



EFFECT OF SUBLETHAL CONCENTRATIONS OF INSECTICIDE DICHLORVOS ON RESPIRATORY RATES OF SNAIL LYMNAEA ACCUMINATA (LAMARCK)



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Abstract: Snails *Lymnaea accuminata*, were exposed to 1.4 mg/l (1/10th of 96 hr LC₅₀) and 2.8 mg/l (1/5th of 96 hr LC₅₀) of insecticide Dichlorvos. Initially at 24 hours, at both the concentrations increase in respiratory rate is noted. At 48 hours stage, increase in respiratory rate is noticed at both the sublethal concentrations. At 72 hours stage in both the sublethal concentrations reduction in oxygen consumption is noted. At the end of 96 hours, again in both the concentration decrease in oxygen consumption prevailed. These experimental snails upon transfer to fresh water for 24 hours, showed recovery in respiratory rate. Respiratory rates are discussed with respect to sublethal concentration and time of exposure to toxicant Dichlorvos.

Keyword: *Lymnaea accuminata*, Respiratory rates, Dichlorvos.

INTRODUCTION:

Respiratory rates is the basic parameter, Change in respiratory rates serves as the one of the indicators of environmental stress. Effect of insecticides on the oxygen consumption of mollusc has been studied by Agarwal (1978) he observed effects of Endrin on certain fresh water gastropods, Rao and Mane (1978) noted effects of Malathion on survival and respiration of *Mytilus gallanoprovincialis*. Moorthy et. al. (1984) reported changes in the respiration and ionic constituents in tissues of fresh waater mussel exposed to Methyl parathion, Thosar and Lonkar (1994) studied effect of Metasystox on the oxygen consumption of *Vivipara bengalensis*. and Rohankar and Kulkarni (2005) reported alteration in oxygen consumption in freshwater snail *Bellamya bengalensis* during pesticide exposure. Lonkar (2012) reported changes in oxygen consumption rates of mollusk *Indoplanorbis exustus* exposed to sublethal concentrations of insecticide Tricel.

Less information is available on oxygen consumption of snail *Lymnaea accuminata* exposed to insecticide. Therefore the present investigation is attempted.

Material and Methods

The specimens of snail, *Lymnaea accuminata* were collected locally and were acclimated to the laboratory condition for 7 days in the glass aquaria filled with chlorine free tap water. Physicochemical parameters of chlorine free tap water showed following

ranges, pH 7.1 to 7.4, dissolved oxygen 7.2 to 7.6 mg/l, free CO₂ Nil, Total hardness (as CaCO₃) 161-173 ppm. Alkalinity 142-160 mg/l, Temperature 27 to 29 oC.

For finding 96 hr LC₅₀, static bioassay experiments were set by using the toxicant Dichlorvos (Dichlorvos 76% Hindustan Insecticide Limited Raigadh Maharashtra, India) insecticide compound. Initially, bioassay experiments were set with a wide range of toxicant and finally with closer ranges. Various concentrations were prepared by dilution method. Cleaned similar sized and preweighed Snails were exposed to 1.4 mg/l (1/10th of 96 hr LC₅₀) and 2.8 mg/l (1/5th of 96 hr LC₅₀) concentration for 24, 48, 72 and 96 hours. The toxicant solutions were renewed after every 24 hours. "A closed chamber" method was used for the measurement of oxygen consumption of snails. The oxygen content was determined by Winkler method at the end of 24, 48, 72 and 96 hours. The recovery rates were determined by transferring the experimental animals in toxicant free water. Oxygen consumption was calculated in terms of mg/hr/gram body weight of snail. Respiratory response values were found after calculating the percent normal oxygen consumption. In each experiment about 10-15 animal were used.

Results

Snail *Indoplanorbis exustus* of size 1.4. cm and average weight 0.3.7 gms. Were exposed to two sublethal concentration 1.4 mg/l (1/10th of 96 hr LC₅₀) and 2.8 mg/l (1/5th of 96 hr LC₅₀) of Dichlorvos. Initially after 24 hours, at both the concentrations an increase in oxygen consumption rate is noticed (116.14% and 108.42%) at lower and higher concentration respectively. At 48 hours stage increase in oxygen consumption rate is recorded at lower concentration (Oxygen consumption rate is 101.43%), while at higher concentration oxygen consumption rate is found to be decreased to

102.45%. At 72 hours stage in both the sublethal concentrations, reduction in oxygen consumption rate is noticed the values being 97.37% and 96.34% for lower and higher concentration respectively. At the end of 96 hours, again in both the concentrations, decrease in oxygen consumption rate prevailed. At lower concentration the oxygen consumption rate is 90.00% and for higher concentration it is 88.92%. Upon transfer to freshwater for 24 hours these experimental snails showed recovery in oxygen consumption rate (102.30% and 101.17%) in snails previously exposed to lower and higher concentrations respectively. (Table – 1 Fig.-1).

Discussion

In the present investigation at 24 and 48 hours stage an increase in oxygen consumption rate (respiratory rates) is noticed in the snail *Lymnaea accuminata* exposed to both sublethal concentration. At 48 hours decrease in oxygen consumption was noted at lower and higher concentration, at 72 hours stage the decrease in oxygen consumption is found at both the concentration. At 96 hours exposure at both the concentration decrease in oxygen consumption is noted. Rao and Mane 1978) noticed an initial stimulation in oxygen consumption rate of *Mytilus gallanoprovincialis* exposed to low sublethal concentration of Malathion. Hanumante et.al. (1980) noticed an increase in respiratory rate for 96 hours in the pulmonate, *Onchidium vespiculatum* exposed to sublethal concentration of DDT. Moorthy et.al. (1984) noticed an initial elevation in oxygen consumption of freshwater mussel *Lamellidens marginalis* followed by decrease in oxygen consumption. (Mane et. al 1984) studied the effect of Cythion - Malathion (0.081 ppm) on oxygen consumption in three freshwater bivalve for 96 hours and reported that, the rate of oxygen consumption increased initially in *Lamellidens carianus* (Lea) and *L. marginalis* (Lamarck), whereas mortality occurred in *Indonia caeruleus*. But when *I. caeruleus* were exposed to lower concentration (0.004 ppm and 0.012 ppm) of Cythion - Malathion, the rate of oxygen consumption increased as compared to control. They have attributed this increase in oxygen consumption in all three bivalves to their behavior resulting in excessive muscular activity. Thosar et.al. (2001) noticed an increase in the oxygen consumption of snail *L. accuminata* at 24, 72 and 96 hours exposed to 3.4 mg/l concentration of Metasystox. They also found that when these snails were exposed to higher sublethal concentration (6.8 mg/l), the Oxygen consumption rate is increased at all exposure periods i.e. 24, 48, 72 and 96 hours. Rohankar and Kulkarni (2005) reported the alteration in oxygen consumption of freshwater snail *Bellamya bengalensis*. exposed to Phosphomidon. The snails was exposed to lethal concentration (0.135mg/l) and two sublethal concentrations (0.045mg/l and 0.0675mg/l) of Phosphamidon an acute and chronic treatment at normal room temperature. They reported significantly rise in oxygen consumption of snail by 1.14% at lethal concentration, 7.6% at higher sublethal concentration, 10.88% at higher sublethal concentration at the end of 24 hours exposure. Lonkar (2012) reported initial increase in oxygen consumption at 24 hours exposure in *Indoplanorbis exustus* exposed to sublethal concentrations 1.4 mg/l and 2.8 mg/l of insecticide trichel.

Agrawal, (1978) reported decrease in oxygen consumption of snail *L. accuminata*, *L. luteola* and *V. bengalensis* exposed to sublethal concentration of organ chlorine insecticide Endrine. He inferred that, the death of snail is due to great reduction in the oxygen consumption. Mahendra and Agrawal (1981) also noticed reduction in the oxygen consumption of snail *Lymnaea acuminata* exposed to 10 mg/l and 20 mg/l of Trichlorphon for 24 and 48 hours. Thosar and Lonkar (1994) noted reduction in oxygen consumption rate in snail *V. bengalensis* exposed to two sublethal concentration (1.30 mg/l and 2.60 mg/l) of organophosphorus insecticide Metasystox. Thosar et. al (2000) studied respiratory response of the snail *Vivipara bengalensis* exposed to sublethal concentration of the insecticide Fenval (1.85mg/l and 3.70mg/l). Fall in oxygen consumption rate was noted at 3.7mg/l concentration. Thosar et.al. (2001) exposed the snail *Lymnaea accuminata* to Metasystox and reported decrease in oxygen consumption rate at 48 hours exposure at lower sublethal concentration.

Experimental snails *Lymnaea accuminata* after transfer to toxicant free, chlorine free tap water for 24 hour, showed recovery this may be due to observation that the 24 hours time is sufficient for the gills to recover.

Table-1
Changes in respiratory rate of *Lymnaea accuminata*
exposed to different concentration of Dichlorvos

Concentration of Dichlorvos in mg/l	Exposure period in hours				Recovery in tap water	Oxygen consumption
	24	48	72	96		
Normal snail	0.0414	0.0364	0.0446	0.0386	0.0358	Rate mg/hr/gm body weight
	100%	100%	100%	100%	100%	Taken as 100%
1.4 mg/l Dichlorvos	0.04808	0.03692	0.04342	0.03485	0.03662	Rate mg/hr/gm body weight
	116.14%	101.43%	97.37%	90.00%	102.30%	Percent of normal
2.8 mg/l Dichlorvos	0.04488	0.03730	0.04296	0.03409	0.03620	Rate mg/hr/gm body weight
	108.43%	102.45%	96.34%	88.92%	101.17%	Percent of normal

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