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# Toxicity of organophosphate and synthetic pyrethroid pesticides on rohu fish (*Labeo rohita*) fingerlings

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**Abstract-** The aim of the experiment was to evaluate the toxicity of organophosphate pesticides (chlorpyrifos) and synthetic pyrethroid pesticides (fenpropathrin) to Rohu fish (*Labeo rohita*) fingerlings. The $LC_{50}$ for Rohu fish (*Labeo rohita*) fingerlings was 5.70, 0.5, 0.015 and 0.26 ppm for chlorpyrifos, methyl parathion, fenvalerate and fenpropathrin, respectively. These pesticides are highly sensitive to fingerlings and is alarming as it is commonly used in the agricultural fields and may affect the fisheries sector.

**Key words: Pesticides, Methyl parathion, Fenvalerate, Rohu fish (*Labeo rohita*) fingerlings, ecosystem.**

## INTRODUCTION

The indiscriminate use of pesticides has increased to protect crops from insect pests, and it contaminating land and water from production sites and storage tanks, run-offs from fields. Pesticides affects the non-target organism also e.g. invertebrates, mammals, birds and fishes, Organophosphate (OP), carbamate and synthetic pyrethroid (SP) pesticides are mostly used in agriculture to control pests due to their non-persistent nature in the environment.[1] These pesticides drastically affects and their high toxicity to some non-target species has been observed by many workers.[2-4] Laboratory studies revealed that pesticides can be acutely toxic to freshwater and estuarine organisms also.[5,6] The Rohu fish (*Labeo rohita*) is one of the important fish in composite fish culture and are very common in inland water.

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Acute toxicity is a convenient tool used extensively to evaluate the toxicity of physiologically active substances and also to evaluate the potential of chemical contamination on commercially and ecologically important species.[7] The objective of the present study is to evaluate the toxicity of selected pesticides to Rohu fingerlings, so that the farmers may be aware about the effect of pesticides on fish culture.

## MATERIALS & METHODS

Methyl parathion 5% EC, fenpropathrin 20% EC, fenvalerate 20% EC, chlorpyrifos 40% EC were procured from local market. Stock solution of 100 ppm and appropriate working concentrations were prepared in filtered water. The fingerlings of Rohu fish (*Labeo rohita*) average weight 105 g were procured from local hatchery.

Standard bioassay methods were followed to evaluate toxicity of pesticide using static bioassay system.[8,9] $LC_{50}$ were carried out in glass jars of 2 litres capacity (20.5 x 13.5cm). All glassware was acid cleaned prior to the tests. Initially all test organisms were treated with wide range of

pesticide concentration in filtered water to evaluate the at which mortality around 50% occurs. For each concentration of test pesticide ten fingerlings were exposed in groups. The experiment was repeated with five or more concentrations of different pesticides for test organism. The different concentrations of pesticides ranged between 0.1-8 ppm. The tests and controls for each experiment were in triplicate and the controls had only water. The other experimental conditions, such as, temperature (28±1°C), pH 7.57, was maintained. Acute toxicity measured as mortality of organisms exposed to each pesticides was estimated by determination of the 24 h $LC_{50}$ (the concentration of the pesticides which kills fifty percent of the test animals after 24 h exposure). Organisms were considered dead if they did not exhibit movement and it laid immobile.

## RESULTS & DISCUSSION

The results obtained in experiments, where Rohu fingerlings were tested against organophosphates and synthetic pyrethroid pesticides, show that fingerlings were sensitive to all pesticides tested. it was found higher the concentration more was mortality. The variability in the degree of sensitivity is reflected by the lethal concentration values of pesticides, at which 50% mortality occurs. The 24 h $LC_{50}$ was 5.7, 0.5, 0.015 and 0.26 ppm for chlorpyrifos, methyl parathion, fenvalerate and fenpropathrin respectively. Among rohu fingerlings are considered as more sensitive to fenvalerate followed by fenpropathrin, methyl parathion and then chlorpyrifos.

Fingerlings appear to be highly sensitive to pesticides and have low $LC_{50}$ values, which may be due to the fact that both OP and SPs are particularly produced to target insects which also include crustaceans.[10] As OP and SP pesticides are non-persistent in nature and readily degradable, therefore acute toxicity test of 24h $LC_{50}$ were considered in the present study.

Fingerlings used in the present study, were highly sensitive as expected in line with findings of some previous studies, in other organisms[11] for example, copepods, brine shrimp, fish. Generally, in bioassay of fingerlings are employed for toxicity test to predict environmental risk. Juveniles are more sensitive to environmental impacts than the adult.[12] The reason is that fingerlings have higher surface area to volume ratios than adults and have faster uptake kinetics of the chemical.[12] The metabolic capacity in fingerlings may be different from that in adults.[13]

**Table 1- Toxicity of organophosphate pesticides and synthetic pyrethroid pesticides on *Labeo rohita* fingerlings after 24 h of treatment showing $LC_{50}$.**

| Pesticides | No. of fingerlings | Concentration tested (ppm) | $LC_{50}$ (ppm) level |
|---|---|---|---|
| Methyl parathion | 150 | 1.0- 8 | 0.5±0.06 |
| Chlorpyrifos | 150 | 0.1 - 0.8 | 5.70±0.07 |
| Fenvalerate | 150 | 0.1- 2 | 0.015±0.05 |
| Fenpropathrin | 150 | 0.1-0.8 | 0.26±0.10 |

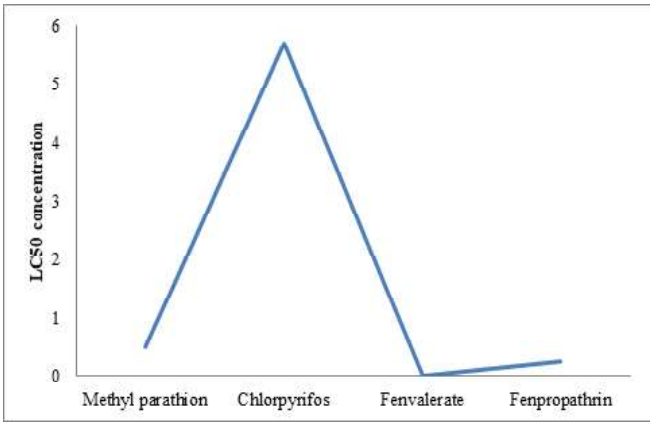


**Fig 1: $LC_{50}$ of the selected pesticides on *Labeo rohita* fingerlings**

The $LC_{50}$ values found in the present work can be compared with those reported earlier by other authors for effects of different pesticides on various fish species. The $LC_{50}$ values for different organisms provides only a rough indication of differences in specific tolerance as a number of factors influence the bioassay results, such as, temperature[14] and degree of susceptibility of test organisms.[15] It has been reported that pesticides toxicity increases with temperature.[14] For any species, sensitivity to a given pesticide varies with age, sex, nutritional background, health, stress and the environment. Variability due to differences in sensitivity between sexual and asexual species, as well as among intra- strains and clones of the same species has been reported for aquatic invertebrates used in ecotoxicological studies. It is also reported that the toxicity differs from species to species[6] and in some cases from place to place, which may be due to differences in bioassay techniques and purity of pesticides used, the differences found could also result from differences in tolerance to the exposure between species. Different

pesticides or even different salts of same pesticide have variable effect on same organisms.[6] This is also true for the toxicity of same group of pesticide to the same organism e.g., fingerlings when exposed to OP pesticide; phorate and methyl parathion, when exposed to organ chlorine (OC) pesticide; DDT and heptachlor[16], when exposed to OC pesticide; BHC and lindane.[17]

The 24 h $LC_{50}$ of fingerlings was very low for both OP (chlorpyrifos, methyl parathion) and SP (fenvalerate and fenpropathrin) pesticides showing sensitivity of these organisms. Since India is an agricultural country and these pesticides are used in agricultural land. There is a paucity of data of these pesticides. Deterioration in the quality of aquatic environment affects the fish industry as well as the aquaculture in the inland waters.

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