Comparative sensitivity of two freshwater snail *Melanopsis nodosa* and *Bulinus truncatus to 2, 4-D pesticide*

Mohammed J.AL-Obaidy*

Date of acceptance 14/2/2006

Abstract

The molluscicidal effects of herbicide 2, 4-D were studied against tow species of freshwater snail ***Bulinus truncatus*** and ***Melanopsis nodosa*** by short term experiments. Calculated values of lethal concentrations (LC50 and LC100) were maid to two spices for different period of time 24hr, 48hr, 72hr and 96hr. The study had showed that the herbicide 2, 4-D was toxic against the tow species. The toxicity of the herbicide was low or unknown in low concentrations in the first period of exposure 24and 48hr to two spices but it increase gradually with increase period of exposure. The spice of *B.truncatus* was more tolerant than the *M.nodosa*. All the individual of ***M*** *nodosa* was death while in *B.truncatus* the complete death was not appear until finish the period of exposure 96hr.

Introduction

2, 4-D (Dichlorophenoxy acetic acid) is used in many commercial products. A few commercial names for products containing 2, 4-D includes Weed trine-II, Aqua-Kleen, Barrage, Plantgard, Lawn-Keep, Planotox and Malerbane (1).

2, 4-D, a chlorinated phenoxy compound, functions as a systemic herbicide and is used to control many types of broadleaf weeds. There are many forms or derivatives (esters, amines, salts) of 2; 4-D and these vary in solubility and volatility. Unless otherwise specified, this study will refer to the acid form of 2, 4-D. This compound is used in cultivated agriculture and in pasture and rangeland applications, forest management, home and garden situations and for the control of aquatic vegetation. 2, 4-D was a major component (about 50%) of the product Agent Orange used extensively throughout Vietnam. However most of the problems associated with the use of Agent Orange were associated with a contaminant (dioxin) in the 2, 4, 5-T component of the defoliant. The association of 2, 4-D with Agent Orange has prompted a vast amount of study on the herbicide (2).

The 2, 4-D acid forms, the oil-soluble amine salt and low-volatile ester do not dissolve well in water. Other amine salts dissolve very well in water. (3).

2, 4-D has only limited potential to contaminate ground-water. 2, 4-D ranges from being mobile to highly mobile in sand, silt, loam, clay loam, and sandy loam. However, it is unlikely to be a ground-water contaminant due to the rapid degradation of 2, 4-D in most soils and rapid uptake by plants. Most reported 2; 4-D ground-water contamination has been associated with spills or other large sources of 2, 4-D release (4).

Maximum concentrations of 2, 4-D applied to surface water are reached in one day. 2, 4-D residues dissipate rapidly, especially in moving water. 2, 4-D residues may be detected in still water after 6 months. Do not apply 2, 4-D directly to water or wet-lands such as swamps, bogs, marshes, and potholes except as specified for certain aquatic uses. Do not contaminate water when disposing of equipment wash waters (5).

The freshwater snail *Melanopsis nodosa* (Mollusca: Gastropoda), is widely

*Topical Diseases Unit/University of Baghdad

distributed in Iraq and the Northern part of India (6, 7, 8, 9).

The snails of *Bulinus truncatus* are known to act as intermediate host of human *Schistosomiasis* a dreadful disease caused by parasitic trematode worm in both humans as well as in animals is widespread in the world especially in developing countries (10, 11).

MATERIALS and METHODS

1. **Collection of snails**: The freshwater snails ***M.nodosa*** and ***B.truncatus*** were collected from Alyosifia River (25-km south Baghdad) a branch of Euphrates River.

The snails are collected with zooplankton net and put in a plastic container filled with river water. The snails were isolated and identities in class beakers .They were fed with *Alfa alfa* extract (3-6drop daily) and the water was changed twice in a week.

Snails were acclimated at room temperature for 7days to be ready to treatment and to make shore that the snails will not affected with any out effectives. After that we had chosen the adult stages to treatment.

2. **Toxicity studies**: The toxicity of the herbicide 2,4-D (2,4-Dichlorophenoxyacetic Acid) was screened as described by (12).Absence of movement of the snails and no response to kick by class rod was considered as an end point of experiment for calculating the per cent mortality. The toxicity of herbicide against adult snails was carried out with ten snails of each spice. The two spices of snails were exposed to serial concentrations (0.1-1.1 ml/l) of the herbicide for 96 h.

After exposure, they were transferred to tap water for further 24 h and later the percent mortality of snails was calculated. The dead snails were removed immediately from the exposure medium.

All the experiments were replicated three times. The mean duration required for the death of the snail was calculated and the data were statistically analyzed and subjected to regression curve using sigma plot.

The data obtained from the above studies were subjected to probit analysis (13) to calculate LC50 and LC100 values.

RESULTS and DISCUSSION

The probit values of 2, 4-D against ***M.nodosa*** snails are shown in Table 1 and mentioned in Figs 1. The probit values of 2, 4-D against ***B.truncatus*** snails are shown in Table 2 and mentioned in Figs 2. From the probit values found that the LC50 values against ***M.nodosa*** are calculated as 0.3 ml/l in 24hour ,0.2 ml/l in 48 hour ,0.1 in 72 hour ,and 0.1 in 96 hour respectively. The LC50 values against ***B.truncatus*** are calculated as 0.5 ml/l in 4 hour ,0.1 in 72 hour ,and 0.1 in 96 hour respectively (Table 3) . The calculated values of LC100 of 2, 4-D against the ***M.***nodosa are 1.1 ml/l in 24 and 48 hour, 0.9 ml/l in 72 hour and 0.8 ml/l in 96 hour. The values of LC100 of 2, 4-D against the ***B.truncatus*** are not appearing all the period of exposure (Table 3).

The results show the LC50 values for 2, 4-D against ***M.nodosa*** were less than the values against ***B.truncatus*** (Table 3).

Highest mortality of the ***M.nodosa*** snails in this study was observed after 72 h of exposure that due to the sensitivity of this snail (14).

The studies on the mortality pattern of ***M.nodosa*** snails show the complete mortality, but the ***B.truncatus*** needs for long time to show that, that mean the snail of ***M.nodosa*** is more sensitive than the snail of ***B.truncatus*** .The *B.truncatus* is tolerant to the different environmental stress as changes in pH, hardness of water, and different pollutants including pesticides and molluscicides (15, 16).

The rapid action of 2, 4-D in killing snails is due to its toxic effect on the respiratory

function of the snails by acting as uncoupler of oxidative phosphorylation at the mitochondrial level (17, 18). In the case of ***B.truncatus*** high mortality started after 48 h of exposure, the molluscicidal action of herbicide 2, 4-D may require its accumulation into the body of the snail (19).

Table 1: The probit value of *B.truncatus* snails exposed to different concentrations of 2, 4-D for 96 hour.

Con. ml/l	Probit24	Probit 48	Probit 72	Probit 96
Control	.00000	.00845	.20294	.36869
0.1	.00000	.12835	.48230	.74245
0.2	.00000	.18854	.54498	.80182
0.3	.00000	.26359	.60655	.85208
0.4	.00000	.35146	.66557	.89300
0.5	.00000	.44811	.72075	.92505
0.6	.00002	.54796	.77108	.94920
0.7	.00037	.64485	.81588	.96670
0.8	.00467	.73316	.85477	.97890
0.9	.03421	.80876	.88772	.98709
1	.14801	.86955	.91494	.99237
1.1	.39445	.91547	.93689	.99565

Table 2: The probit value of *M.nodosa* snails exposed to different concentrations of 2, 4-D for 96 hour.

Con. Ml/l	Probit 24	Probit 48	Probit 72	Probit 96
Control	.00000	.00000	.13889	.30519
0.1	.01040	.14139	.66007	.85394
0.2	.09415	.36817	.76185	.91405
0.3	.37460	.65567	.84420	.95339
0.4	.75055	.87246	.90515	.97678
0.5	.95275	.96964	.94642	.98939
0.6	.99619	.99551	.97198	.99556
0.7	.99941	.99660	.98646	.99830
0.8	.99981	.99698	.99396	1.00000
0.9	.99988	.99752	1.00000	1.00000
1	.99994	.99906	1.00000	1.00000
1.1	1.00000	1.00000	1.00000	1.00000

Table3:Lethal concentrations (LC50& LC100) of herbicide 2, 4-D to two species of freshwater snails.

Time	24h		48h		72h		96h	
Lethal con. ml/l	LC50	LC100	LC50	LC100	LC50	LC100	LC50	LC100
M.nodosa	0.3	1.1	0.2	1.1	0.1	0.9	0.1	0.8
B.truncatus	-	-	0.5	-	0.1	-	0.1	-

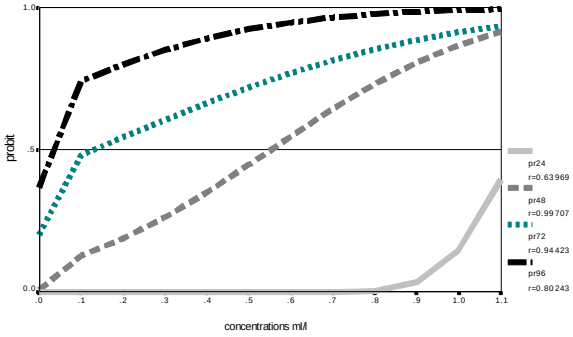

Figure (1): Toxicity of 2, 4-D pesticide to the snail of *B.truncatus* for 96 hour exposure

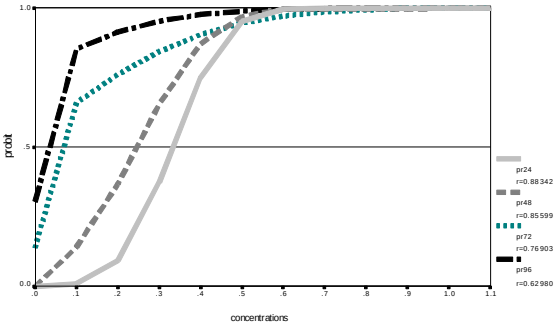

Figure (2): Toxicity of 2, 4-D pesticide to the snail of *M.nodosa* for 96 hour exposure

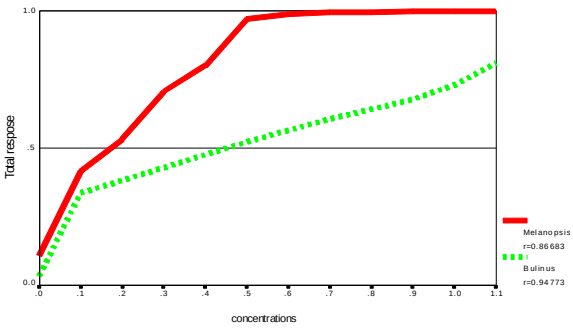

Figure (3): The total response of *B.truncatus and M.nodosa* exposure to 2, 4-D pesticide.

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مقارنة حساسية نوعان من قواقع المياه العذبة لمبيد ***Melanopsis nodosa* and *Bulinus truncatus to 2, 4-D***

محمد جابر العبيدي *

*وحدة بحوث امراض المناطق الحارة/جامعة بغداد.

الخلاصة:

تم دراسة حساسية نوعين من قواقع المياه العذبة هما ***Bulinus truncatus*** و ***Melanopsis nodosa*** لسمية مبيد الأعشاب2,4-D بطريقة الاختبارات قصيرة الامد . تم حساب التراكيز المميتة (LC50&LC100) للمبيد لكلا النوعين لمدد تعرض مختلفة 24 ساعة و 48ساعة و72ساعة و96ساعة . أوضحت الدراسة أن المبيد سام لكلا النوعين. سمية المبيد العشبي كانت قليلة او غير معروفة التأثير في التراكيز القليلة في فترات التعرض الاولى 24و48 ساعة لكلا النوعين ولكنها ارتفعت تدريجيا بزيادة مدة التعرض . وجد ان النوع ***B. truncatus*** اكثر مقاومة من النوع ***M. nodosa***. ان افراد النوع الثاني ماتت جميعا بينما في حالة النوع***B. truncatus*** فان الموت الكامل لافراد التجربة لم يظهر حتى بعد انتهاء مدة التجربة 96ساعة.