



Alteration in oxygen consumption of fresh water fish *Puntius stigma* exposed to sublethal concentrations of insecticide Phytofos

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Abstract

Now a days large number of new insecticide formulations are used to protect the crops from various insects. Water pollution caused by insecticide is a serious problem it affects the aquatic animals adversely. Static bioassay experiments were conducted to find out 96 hr LC 50 value for fish *Puntius stigma*. For finding out respiratory response, the fishes of average length 3.7 Cm. were exposed to 0.4 mg/l (1/10 96 hr LC 50) and 0.8 mg/l (1/5 96 hr LC 50) concentrations of Phytofos. The respiratory response in terms of oxygen consumption was recorded at 24,48,72 and 96 hours. At the end of first 24 hours there is an increase in oxygen consumption is noted at 0.4 mg/l and 0.8 mg/l concentrations. At 48 hours exposure there is decrease in oxygen consumption at concentration 0.4 mg/l and at concentration 0.8 mg/l. At the end of 72 hours, there is a fall in oxygen consumption rate at both the concentration is recorded. At the end of 96 hours exposure, a reduction in oxygen consumption rate at concentration 0.4 mg/l and a just a little more fall in oxygen consumption at concentration 0.8 mg/l is noted. On transfer to toxicant free water (after 96 hours to 120 hours exposure) fishes showed recovery. Oxygen consumption in fishes are discussed with respect to time of exposure and sub lethal concentrations of insecticide Phytofos.

Keywords: Oxygen consumption, *Puntius stigma*, Phytofos

Introduction

Insecticide formulations are used to protect the crops from various insects. These toxic insecticides with agricultural field run off, percolation through soil and through faulty handling reaches in the aquatic ecosystem and causes harm to aquatic animals. Phytofos is a insecticide which is widely used in central India. Change in the oxygen consumption is a good parameter to asses the toxicity. So in the present study respiratory response of fish *Puntius stigma* exposed to sublethal concentrations of insecticide Phytofos is studied.

Material and Methods

The fishes *puntius stigma* were collected from Green lake Umrer and were acclimated to the laboratory conditions for 7 days, in the glass aquaria filled with chlorine free tap water.

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The physic-chemical parameters of water showed following ranges pH 6.8 to 7.2, dissolved oxygen 7.5 to 7.8 mg/l, CO₂ Nil, total hardness (as CaCO₃)170 to 174 ppm, total alkalinity 150 to 166 mg/l, temperature 26 °C to 28 °C. the average length of fish was 3.8 cm. the static bioassay experiments were performed by using the toxicant Phytofos (Phytofos: Monocrotophos 36% SL. Manufactured by Phyto Chem INDIA Ltd. Bonthapally, A.P.).various concentrations were prepared by dilution method. Initially bioassay experiments were set with wide ranges of toxicant concentrations and finally with closer ranges to find out 96 hr LC50 value. The fishes were exposed to 0.4 mg/l (1/10th of 96 hr LC 50) and 0.8 mg/l (1/5th of 96 hr LC 50) concentrations for 24, 48, 72 and 96 hours. The solutions were renewed after every 24 hours. A closed chamber method was used for measurement of oxygen consumption. The oxygen content of water was determined by Winkler method, at the end of 24,48,72 and 96 hours. The recovery rates were



determined by transferring the experimental fishes (those were exposed to the toxicant for 96 hours). In the toxicant free water. In each experiment about 08 fishes were used. Oxygen consumption was calculated in terms of mg/gm body weight of fish/hour. Oxygen consumption curves were drawn after calculating the percent normal oxygen consumption rates.

Results and Discussion

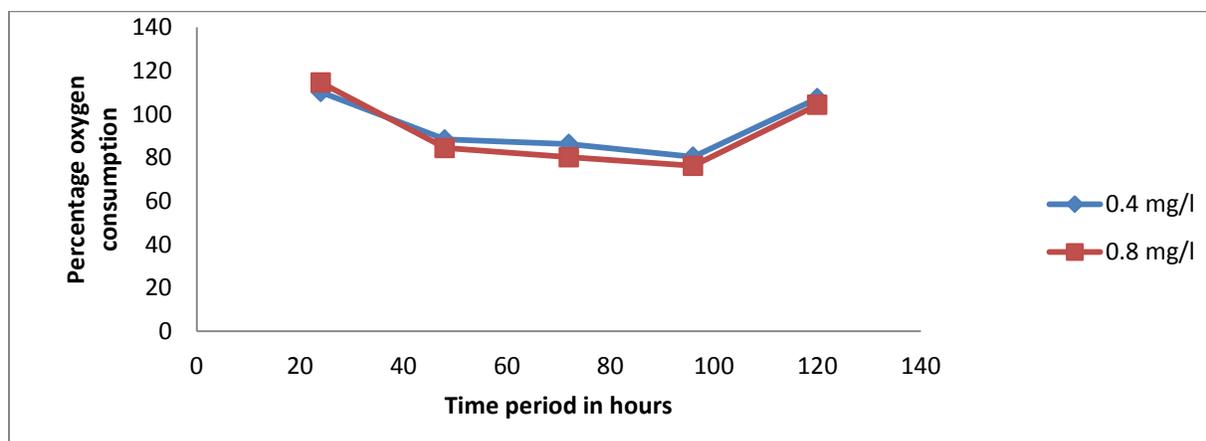
At the end of first 24 hours, there is an increase in oxygen consumption at 0.4 mg/l and 0.8 mg/l concentrations are noted values are 110.12% and 114.48% respectively. At 48 hours exposure there is decrease in oxygen consumption at concentration 0.4 mg/l, the value being 88.30% and at

concentration 0.8 mg/l a decrease in oxygen consumption rate is noted (84.40%). At the end of 72 hours, there is again fall in oxygen consumption 86.18% and 80.10% at 0.4 mg/l and 0.8 mg/l respectively. At the end of 96 hours exposure a reduction on oxygen consumption rate at concentration 0.4 mg/l and a little more fall in oxygen consumption at concentration 0.8 mg/l is noted, the value are 80.34% and 76.14% respectively. On transfer to toxicant free water (after 96 hours to 120 hours exposure) recovery in oxygen consumption is noted. The oxygen consumption reaches to 107.34% and 104.20% in the fishes which were previously exposed to 0.4 mg/l and 0.8 mg/l concentration respectively (Table-1 and Fig-1).

Table 1. : Alteration in the oxygen consumption of *Puntius stigma* exposed to sublethal concentration of Phytofos

Concentration of Phytofos in mg/l	Exposure period in hours				Recovery in tap water	Oxygen consumption
	24	48	72	96		
Normal fish	0.4230	0.4269	0.4260	0.4209	0.4290	Rate mg/hr/gm body weight
	100%	100%	100%	100%	100%	Taken as 100%
0.4mg/l Phytofos	0.4658	0.3769	0.3929	0.3373	0.4604	Rate mg/hr/gm body weight
	110.12%	88.30%	86.18%	80.34%	107.34%	Percent of normal
0.8 mg/l Phytofos	0.4842	0.3603	0.3412	0.3204	0.4470	Rate mg/hr/gm body weight
	114.48%	84.40%	80.10%	76.14%	104.20%	Percent of normal

Fig.1: Alteration in the oxygen consumption of *Puntius stigma* exposed to sublethal concentration of insecticide Phytofos



In the present investigation, the effects of exposure of sub lethal concentrations of Phytosofos on the oxygen consumption rate (respiratory response) at 24, 48, 72 and hours, for fish *Puntius stigma* have been studied. Recovery after 96 hours to 120 hours in the toxicant free water also have been evaluated. It has been observed that in fish *Puntius stigma* the insecticide treatment resulted in a change in oxygen consumption or respiratory response. In the present study decrease in oxygen consumption is noted at 48 hours in lower and higher sublethal concentration (0.4mg/l and 0.8 mg/l) in both the concentrations at 72 hours. At the end of 96 hours exposure, a reduction in oxygen consumption rate at concentration 0.4 mg/l and just a little more fall in oxygen consumption rate at concentration 0.8 mg/l is noted. Wodnie and Rocz (1976) noted reduction in oxygen consumption in fish *Lebistes reticulatus* for 6 and 12 hours treated with different concentrations of Malathion, Foschlor and Dichlorphos. Reddy and Gomathy (1977) reported that exposure to a sublethal concentration of Thiodon lead to 40% decline in oxygen consumption rate of *Mystes vitatus*. Rao *et al.* (1981) noted reduction in oxygen consumption rate in fish *Macrogathus aculeatum* treated with Endosulphon. Manoharan and subbiah (1982) noted that *Barbus stigma* treated with sublethal concentrations of Endosulphon showed 10% to 16% reduction in respiratory rate. Rao *et al.* (1985) studied effect of sublethal dose of Methyl parathion on respiration of fish *Tilapia mossambica*. Reddy (1988) recorded decrease in the oxygen consumption in fish *Cyprinus carpio* exposed to sublethal concentration of Malathion. Thosar and Lonkar (1999) noted decrease in respiratory response in female fish *Lebistes reticulatus* at 24,48,72 and 96 hours exposed to 0.118 mg/l of insecticide Fenval. Thosar and Lonkar (2004) reported reduction in the respiratory response in male fish *Lebistes reticulatus* at 24, 72 and 96 hours exposed to 2.15 mg/l and at 72 and 96 hours exposed to 4.30 mg/l of Metasystox. Contrary to above made observation in the present study increase in oxygen consumption rate is also noted at 24 hours at 0.4 mg/l and 0.8 mg/l concentration. Venugopal *et al.* (1989) reported increase in the rate of respiration in fish *Cyprinus carpio*

communis exposed to sublethal concentration 180 ppm and 220 ppm of Monocrotophos. Gopal *et al.* (1989) showed an increase in the oxygen consumption when the fishes *Channa puctatus* were exposed to sublethal concentration of Lindane. Thosar and Lonkar (1999) noted increase in oxygen consumption in female fish *Lebistes reticulatus* at 24 and 48 hours exposed to 0.118 mg/l of Fenval. Thosar and Lonkar (2004) also noted increase in the oxygen consumption in male *L.reticulatus* at 48 hours exposed to 4.30 mg/l of Metasystox. Sarnoraj *et al.* (2005) observed the respiratory alteration induced by Parrysulphon (an organochlorine) and Sicocilcon (an organophosphate) pesticide in the fresh water fish *Mystus vitatus* the fishes were exposed to the two sublethal concentration of Pyrysulphon (0.1072 and 0.3345 ppm) and Silcocilcon (0.3358 and 0.5717 ppm) then the oxygen consumption of exposed fish to different sublethal concentration was analysed on 1st, 10th, 30th and 60th day of exposure it showed an elevated consumption of oxygen on the first day. As duration of exposure extends beyond 24 hours the rate of oxygen consumption showed decreasing trends. The same trend was noted in Silcocilcon exposed fish. Kannedi *et al.* (2007) exposed fish *Channa punctatus* to insecticide Monocrotophos and noted initial increase with lower concentration and decrease with increasing concentration, this is attributed to gill damage. Remia *et al.* (2008) studied the effect of Monocrotophos on fish *Tilapia mossambica* for 24, 48, 72 and 96 hours exposure. The oxygen consumption was increased by 40.97%, 49.02%, 42.96% and 46.53% respectively. It may be due to respiratory distress as a consequence of the impairment of oxidative metabolism due to toxicant stress. Recovery in toxicant free water is noted in the fishes which were previously exposed to both sublethal concentrations for 96 hours. Similar kind of recovery was noted by Thosar and Lonkar (1999, 2004) in female fish *L.reticulatus* previously exposed to sublethal concentrations of Fenval, and also in male *L.reticulatus* exposed to sublethal concentration of Metasystox. In the present study it is noted that varied respiratory response in fish *Puntius stigma* is may be due to insecticide stress and the damage to gill of the fish.



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