



Acute Toxicity of a Pesticide Cidial to an Exotic Fish *Tilapia mossambica*

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Key Words:

Tilapia mossambica
Acute toxicity
Behavioural response
Pesticide
Cidial

ABSTRACT

Investigation on the toxic effects of a pesticide cidial on an exotic fish *Tilapia mossambica* at $22 \pm 0.15^\circ\text{C}$ was made. Toxicity tests were carried out to estimate LC_0 , LC_{50} and LC_{100} values of cidial by exposing the fish for different durations. Six ppm of the pesticide formed $\text{LC}_{50}/96$ hrs, whereas 1.5 ppm and 8 ppm represented LC_0 and $\text{LC}_{100}/96$ hrs values respectively. Some remarkable changes in behavioural response of the fish in the toxic media were also observed such as hyperexcitability, abnormal changes in position, rapid opercular movement, frequent jumping, loss of equilibrium, etc. and finally death, showing acute toxic nature of the pesticide.

INTRODUCTION

To meet the ever-increasing demand of the rising human population there has been an increasing use of agricultural chemicals like pesticides to save the standing crops from the attack of pests and to boost crop production. Due to injudicious and indiscriminate use of pesticides, the natural water resources such as lakes, reservoirs, rivers, ponds, paddy-fields, streams and other low lying areas are getting polluted all over the world. Pesticides, affect the whole ecosystem, particularly the aquatic ones, leading to unwarranted mortality of aquatic biota, in general, and fishes in particular as revealed by several workers (Mhatre et al. 1980, Sadhu & Shafi 1988, Sadhu 1993, Srivastava & Srivastava 1995, Singh 1996, Israfil 1999, Marandi 2002, Alam 2002, Sadhu et al. 2003, Kumari 2005). The persistence of toxic chemicals in aquatic environment becomes dangerous for the survival of fish (Parrish 1985) and their food organisms. Therefore, it is essential to study the toxic effects of pesticides on living organisms.

In the present study, attempt has been made to find out the effects of an organophosphate chemical, cidial (phenthoate 50% EC, a product of Isagro (Asia) Agrochemicals Ltd., Mumbai) on an exotic fish *Tilapia mossambica*.

MATERIALS AND METHODS

Adult *Tilapia mossambica* were collected from freshwater ponds of Ramgarh (Jharkhand) and brought to the laboratory. Only healthy fish were used and the length and weight of the fish ranged from 8-12 cm and 30-40 g respectively. Firstly, the fish were washed thoroughly and then rinsed in 0.1% KMnO_4 solution to avoid dermal infection, if any. Fishes were acclimatized in glass aquaria for 10 days. During this period, they were fed with fish food. The physicochemical analysis of the diluent water was carried out as per the procedures of APHA (1985).

The fish were subjected to different concentrations of cidial to carry out toxicity tests to find out LC_0 , LC_{50} and $\text{LC}_{100}/96$ hr values for different durations. Observations on behavioural responses of fish were also made in the toxic media.

Table 1: Mortality percentage of the adult *T. mossambica* on exposure to different concentration of cidal at $22 \pm 0.15^\circ\text{C}$.

Sr. No	Cidial concentration in ppm	No of specimen	Mortality Percentage (Avg. in hrs)					Remarks
			12	24	48	72	96	
1.	1.5	100	Nil	Nil	Nil	Nil	Nil	Non lethal dose
2.	2	100	Nil	Nil	Nil	Nil	3	Safe level
3.	2.5	100	Nil	Nil	Nil	3	7	
4.	3	100	Nil	Nil	3	5	10	
5.	3.5	100	1	3	5	8	15	
6.	4	100	3	5	8	12	20	
7.	4.5	100	4	8	11	15	25	
8.	5	100	6	10	15	23	33	
9.	5.5	100	8	15	22	30	40	
10.	6	100	13	20	28	38	50	LC ₅₀ /96 hr
11.	6.5	100	15	28	38	48	60	
12.	7	100	28	37	48	60	74	
13.	7.5	100	38	50	60	74	85	
14.	8	100	50	60	75	88	100	LC ₁₀₀ /96 hr
15.	8.5	100	65	80	95	100	100	

RESULTS AND DISCUSSION

The results of the study of acute toxicity of cidal at $22 \pm 0.15^\circ\text{C}$ are given in Table 1, which reveal toxic nature of the pesticide. Six ppm of the pesticide formed LC₅₀/96 hr, whereas, 1.5 ppm and 8 ppm represented LC₀ and LC₁₀₀/96 hr respectively.

The physico-chemical analysis of normal and contaminated water forming LC₅₀ dose of cidal are presented in Table 2. Significant changes have been found with respect to free CO₂, dissolved oxygen, pH and total alkalinity, etc. showing their direct role in survival of the fish fauna (Sadhu 1993, Singh 1995, Marandi 2000, Sadhu et al. 2003). These changes are directly related to breathing process of fishes as also found by Akhtar (1985), Sultan & Sharma (1990), Nanda & Tiwari (1999) and Sadhu et al. (2003).

When the fish were exposed to the pesticide, it showed significant behavioural changes like hyperexcitability, increased aerial excursion, jumping and escaping, fast and erratic movement, abnormal change in position, etc. The rate of operculum movement, mucous secretion from skin and respiration through gill also increased. After some time, the opercular movement of the fish slowed down although it tried to stay at upper water surface, but loss of body equilibrium was pronounced. Finally, all the body activities decreased and the fish settled down at base of the aquaria and died. The same type of behavioural changes in fishes have been seen by Bhatnagar et al. (1988), Singh & Singh (1999), Alam (2002) and Tiwari & Singh (2004) in pesticide affected fishes. The behaviour of fishes in different ways is mainly related to change in the physicochemical environment and metabolic pathways. On the basis of the results obtained here, it can be concluded that the pesticide cidal is highly toxic to fishes, especially *Tilapia mossambica*.

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Table 2: Physicochemical characteristics of the diluent water (normal water) and LC₅₀ dose of cidial at 22 ± 0.15°C.

S.No.	Parameters	Diluent water	Sub-lethal dose (6 ppm)
1.	Colour	Colourless	Light opaque
2.	Odour	Odourless	Unpleasant
3.	Temperature, °C	22 ± 0.15	22.56 ± 0.10
4.	pH	7.6 ± 0.45	7.25 ± 0.06
5.	Turbidity, ppm	15.02 ± 0.32	16.46 ± 0.42
6.	Viscosity	1.2 ± 0.35	1.5 ± 0.50
7.	DO, mg/L	7.65 ± 0.25	5.72 ± 0.20
8.	Free CO ₂	1.45 ± 0.09	2.15 ± 0.12
9.	Total alkalinity, mg/L	120.2 ± 0.81	125.6 ± 0.71

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