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Original Research Article

Acute Toxicity of Bentazone (Herbicide) and Chlorpyrifos (Insecticide) on *Oreochromis niloticus* (L., 1754) Larvae (Bioassay)*

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ABSTRACT

In this study, in aquatic environments negative effects which may occur in order to have information about, the acute toxicity Bentazone (Herbicide) and Chlorpyrifos (Insecticide) which widely used in agriculture in Cukurova Region has been researched into larvae *Oreochromis niloticus* (L., 1754). In this study, the test fish *O. niloticus* larvae (average weight 1.21±0.52 g, average length 4.29±0.2 cm) were obtained from the Çukurova University Fisheries Faculty Freshwater Fish Research and Application Station. In the experiment, five different concentrations together with the control group were used 2 test series. In the present study, methods of bioassay test which static method has been applied. The study was carried out under laboratory conditions at 25±2 °C. The results has been estimated with the dose-response data were fitted a log-logistic model by using R 3.0 statistical computation environment and DRC library. The 24-h acute LC_{50} values were calculated. According to the results, acute toxic effects researched Bentazone (Herbicide) and Chlorpyrifos (Insecticide) the 24-h LC_{50} acute toxic lethal concentration values for *Oreochromis niloticus* (L., 1754) larvae were calculated Bentazone (Herbicide) LC_{50} 14.86±0.19 mgl^{-1} and Chlorpyrifos (Insecticide) LC_{50} 0.40±0.02 mgl^{-1}.

Key Words: Bentazone, Chlorpyrifos, *Oreochromis niloticus*, LC_{50}, Bioassay

Bentazone (Herbisit) ve Chlorpyrifos (İnsektisit)'un *Oreochromis niloticus* (L.,1754) Yavruları Üzerine Akut Toksik Etkisinin Araştırılması (Biyodeney)

ÖZET

Bu çalışmada, sucul ortamlarda meydana getirebileceği olası olumsuz etkiler hakkında bilgi sahibi olabilmek için, Çukurova Bölgesi'nde tarım alanlarında yoğun olarak kullanılan Bentazone (Herbisit) ve Chlorpyrifos (İnsektisit)' un *Oreochromis* niloticus (L.,1754) yavruları üzerine akut toksik etkisi biyodeney yöntemiyle araştırılmıştır. Çalışma, laboratuarda 25±2°C'de, akvaryumlarda, ortalama ağırlığı 1.21±0.52 g ve ortalama boyu 4.29±0.2cm olan balıklarla, her pestisit için 2'şer tekrarlı, statik biyodeney yöntemine göre yürütülmüş; log-logistik model istatistik analiz yöntemiyle incelenmiş ve 24 saatlik akut LC_{50} hesaplanmıştır. Araştırma sonucunda, *Oreochromis niloticus* (L.,1754) yavrularına ait 24 saatlik akut toksik öldürücü konsantrasyon değerleri, bir herbisit olan Bentazone için LC_{50} 14.86±0.19 mgl^{-1} ve bir insektisit olan Chlorpyrifos için LC_{50} 0.40±0.02 mgl^{-1} olarak hesaplanmıştır.

Anahtar Kelimeler: Bentazone, Chlorpyrifos, *Oreochromis niloticus*, LC_{50}, biyodeney.

INTRODUCTION

Pesticides are needed to be fully considered because they are toxic, they difficultly can decompose and they can accumulate in the environment and on the living organisms.

In water, heavy contamination of pesticides leads shortage of oxygen and so it leads to toxication. It leads to mass mortality of fish and other organisms (Çelikel 2011).

Bentazone an effective herbicide against foreign weeds affecting soy beans, peas, onions and beans. It is toxic and for aquatic organisms. It is not adsorbed by the soil, so ground waters can probably include it (Torun 2011).

Chlorpyrifos is a broad-spetectrum and organo-phosphored insecticid which is used for combating arthropods and insects in agricultural areas (Girón-Pérez et al. 2006, Gündüz et al. 2012).

In this study, to have information about the possible negative effects of Bentazone (Herbicide) and Chlorpyrifos (Insecticide) in the aquatic environment; acute toxic effects of Bentazone (Herbicide) and

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Chlorpyrifos (Insecticide), which widely used in agricultural Çukurova Regions, on *Oreochromis niloticus* (L., 1754) larvae are investigated by methods of bioassay test which static method has been applied.

MATERIALS VE METHODS

In this study, the test fish *Oreochromis niloticus* larvae were obtained from the Çukurova University Fisheries Faculty Freshwater Fish Research and Application Station and which are average weight of 1.21±0.52 g and average length of 4.29±0.2 cm.

In this study, static method of acute bioassay methods was applied (APHA, AWWA, WEF 1998). Fishes were taken to stock the aquariums for adaptation to laboratory conditions. Fishes were stopped feeded two days prior to the experiment. In the experiment 20x40x30 cm glass aquariums were used and pH and oxygen values in both stock and experiment aquariums were observed.

Researches are including two sections; preliminary and main experiments. The concentration determined in preliminary experiments were used in main experiments. In the study, for each pesticide five different concentrations together with the control group were used 2 test series. Each experiment were repeated for two times.

First, stock solutions of Bentazone ($480gl^{-1}$) and Chlorpyrifos ($480gl^{-1}$) are prepared. The concentrations used in preliminary and main experiments were taken from these stock solutions.

As a result of experiments, the mortality rates of fish were determined and the concentrations that mortality the 50% of the fishes were determined. The results has been estimated with the dose-response data were fitted a log-logistic model by using R 3.0 (R Core Team, 2013) statistical computation environment and DRC library (Ritz and Streibig 2005).

RESULTS

The experiments were carried out under laboratory conditions at 25±2 ^{o}C, The pH value were measured 8.1-8.3 Bentazone and 7.6-8.3 Chlorpyrifos. The dissolved O_2 value were measured 7.7-6.2 mgl^{-1} Bentazone and 7.6-5.6 mgl^{-1} Chlorpyrifos.

Bentazone

LC_{50} value for 24 hours is obtained as 14.86 ± 0.19 mgl^{-1} (Figure 1).

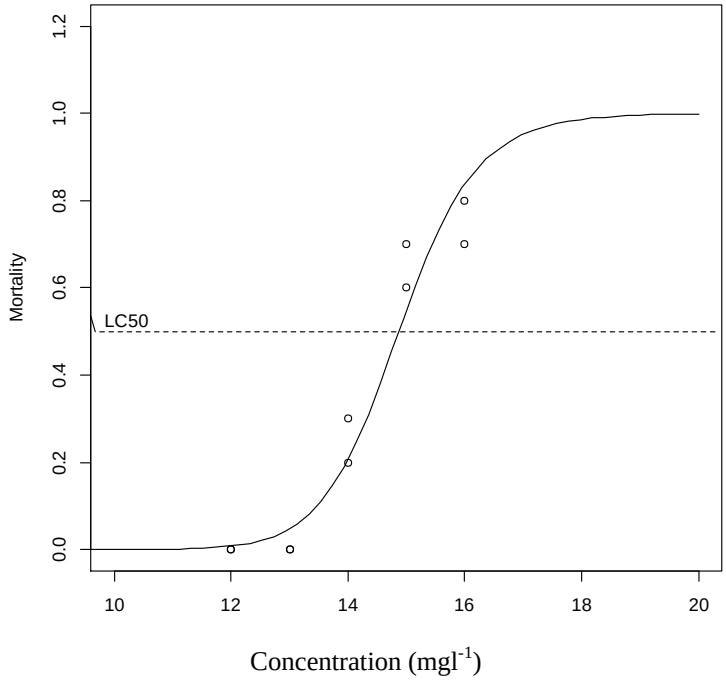

Figure 1. LC_{50} value of *O. niloticus* for 24 hours

Chlorpyrifos

LC_{50} value for 24 hours is obtained as 0,40±0,02 mgl^{-1} (Figure 2).

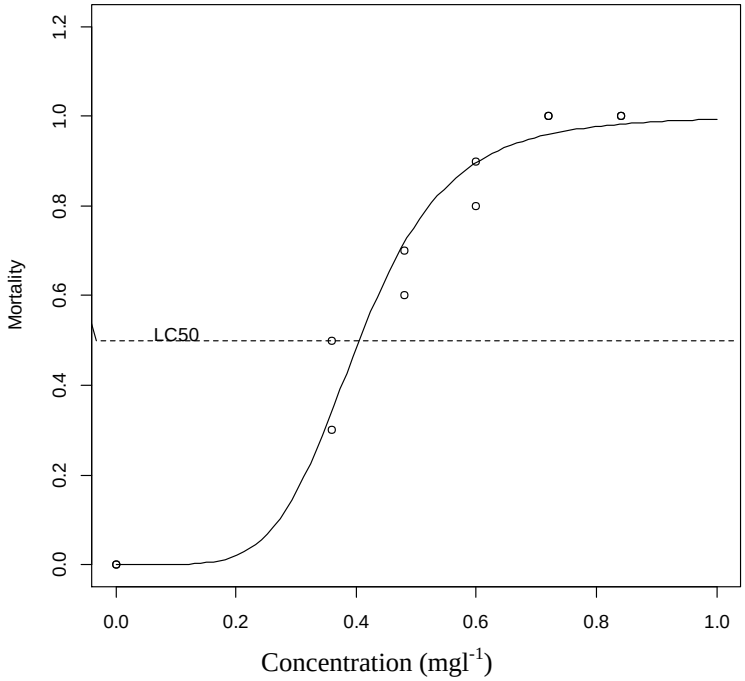

Figure 2. LC_{50} value of *O. niloticus* for 24 hours

DISCUSSION

Different results are found in various sources about the lethal concentration values established from the experiment done to determine the effects of pesticides on fishes. There are some causes of these differences, such as the fish biology, living conditions, physical and chemical properties of water and the methods applied (Fındık et al. 2001).

As a result of experiments, Bentazone (Herbicide) and Chlorpyrifos (Insecticide) the 24-h LC_{50} acute toxic lethal concentrations values for *Oreochromis niloticus* (L., 1754) larvae were calculated to be 14.86±0.19 mgl^{-1} and 0.40±0.02 mgl^{-1}, respectively.

Some compliant and non-compliant sides can be observed when these experiments compared with previous studies with various herbicides and insecticides.

O. niloticus for some results of toxicity studies conducted with herbicides;
LC_{50} value for 96-h for Paraquats (average weigth of 6.97-7.72 g) was determined as 12.25 mgl^{-1} (Babatunde and Oladimeji 2014); LC_{50} value for 24-h for Gylphosate 480 SL was determined as 72.73 mgl^{-1} (Özdemir et al. 2009); LC_{50} value for 96-h (average weigth of 1.515±0.376 g and average length of 4.929±0.412 cm) was determined as 313.98 mgl^{-1} (Fındık et al. 2001) have been reported.
Some results of toxicity studies conducted with Chlorpyrifos;
LC_{50} value for 96-h for *Cyprinus carpio* (average weight 20.66 ± 1.21 g and average length of 10.70 ± 0.15 cm) was determined as 2.08 mgl^{-1} (Gündüz et al. 2012); LC_{50} value for 96-h for *O. niloticus* (average weigth 80 g) was determined as 1.023mgl^{-1} (Girón-Pérez et al. 2006); LC_{50} value for 48-h for *Oryzias latipes* larvae was determined as 0.30 mgl^{-1} (Carlson et al.1998) have been reported.

According to these results; LC_{50} value we have found for a herbicide Bentazone is compliant with the report of Babatunde and Oladimeji (2014), and LC_{50} value we have found for an insecticide Chlorpyrifos is compliant with the report of Carlson et al. (1998). It is thought that, the causes of the differences with other reports are fish length, fish types and ambient temperature.

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