

## RESEARCH REPORT

# Effect of Quinalphos, Cypermethrin and their mixture on oxygen consumption of the fish, *Lebistes reticulatus* (Peters)

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| Manuscript details:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ABSTRACT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
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| <p>Received: 22.10.2017<br/>Revised: 22.11.2017<br/>Accepted: 21.12.2017<br/>Published: 31.12.2017</p> <p><b>Cite this article as:</b><br/>Maske JS (2017) Effect of Quinalphos, Cypermethrin and their mixture on oxygen consumption of the fish, <i>Lebistes reticulatus</i> (Peters), <i>Int. J. of Life Sciences</i>, Volume 5(4): 809-810.</p> <p><b>Copyright:</b> © Author, This is an open access article under the terms of the Creative Commons Attribution-Non-Commercial - No Derives License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.</p> <p>Available online on <a href="http://www.ijlsci.in">http://www.ijlsci.in</a><br/>ISSN: 2320-964X (Online)<br/>ISSN: 2320-7817 (Print)</p> | <p>Indiscriminate use of agrochemicals, like fertilizers, pesticides and their different formulations in crop fields for controlling various pests making the problem of water pollution more serious. 96 hr LC<sub>50</sub> value of Quinalphos, Cypermethrin and combination of these two insecticides were determined for the larvivorous fish, <i>Lebistes reticulatus</i> by following bioassay method. To find out the oxygen consumption, the fishes having average size of 2.8 cm and average weight of 0.48 gm were exposed to two different (1/5th of 96 hr LC<sub>50</sub> and 1/10th of 96 hr LC<sub>50</sub>) sublethal concentrations: 0.180 mg/L and 0.090 mg/L of Quinalphos, 0.002 mg/L and 0.001 mg/L of Cypermethrin, and 0.004 mg/L and 0.002 mg/L of the mixture of these insecticides in 1:1 ratio. Oxygen consumption rates were recorded at 24 hours exposure. In Quinalphos, Cypermethrin and their combination, the increased change in oxygen consumption in comparison with control value is found at both the sublethal concentrations. In Cypermethrin exposed fishes, oxygen consumption was relatively more than in mixture and Quinalphos.</p> <p><b>Keywords:</b> Quinalphos, Cypermethrin, Oxygen consumption, <i>Lebistes reticulatus</i>.</p> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <h2>INTRODUCTION</h2> <p>In recent years, heavy metals, pesticides, industrial and sewage effluents discharged at various locations in the upstream course of the rivers are gradually accumulated in the water bodies like reservoirs and lakes. Thus, the aquatic environment gets polluted. Most of the water bodies receive run-offs from catchments covering agricultural crop fields during monsoon season which get exposed to different types of fertilizers, pesticides and their various formulations, rendering in long term adverse effect on fish and other useful fauna and flora of the aquatic environment (Jain, 2000). Quinalphos is a organophosphate and cypermethrin is a synthetic pyrethroid insecticide soluble in water are widely used in India to kill the pests from agricultural fields. Aquatic organisms solely depend on dissolved oxygen in the water for their survival. Hence, oxygen is the most important parameter of water which keeps on changing due to other physical conditions. Dissolved oxygen is</p>                                                                                                                                                                                                                                |

essential for the metabolism of all the aquatic organisms and all the biological activities depend on it. The rate of oxygen consumption is a general measure of the intensity of metabolism (Fry, 1957). The metabolic rate, measured as oxygen consumption in aquatic organisms, is greatly altered by various pesticides (Joseph and Joshua, 2002). Cairns (1966) stated that testing the oxygen consumption is one of the best methods to assess the toxic effects. Hence, it has a greater importance to study the oxygen consumption of fish, *Lebistes reticulatus* exposed to sublethal concentrations of Quinalphos, Cypermethrin and the combination of these two insecticides.

## MATERIALS AND METHODS

The oxygen consumption of animal is regarded as an index of metabolic activities. It changes under any stress. The closed chamber method has been used in determining the rate of oxygen consumption by measuring the oxygen content of water in a sealed container (respiration bottle) in which test animals are released (Fry, 1957). The volume of water in the bottles was in proportion to the size and weight of the test animals.

The fishes, *Lebistes reticulatus* acclimatized to the laboratory conditions were not fed at least 12 hours prior to experimentation in order to eliminate the increase in oxygen consumption after feeding. Ten test fishes were exposed separately to the different sublethal concentrations of toxicants in each respiration bottle. After 24 hours, they were transferred to the respiration bottles which contained the same concentrations of toxicants to which the animals were exposed. After a known predecided interval of time, the dissolved oxygen content of the water from each respiration bottle was estimated by the modified Winkler's iodometric titration method. Likewise, the dissolved oxygen content of the water of the control and blank respiration bottle was also estimated. From the dissolved oxygen of a) blank, b) control in which normal fishes were placed and c) test solutions to which fishes were exposed, the oxygen consumption of exposed fishes was calculated. The difference in dissolved oxygen content of the initial and final samples was taken as the amount of oxygen consumed by the fishes during the period of experimentation. The weights of control and exposed fishes were noted and the values of oxygen consumption were expressed as mg of oxygen consumed/gm weight of fish/hour.

## RESULTS

Oxygen is the most primary need for all living organisms for survival which provides energy for their vital activities. Studies on oxygen consumption (respiratory response) form a useful tool in the evaluation of toxicant stress on the aquatic organisms and give an index of metabolic activities. The rate of oxygen consumption varies according to size, weight, sex and age of the animals. Hence, in the present study, the changes in oxygen consumption rate of the fish *Lebistes reticulatus* exposed to sublethal concentrations (1/5th and 1/10th of the 96 hr LC<sub>50</sub>) of Quinalphos, Cypermethrin and their combination (in 1:1 ratio) for 24 hours are observed.

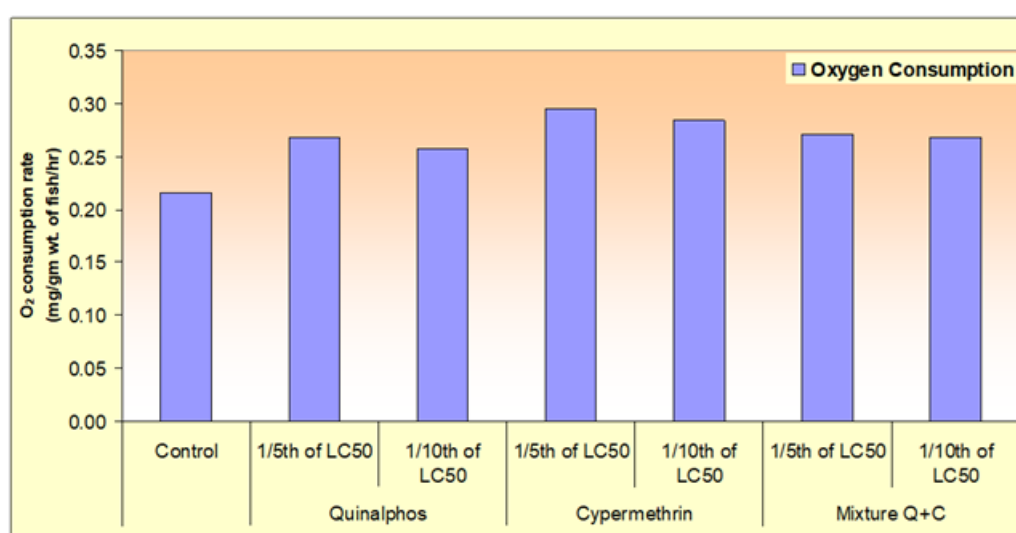
A separate control was maintained for each exposure. At the end of the exposure period, the fishes were taken out and they were introduced to respiratory chambers (bottles) separately containing the test solution of the same concentration. Then they were allowed to respire the dissolved oxygen present in the water of respiratory bottle for a predecided time and the oxygen consumption rates were evaluated.

The changes in oxygen consumption rate of the fish, *Lebistes reticulatus* exposed to various sublethal concentrations of insecticides are presented in Table-1 and also illustrated in Figure-1. Fishes having average size 2.8 cm and average weight 0.48 gm are exposed for 24 hours to two different sublethal concentrations of Quinalphos, Cypermethrin and the mixture of these two insecticides.

The oxygen consumption of control fish is 0.2151 mg/gm body wt of fish/hr. After 24 hours of exposure to insecticides, the rate of oxygen consumption is increased in comparison with control value. In case of Quinalphos, the increased change in oxygen consumption over the value of control is 0.0534 and 0.0416 mg/gm body wt/hr for sublethal concentrations of 0.180 mg/L and 0.090 mg/L respectively, 0.08 and 0.0689 mg/gm body wt/hr for sublethal concentrations of 0.002 mg/L and 0.001 mg/L of Cypermethrin respectively, and 0.055 and 0.053 mg/gm wt/hr in 0.004 mg/L and 0.002 mg/L sublethal concentrations respectively of mixture of Quinalphos and Cypermethrin. The estimated 't' values confirmed that, there are significant differences at  $P < 0.001$  between the oxygen intake of control and treated fishes with sublethal concentrations of insecticides.

**Table 1: Changes in Oxygen Consumption rate of fish *Lebistes reticulatus* exposed to different sublethal concentrations of Quinalphos, Cypermethrin and their mixture for 24 hrs**(Each value of O<sub>2</sub> consumption (mg/gm wt. of fish/hr) represents a mean of three observations)

| Sr. No. | Control/ Exposed fish to insecticides                                   | Mean of O <sub>2</sub> consumption (mg/gm wt/hr) | ± SD     | SE of mean | % of change over control | t' value with 2 df | P      | Significance |
|---------|-------------------------------------------------------------------------|--------------------------------------------------|----------|------------|--------------------------|--------------------|--------|--------------|
| 1.      | Control                                                                 | 0.2151                                           | + 0.0003 | 0.00017    | +24.83%                  | -462.46            | <0.001 | Significant  |
|         | Quinalphos 0.18 mg/L (1/5 <sup>th</sup> of 96 hr LC <sub>50</sub> )     | 0.2685                                           | ± 0.0005 | 0.00029    |                          |                    |        |              |
| 2.      | Control                                                                 | 0.2151                                           | + 0.0003 | 0.00017    | +19.34%                  | -72.05             | <0.001 | Significant  |
|         | Quinalphos 0.09 mg/L (1/10 <sup>th</sup> of 96 hr LC <sub>50</sub> )    | 0.2567                                           | ± 0.0007 | 0.00040    |                          |                    |        |              |
| 3.      | Control                                                                 | 0.2151                                           | + 0.0003 | 0.00017    | +37.19%                  | -1385.64           | <0.001 | Significant  |
|         | Cypermethrin 0.002 mg/L (1/5 <sup>th</sup> of 96 hr LC <sub>50</sub> )  | 0.2951                                           | ± 0.0004 | 0.00023    |                          |                    |        |              |
| 4.      | Control                                                                 | 0.2151                                           | + 0.0003 | 0.00017    | +32.03%                  | -596.69            | <0.001 | Significant  |
|         | Cypermethrin 0.001 mg/L (1/10 <sup>th</sup> of 96 hr LC <sub>50</sub> ) | 0.284                                            | ± 0.0005 | 0.00029    |                          |                    |        |              |
| 5.      | Control                                                                 | 0.2151                                           | + 0.0003 | 0.00017    | +25.57%                  | -119.08            | <0.001 | Significant  |
|         | Mixture Q+C 0.004 mg/L (1/5 <sup>th</sup> of 96 hr LC <sub>50</sub> )   | 0.2701                                           | ± 0.0005 | 0.00029    |                          |                    |        |              |
| 6.      | Control                                                                 | 0.2151                                           | + 0.0003 | 0.00017    | +24.64%                  | -131.14            | <0.001 | Significant  |
|         | Mixture Q+C 0.002 mg/L (1/10 <sup>th</sup> of 96 hr LC <sub>50</sub> )  | 0.2681                                           | ± 0.0004 | 0.00023    |                          |                    |        |              |

**Fig. 1: Respiratory response of *Lebistes reticulatus* exposed to sub-lethal concentrations of Quinalphos, Cypermethrin and their Mixture for 24 hrs.**

In the present investigation, the effects of two different sublethal concentrations (1/5<sup>th</sup> and 1/10<sup>th</sup> of 96 hr LC<sub>50</sub> value) of an organophosphate insecticide Quinalphos (0.180 mg/L and 0.09 mg/L), a synthetic pyrethroid insecticide Cypermethrin (0.002 mg/L and 0.001mg/L) and Quinalphos-Cypermethrin combination (0.004 mg/L and 0.002 mg/L) on oxygen consumption rate of the fish *Lebistes reticulatus* after 24 hours exposure period have been studied. The fishes exposed to each toxicant for 24 hours showed a gradual increase in the oxygen consumption rate with the progressive increase in concentrations of the toxicants. The

percentage increase in oxygen consumption in the Quinalphos exposed fish was by 24.83% and 19.34%, in the Cypermethrin exposed fish by 37.19% and 32.03%, and in the mixture exposed fish by 25.57% and 24.64% at higher and lower sublethal concentrations respectively as compared to control. The test of significance (t-test) confirmed that there were significant differences between the oxygen intake of control and treated fishes with sublethal concentrations of insecticides. In Cypermethrin exposed fishes, oxygen consumption was relatively more than in mixture and Quinalphos. The increase in the oxygen consumption

may be due to stress of insecticides. The initial rise in the respiration rate might be due to acceleration of oxidative metabolism probably to meet energy demand during the initial hours of exposure. These observations are in conformity with the studies of Bakthavathsalam and Reddy (1985), Jawale (1985), Sornaraj *et al.* (2005), Prasad and Roy (2006) and Remia *et al.* (2008) who reported a similar increase in oxygen consumption of fishes exposed to pesticides, initially at 24 hours of exposure period.

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