespread invertebrate species colonizing temperate limnic system which given the species importanceand have the potential to produce scientifically relevant information ,leading to a better understanding of the damage caused by aquatic contamination,as well as the mode of action of toxicants(Joao Amorim,2019).Pesticides are chemicals that contain oxygen,sulfur ,chlorine,nitrogen,phosphorous and bromine as well as heavy metals such as copper,arsenic, sulphates,lead and mercury.when pesticides contaminate waters ,such waters become harmful to living organisms that consume or come in contact with them (Zakari Aja,2017).Copper ,Lead,Mercury and other heavy metals causes toxic effect on freshwater ecosystem like gastropods(Kevin V.Briks et al 2011).).Freshwater ecosystems are the most valuable water resources and they are affected by numerous types of human influences that have a negative effect on their water quality and ecological

condition (S. Sadozai et al, 2013). Organochlorine insecticides used in agriculture were dissolved in water and aquatic pollution caused (Mace G Barron, 1995). Mollusc habitat includes all types of freshwater bodies, ranging from small temporary ponds, streams to large lakes and rivers, however there is a more urgent concern to develop baseline information about the current patterns of diversity and distribution of freshwater snails, this information forms the basis on which to assess how freshwater ecosystems are being directly changed over time by human activities, for example by habitat modification, impacts of pesticides on species physiology and community structure (Melek zeybek, Mar 2016). Freshwater snails feed on algae, zooplankton and organic waste and provide food for many types of fish, birds and human beings so they are important in ecosystem as well as food chain (Usang Ukam et al, Jun 2018). So as the pesticides are getting hazardous the manufacture and use of organochlorine insecticides in the United States decreased dramatically during the 1970s, in part because of their adverse effects on fish, wildlife and the tendency of the component to bioaccumulate (Mace G Barron, 1995). Chlorpyrifos use has induced health issues and water pollution (Ahmed Ali Romeh et al, 2013). Not only on aquatic life but Chlorpyrifos and cypermethrin induce apoptosis in human neuroblastoma cell line SH-SY5Y (Grzegorz Roszewski et al, 2015).

So the present study is designed to investigate the toxic impact of Chlorpyrifos and cypermethrin on behaviours of pond snail *Lymnaea stagnalis*.

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#### **Material and Methods:**

##### **Collection area:**

For the present experiment aquatic pulmonate snail *Lymnaea stagnalis* were collected from Lotus pond, botanical garden of Sadguru Gadage Maharaj College, Karad (Maharashtra, India)

##### **Experimental setup:**

For studying the behavioral toxicology of *Lymnaea stagnalis* 50 experimental species (shell size 15-20 mm) were used. Species were divided into 5 sets. As control set -1, set -2, set -3, set -4 and set -5 (10 in each). For the intoxication study, pre-determination LC50 concentration of Chlorpyrifos + Cypermethrin 0.66 ppm was induced in each of experimental set. For studying the toxic impact of the Chlorpyrifos and cypermethrin on *Lymnaea stagnalis* snails were subjected to the mean LC50 concentration for 3 days (72 hours). The behavioral changes after intoxication were recorded.

Toxic impact on behavior of freshwater snail *Lymnaea stagnalis* were recorded as per the intoxication and exposure time by observing the feeding, locomotory, respiratory, protective behavior, courtship behavior as well as the secretion of mucus and calcium uptake through the body these behaviors were recorded.

## Results

### Behavioral changes due to toxic impact of Chlorpyriphos+cypermethrin:

When the snails are exposed to LC50 concentration for 24 hours then the snails are starting to expand their body parts ,foots are get streched .snails are becomes less active that is locomotion rate was get reduced.Snails Pairing is observed in only few snails,they are remains attached in day 1st observation.

After the 48 hours of exposure to LC50 concentration seviour changes were observed.Extra mucous secretion through the buccal mass and mantle cavity is observed.Snails showed poor response to the forcep touch and vibrations. Snails become immovable .All the body parts were retracted into the shell.Snails show only pulmonary respiration,aerial respiration was not seen.Pairing of snails was not seen.

After 72 hours of exposure the snails lost the movement capacity and there was no response to external stimuli was observed.courtship behaviour was not seen. The Shell becomes thin ,fragile and semitransparent owing to decalcification that is chlorpyriphos affecting on the level of calcium uptake of the body.

Sr.No	Type of behaviour	Behaviour of normal group of snail
1	Response to external stimuli	Control group of snails showed quick response.
2	Movements of tentacles	Tentacular movement was fast and regular.
3	Respiration	Pulmonary and aerial respiration was seen
4	Locomotion and mucous secretion	Snails were active and tightly attached to the surface with the help of foot.ample mucous secretion through mantle and buccal cavity.
5	Courtship behavior	Pairing of snails normally seen.

Sr.No	Type of behavior In Exposure (LC50 conce.) Group	After 24 Hours	After 48 hours	After 72 hours
1	Response to external stimuli	Tolerate toxicity with the help of operculum.	Operculum is closed and retraction of body parts in the shell.	Operculum is tightly closed and body inverted inside.
2	Movements of tentacles	Tentacular movement was reduced.	Remained steady.	No movement seen.
3	Respiration	Initially aerial and aquatic respiration observed.	Only aquatic respiration observed.	Snails remain steady and movement of pneumostome was poor.
4	Locomotion and mucous secretion	Initially snails were quit active and ample mucous secretion.	Snails become inactive and mucous secretion increased through buccal cavity.	Snails become non- motile and quantitatively extra mucous secretion through mantle and buccal cavity.
5	Courtship behaviour	Initially pairing was seen among the snails .	Snails detached from each other.	Courtship behavior not observed.

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#### Discussion:

#### Experimental species:

*Lymanea stagnalis* belongs to phylum Mollusca ,class gastropoda(Cuvier,1797).Order Basommatophora and family Lymnaeidae.Genus name is *Lymnea*(Lamarck,1801) and species *stagnalis*(Linnaeus,1758).[ITIS Report].

### **Normal behavior of freshwater snail *Lymnaea stagnalis*:**

Snails were acclimatized for 15 days and normal behaviors were recorded-

Locomotion is carried out by the coordinated front-to-back beating of cilia on the sole of the foot (Paul R. Benjamin). *Lymnaea* has gas filled lung and ventilation is accomplished by opening and closing movements of the apex of muscular tube known as pneumostome that forms entrance to the lung. (Paul R. Benjamin). Touch to the skin is mainly an aversive stimulus mediated by primary touch receptors with local receptive fields covering the whole surface of the body is one of the characteristic of *Lymnaea stagnalis*. (Paul R. Benjamin). Snails are positively or negatively geotactic is depends on the oxygen content of the water (Paul R. Benjamin). Whole –body withdrawal reflex involves in *Lymnaea stagnalis* and strong tactile stimuli produce. (Paul R. Benjamin). Feeding in *Lymanea stagnalis* is arhythmic motor behavior consisting of a repetitive sequence of movements called rasp (Paul R. Benjamin). The snail playing the male role climbs on the shell of the prospective female, moves over the shell in a counterclockwise direction until he reaches the area of female gonophores, the preputium is then everted through male pore and insertion in the female pore occurs, this is the courtship behavior of the *Lymnaea stagnalis*. pairing of snails in water we can see. (Paul R. Benjamin).

### **Behavioral change after intoxication of Chlorpyrifos+ Cypermethrin:**

Intoxication of toxicants altered the normal behavior of animal including feeding, respiratory, mucous secretion, locomotory and courtship behavior (S.B. Kamble and N.A. Kamble, 2014). The control snails were submerged and aerial and pulmonary respiration was observed but in exposure group showed only pulmonary respiration (P. Mahobia, Sept. 2013). Also the toxic effect of copper on snail *Lymnaea stagnalis* showed reduced calcium uptake of the body and effect on other physiological parameters (Kevin V. Briks et al 2011). Randall J. et al (Nov. 2004) demonstrated the effect of ionic liquids on the survival, movement and feeding behavior of the freshwater snail, *Physa acuta*. Kathleen M. Munley et al. (2013) explained the toxic impact of lead on the growth inhibition and also on life cycle of freshwater snail *Lymnaea stagnalis*. Intoxication of chlorpyrifos and cypermethrin also affecting decalcification of shell it become fragile and semitransparent (P. Mahobia, Sept. 2013). After the acute exposure of snails on LC50 concentration they showed dullness and become inactive throughout the experiment. Feeding was stopped in treated group body was retracted in the shell and slightly protruded foot were observed. The insecticide Chlorpyrifos and cypermethrin causing behavioral toxicology in pond water snail *Lymnaea stagnalis*.

The given survey indicated that the behavior and physiology of the molluscan animals affecting due to the toxic compounds like insecticides, pesticides, toxic metals as well as heavy metals, in future the improper use of insecticides going to destroy the ecosystem and food chain of the environment.

### Conclusion:

The objective of the given study is to determine the acute sensitivity of chlorpyrifos and cypermethrin of the freshwater pulmonate snail *Lymnaea stagnalis*. The current study is able to assess the toxic impact of insecticides (chlorpyrifos + cypermethrin), Pesticides, toxic metals and heavy metals on aquatic ecosystem. The present study is first of its kind that deals with the water pollution and behavioral change due to overuse of insecticide chlorpyrifos and cypermethrin.

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Collection area:



LC50 count:

Mortal snails- *Lymnaea stagnalis*:

