

Determination of Lethal Concentration (LC 50) of *Channa Striata*

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Abstract: The present study was conducted to assess the acute toxicity of *Channa striata* by static bioassays. *Channa striata* is a native fresh water carnivorous air breathing fish species. The average length and weight of fish used in the present investigation were 18-20 cm and 40-45g, respectively. The fishes were fed daily with minced fish and chicken liver. Only healthy and active animals of more or less similar size were randomly selected for the experiment. The physico-chemical parameters such as pH, Temperature, Dissolved Oxygen of test water were measured daily. The ten fishes were exposed to Organophosphate pesticide Chlorpyrifos with different concentrations of 1.5, 2.5, 3.5, 4.5 and 5.5 mg/l. All the exposed fishes were daily observed and dead fishes were removed immediately. The mortality was recorded on daily base. The LC50 value at 96 hr was found to be 4.521 ppm to *C. striata*. The data obtained were statistically evaluated by using Finney's probit analysis method. It was found that there was positive relationship between the mortality and concentration level.

Keywords: *Channa striata*, Chlorpyrifos, LC50, Organo phosphate pesticide, pH

1. Introduction

The use of pesticides has become an essential part of modern agricultural systems. Pesticides are substances that are meant to control pests including weeds. Pesticides are one of the chief classes of toxic substances used in India for management of pest in agricultural lands and control of insect vectors of human disease [10]. Pesticide can enter surface waters via different ways, among which runoff driven by precipitation or irrigation. Which are the main sources of contaminating aquatic environment. The exposure can cause direct effects on all levels of biological organization, while the toxicant mode of action largely determines which group of organisms is affected. Continued exposure to these contaminants caused a number of alterations in the physiological, and biochemical processes [9]. The aquatic environment is continuously being contaminated with toxic chemicals from industrial, agricultural and domestic activities. Alterations in the chemical composition of natural aquatic environments can affect the freshwater fauna, particularly fish. These xenobiotics even at low concentration can interfere with the metabolism of the organism [15].

According to [2] Chlorpyrifos (O, O diethyl O-3,5,6-trichloro-2-pyridylphosphorothioate is one of the earliest developed organophosphate pesticide, introduced in India in 1965. Which is commonly used in agriculture and residential pest control. In India, CPF is classified as an extremely hazardous pesticide [12]. It is regularly used on crops and in the warehouses, for the eradication of a wide range of insect-pests. This reaches to the aquatic ecosystem through rain and affecting aquatic organism. Chlorpyrifos passes via air drift or surface runoff into surrounding waters and gets accumulated in different aquatic organisms, particularly fish, harmfully affecting them [13]. The chlorpyrifos enters the food chain and their subsequent bioaccumulation and biotransformation at different trophic levels have disastrous effect to the ecosystem.

Acute toxicity caused by a toxicant on freshwater fish can evaluate by quantitative parameters like survival and mortality of test animals and sensitivity of fish species against pesticide toxicity. *Channa striata* is commonly called chevron snakehead, striped Murrel or striated Murrel is one of the most economically important species inhabiting fresh water as well as brackish water [14]. It is also a well-known food fish widely used for medicinal and pharmaceutical purpose. The main objective of the present study was to determine the lethal concentration (LC50) of freshwater Murrel *Channa striata* exposed to sub-lethal concentrations of Organophosphate pesticide chlorpyrifos.

2. Materials and Methods

Freshwater murrel *Channa striata* (SL 18±2 cm, 43±2g) were collected from fresh water habitat and kept in large glass aquaria bearing tap water for 20 days in the laboratory for acclimatized in normal photoperiod and temperature and starved for 24 hours prior to experimentation. Fishes were fed daily with minced fish and chicken liver, and water was renewed every day. The test solution of Chlorpyrifos were prepared by using distilled water (having Dissolved Oxygen=6.0mg/l; pH=7.1 and room temperature 28±2° C). 96-hour acute toxicity test were done by using various concentration of Chlorpyrifos (1.5mg/l, 2.5mg/l, 3.5mg/l and 4.5mg/l). The data found were statistically evaluated by using Finney's probit analysis method.

3. Results and Discussion

The evaluation of toxic impact of Organophosphate pesticide Chlorpyrifos on the fresh water fish *Channa striata* was selected for the toxicological study. No fish died during the period of acclimatization (20 days) before exposure to pesticide Chlorpyrifos. The relation between the Chlorpyrifos concentration and mortality rate of fresh water murrel *C. striata* is presented in Table. 1. The results indicated different mortality rate of fishes which increased

with the corresponding increase in concentration of Chlorpyrifos. According to Probability analysis by [7], the median lethal concentration (LC50) of Chlorpyrifos to *C. striata* for 96 h of exposure was calculated as 4.521 ppm. The lower and upper lethal confidence limits (95%) for chlorpyrifos indicate a range of 3.583 ppm to 5.577 ppm within which the concentration response for 96 h exposure (Table.1). Similar work was observed by [3], [11].

The mortality rate increased with increase in the concentration of Chlorpyrifos (Table.1). The percent mortality after changing to probit mortality was plotted against log concentration of Chlorpyrifos using probit method. In this a straight line were obtained and the LC50 value obtained from the graph was 4.52 ppm. Mortality in control group was virtually absent and found to be suitable for LC50 upper and lower confidence limits and fitted for regression equation for 96 h exposed period (Fig.1). The susceptibility of *Channa striata* to the toxic effect of chlorpyrifos is directly proportional to the concentration and duration of the dose. If the dose increases the rate of mortality will also increase. Similar works also reported in *Cyprinus carpio* and *Ctenopharyngodon idell* [8], *Clarias gariepinus* [5], *Channa punctatus* [6], *Heteropneustes fossilis* [1], *Cirrhinus mrigala* [4].

So, it is concluded that higher percentage of mortality occurred with the increase in concentration and exposure period. Susceptibility of *Channa striata* to the different dose of Chlorpyrifos was duration and concentration dependent as mortality increased with an increase in its concentration. The results of this study may help to understand the acute toxicity of the pesticide in the field and may work as early warning indicators of pesticide toxicity in the freshwater fishes. This data clearly indicates that Chlorpyrifos is also toxic to *Channa striata*.

4. Conclusion

On the basis of above results and discussion, it can be concluded that the Chlorpyrifos may have had a higher assimilation and toxicity in aquatic organisms. The pesticides discharged into aquatic environment caused chronic stress conditions that have harmful influence on aquatic life. The useful qualities of pesticides, they attract the farmer and health departments to use them against pest control. But these compounds are found to be highly toxic to aquatic biota and especially to fish, creating serious threat to the food webs in the aquatic ecosystems. So, there was a dreadful need to evaluate the hazardous potential of these pesticide residues in aquatic ecosystems.

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Table 1: LC50 value of *Channa striata* exposed to different concentrations of Chlorpyrifos for 96 hours.

Sl. No.	Concentration (ppm)	Log Concentration	No. of Fishes Exposed	No. of Fishes Respond	Probit Kill %	Percent Kill %
1	1.5	0.176091	12	1	3.59	8.33
2	2.5	0.39794	12	2	4.05	16.7
3	3.5	0.544068	12	4	4.56	33.3
4	4.5	0.653213	12	6	5	50
5	5.5	0.740363	12	8	5.44	66.7

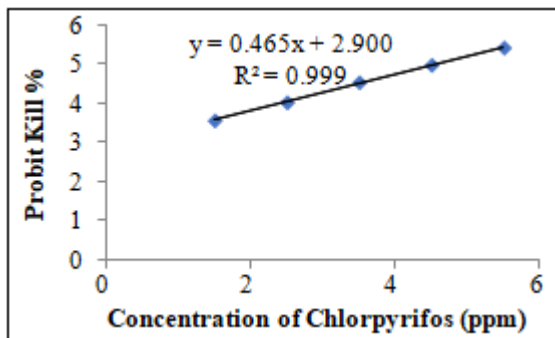


Figure 1: Graph of Concentration of Chlorpyrifos vs Probit kill