

Effect of Prophenophos and Fenvalerate on the respiratory rate of freshwater fish *Channa orientalis* (Schneider)

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ABSTRACT : Pesticides are toxic to aquatic organisms which are important components of food chain such as fishes. The effect of Prophenophos and Fenvalerate on the rate of respiration of freshwater fish *Channa orientalis* was observed after 24,48,72 and 96 hrs. exposure as acute treatment and 7,14 and 21 days exposure as chronic treatment. The rate of oxygen consumption of *C. orientalis* had been determined after exposing fishes to 13.9852 ppm and 2.7970 ppm for acute and chronic exposures of prophenophos respectively and 0.7015 ppm and 0.1403 ppm for acute and chronic exposures of Fenvalerate respectively.

Oxygen consumption was found to be decreased.

Index Terms- *Channa orientalis*, Fenvalerate, Oxygen consumption, Prophenophos.

I. INTRODUCTION

Respiration is one of the life processes during which the organisms obtain oxygen from external environment and utilize it for the purpose of energy release during oxidative metabolism. The respiratory activity of fish was used as an indicator of its response to water pollution (Jones, 1947). Oxygen consumption rate of freshwater fishes differ from species to species. Oxygen consumption per unit wet weight is influenced by the size (weight) of fish. It is a very sensitive physiological process and the change in respiratory activity has been used as an indicator of stress in toxicant exposed animals (Anderson, 1971; Sharp *et.al.*, 1979). One of the early symptoms of acute pesticide poisoning is the alteration of failure of respiratory metabolism (Holden, 1973). The relationship between the respiratory activity of animals and pollutants have been revised by some workers (Gupta *et.al.*, 1994; Zyadan *et.al.*, 2000; Villar *et.al.*, 2000; Patil *et.al.*, 2006; Patil *et.al.*, 2009, Kumar *et.al.*, 2009).

Freshwater fishes are important organisms of aquatic food chain, furthermore they are the source of human food in various parts of the world. Hence, the present work has been undertaken to study the alterations in the rate of oxygen consumption and histomorphological changes in the gill structure of the freshwater fish *Channa orientalis*. Jhingran (1979), Sastry *et.al.* (1972) studied the problem of water pollution in fishes in Madhya Pradesh. Kale *et.al.* (2003) reported initial increase in the rate of O₂ consumption in the fish *Rasbora daniconius* exposed to cadmium chloride which may be due to bioaccumulation of cadmium in body tissues like gill, intestine and liver.

Mostly the pesticide pollutants affect the respiratory physiology, by changing the oxygen uptake by organism. In many fishes the metabolic rate decrease with increasing weight (Job, 1995). The animals exposed to pesticides show alteration in oxygen consumption and it is associated with morphological damage to gill tissue. Toxicity of organophosphate (Dimecron) and organochlorine (Lindane) pesticides to fish *Anabas scandens* were studied in detail by Gouda *et.al.* (1981).

MATERIALS AND METHODS

Live specimens of *Channa orientalis* were collected from Shivan river of Nandurbar, Dist. Nandurbar, Maharashtra. They were maintained in the glass aquarium in the laboratory. The fishes were fed daily with small pieces of earthworms during a minimum acclimatization period of 6 to 8 days in the laboratory. They were washed with 0.1% of KmNo₄ solution to avoid dermal infection and were kept in aquaria having a working volume of 5 litres of dechlorinated tap water for three days. Overcrowding was avoided by keeping a small number of healthy and same sized fishes length, 5-7 cm and weight 23 to 33 g in different aquaria. Water from aquaria was changed after every 24 hrs. At the time of experimentation, the room temperature was 28 °C and pH of the water maintained during the experimentation was 7.4±0.2

Fishes were divided into three groups for acute treatment, one of which was considered as control, animals of second group were exposed to acute treatment of Prophenophos (13.9852 ppm) and the animals of third group were exposed to acute dose of Fenvalerate (0.7015 ppm) for 24,48,72 and 96 hrs.

Similarly for chronic treatment one group served as control and two groups were exposed to prophenophos (2.7970 ppm) and fenvalerate (0.1403 ppm) respectively. The rate of oxygen consumption of control and animals exposed to acute

treatment was estimated for 24,48,72 and 96 hrs. and the animals exposed to chronic dose was estimated after every 7 days with control up to 21 days. Oxygen consumption was estimated by standard Winkler's method (Welsh and Smith, 1960). Oxygen consumption was expressed as ml of oxygen consumed per gm of body wet weight per hr. per lit. (ml of oxygen consumed /gm of body wt/hr/lit). The "t" test was carried out and percent change in oxygen consumption was noted.

RESULTS

In the present investigation the oxygen consumption rate of *Channa orientalis* after acute and chronic exposure to pesticides, Profenophos and Fenvalerate was studied and significant alteration in the oxygen consumption was found to be decreased. It may be due to inhibition in the metabolic activity. The decrease was maximum in chronic treatment as compared to acute treatment. The results are summarised in Table 1 and 2.

Table No. 1

The rate of oxygen consumption of *Channa orientalis* (Schneider) after acute exposure to pesticides (Profenophos and fenvalerate)

Sr.No	Treatment	Average oxygen consumption \pm S.D. ml/gm/hr./lit.			
		24 hours	48 hours	72 hours	96 hours
1	Control	0.0118 \pm 0.0001264	0.0185 \pm 0.0009088	0.0204 \pm 0.0013088	0.023 \pm 0.0026044
2	Profenophos	0.0089 \pm *** 0.0005 24.5762	0.178 \pm * 0.0003549 3.7837	0.0224 \pm *** 0.0001189 9.8039	0.0249 \pm * 0.0004538 4.1841
3	Fenvalerate	0.0213 \pm *** 0.001312 80.5084	0.0266 \pm *** 0.0004074 43.7837	0.0281 \pm *** 0.0007348 37.7450	0.0274 \pm *** 0.0003741 14.6443

Table No.2

The rate of oxygen consumption of *Channa orientalis* (Schneider) after chronic exposure to pesticides (Profenophos and fenvalerate)

Sr.No	Treatment	Average Oxygen consumption S.D. ml/gm/hr./lit.		
		7 Days	14 Days	21 Days
1	Control	0.0241 0.0016	0.0234 0.0006	0.0234 0.0003
2	Profenophos	0.0318 \pm *** 0.0004 31.9502	0.0280 \pm *** 0.0004 19.6581	0.0310 \pm *** 0.0023 32.4786
3	Fenvalerate	0.0285 \pm *** 0.0009 18.2572	0.0282 \pm *** 0.0013 20.5128	0.0285 \pm *** 0.0008 21.7948

1. Each value is a mean of three observations. S.D.

2. (+) or (-) indicate percent variation over control.

Value are significant at N.S. = Not Significant

** = P < 0.01

* = P < 0.05

*** = P < 0.001

DISCUSSION

Oxygen consumption by fish is a function of its metabolic activity. The properties of fish blood haemoglobin play an important part in oxygen transport and oxygen consumption (Shepard, 1955; Black, 1955). Measurement of oxygen consumption has been used to access the healthy status of aquatic organisms (Cairns, 1974). Measurement of oxygen consumption is an established method which provides useful information about normal respiratory physiology such as oxygen uptake in a living organism may serve as an indicator of the physiological state (Sigmon, 1979).

Decrease in the rate of O₂ consumption would be due to internal action of Profenophos and Fenvalerate by altering the metabolic cycle at sub cellular level. The restless and increased opercular movements in the fish exposed to toxicants are characteristics of fish put to hypoxic condition (David, 1995) resulting in more amount of toxicants to be brought in contact with the secondary lamellae of the gills causing a greater damage to the respiratory epithelium implying impaired oxygen uptake.

In the present study Profenophos was found to be less toxic than Fenvalerate to the fish *Channa orientalis*.

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