

Acute toxicity of endosulfan to immature and adult Gastropods*Lymnaea Radix cor* (Annandale and Prashad , 1919)Ama'al G. Yasser¹Murtada D. Naser²Najem M. Aziz²¹Department of Vertebrates²Department of marine biology, Marine Science Centre, University of Basrah, Iraq**Abstract**

Endosulfan, polycyclic organochlorine pesticide contaminating aquatic ecosystem as a potential toxic pollutants, was investigated in the present study for acute toxicity. The immature and adult gastropods *Lymnaea Radix cor* were selected for the bioassay experiments. The 96 h LC₅₀ were determined for the both stages. Data obtained from endosulfan acute toxicity tests were evaluated using the Probit Analysis Statistical Program. The 96h LC₅₀ values for immature and adult snails were estimated as, (0.38) and (0.91) mg/l, respectively.

Keywords: Endosulfan; Acute toxicity; *Lymnaea Radix cor*; LC₅₀

Introduction

Discharge of toxic pollutants into the aquatic environment presents a potential risk to the biota, unless the concentration of pollutants discharged are confined within certain limits. Toxicity tests carried out on representative components of the aquatic flora and fauna facilitate quantification of these limits.

Endosulfan is a chlorinated hydrocarbon insecticide and acaricide of the cyclodiene subgroup (Anonymous, 1998). It is made up of a mixture of two isomers, α and β , both of which have similar insecticidal properties (Goebel, *et al.*, 1982). Endosulfan and both its isomers work by inhibiting the $\text{Na}^+ - \text{K}^+$ ATPase (enzyme responsible for regulating the $\text{Na}^+ - \text{K}^+$ channels along nervous system pathways) and the mitochondrial Mg^{2+} ATPase (enzyme responsible for regulating the ATP production in the mitochondria (Goebel, *et al.*, 1982; Dorval, *et al.*, 2003). Endosulfan is widely used by fishermen illegally to capture fish especially in the Southern Iraqi Marshes and that cause a great destruction to the marshes environment (Al-Helfi, 2000).

Lymnaea Radix cor (Mollusca; Gastropoda) is a freshwater pulmonate snail widely distributed in Mesopotamia where it is one of the intermediate hosts of *fasciola hepatica*. It is a hermaphroditic species but cross fertilization occurs as well.

Data regarding the toxicity of the pollutants pesticides in our region to benthic macroinvertebrates are little (Jaweir; 1989; Al-Yasseri, 2000). Unfortunately, there is no studied available on immature invertebrates toxicity tests, but they are carried out only with adult individuals. Tests to evaluate toxicity to immature snails are far less frequently conducted.

This study was performed to evaluate acute toxicities of endosulfan to immature and adult stages of *Lymnaea Radix cor* to determine the most sensitive stage of this important freshwater organism. This gastropods species were chosen for the study because they are abundant in the study area and are also a principle prey of many fish and larger invertebrates. They can also be transported easily and maintained in the laboratory. These characters make them ideal test species for toxicity bioassay.

Materials and Methods

The gastropods *Lymnaea Radix cor* were collected from banks of Garmat Ali River (Fig 1). They were identified according to Annandale and Prashad (1919), with median average length (10-12)mm for adult and (3-5)mm for immature snails. The animals were transported to the laboratory in freshwater from the collection site.

In the laboratory, the animals were separated and they were kept in large holding 5 L capacity which filled with stored tap water. The animals were acclimized for 7 days prior to the start the experiment, under 12:12 hour light: dark regime with continuous aeration. Tap water change daily and snail were fed twice a day.

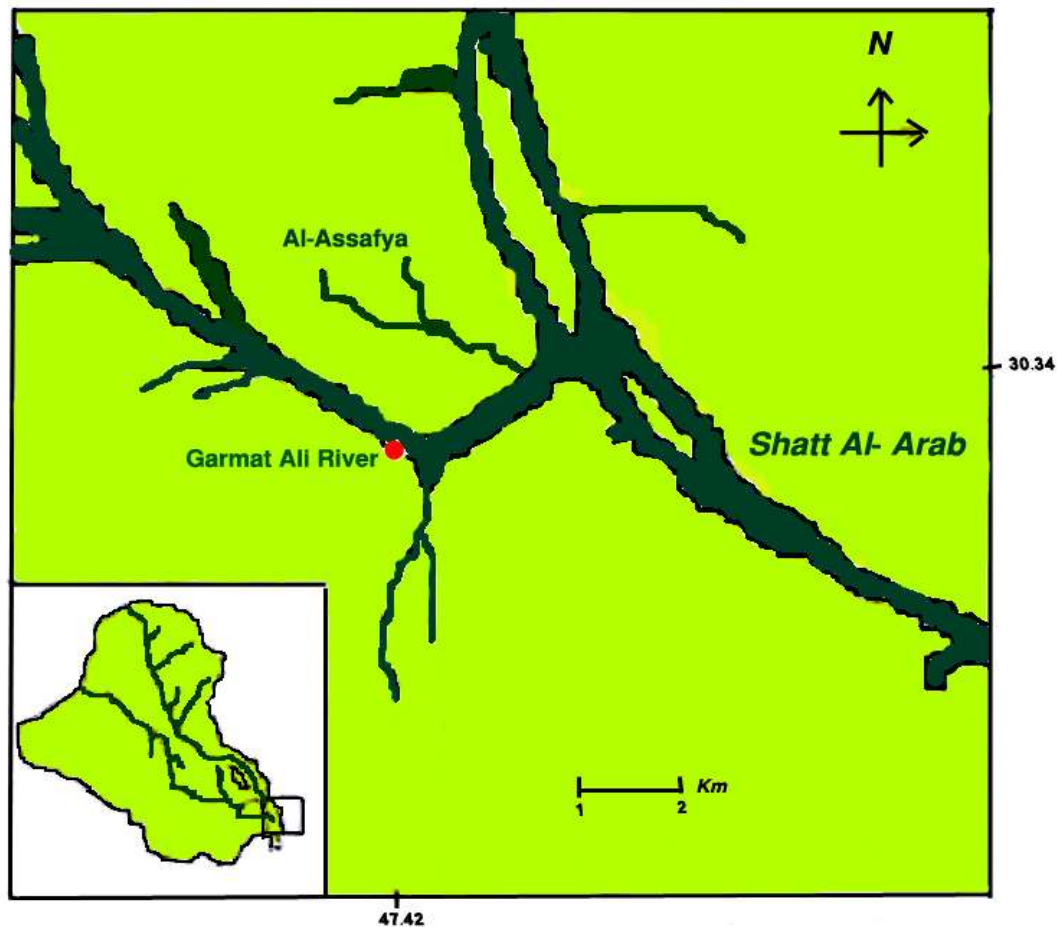


Fig . 1 Sampling site

The commercial grade endosulfan, Thiordan® 35 EC (soluble in water) was used in this study. For experimental purposes stock solutions from which different concentrations required for the present study were made. After acclimatization snail were selected at random and transferred to glass tank filled with stored tap water (tap water stored for (8-10) days was used for experimental studies to nullify the effect of chlorine present in water) then pesticide concentration were add to water.

Static acute bioassay were conducted using five test concentrations (0.5, 1.0, 2.5, 5.0, 10.0) mg\L plus a control series. Each series consisted of three replicates with 10 animals for both adults and immatures of *L. Radix cor*.

Observations for mortality were made every three hours. The criterion for determining death was the absence of movement when the animals were gently prodded for 1 min. under dissecting microscope. Dead animals were removed at each observation. Tests were rejected when the control mortality exceeded 10 %.

The mean pH and salinity during the experimental period in all bioassay were 8 ± 0.3 and $1.4 \text{ ppt} \pm 0.2$, respectively.

Data Analysis

A computerized probit analysis was carried out according to methods of Finney (1971). Mortalities recorded in the three beakers for each concentration were pooled. The percentage mortality at each concentration was corrected for any control mortality using Abbott's formula.

Results and Discussion

The calculated 96h LC₅₀ values of technical endosulfan, using a static bioassay system to adult and immature gastropods *L. cor* were (0.91)mg/l and (0.38) mg/l, respectively (table 1). Control mortality was zero.

Table 1: Acute toxicity of endosulfan in immature and adult gastropods (*Lymnaea Radix cor*)

Life stage	96h LC ₅₀ (mg/l)	95% Confidence limits	
		Lower	Upper
Immature	0.38	0.011	0.734
Adult	0.91	0.228	1.702

Note. Control group (theoretical spontaneous response rate) = 0.0000.

Published data with other species report that immature stages are more sensitive than adult stages. This has been observed with other freshwater snails such as *physa gyrina* (Wier and Walter, 1976) and *Lymnaea stagnalis* (Coourdassier *et al.*, 2004), and *Biomphalaria tenagophila*

(Oliveira-Filho *et al.*, 2005), also in insects

Chironomus riparius (Williams *et al.*, 1986). On the other hand for life stages of the grass shrimp *Palaemonetes pugio* adults were more sensitive to endosulfan than larvae (Key *et al.*, 2003).

Different levels of endosulfan sensitivity were determined for some gastropods (Table 2).

Table 2. Acute toxicity of endosulfan to gastropods

Species	Exposure time (hr)	LC ₅₀ (mg/l)
<i>Bellamyia dissimilis</i>	96	1.8 ^a
<i>Biomphalaria tenagophila</i>	96	0.89 ^b
<i>Biomphalaria tenagophila</i>	96	0.12 ^{*,b}
<i>Lymnaea cor</i>	96	0.91 ^c
<i>Lymnaea cor</i>	96	0.38 ^{*,c}
<i>Planorbarius corneus</i>	96	3.23 ^d

* = immature stage; a = Jonnalagadda & Rao (1996); b = Oliveira-Filho *et al.*

(2005); c = present study; d = Otludil *et al.* (2004)

The LC₅₀ values obtained from these toxicity studies provide data on the comparative effect of pollutants especially pesticides and are useful in screening potentially toxic substances. Moreover, the present study with these gastropods, indicate the usefulness of these animals in toxicity testing. Their suitable size makes them convenient test organisms. Their widespread distribution, ease of collecting from the field, ease of handling in the laboratory makes it possible to use large numbers of specimens per replicate giving greater statistical validity to the results.

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السمية الحادة لمبيد الاندوسلفان في صغار وبالغات القوقع

Lymnaea Radix cor (Annandale & Prashad,1919)

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الخلاصة

في الدراسة الحالية تم اختبار السمية الحادة للمبيد الكلوريني العضوي المتعدد الحلقات (الاندوسلفان) الذي يعتبر من الملوثات الخطرة للبيئة. تم اختيار يافعات وبالغات القوقع *Lymnaea Radix cor* في تجارب السمية الحادة و حدد لها التراكيز المميته LC_{50} خلال الفترة ٩٦ ساعة من التعرض. استخدم برنامج التحليل الاحصائي البروبيت لحساب السمية الحادة الاندوسلفان وقد كانت قيم التراكيز النصف القاتلة ليافعات وبالغات القوقع للزمن ٩٦ ساعة من التعرض هي (0.38 و 0.91) ملغرام / لتر على التوالي.