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Acute toxicity and behavioural response of the food fish *Channa punctatus* (Bloch) to an Insecticide Trichlorfon

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ABSTRACT

Trichlorfon is an organophosphate to insecticide and highly toxic pollutant, when enters in aquatic bodies through the rain water, it adversely affects the fauna of aquatic ecosystems. The aim of the present study was to assess the acute toxicity of Trichlorfon on food fish *Channa punctatus.* The fish were exposed to different concentrations of Trichlorfon to determine LC50 values for 96 h and study their behavioural effects on fish population. After the study we found that the test fishes exhibited erratic swimming, decreased rate of opercular movement, copious mucous secretion, increased surfacing and inability to balance with increasing exposure time.

Key words: *Acute toxicity, Channa punctatus, Trichlorfon*

Introduction

The term pesticide covers a wide range of compounds including insecticides, fungicides, herbicides, rodenticides, molluscicides, nematicides, plant growth regulators and others. They are used in agriculture to protect crop but it also influenced the environment through surface runoff and affects aquatic fauna and flora. Trichlorfon is a synthetic organic chemical used as an insecticide to protect the crops and animals from insect weeds and diseases. It is dense, colourless liquid that evaporates easily into air and dissolves slightly in water. It can enter in body through lungs if it is in the air and it enters through stomach when present in drinking water and react with an important enzyme in brain and nerves called acetyl cholinesterase and stop them working properly and muscles are disrupted. Many studies have been conducted to assess toxic effects of Trichlorfon an organism in the environment using indices including mortality, immobilization and growth inhibition.

Materials and Methods

The fresh water fish (*Channa punctatus*) was collected from local fish market (average length 15 cm and weighed ± 160.25 g) and washed with 0.5% $KMnO_4$ Solution and kept it in aquarium whose capacity is 20 l. During this period fish were fed with rice brain mix mustard oil cake. Water was renewed on alternate days.

After two weeks of acclimatization fish were exposed to different concentrations of Trichlorfon. Stock solution of 1 mg/ml. Solution of Trichlorfon was prepared in absolute alcohol. Fishes were separated into 5 groups of 20 fish each, and exposed to 0.5, 0.1, 0.15 and 0.2 mg/l of Trichlorfon in aquaria.

To determine LC50 values for 24, 48,72, 96 hours, four replicates were taken from each group along with a control run simultaneously. During this period no feed was administrated to fish. Mortality of fish was analysed by Probit analysis, each group was recorded and dead fish were removed. Behavioural responses of fishes were noted during first 6h and at 24, 48, 72, 96h after exposure

Results and Discussion

The fish exhibit a number of abnormalities in their behaviour when exposed to Trichlorfon, within a few minutes of exposure to higher concentration the fishes appear excited. surfacing frequency and gulping of surface water with occasional coughing was increased remarkably in exposed fish opercular movement was observed to decrease with increasing concentration of the trichlorfon. The exposed fish exhibited heavy mucous secretion along with imbalance in posture and loss of equilibrium. Finally, they succumbed to the toxicant with mouth and operculum wide open and body slime covered. At lower concentrations, however changes in behaviour were not as conspicuous. It is generally known that organophosphorus compounds induce neurotoxicity. Ataxia and a reduction in neurotoxic esterase (NTE) activity were reported (Aldridge and Johnson, 1971; Johnson, 1978).

The behavioural and morphological changes observed in the present work, may be due to the inhibition of acetylcholinesterase activity. Irregular, erratic and darting swimming movements, hyper excitability, loss of equilibrium and hitting to the walls of the test tank before finally sinking to the bottom just before death all reveal neurotoxicity. Increased mucus secretion may be considered a protective method to counter the irritating effect of the toxicant. Ethological responses are the most sensitive parameters for measuring neurotoxicity in presence of the toxicants. In contrast, several studies showed

Table 1. Percent mortality during the exposure to different concentrations of Trichlorofon

Treatment	Total no. of fishes exposed	No of dead fish (96 hours)	% Mortality
0%	20	0	0
10%	20	14	70
30%	20	17	85
50%	20	20	100
70%	20	20	100
90%	20	20	100
100%	20	20	100

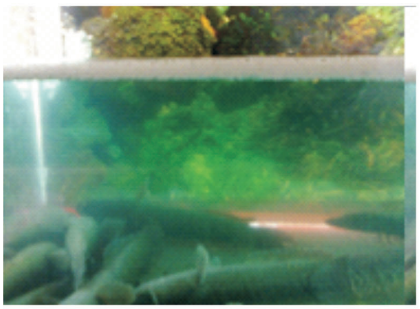

Fig. 1. Copious mucous secretion

Fig. 2. Unconsciousness between fishes

Fig. 3. Erected dorsal fin

Fig. 4. Erected caudal

Fig. 5. Sinking to the bottom just before death

Fig. 6. Death of fish

no delayed neurotoxicity in oral and dermal administration (Aldridge and Johnson, 1971; Durham *et al.,* 1956; Johnson, 1969, 1975a, b, 1978, 1981; Lotti and Johnson, 1978).

The loss of equilibrium noticed, in the present case, during long term exposure to higher concentration of effluent may be due to nonfunctioning of the brain. Irregular, erratic and darting swimming movements, hyper excitability, loss of equilibrium and hitting to the walls of the test tank before finally sinking to the bottom just before death in the present cases, all reveal neurotoxicity. Increased mucus secretion is a protective method to counter the irritating effect of the toxicant.

Bioaccumulation of different pesticides directly affect the fish (rao and Pillala, 2011) and fishes shows toxic beh behaviour, alter swimming ability feeding and their position(scott and sloman 2004; Krian and Jha, 2009; David *et al.,* 2008 and 2010; Nagaraju *et al.,* 2011 satyyvardhan 2013,ullahet al,2014.Due to sub – lethal concentration of pesticides structural and functional changes occurred in aquatic organisms and causes of mortality (Crisp *et al.,* 1998; Brouwer *et al.,* 1999; Sancho *et al.,* 2003; Srivastava and Singh, 2013c; 2014; Ullah *et al.,* 2014)

Toxicity of Cypermethrin cause darting, erratic and irregular swimming movements, loss of equilibrium, hyperexcitability and sinking to bottom in Labeorohita (Marigoudar *et al.,* 2009; Ullah *et al.,* 2014).

Conclusion

Pesticides & insecticide are used in agriculture for growth of crop but which polluted water bodies through surface runoff and which cause harmful effect on aquatic fauna.

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