



Full Length Research Paper

Toxicity of seven pesticides belonging to different chemical groups against the glassy clover snail, *Moncha obstructa* by using three method of application under laboratory conditions

Ahmed A. Sallam¹, Abd El-Alem S.S. Desoky¹, Sherif Abouelkassem², Talat M.M. Abd El-Rahman²

¹Plant protection Department, Faculty of Agriculture, Sohag University, Egypt.

²Plant protection Department, Faculty of Agric., Al-Azhar University, Branch Assiut, Egypt.
Corresponding Author's E-mail: abdelalem2011@yahoo.com

Abstract

The toxicity of seven pesticides belonging to different chemical groups as metaldehyde, abamectin, methomyl, profenofos, copper hydroxyl, chlorfenapyr and imidacloprid by using three different methods as DLL (Dipping lettuce leaves), BBMB (Baits of bran with methylene blue) and BBM (Baits of bran with molasses) against land snails, *M. obstructa* under laboratory conditions. Results presented that metaldehyde was the most toxic compound where LC₅₀ values by using methods of DLL, BBMB and BBM were 151, 52 and 60 ppm, respectively, while imidacloprid was the least toxic compound where LC₅₀ values methods of DLL, BBMB and BBM were 36111, 33792 and 36789, respectively. These compounds could be arranged as following: metaldehyde > abamectin > methomyl > profenofos > copper hydroxyl > chlorfenapyr > imidacloprid. Moreover, the study presented that toxicity of any tested compound was varied according to the method of application and method of BBMB was the most effective following: DLL and BBM with all tested pesticides except copper hydroxyl was method of DLL was the most effective following: BBMB and BBM.

Key words: DLL, BBMB, BBM, land snails, *Moncha obstructa*.

INTRODUCTION

The terrestrial snails became an economic serious pest in Egypt. Land snails attack different kinds of plants i.e. cereal, vegetables, orchard trees and ornamental plants at the different growth stages and reducing their yield (El-Okda, 1980). It causes serious economic damage especially in horticulture and ornamental plants (Godan, 1983). In addition, the movement of snails causes an undesirable smell which prevents men and even animals

from feeding on these contaminated plants (El-Okda, 1984; Kassab and Daoud, 1964; Sallam *et al.*, 2009). The chemical control of snail populations through the application of molluscicides remained the most effective method, particularly over large areas (Miller *et al.*, 1988; Heiba *et al.*, 2002; Radwan *et al.*, 2008). Currently these snail species are controlled chemically by using certain pesticides with using many different methods and

this is similar to the main aim of the present study for controlling *M. obstracta* under laboratory conditions.

MATERIALS AND METHODS

Tested pesticides: seven pesticides belonging to different chemical groups as metaldehyde (Gastrotox® E 5 % G), abamectin (Cam-mek 1.8% EC), methomyl (Lannate® 90% SP), profenofos (Seliton 72% EC), copper hydroxyl (Zoom2007 25% WP), chlorfenapyr (Challenger® 36 % SC) and imidacloprid (Imidor 35% SC).

Tested land snails: Land snail of *M. obstracta* were collected from infested nurseries in experimental farm of the faculty of Agriculture Assuit university, field crops in Assuit Governorate next to El Azhar Carpark and field crops in El-Wasta in Assiut Governorate as described by Genena (2008). The obtained snails were transferred in plastic bags to the laboratory, then kept in plastic containers filled with moist sandy loamy soil 1:1 by volume and fed on fresh leaves of lettuce (*Lactucasativa L.*) for 15 days to be laboratory acclimatized. Dead snails were removed and only healthy snails were used in the following experiments.

Method of application

Dipping leaves method: These compounds were tested on land snail species *M. obstracta* using leaf dip method technique. Plastic cups (500 gm capacity) filled with moist sandy loamy soil as described above then covered with their plastic cover contained certain holes. Fresh lettuce leaves were washed carefully and dried placed on the plastic cups as a food for the tested land snails for several days before the experiment. For pesticides treatment, fresh lettuce leaves were dipped in different concentrations to each compound for 60 seconds then left for dryness.

Baits with methylene blue: Pesticide baits were prepared according to the method suggested by Hanafy *et al.* (1998). Accordingly, concentration of the tested pesticides was dissolved in 100 ml water, addition to the methylene blue 0.5% as attractant material. After that, each of the pesticide concentration was mixed with 100 gm wheat bran then they are mixed well. Control treatment was prepared by using wheat bran, methylene blue 0.5% and 100 ml water then they are mixed well without addition of pesticide concentration.

Baits with molasses (Honey sugar cane): Pesticide baits were prepared according to the method suggested by Ghamry *et al.* (1994). Accordingly, concentration of the tested pesticides was dissolved in 100 ml water, addition

to 5 ml molasses as attractant material. After that, each of the pesticide concentration was mixed with 95 gm wheat bran, then, they are mixed well. Control treatment was prepared by using wheat bran, molasses and 100 ml water then they are mixed well without addition of pesticide concentration.

In previous three methods, four replicates were prepared for each concentration and ten adult snails similar in shape and age were transferred to each plastic cups after adding the bait to it. The plastic cups were placed under the laboratory conditions at $20C \pm 2C$ and $60\% \pm 5\%$ RH. Tested snails were examined after 1, 2, 3 days, where the dead individuals were counted and removed. Mortality percentages in each population of the snail species were calculated and corrected according to the Abbott's formula (1925).

Data analysis

Probit analysis was done to estimate LC_{50} and LC_{90} values and confidence limits as well as slope value of LCP lines for the seven pesticides using SPSS V. 10 system software (SPSS Inc., 1999).

RESULTS AND DISCUSSION

Toxicity of the tested pesticides against the glassy clover snail, *Moncha obstracta* after 72 hour of treatment by using three method under laboratory conditions

Toxicity of seven pesticides belonged to different chemical groups against land snails, *M. obstracta* under laboratory conditions. These pesticides were include metaldehyde (Gastrotox® E 5 % G), abamectin (Cam-mek 1.8% EC), methomyl (Lannate® 90% SP), profenofos (Seliton72% EC), copper hydroxyl (Zoom2007 25% WP), chlorfenapyr (Challenger® 36 % SC) and imidacloprid (Imidor 35% SC), by using three different methods.

Results presented in table (1) indicated that metaldehyde was the most toxic compound compared with the rest of tested compounds which exhibited low toxicity levels by using method of dipping lettuce leaves against land snails, *M. obstracta*. LC_{50} values were 151, 260, 5743, 8906, 11414, 26968 and 36111 ppm and LC_{90} values were 384, 924, 18651, 25738, 38239, 120820 and 124534ppm for metaldehyde, abamectin, methomyl, profenofos, copper hydroxyl, chlorfenapyr and imidacloprid, respectively.

As shown in Table (2) similar results were obtained to

Table 1: Toxicity of the tested pesticides against the glassy clover snail, *Moncha obstructa* after 72 hour of treatment by using method of dipping lettuce leaves under laboratory conditions.

Pesticides	LC ₅₀ ± SE (ppm)	95% Fiducial limits (LCL-UCL)	LC ₉₀ ± SE (ppm)	95% Fiducial limits (LCL-UCL)	Slope ± SE
Metaldehyde 5%G	151±10	95-217	384±21	256-1133	3.17±0.11
Abamectin 1.8 EC	260±17	148-482	924±51	501-7090	2.34±0.09
Methomyl 90% SP	5743±410	3543-9545	18651±950	10720-35630	2.51±0.14
Profenofos 72% EC	8906±328	5357-13422	34647±725	16159-58028	0.79±0.01
Cooper hydroxide 25% WP	11414±688	7089-18664	38239±988	23300-905947	2.46±0.10
Chlorfenapyr 36% SC	26968±775	16443-77746	120820±6521	50459-269936	2.09±0.09
Imidacloprid 35% SC	36111±820	20908-54253	124534±6760	65621-289741	2.64±0.08

Notes:LC₅₀ lethal concentration that kills 50% of the exposed snails. LC₉₀lethalconcentration that kills 90% of the exposed snails.SE standard error (all values are mean of four replicates). LCL lower confidence limit.UCL upper confidence limit. Slope Regression Coeff

Table 2: Toxicity of the tested pesticides against the glassy clover snail, *Monchaobstructa* after 72 hour of treatment by using baits of bran with methylene blue 0.5% under laboratory conditions.

Pesticides	LC ₅₀ ± SE (ppm)	95% Fiducial limits (LCL-UCL)	LC ₉₀ ± SE (ppm)	95% Fiducial limits (LCL-UCL)	Slope ± SE
Metaldehyde 5%G	52±2	33-74	127±6	85-436	3.25±0.05
Abamectin 1.8 EC	170±7	112-281	491±23	293-1755	2.76±0.04
Methomyl 90% SP	3154±55	2121-4843	8342±345	5277-29099	0.81±0.02
Profenofos 72% EC	8897±328	5246-18131	25738 ± 792	17368-73657	2.16±0.04
Cooper hydroxide 25% WP	22450±735	12374-49640	70210±33 99	51416-150706	1.96±0.13
Chlorfenapyr 36% SC	24812±761	16143-39202	72377±11 31	49875-160112	2.41±0.08
Imidacloprid 35% SC	33792±837	23423-46529	76741±14 35	49719-168973	3.77±0.16

Notes:LC₅₀ lethal concentration that kills 50% of the exposed snails. LC₉₀lethalconcentration that kills 90% of the exposed snails.SE standard error (all values are mean of four replicates). LCL lower confidence limit.UCL upper confidence limit. Slope Regression Coeff.

tested pesticides by using baits of bran with methylene blue 0.5 against land snails, *M. obstructa*. LC₅₀ values

were 52, 170, 3154, 8897, 22450, 24812 and 33792 ppm and LC₉₀ values were 127, 491, 8342, 34647, 70210,

Table 3: Toxicity of the tested pesticides against the glassy clover snail, *Monchaobstructa* after 72 hour of treatment by using baits of bran with molasses under laboratory conditions.

Pesticides	LC ₅₀ ± SE (ppm)	95% Fiducial limits (LCL-UCL)	LC ₉₀ ± SE (ppm)	95% Fiducial limits (LCL-UCL)	Slope ± SE
Metaldehyde 5%G	60±2	37-97	182±6	108-367	2.67±0.04
Abamectin 1.8 EC	271±9	167-509	1193±62	600-2253	1.99±0.03
Methomyl 90% SP	14078±413	9304-23960	41836±1446	24410-108394	2.70±0.06
Profenofos 72% EC	15690±496	9883-32090	56116±2197	28875-114064	2.31±0.05
Cooper hydroxide 25% WP	23645±657	12823-40061	85375±3878	45425-182018	2.10±0.04
Chlorfenapyr 36% SC	27562±565	16794-81035	127864±3262	51371-300106	2.00±0.05
Imidacloprid 35% SC	36789±1195	17852±66313	151609±8179	78020-371984	2.08±0.05

Notes: LC₅₀ lethal concentration that kills 50% of the exposed snails. LC₉₀ lethal concentration that kills 90% of the exposed snails. SE standard error (all values are mean of four replicates). LCL lower confidence limit. UCL upper confidence limit. Slope Regression Coeff.

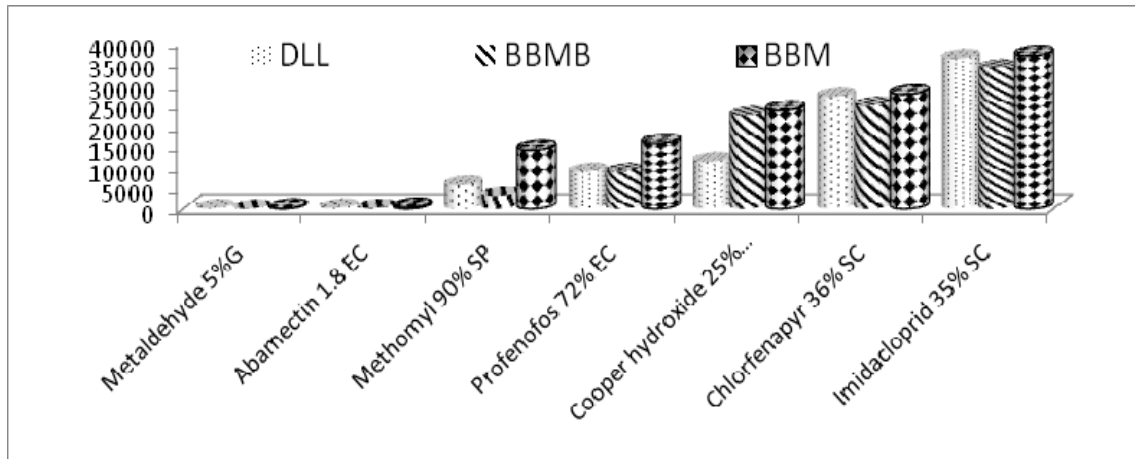
72377 and 76741 ppm for metaldehyde, abamectin, methomyl, profenofos, copper hydroxyl, chlorfenapyr and imidacloprid, respectively.

As shown in Table (3) similar results were obtained to tested pesticides by using baits of bran with molasses against land snails, *M. obstructa*. LC₅₀ values were 60, 271, 14078, 15690, 23645, 27562 and 36789 ppm and LC₉₀ values were 182, 1193, 41836, 56116, 85375, 127864 and 151609 ppm for metaldehyde, abamectin, methomyl, profenofos, copper hydroxyl, chlorfenapyr and imidacloprid, respectively.

When discussing the foregoing results, it is worthy to mention here that may be due to toxicity of metaldehyde increasing during dry climatic conditions is similar to climate of Assuit Governorate, these results are agreement with (Dax1, (1970; Moens, 1970) They are applied during dry climatic conditions are usually more successful than the degree of control achieved during damp, high humidity conditions, at which time snails are likely to be more active. (Henderson, 1970; Henderson and Triebkorn, 2002) The principal toxic effect of metaldehyde is through stimulation of the mucous gland which cause excessive sliming, leading to death by dehydration. Also, Abd El-Wakeil (2005) studied that the metaldehyde can affect mollusks either by contact, with absorption through the skin, or through the gut when eaten. The main effect is that of an irritant, causing the molluscs to produce masses of mucus, leading to dehydration and sometimes death. Loss of mucus also

means that the animals can no longer move around, so that death and dying animals are found close to the baiting site. Molluscs that have been poisoned by methiocarb can however, move around for a while, but then swell up with fluid and become immobile dying shortly afterwards. In dry conditions this swelling can be reduced, and some animals may recover, although generally recovery rates are lower than with metaldehyde. These results are agreement with Ghamry *et al.* (1993) found that metaldehyde, methiocarb, thiocarb, cyanophos and monocrotophos were tested by using baits against two landsnails, *M. cartusiana* and *E. vermiculata*. They found that mortality after 14 days were 93, 87, 70, 45 and 36% for *M. cartusiana* and 85, 82, 63, 39 and 28% for *E. vermiculata*, respectively. Also, Abd El-Aal and Hamed (2010) found that metaldehyde, profenofos were the most toxic to *E. vermiculata* and *M. cartusiana* with toxicity index of 88.6, 97.3 and 100.0, 100.0, respectively. Also, El Gohary and Genena (2011) studied the effect three molluscicide, Gastrotox, Mlotov, and Mesuroil in tissues of the two land snails, *Monachacantiana* and *Eobania vermiculata*. They found that the three molluscicides were affected in the activities of five vital enzymes, total lipid and total protein when applied against the tested land snails. Also, El Gohary and Genena (2011) studied the effect three molluscicide, Gastrotox, Mlotov, and Mesuroil in tissues of the two land snails, *Monachacantiana* and *Eobania vermiculata*. They found that the three molluscicides were affected in the

Figure. 1: Comparison of three methods treatment by using LC₅₀ to seven pesticides after 72 hour from treatment against the glassy clover snail, *Moncha obstructa* under laboratory conditions.



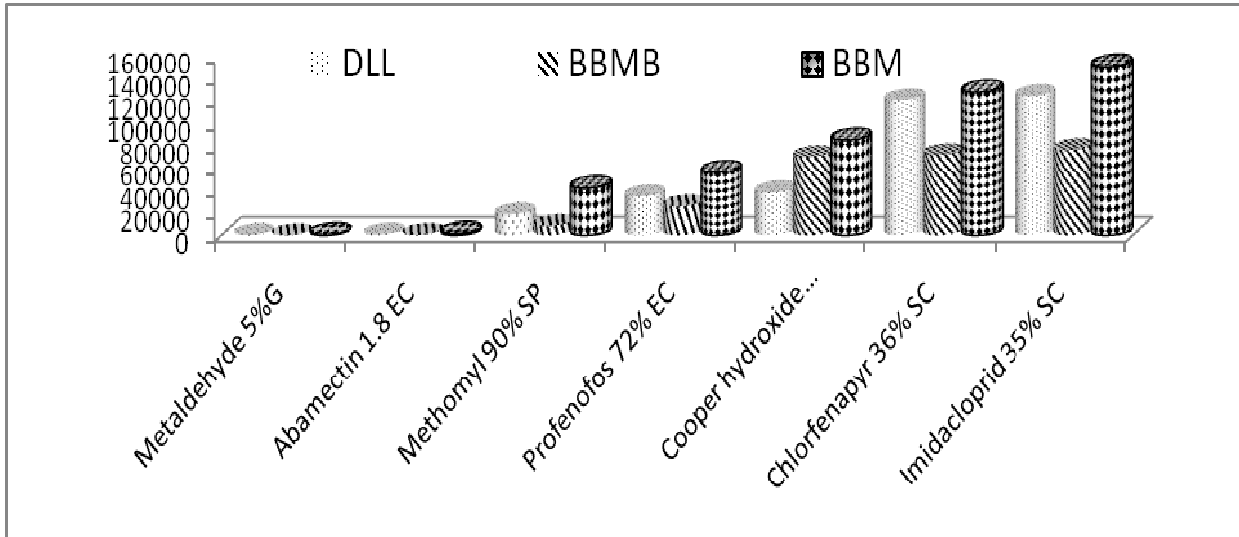
activities of five vital enzymes, total lipid and total protein when applied against the tested land snails. While, El-Okda *et al.* (1989) Study of toxicity methomyl, aldicarb, oxyamyl, methiocarb, du-pont-1642 and metaldehyde by using baits against *Helix sp.*, *E. vermiculata*, *T. pisana*, *Rumina sp.*, *Cochlicella sp.*, *Helicella sp.*, *Limax sp.* and *Oxychilus sp.*, they found that aldicarb, methomyl, oxamyl and du-pont-1642 showed the highest toxicity, on the other hand methiocarb and metaldehyde were less toxic. Ghamry *et al.* (1994) evaluated fourteen insecticides against two land snails; *M. contiana* and *E. vermiculata*. Results from bait tests revealed that, methomyl, dithiocarb, carbaryl, chlorpyrifos and dimethoate were effective for killing snails after 12 days under laboratory conditions. On the other hand, the same trend was observed with those insecticides under field conditions. El-Okda *et al.* (1989) evaluated the efficacy of the formulated local 0.5%, aldicarb, oxamyl, methiocarb, Lannat and metaldehyde in controlling the land molluscs; *H. aspersa*, *Eobania sp.*, *Theba sp.*, *Rumina sp.* and *oxychilus sp.* The results indicated that, aldicarb, oxamyl and Lannat gave the highest toxicity against the most snails and slugs species, while methiocarb and metaldehyde were less toxic.

Comparison of three methods treatment to seven pesticides after 72 hour from treatment against the glassy clover snail, *Moncha obstructa* under laboratory conditions

Three different methods as DLL (Dipping lettuce leaves),

BBMB (Baits of bran with methylene blue) and BBM (Baits of bran with molasses) were used to evaluate seven pesticides as metaldehyde, abamectin, methomyl, profenofos, copper hydroxyl, chlorfenapyr and imidacloprid, against land snails, *M. obstructa* under laboratory conditions. Results presented in figure 1 and 2 indicated that toxicity of any tested compound was varied according to the method of application. Notes that method of BBMB was the most effective with metaldehyde, following: BBM and DLL. LC₅₀ values were 52, 60 and 151 ppm and LC₉₀ values were 127, 182 and 384 ppm, respectively. Also, Notes that method of BBMB was the most effective with abamectin, following: DLL and BBM. LC₅₀ values were 170, 260 and 271 ppm and LC₉₀ values were 491, 924 and 1193 ppm, respectively. Also, Notes that method of BBMB was the most effective with methomyl following: DLL and BBM. LC₅₀ values were 3154, 5743 and 14078 ppm and LC₉₀ values were 8342, 18651, and 41836 ppm, respectively. Also, Notes that method of BBMB was the most effective with profenofos following: DLL and BBM. LC₅₀ values were 8897, 8906 and 15690 ppm and LC₉₀ values were 25738, 34647, and 56116 ppm, respectively. While, notes that method of DLL was the most effective with copper hydroxyl, following: BBMB and BBM. LC₅₀ values were 11414, 22450 and 23645 ppm and LC₉₀ values were 38239, 70210 and 85375 ppm, respectively. Also, method of BBMB was the most effective with chlorfenapyr following: DLL and BBM. LC₅₀ values were 24812, 26968 and 27562 ppm and LC₉₀ values were 72377, 120820, and 127864 ppm, respectively. Also, method of BBMB was the most effective with imidacloprid following: DLL and

Figure 2: Comparison of three methods treatment by using LC₉₀ to seven pesticides after 72 hour from treatment against the glassy clover snail, *Moncha obstructa* under laboratory conditions.



Notes: DLL dipping lettuce leaves. BBMB baits of bran with methylene blue. BBM baits of bran with molasses.

BBM. LC₅₀ values were 33792, 36111 and 36789 ppm and LC₉₀ values were 76741, 124534, and 151609 ppm, respectively.

When discussing the foregoing results, it is worthy to mention here that, method of BBMB was the most effective with metaldehyde, abamectin, methomyl, profenofos, chlorfenapyr and imidacloprid this may be due to blue color as attractive material for land snails. While, method of dipping lettuce leaves was the most effective with copper hydroxyl this may be due to that the color of baits converted to the green color because of the color of cooper hydroxide 25% WP pesticide, in this case this may be due to that unattractiveness the snails to baits so method of dipping lettuce leaves was more effective than the baits. These results agreed with Ismail (2009) studied effect of three colors i.e. blue, green and red on attractiveness of *Eobania vermiculata* snails were tested in citrus orchard. Results revealed that blue colour was the most preferable, while red color was the lowest one. The effect of three carrier materials (fine wheat bran, boiling rice and dry crushed bread) on the efficiency of methomyl were studied against *Monacha cartusiana* snail. Boiling rice proved to be the most effective while carried material dry crushed bread was the lowest one. Two types of attractive materials (sugar cane syrup and Birell syrup) were evaluated with the three previous carrier materials alone. Obtained results show that Birell syrup (Barley syrup) was more attractive than sugar cane

syrup. Finally he recommended that adding blue colour to the poisonous baits increase its attractiveness and Birell syrup increase the efficiency of methomyl when applied as poisonous baits against the two land snails, *Monacha cartusiana* and *Eobania vermiculata* under field conditions. Gabr *et al.* (2006) studied the effectiveness of certain pesticides namely, i.e. methomyl (Lannate); paraquate (Garamoxone); oxyfluorfen (Goal); Glyphosate (Lansar) and pendimethalin (Stomp) against adult stage of three species of land snails (*H. vestalis*, *M. contiana* and *E. vermiculata*) under laboratory conditions using three methods for testing, i.e. direct spray, dipping and poisonous bait technique. He found that toxicity of any tested compound was varied according to the method of application.

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