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Acute toxicity of cypermethrin against fresh water fish, *Mystus vitatus*

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Abstract
Pesticides are the biological toxicants, which are being used by the man to kill the pests for increasing the yield of many crops and insect vectors to control the spread of disease. Pesticides cause several ill effects to aquatic ecosystem and organisms including fish. The experimental fish, *Mustus vitatus* were exposed to five acute concentrations (0.00ml/L, 0.020ml/L, 0.040ml/L, 0.060ml/L, 0.080ml/L and 0.10ml/L) and the 96 h LC_{50} was found to be 0.044 ml/L. Furthermore, the exposed fish showed behavioural changes include hyperactivity, loss of equilibrium, rapid swimming, disturbed opercular movements, increased surface activity and loss of equilibrium. The result also revealed that mortality rate depends upon concentrations of Cypermethrin and duration of exposure.

Keywords: Probit analysis, $LC_{50,}$ cypermethrin, *Mystus vitatus*

Introduction
Pesticides are the biological toxicants, which are being used by the man to kill the pests for increasing the yield of many crops and insect vectors to control the spread of disease. The use of pesticides has caused severe environmental and health hazards to organisms including human beings (Prakash and Verma, 2014) [9]. The indiscriminate use of pesticides in agriculture, animal husbandry and post-harvest technology is a threat to the natural water system, making it unfavorable for aquatic life, public health and welfare of mankind (Tilak *et al*., 2007) [13]. These pesticides enter the food chain and their subsequent bioaccumulation and biotransformation at different trophic levels have catastrophic effect to the ecosystem Different pesticides are used at ponds for treating fish parasitic diseases or applied to the agriculture lands are carried away by rains and floods as runoff to the water bodies and this alters the physico-chemical properties of water (Richards, 1988) [10]. Water quality parameters such as temperature, dissolved oxygen, pH, turbidity, alkalinity as well as conductivity are influenced by the rate of pollutants entering the water and causes lethal effect on the aquatic organisms (Olufayo, 2009) [6].
Pesticides can produce adverse effects in a biological system, seriously damaging its structure and function of living system finally leads to death of organism. When pesticide reaches the aquatic environment, it may be present there for several days or weeks, depending upon its solubility, producing of mass mortality, morphological, physiological and behavioral changes in the organisms. Fish are often used as indicators of such biological impacts of pollutants as they respond to low concentrations of toxic substances (Ayas *et al*., 2007) [1].
Cypermethrin is a synthetic pyrethroid used for the control of ectoparasites which infest cattle, sheep, poultry and some companion animals. Presently, the cypermethrin has been widely used as a chemotherapeutic agent for the control of ectoparasite infestations in marine cage culture and freshwater aquaculture (Monir *et al*., 2015) [4]. It is highly toxic to fish because of their slow metabolism and delayed elimination of these compounds (Bradbury and Coats, 1989) [2].
Toxicity tests are experiments designed to predict the concentrations of toxicant and its duration of exposure required to produce an effect. Toxicity is species-specific because individuals have different levels of response to the same dose of a toxic substance (Smith and Stratton, 1986) [11]. The acute toxicity data are important and beneficial in the fixation of sub lethal concentrations for chronic toxicity tests.

LC_{50} is the estimation of the dose or concentration necessary to kill 50% of a large population of the test species. Probit analysis is a type of regression used to analyze binomial response variables. Probit analysis is commonly used in toxicology to determine the relative toxicity of toxicant or pollutant to living organism. Probit method is widely accepted and most accurate method for calculating LC_{50}. Therefore the present investigation aimed to evaluate the acute toxicity bioassay of insecticide, Cypermethrin against fresh water fish, *Mystus vitatus.*

Materials and Methods

Freshwater cat fish, *Mystus vitatus* (average length 7.0-8.0 cm and average weight 6.0-6.5 gm) was collected from local freshwater bodies and dip in 0.1% of potassium permanganate solution for 2 minute. The fishes were acclimatized in laboratory conditions for 7 days. During acclimatization the fishes were fed with commercial feed. The feeding of fishes were stopped before experiment. The mortality was recorded after a period of 96 h and dead fishes were removed immediately after death during observation. Stock solution of Cypermethrin of various concentrations were prepared and 10 fishes was kept in each rectangular glass aquaria separately to estimate mortality between 0% and 100%. For 96h LC_{50} test, separate 6 concentrations (0.00ml/L, 0.020ml/L, 0.040ml/L, 0.060ml/L, 0.080ml/L and 0.10ml/L) of Cypermethrin were taken to find out the narrow range of median lethal concentrations.

Result and Discussion

The percent mortality observed for each dose was calculated and converted to probits. Acute toxicity test *i.e.* LC_{50} values show susceptibility of fish to particular toxicant or pollutant and reflect their survival potential. In the present study, the percent mortality, and probit mortality of Cypermethrin for fish, *Mystus vitatus* at and 96 hrs are presented in table 1&2. The 96 h LC_{50} value was found with 0.044 ml/L (Table2) but the lowest (20%) and highest (100%) mortality was observed in 0.020 and 0.10 ml/L, respectively in the experiment. However, fishes exposed to dechlorinated tap-water were observed to be healthy and normal. The percent mortality and probit mortality of the freshwater cat fish *Mystus vitatus* at different concentrations along with log concentration was shown in (Table.1) under the toxicity evaluation. When pesticide concentration was increasing the mortality of the fish was increased. Nwani *et al.*, (2013) [5] reported that median lethal concentration of chlorpyrifos based pesticide Termifos to African catfish *Clarias gariepinus* were found to be 0.861 mg/L. The toxicity of a pesticide could vary from species and this variation is due to differential tolerance of animals to pesticide exposure (Singh, 2013) [11].

The behavioural reactions observed in the Cypermethrin exposed fish were erratic swimming, increased respiration rate, discolorations of the skin, loss of reflex, hyperactivities, surfacing, increasing opercula ventilation, excess mucus section and these effects increased with increasing concentration of the toxicants and duration of exposure. However, fishes of the control group was found to be normal behavior during the experimental period. Increased the experimental duration, the treated fish showed increase in weakness, motionless and gasp for air with slow opercula movement.

Table 1: The 96 hr acute toxicity of Cypermethrin on freshwater fish, *Mystus vitatus* percent mortality

S. N.	Conc. in mg/l	Log Conc.	No of fish exposed	No of fish dead up to 96 hr	Percent mortality	Probit mortality
1	0.00	0	10	0	0	0
2	0.020	-3.912	10	2	20	0.112
3	0.040	-3.219	10	3	30	0.437
4	0.060	-2.813	10	6	60	0.678
5	0.080	-2.526	10	8	80	0.816
6	0.10	-2.303	10	10	100	0.893

Table 2: LC_{50} values with 95% confidence limits for Cypermethrin based on dissolved concentrations estimated according to (Finney Probit method, 1971)

S.N.	Concentration	Exposed Fish	% Mortality	Log Concentration	95% Confidence Limits for Log concentration	
					Lower Bond	Upper Bond
1	0.044	10	50	-3.115	-3.475	-2.8445

Cypermethrin are commonly used in agriculture sector that continuously pollute the inland fishery water. This result indicated that the fish was unable to withstand the exposure of cypermethrin with time and thereby the toxicity of the insecticide was possible on long exposure. The stressful behavior such as erratic movement, increased respiratory rate, loss of reflex action, discoloration, excess mucus secretion, changes in behavior and increased operculum beating, resting at the bottom of the treated fish due to the toxic effect of cypermethrin on the gills was similar with the findings of Omitoyin *et al.*, 2006 [7] and Omoniyi *et al*., 2002 [8]. The changes in behavioral patterns exhibited by the treated fish were possibly to counteract aquatic hypoxia condition possibly due to the cypermethrin. When there is impossibility of escape from hypoxic stress, physiological alterations may be evoked to compensate for low oxygen supply (Graham and Iwama, 2003) [3].

The freshwater catfish, *Mystus vitatus* exposed to various concentration of cypermethrin resulted that this synthetic pyrethroid was highly toxic to the *Mystus vitatus* with lethal concentration (LC_{50}) of 0.044ml/L. As the concentration of cypermethrin was increased the survivability rate of exposed fish were gradually decreased.

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References:

1. Ayas Z, Ekmekci G, Ozmen M, Yerli SV. Histopathological changes in the livers and kidneys of

fish in Sariyer Reservoir. Turkey Environmental Toxicology and Pharmacology. 2007;23:242-249.
2. Bradbury SP, Coats JR. Comparative toxicology of the pyrethroid insecticides. Rev. Environ. Contam. Toxicol. 1989;108:133-177.
3. Graham M, Iwama GK. The physiological effects of anaesthetic ketamine hydrochloride on two Salmorid species. Aquaculture. 2003;90:323-331.
4. Monir MS, Ashaf-Ud-Doulah M, Khalilur RM, Akhter JN, Rayhan MH. Effect of cypermethrin on the histoarchitecture of gills and liver of a freshwater catfish, *Pangasianodon hypophthalmus*. Asian J Med. Biol. Res. 2015;1(3):641-647.
doi: 10.3329/ajmbr.v1i3.26488
5. Nwani CD, Lakra WS, Nagpure NS, Ravindra Kumar, Kushwaha B, Srivastava SK. Muragenic and genotoxic effects of Carbosulfan in freshwater air breathing fish Channa Punctatus (Bloch) using micronucleus assay and alkaline single-cell gel electrophoresis. Food and Chem. Toxicol. 2010;48:202-208.
6. Olufayo MO. Haematological Characteristics of *C. gariepinus* juveniles exposed to Derris root powder. Afr. J. Food Agric. Nutr. Dev. 2009;9:921-933.
7. Omitoyin BO, Ajani EK, Adesina BT, Okuagu CNF. Toxicity of lindane (Gamma Hexachlorocyclohexane) to *Clarias gariepinus* (Burchell, 1822). World J. Zool. 2006;1:57-63.
8. Omoniyi I, Agbon AO, Sodunke SA. Effect of lethal and sublethal concentrations of Tobacco (*Nicotianato baccum*) leaf dust extract on weight and haematological changes in *Clarias gariepinus* (Burchell). Journal of Applied Sciences and Environmental Management. 2002;6:37-41.
9. Prakash S, Verma AK. Effect of Organophosphorus Pesticide (Chlorpyrifos) on the Haematology of *Heteropneustes fossilis* (Bloch). International Journal of Fauna and Biological Studies. 2014;1(5):95-98.
10. Richards RH. Diseases of farmed fish: Salmonids. Veterinary Records. 1988;112:124-126.
11. Singh RN. Acute toxicity of an organophosphate, dimethoate to an air breathing fish, *Colisa fasciatus* (Bl.and Schn), Indian J Sci. Res. 2013;4(1):97-100.
12. Smith TM, Stratton GW. Effects of synthetic pyrethroid insecticides on non-target organisms. Res. Rev. 1986;97:93-119.
13. Tilak KS, Veeraiah K, Butchiram MS. Effect of phenol on haematological components of India major carps *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*. J Environ. Biol. 2007;28:177-179.