J. BIOL. ENVIRON. SCI.,
2016, 10(30), 125-128

Original Research Article

Acute Toxicity of Abamectin (Insecticide) on *Daphnia magna* (Straus, 1820)

Cansev Azgın[*] and Münir Ziya Lugal Göksu
Çukurova University, Fisheries Faculty, 01330 Balcalı, Adana, TURKEY

Received: 02.12.2016; Accepted: 16.12.2016; Published Online: 30.12.2016

ABSTRACT

Abamectin is used for the insect and mite pests control cotton, citrus fruit, vegetables, potatoes and other crops. Abamectin is not directly used in aquatic ecosystems, but it may have adverse impact on aquatic environment. The aim of this study was to determine the acute toxicity of abamectin (insecticide) on *Daphnia magna* (Straus, 1820) (Cladocera, Crustacea). *D. magna* were obtained from the Çukurova University Fisheries Faculty Freshwater Fish Research and Application Station. In the experiment, five different concentrations and one control group have been used. Each experiment was repeated two times. In this research, the static test method of acute toxicity test was used. The experiments were conducted under laboratory conditions at 20±2 ºC. The results have been estimated with the dose-response data and were fitted with a log-logistic model by using R 3.0 statistical computation environment and DRC library. The 24-h and 48-h acute LC_{50} values were determined. According to the results, acute toxic effects researched Abamectin, the 24 h and 48 h LC_{50} acute toxic lethal concentration values for *D. magna* were calculated to be 0.020 μgl^{-1} and 0.0043 μgl^{-1}.

Keywords: Bioassay, Insecticide, Abamectin, *Daphnia magna*, LC_{50}

INTRODUCTION

Due to their being heavy toxicity and difficulties of decomposition, pesticides are one of the most important toxics which needs to be fully considered in the nature. Especially in the waters, contamination of pesticides can be caused oxygen shortage and fish poisonings, other aquatic organisms of mass mortality.

Abamectin is used for the insect and mite pests control cotton, potatoes, citrus fruit, vegetables and other crops. Abamectin is not directly used in aquatic ecosystems, but it may have negative impact on aquatic environment. Veterinary drugs such as the avermectins are widely used in veterinary medicine as anthelmintics against internal and external parasites of pigs, cattle, and horses, goats, and sheep (Campbell and Benz 1984; Suarez 2002; Tišler and Eržen, 2006).

Daphnia magna is one of the most significant fresh water species used in ecotoxicity testing through the world. It has been used commonly to detect the toxicity of effluents, water and sediment samples and has been demonstrated to be sensitive to many environmental contaminants (Yegane et al., 2008).

In this study the aim was to evaluate the effects of abamectin, insecticide widespread used in agriculture throughout the Çukurova Region, on *D. magna* are investigated by the static test method of acute toxicity test.

MATERIALS AND METHODS

In this study, *D. magna* were obtained from the Çukurova University Fisheries Faculty Freshwater Fish Research and Application Station.

In this study, the static method of the acute bioassay methods was applied (APHA, AWWA, WEF, 1998). *D. magna* were taken to stock the aquariums for adaptation to the laboratory conditions. Reproductive daphnia were separated and young neonates were used one day before the start of the experiments. Two days prior to the experiment was stopped feeding the *D. magna*. In the experiment 100 ml glass flask were used and pH, temperature values in both the experiment and stock aquariums the was observed. Observations were made at 24 h and 48 h the results recorded.

The research includes two sections; preliminary and main experiments. The concentration determined in preliminary experiments was used in the main experiments. In the study, five different concentrations 24 h (0.01,

[*] Corresponding author: acansev@cu.edu.tr

0.02, 0.03, 0.04, 0.05 μgl^{-1}) and 48 h (0.003, 0.006, 0.009, 0.012, 0.015 μgl^{-1}) together with the control group (0.00 μgl^{-1}) were used test flask. Each experiment was repeated twice.

Initially, abamectin (18gl^{-1}) was prepared. The concentrations used in the preliminary and main experiments were then taken from these stock solutions.

As a result of the experiments, the mortality rates of *D. magna* were determined 50%. The results have been calculated with the dose-response data that were fitted with a log-logistic model (Jeske et al., 2009) by using R 3.0 (R Core Team, 2013) statistical computation environment and DRC library (Ritz and Streibig, 2005).

RESULTS

The experiments were conducted under laboratory conditions at 20±2 ^{o}C, pH 7.1-8.6. The calculated 24-h and 48-h acute LC_{50} values (95% confidence limits) of abamectin, using a static bioassay system for *D. magna* were 0.020 μgl^{-1} and 0.0043 μgl^{-1}.

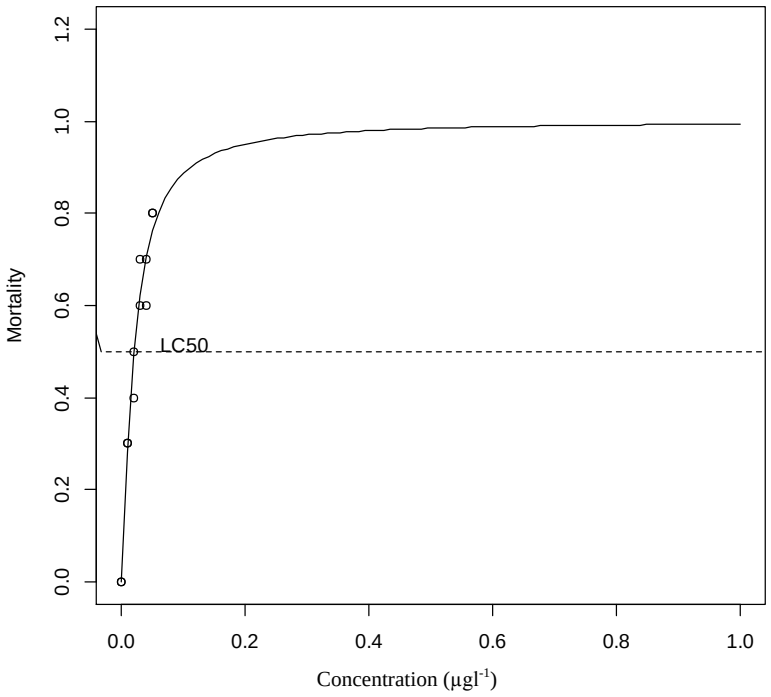

Figure 1. LC_{50} value of *D. magna* for 24 hours.

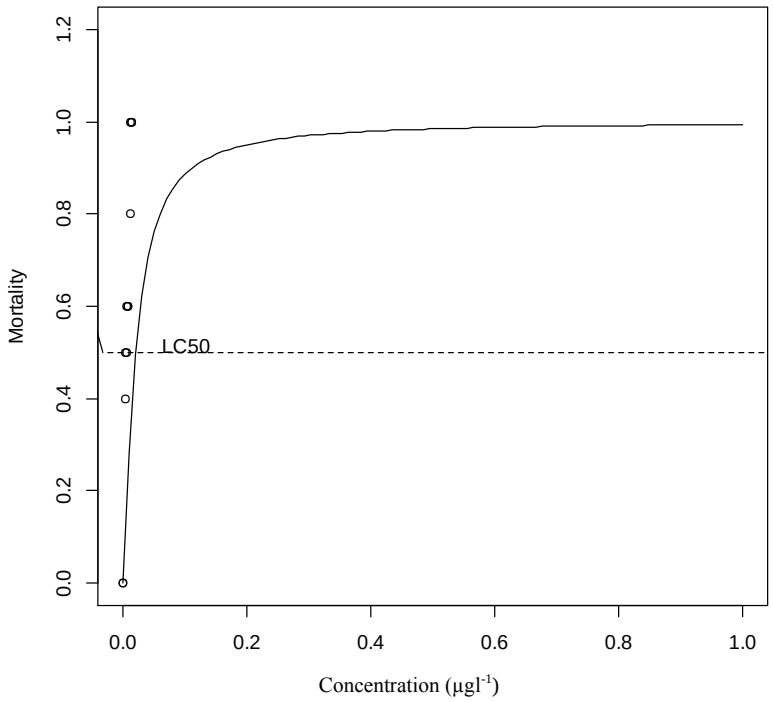

Figure 2. LC_{50} value of *D. magna* for 48 hours.

DISCUSSION

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

As a result of the experiments, abamectin the 24-h and 48-h LC_{50} acute toxic lethal concentration values for *D. magna* were determined to be 0.020µgl^{-1} and 0.0043µgl^{-1} respectively.

Some results of the toxicity studies were performed with values abamectin, 96-h LC_{50} value for *Cyprinus carpio* was determined as LC_{50} 1.243 mgl^{-1} (Hedayati et al., 2014); 96-h LC_{50} value for *Danio rerio* was determined as LC_{50} *33* µgl^{-1} 96-h LC_{50} value for *Chironomus xanthus* was determined as LC_{50} 2.67 µgl^{-1}, 48-h EC_{50} value for *Daphnia similis* was determined as 0.0051 µgl^{-1} (Novelli et al., 2012) ; 96-h LC_{50} value for *Msyidopsis bahia* was determined as LC_{50} 0.0022 µgl^{-1} (Wislocki et al.,1989 ; Kolar and Eržen, 2006) have been reported.

According to these conclusions; compliance with reports of LC_{50} values 0.0051 µgl^{-1} and 0.0022 µgl^{-1} we have determined for abamectin in this study. The difference with the others reports are thought to be caused by the differences in species, living environment, length, age and ambient temperature.

Consequently, when the LC_{50} values determined in the experiment were taken into consideration, it was observed that the LC_{50} value reduced as the application time of the pesticide was extended. In terms of the lethal effects of insecticide and the conclusions obtained in other researches, it is considered that trading formulations may also be influential in terms of these study results. The conclusions of the research are opinion to be a guide for practitioners who are engaged in scientific work, particularly for the safeguard of aquatic ecosystems.

ACKNOWLEDGEMENTS

The study was financially supported by the Çukurova University Scientific Research Fund (Project No. FED-2016-7200)

REFERENCES

APHA, AWWA, WEF (1998). Standard Methods For The Examination Of Water and Waste Water, 20th edit. p.614-743 Washington, DC.

Campbell WC, Benz GW (1984) Ivermectin: a review of efficacy and safety. J Vet Pharmacol Ther 7:1–16.

Fındık, Ö., Taşdemir, M., Çevik, F., Göksu, M.Z.L. (2001). 2-4 D'nin *C. carpio* (L.,1758) ve *O. niloticus* (L.,1754) Yavruları Üzerine Akut Toksik Etkisinin Araştırılması. XI.Ul. Su Ür. Semp. Bil. 4-6/9 2001 C:1 pp. 492-497.

Hedayati, A., Vajargah, M.F., Yalsuyi, A.M., Abarghoei, S., & Hajiahmadyan, M. (2014). Acute toxicity test of pesticide abamectin on common carp (*Cyprinus carpio*). Journal of Coastal Life Medicine, 2(11), 841-844.

Jeske, D.R., Xu, H.K., Blessinger, T., Jensen, P. And Trumble, J. (2009). Testing for the Equality of EC_{50} Values in the Presence of Unequal Slopes With Application to Toxicity of Selenium Types, Journal of Agricultural, Biological, and Environmental Statistics, 14, pp.469–483.

Kolar, L. and Eržen, K.N. (2006). Veterinary parasiticides–are they posing an environmental risk. Slov Vet Res, 43(2), 85-96.

Novelli, A., Vieira, B.H., Cordeiro, D., Cappelini, L.T.D., Vieira, E.M., & Espíndola, E.L.G. (2012). Lethal effects of abamectin on the aquatic organisms *Daphnia similis*, *Chironomus xanthus* and *Danio rerio*. Chemosphere, 86(1), 36-40.

R CORE TEAM (2013). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.URL http://www.R-project.org/.

Ritz, C. And Streibig, J. C. (2005). Bioassay Analysis using R. J. Statist. Software, Vol 12, Issue 5.

Suarez VH (2002) Helminthic control on grazing ruminants and environmental risks in South America. Vet Res 33:563–573.

Tisler, T., Erzen, N.K. (2006). Abamectin in the aquatic environment. Ecotoxicol 15, 495-502.

Wislocki PG, Grosso LS, Dybas RA. (1989). Environmental aspects of abamectin. Use in crop protection. In: Campbell WC, eds. Ivermectin and abamectin. New York: Springer Verlag,182-200.

Yegane, Ö., Parlak, H., Arslan, Ö.Ç., & Boyacıoğlu, M. (2008). Sediment Toxicity of Streams Flow through the Inner Part of İzmir Bay with *Daphnia magna* Straus, 1820. Su Ürünleri Dergisi, 25(1).