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Acute Toxicity of Lufenuron (Insecticide) on Oreochromis niloticus (L., 1754) Larvae

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ABSTRACT
In this study, lufenuron (insecticide) acute toxic effects on larvae of *Oreochromis niloticus* (L., 1754) used in intensively cotton and corn farming in agricultural areas inside of Çukurova Region was investigated by bioassay method for to be informed about the possible adverse effects that may be caused in the aquatic environment. The study was carried out with 25 ± 2 ^{o}C in the laboratory and the test fish which an average weight of 1.36 ± 0.5 g and average length 5.56 ± 0.6 cm in aquariums by two replicates according to the static bioassay method. Data were analysed by log-logistic model statistical analysis method 24-h and 48-h LC_{50} values were calculated fish mortality in statistical analysis considering the observed acute toxic effects of the investigation lufenuron *O. niloticus* larvae 24-hour LC_{50} 1.80 ± 0.06 mgl^{-1}, while the 48-hour LC $_{50}$ value is calculated as LC_{50} 1.77 ± 0.04 mgl^{-1}.
Keywords **-** Bioassay**,** Insecticide, Lufenuron, *Oreochromis niloticus*, LC_{50}.

I.   INTRODUCTION

Pesticides are pollutants that should be taken into account because of they have difficult decomposition and toxicly due to their ability to accumulate in the environment and in living organisms. Heavy contamination of pesticides leads to oxygen shortage and poisoning massive deaths of fish and other living things in water.

Thanks to the agricultural pesticides used in agricultural applications in the Çukurova Region while protecting the farmer product and getting more yield but most of the time pollute aquatic environments by unconscious pesticides. It also bring about the risk of poisoning of human beings and other living things in case of the accumulation of applied pesticides in the soil over time or the consumption of products with pesticides residues [1].

Lufenuron is a medicine used against cotton leafworm (cotton and pepper) and striped leafworm (maize) and also effective on larvae and poisonous for fishes [2].

In this study, lufenuron (insecticide) acute toxic effects on larvae of *Oreochromis niloticus* (L., 1754) used in intensively cotton and corn farming in agricultural areas inside of Çukurova Region was investigated by bioassay method for to be informed about the possible adverse effects that may be caused in the aquatic environment.

II. MATERIALS AND METHODS

In this study, Çukurova University Fisheries Faculty Freshwater Fish Research and Application Station the test fish *O. niloticus* larvae with an average weight of 1.36 ± 0.5 g and average length of 5.56 ± 0.6 cm were used in the study also static method was applied to acute bioassay method [3]. Fishes were taken to stock aquariums for compliance with laboratory condition and feeding until the time of the experiment. Two days prior to the experiment was stopped feeding the fish. Dissolved oxygen, pH and temperature values were observed in the aquariums. (20x40x30 cm glass aquariums were used in the experiment).

The research consists of two parts as preliminary and main assays. Concentrations determined in the preliminary experiments were applied in the main experiments. 6 series consisting of control group and 5 concentrations (0.0-control, 1.6, 1.8, 2.0, 2.2, 2.4mgl^{-1}) were formed in the experiments and worked with two reiteration. Lufenuron (50 gl^{-1})'s stock solution was prepared first after than the concentrations in the preliminary experiments and the main experiments were used by diluting this stock solution.

As result of experiments, the mortality rates in fish were determined and the concentrations that mortality 50% of the fishes was determined. Log-logistic model [4], R 3.0 [5] and DRC library [6] statistical method were applied using dose-response data for the results.

III. RESULTS

The experiments were conducted under laboratory conditions at 25 ± 2°C, pH 7.8-8.1 dissolved O_2 7.5-5.4 mgl^{-1}.
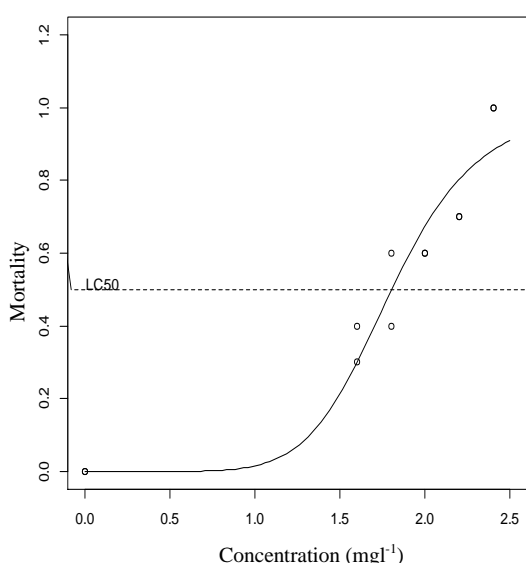
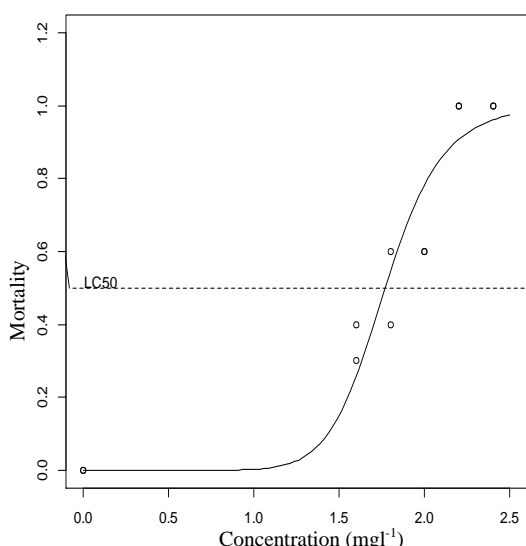**Figure 1.** LC_{50} value of *O. niloticus* for 24 hours.

Figure 2. LC_{50} value of *O. niloticus* for 48 hours.

The calculated acute LC_{50} values (95% confidence limits) of lufenuron, using a static bioassay system for *O. niloticus* were 24-h LC_{50} 1.80±0.06 mgl^{-1} and 48-h LC_{50} 1.77±0.04 mgl^{-1}.

IV. DISCUSSION

Regarding the lethal concentration values obtained as a result of the experiments carried out in order to determine the effects of pesticides on the fish, there are quite different results in various sources. This difference is mainly due to various reasons such as the fish biology, living conditions, physical and chemical properties of the water and the method applied.

As a result of the experiments, lufenuron (insecticide) the 24-h and 48-h LC_{50} acute toxic lethal concentration values for *Oreochromis niloticus* (L., 1754) larvae were determined to be

1.80±0.06 mgl^{-1} and 1.77±0.04 mgl^{-1} respectively. Some results of the toxicity studies were performed with 96-h LC_{50} values lufenuron: LC_{50} value for *Oncorhynchus mykiss* was determined as 2.6 mgl^{-1} [7], LC_{50} >73 mgl^{-1}; LC_{50} value for *Lepomis macrochirus* was determined as LC_{50} >29 mg l^{-1}; LC_{50} value for *Ictalurus punctatus* was determined as LC_{50} >45 mgl^{-1}; LC_{50} value for *Cyprinus carpio* was determined as LC_{50} >63 mgl^{-1} [8]; [9] have been reported.

According to these conclusions; compliance with reports of LC_{50} value 2.6 mgl^{-1} we have determined for lufenuron in this study. The difference with the others reports are thought to be caused by the differences in fish species, length, age and ambient temperature.

As a result, when the LC_{50} values determined in the study were taken into consideration, it was observed that the LC_{50} value decreased as the application time of the pesticide was prolonged. In terms of the lethal effects of insecticide and the results obtained in other researches, it is considered that commercial formulations may also be effective in terms of these research results.

The results of the study are thought to be a guide for practitioners who are engaged in scientific work, especially for the protection of aquatic ecosystems.

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