

MODULATION IN BEHAVIOR AND RESPIRATORY DYNAMICS OF THE FRESHWATER FISH *Labeo rohita* ON SUBLETHAL DIAZINON EXPOSURE

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Abstract: Present study was performed to investigate the impact of sublethal concentrations of Diazinon on different behavioral aspects of *Labeo rohita*. LC₅₀ of Diazinon for 96 hrs by static bioassay test was found to be 0.004ml/l. The fishes were exposed for 96 hrs. Diazinon exposure caused decrease in resting period, increase in opercular movement and air gulping, increase in jerk, threat and burst swimming behavior. Slow response during feeding, swimming on the upper surface of water hanging vertically, spreading throughout aquarium was also observed in pesticide treated fishes. In the highest concentration i.e. 0.01ml/l mortality of fishes occurred. Fishes died with bending of the mid section of the body and opening mouth. Fishes lay down motionless at the bottom of aquarium before death. Fading of body colour was also observed in Diazinon treated fishes. These results suggest that sublethal concentrations of Diazinon have negative impact on the behavior and respiration of *Labeo rohita*.

Keywords: Behavior, Diazinon, *Labeo rohita*, Respiration.

Introduction

In agriculture field the extensive use of pesticides and there is a heightened concern about occupational and community exposure to a accidental or deliberate release of chemicals, such as organophosphate pesticide (OPs) (Pont *et al.*, 2004; Lee *et al* 2009). In agriculture, public health and forestry mainly leads to the contamination of aquatic ecosystem posing a great threat to the environment (Visweswaraiyah; 1975). Organophosphate (OP) pesticide are used openly for infestation management and applied mostly. The farmers, agricultural workers and fisherman's noticed that has been fish affected after pesticide application. Diazinon is brown colored liquid and it has used in agricultural and commercial purpose in throughout the world to control a wide diversity of insects like sucking and chewing type (Cobos-Gasca1995;Cox1992).The Diazinon is a large variety of application soluble in water and produces a chemical half-life recorded upto 12 weeks in water (Blackburn *et al.*,1988).

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Pesticides applied in agricultural field, it has been associated with directly rain-runoff and its unofficial unregulated dumping, where it has been noticed to settle on freshwater environment (Bailey et al.,2000). *Labeo rohita* is edible freshwater fish of great economic connotation and it is used in the composite fish culture. The present study was under taken to evaluate the aquatic toxicity of Diazinon with special emphasis on behavioral and oxygen consumption of the freshwater fish, *L. rohita* exposed to lethal and sublethal concentrations of commercial grade Diazinon. The pollutants such as hazardous substances, heavy metals, petroleum hydrocarbons and pesticides can cause direct toxic effect when released into aquatic ecosystem (Fleeger et al., 2003).

Material and Methods

Animal collection and maintenance:

Indian major Carp (*Labeo rohita*) (6-7cm in length) fingerlings were acquired from Rankala fish seed rearing centre, Kolhapur, Maharashtra. The fingerlings were transferred to 40 l glass tank in the laboratory after proper acclimation. Vigorous aeration was provided in the tanks with aerators. The fish were fed twice a day with ground nut oil cake feed. The walls of the holding tank were thoroughly cleaned and excreta were siphoned off on daily basis to prevent the building of ammonia in the aquarium. Fish were conditioned keeping in tank for 7 days before utilizing them for the experiments. The optimum temperature (24 ± 1 °C), dissolved oxygen (4.69 ± 0.40 mg/lit) and pH (6.53 ± 0.15) of maintained water throughout the experiment. Individuals measuring 6-7cm in total length and weighing 8 ± 2 gm were selected for the present study. Exposure period was for 24,48,72,96 hrs respectively to lethal concentrations of the Diazinon of 0.01, 0.008, 0.006, 0.004, 0.002ml/l.

Assay of Respiratory Rate:

Respiratory rate (oxygen consumption) of Diazinon exposed fish was measured by following the method of Welsh and Smith (1953) as described by Shivakumar (2008). The values are expressed as ml of oxygen consumed/gm wet wt. of fish/hr. The concentration of dissolved oxygen in medium before introduction of test fish and at hourly intervals thereafter was estimated by the 'Wrinkler's' volumetric method(Anonymous 1995) and the result were expressed as oxygen consumed per test fish for 1hr as mg.hr⁻¹/fish(milligram per hours).

Results and Discussion

The pesticide induces changes in the chemical composition of natural aquatic environments which can affect many of the non-target organism, particularly fish (Adams and Greely, 2000). Fishes were observed to breathe and swim slowly, with normal operculum moving and

normal mucus production and the skin colour remained silvery white in throughout the experimental period of 96hrs in control group. But Diazinon exposure caused decreased in resting time, increased in opercular movement and increased jerking in air, threat and burst swimming behavior. Slow response during feeding, swimming on the upper surface of water vertically, spreading throughout aquarium was also observed in pesticide treated fishes and also oxygen consumption rate was decreased.

Hulya et.al. (2006) observed the behavioral alterations made were similar to the observations made by sublethal exposure to Diazinon in *Oreochromis niloticus*. Susan and Sobha (2010) concluded the toxic effect of fenvalerate on Indian major carps, *Labeo rohita*, *Catla catla* and *Cirrihinus mrigala* of behavioral changes such as swimming style, loss of equilibrium, and excess secretion of mucus. Shahi and Singh (2010) observed the abnormal behavioral study in *Channa punctatus* when exposed to different concentrations of rutin, taraxerol and apigenin.

Table-1 Oxygen consumption rate in *Labeo rohita* to varying concentrations of Diazinon at 96hrs.

Sr. No.	Concentrations (ml/l)	Oxygen consumption rate per fish (mg.h ⁻¹)
1	Control	5.65±0.03
2	0.002	4.68±0.03
3	0.004	4.07±0.04
4	0.006	3.05±0.02
5	0.008	3.01±0.04
6	0.01	2.10±0.03

Table-2 Oxygen consumption rate in *Labeo rohita* of Diazinon after 96hrs.

	24hr	SD	48hr	SD	72hr	SD	96hr	SD
Control	5.65	±0.03	5.48	±0.27	5.49	±0.05	4.95	±0.21
24hr	4.51	±0.03	4.2	±0.27	4.47	±0.05	4.17	±0.21
48hr	4.07	±0.03	3.44	±0.03	3.85	±0.08	3.67	±0.25
72hr	3.3	±0.02	3.41	±0.24	3.48	±0.16	2.74	±0.12
96hr	3.1	±0.04	2.79	±0.11	2.7	±0.11	2.42	±0.11

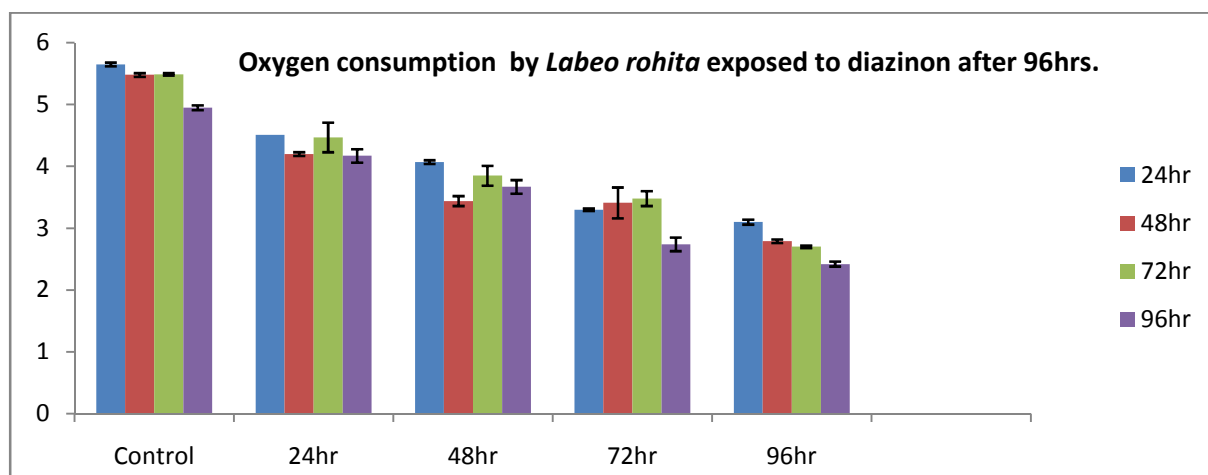


Fig: (mean \pm SD) each value represents the average of four individual estimations per each experimental tank at each time point; Values within same row with different superscripts are significantly different ($P < 0.01$).

Conclusion

The results suggest that sublethal concentrations of Diazinon have negative impact on the behavior and respiration (Oxygen consumption) of *Labeo rohita*. Because of the Diazinon inhibit the acetylcholinesterase activity and it concluded that Diazinon affects on brain of fish and it highly toxic to fish.

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