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Research Paper

A Study on Oxygen Consumption in a freshwater fish *Channa gachua* exposed to Lethal and Sublethal Concentrations of pesticide Fenos Quick.

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Abstract: The purpose of this study was to determine the effects of lethal and sublethal concentrations of pesticide Fenos Quick on oxygen consumption in a freshwater fish *Channa gachua* For finding out respiratory response, the fishes of average length of 15.4 cm and weight of 54.0 ± 2 gm. were exposed to lethal and sublethal concentrations of Fenos Quick for the period 24 hrs. 48 hrs.72 hrs. and 96 hrs. and for sublethal concentration for 7 days, 14 days, 21 days and 28 days. It was observed that the rate of oxygen consumption initially increased and then decreased on pesticide exposure and the decrease was more prominent at 96 hrs. in both lethal and sublethal concentrations. There was a significant increase in oxygen consumption after 24 hrs. and 48 hrs. of exposure to lethal concentration and at sublethal concentration of the Fenos Quick also showed a slight increase by 24 hrs. and 48 hrs but afterwards, the rate of oxygen consumption was slightly decrease below the control level. However, the increase in respiratory rate is higher in lethal concentration as compared to sublethal concentration at 24 hrs. and 48 hrs. At 72 and 96 hrs. the rate of oxygen consumption was decreased and it was higher in lethal concentration than in sublethal concentration of Fenos Quick. Exposure to sublethal concentration continued till 28 days and oxygen consumption was measured on 1st, 7th, 14th, 21st and 28th day. It was observed that the rate of Oxygen consumption initially increases then shows a decline. The increase in oxygen consumption recorded on 7th day was not very significant but it was significant on 14th day. By 21st day, oxygen consumption was found to have declined significantly and it continued to decrease to 28th day.

Keywords: Fenos Quick, *Channa gachua*, Sublethal, oxygen consumption, toxicity, Pesticide, Girna Dam Malegaon.

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Introduction:

In modern Agriculture pesticides are widely used for the production of high-quality food. The contamination of surface water by insecticides is known to have dangerous effects on the, reproduction, respiration, growth and survival of fishes. The rate of Oxygen consumption is a measure of the metabolic status of the animal and is considered as a vital parameter and indicates the physiological and metabolic alteration of the animal. The respiratory rates alter under the influence of several biotic and abiotic factors (Prosser, 1973). The rate of oxygen consumption controls the metabolic activities. The changes in respiratory rates have been used as the indicator of the stress in pollutant exposed organisms Dharmalata and Joshi, 2002. Studies on oxygen consumption in fishes such as *Cirrhinus mrigala* (Mushigeri and David, 2003), *Oreochromis mossambicus* (Logaswamy and Remia, 2009), *Cyprinus carpio* (Neelima et al 2016) *Labeo rohita* (Kalaimani and Kandeepan 2017) *Gambusia affinis* (Vandana Bhavare et al 2019) and reported either increase or decrease their respiration rate in response to variety of pesticides. Sornaraj et al. (2005), Francesco et al., (2008), Logaswamy and Remia, (2009), Franklin et al., (2010) investigated the studies on oxygen consumption form a suitable tool in the assessment of stress due to toxicants on the aquatic organisms and give an index of energy expenditure mechanisms for observing changes in the environment. Hence, the present study was undertaken to evaluate the toxicity of lethal and sublethal concentrations of Fenos Quick on oxygen consumption of the freshwater fish *Channa gachua*. In the present investigation it has been tried to assess Fenos Quick altered respiratory responses in *Channa gachua* which can be used as a bioindicator for assessing pesticide toxicity to fish.

Materials and Methods:

The freshwater air breathing fish *Channa gachua* were collected from Girna Dam Malegaon, District Nashik. The healthy-looking fishes approximately equal length 15.4 ±2 cm and weight of 54.0 ± 2 gm. were selected for experimentation. To avoid a dermal infection, all the fishes were given the treatment with 0.1 % $KMNO_4$. They were acclimatized for 10 days. Fishes of group one was exposed to Fenos Quick of lethal concentration of 0.23 ppm [LC 50 of 96 h], Whereas group second and third of the fishes were exposed of Fenos Quick of sublethal concentration 0.023 ppm [LC 50 of 96 h]. The set of sublethal concentration was continued for duration of 28 days. The rate of oxygen consumption of fishes exposed to lethal and sublethal concentration of Fenos Quick was estimated after every 24 hours up to 96 hours. For fishes exposed to sublethal concentration oxygen consumption was also estimated on 7th, 14th, 21st and 28th day. Simultaneously fourth group of control fishes was also maintained. Oxygen content was measured by Winkler method as modified by Strickland and Parsons (1965) and expressed in ml. of oxygen / gm. wet wt. /hr.

Results and Discussion:

The changes in the rate of oxygen consumption in the freshwater fish *Channa Gachua* were observed after exposing the fishes to the lethal and sublethal concentration of Fenos Quick, which contains Flubendiamide 90 + Deltamethrin 60 SC (8.33% w/w + 5.56% w/w) and the results are represented in table 1 & 2 and graph are shown in figure 1 and 2.

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Table - 1: Effect of lethal and sub lethal concentration of Fenos Quick on oxygen consumption of *Channa gachua.*

Sr. No	Exposure time (in hours	Control	Lethal (0.23 ppm)	Sublethal (0.023 ppm)
1	0	0.0074 ±0.002	0.0044 ±0.002	0.00592 ±0.003
2	24	0.0103 ±0.004	0.0148 ±0.002	0.0125 ±0.002
3	48	0.0088 ±0.002	0.0210 ±0.003	0.0140 ±0.004
4	72	0.0133 ±0.001	0.0029 ±0.004	0.0074 ±0.003
5	96	0.0118 ±0.004	0.0022 ±0.002	0.00518 ±0.0003

(Values are expressed in ml. of oxygen / gm. wet wt. /hr.)

Table - 2: Effect of sublethal concentration of Fenos Quick on oxygen consumption of *Channa gachua.*

Sr. No.	Exposure time (in days)	Control	Sublethal (0.023 ppm)
1	1	0.0170 ± 0.003	0.0185 ± 0.002
2	7	0.0200 ± 0.002	0.0237 ± 0.003
3	14	0.0177 ± 0.002	0.0296 ± 0.002
4	21	0.0222 ± 0.003	0.0111± 0.002
5	28	0.0214 ± 0.003	0.0096 ± 0.003

(Values are expressed in ml. of oxygen / gm. wet wt. /hr.)

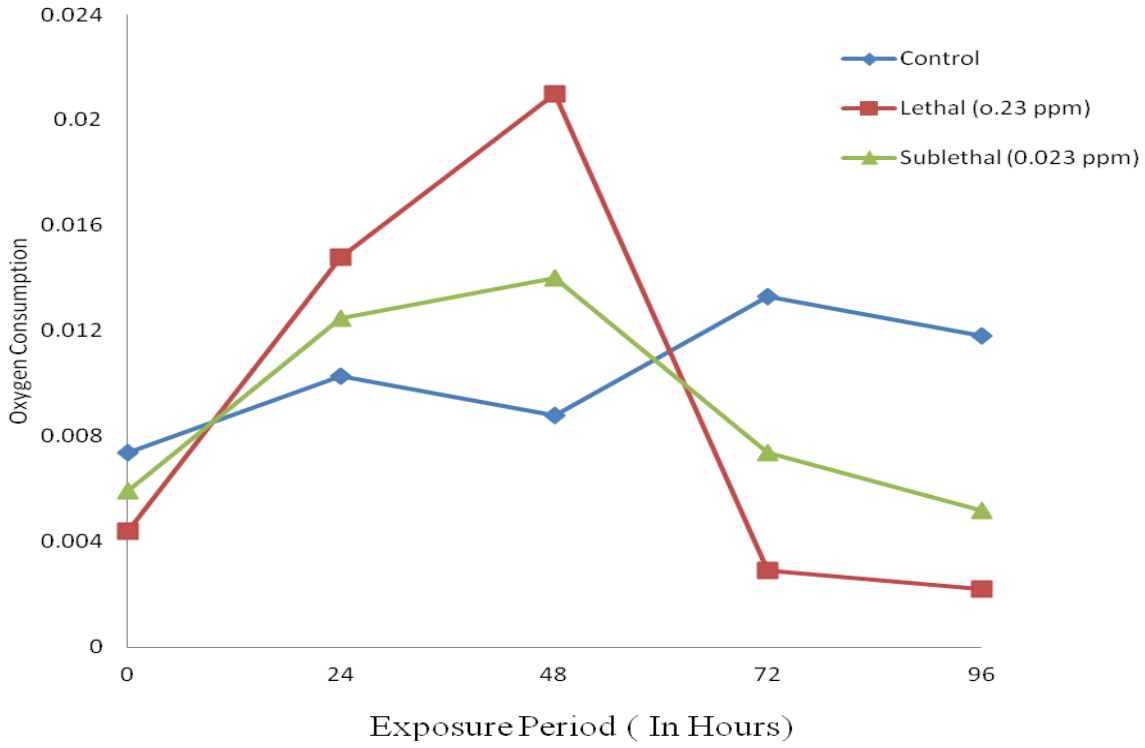

Figure: 1. Effect of lethal and sub lethal concentration of Fenos Quick on oxygen consumption of *Channa gachua.*

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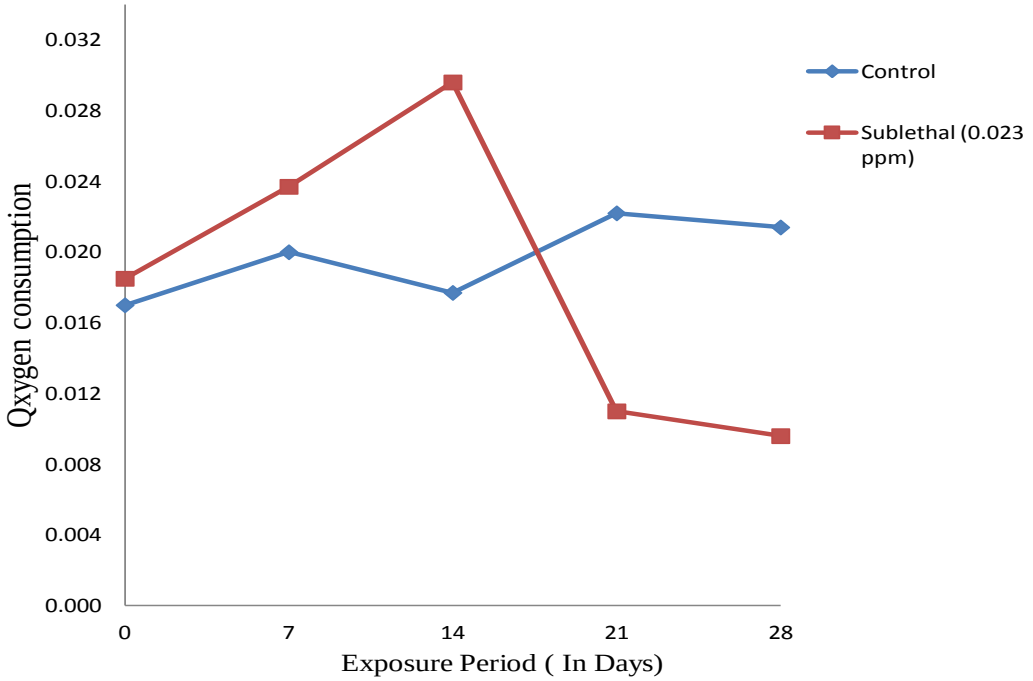

Figure: 2. Effect of sub-lethal concentration of Fenos Quick on oxygen consumption of *Channa gachua.*

Oxygen consumption is expressed as ml. of oxygen / gm. wet wt. / hr. The results indicate that rate of oxygen consumption initially increased and then decreased on pesticide exposure and the decreases were more prominent at 96 hrs. in both lethal and sublethal concentration. In the fish exposed to lethal concentration of Fenos Quick, there was a significant increase in oxygen consumption after 24 hrs. and 48 hrs. of exposure. It was then found to suppress the metabolic activity causing sudden drop in the oxygen consumption at 72 hrs. and till 96 hours The present results also support the earlier observations, where also the decrease in oxygen consumption was progressive with exposure time at both lethal and sublethal concentrations. Raoo, et al. (2003), Shivakumar and David (2004), Vutukuru (2005), Patil and David (2008), Logaswamy and Remia (2009), Shereena et. al. (2009), stated that the disturbance in oxidative metabolism leads to variations in oxygen consumption in different species of fishes exposed to pesticides. Ali et. al. (1985) observed increase in oxygen uptake due to sublethal concentration of dimecron and alicarb on *Channa gachua* and also in *Cyprinus carpio communis*. If gills or membrane functions are destroyed due to xenobiotic chemicals or the membrane functions are disturbed by a change in permeability the oxygen uptake rate would rapidly decrease (Hartl et. al., 2001). Kanabur and Sannadurappa (2001) observed the effect of different concentrations of phenol and cresol on the fish *Oreochromis mossambicus* and they reported that both the toxicants caused a significant decline in the rate of oxygen consumption at higher concentrations. Tilak and Vardhan, (2002) stated that the decrease in oxygen consumption in *Channa punctatus* in sub lethal concentrations of the Cypermethrin due to lowering down of energy requirements which can be considered as adaptive and even strategic. Shelke and Wani (2005) studied the respiratory

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response of freshwater teleost fish, *Amblypharyn godonmola* to certain heavy metals and found that the rate of oxygen consumption decreased with increase in exposure period. Joshi and Kulkarni (2007) reported the effect of pesticides Cypermethrin and fenevelerate on oxygen consumption of the freshwater hill stream fish *Garra mullya* (Skyes) that the rate of oxygen consumption found to be increased in the initial period of analysis in both lethal and sublethal concentrations started decreasing subsequently. Cypermethrin induced respiratory alterations in fish *Labeo rohita* exposed to lethal concentration of Cypermethrin (4µg/l) for 1,2,3 and 4 days increased oxygen consumption on day 1 (8.597%) to day 2 (17.409%) and the increase was decreased (1.289%) on day 4 Marigoudar et al (2009). Oxygen consumption decreases with the time of exposure to the toxicant is evident in the findings of Tilak and Swarnakumari (2009). On exposure to the higher concentration of dimethoate the increase in the rate of oxygen consumption, on exposure of the lower concentration led to decrease in the rate of oxygen consumption of fish *Channa punctatus* as observed by Jothinarendiran (2012). Lonkar (2012) observed the alteration in oxygen consumption of fresh water fish *Puntius stigma* exposed to sublethal concentrations of insecticide Phytofos. The treatment with profenofos lead to significant decrease in oxygen consumption in *Catla catla* was significant as observed by Maharajan et. al., (2013). Neelima (2016) observed effect of lethal concentrations of Cypermethrin 25% EC on experimental fish *Cyprinus carpio* showed an increased tendency in oxygen consumption during the initial time of exposures i.e. 2 to 4 hours and a gradual decrease was observed during the subsequent study period. Pallewad, and Mali, (2022) observed rate of oxygen consumption suddenly increase in initial period of exposure and decreasing trend in 72 and 96 hours in *Channa punctatus* exposed to Automobiles Effluent. Bhavare et.al (2019), recorded the effect of Chlorpyriphos 20% EC on oxygen consumption level of the exposed Mosquito Fish, *Gambusia affinis* at different times of exposure (24, 48, 72 and 96 hrs.) and it was found to be gradually decreased till the end of exposure period (96hrs). The effect of sublethal concentration of Fipronil on oxygen consumption rate of fish *Mahseer fry* that the oxygen consumption rate reduced progressively by 21% and 39% on 7th day and 65% and 82% on 28th day at 6.46 and 12.92µgL concentrations respectively observed by Dhamgaye et al. (2020). Kapil T. Patil (2023) showed effect of acute exposure of freshwater fish *Channa gachua* to mercury chloride significant increase in oxygen consumption at 24 hours, a very significant increase up to 48 hrs. In present study, oxygen consumption in *Channa gachua* was affected in lethal and sublethal concentration of Fenos Quick pesticide to different degrees depending upon the pesticide concentration and duration of exposure.

Conclusion:

This study concludes that the exposure of various concentrations of commonly used pesticide in agriculture Fenos Quick affect the oxygen consumption of *Channa gachua*. On exposure of fishes to lethal concentration of 0.23 ppm [LC 50 of 96 h] and sublethal concentration 0.023 ppm [LC 50 of 96 h] of Fenos Quick for 96 hrs. it was found that rate of oxygen consumption was increased initially due to the Fenos Quick stress. Increase in rate of oxygen consumption was higher in lethal concentrations than in sublethal concentrations of Fenos Quick. During acute exposure to lethal and sublethal concentrations of Fenos Quick, the respiratory rate was found to be depleted at the end of 96 hrs. The decrease was more in lethal concentration than in sublethal concentration which reflects that the pesticidal effect depends upon the pesticidal concentration. During chronic exposure (28 days) with 1/10 of 96 hrs.

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LC50 of Fenos Quick, the rate of oxygen consumption initially increased up to 14th day but later it decreased on 21st day and continued to decline till 28th day of exposure. The result shows that the pesticide, Fenos Quick affects the respiratory metabolism of fish. These results suggest that the altered rates of respiration in *Channa gachua* may also serve as a rapid biological monitor to assess the impact of pesticide such as Fenos Quick on other biotic communities in the water body.

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