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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

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Abstract: *The toxicity of seven pesticides belonging to different chemical groups asmetaldehyde, abamectin, methomyl, profenofos,copper hydroxyl, chlorfenapyr and imidaclopridby using three different methodsas DLL (Dipping lettuce leaves), BBMB (Baits of bran with methylene blue) and BBM (Baits of bran with molasses) against land snails, M. obstracta under laboratory conditions. Results presented that metaldehyde was the most toxic compound where LC_{50} values by using methods of DLL, BBMB and BBM were 151, 52 and 60 ppm, respectively, while imidacloprid was the least toxic compound where LC_{50} 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 BBMwith all tested pesticides except copper hydroxyl was method of DLL was the most effective following: BBMB and BBM.*

Keywords: *DLL, BBMB, BBM, land snails, Moncha obstructa.*

1. INTRODUCTION

The terrestrial snails became an economic serious pest in Egypt. Land snails attackdifferent kinds of plants i.e cereal, vegetables, orchard trees and ornamental plants at thedifferent growth stages and reducing their yield **(El-Okda, 1980)**. It causes serious economicdamage 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 certainpesticides with using many different methods and this is similar to the main aim of the present study forcontrolling *M. obstracta* under laboratory conditions.

2. MATERIALS AND METHODS

2.1. Tested Pesticides

seven pesticides belonging to different chemical groups asmetaldehyde (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).

2.2. Tested Land Snails

Land snail of *M. obstracta* werecollected 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 tothe laboratory, then kept in plastic containers filled with moist sandyloamy soil 1:1 by volume and fed on fresh leaves of lettuce (*Lactucasativa L*.) for 15 days to be laboratory acclimatized. Dead snails wereremoved and only healthysnailswere used in the following experiments.

2.3. 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 methelyn 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 attracted 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 preparedfor 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 ± 2C and 60% ± 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 werecalculated and corrected according to **the Abbott's formula (1925).**

2.4. Data Analysis

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

3. RESULTS AND DISCUSSION

3.1. Toxicity of the tested pesticides against the glassy clover snail, *Moncha obstructa* 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.

Table1. *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: ***LC_{50}*** *lethal concentration that kills 50% of the exposed snails.* ***LC_{90}****lethalconcentration that kills 90% of the exposed snalis.****SE*** *standard error (all values are mean of four replicates).* ***LCL*** *lower confidence limit.****UCL*** *upper confidence limit.* ***Slope*** *Regression Coeff.*

As shown in Table (2) similar resultswere obtained to tested pesticides by using baits of bran with methylene blue 0.5 against land snails, *M. obstracta.* LC_{50} values were 52, 170, 3154, 8897, 22450, 24812 and 33792 ppm and LC_{90} values were 127, 491, 8342, 34647, 70210, 72377 and 76741 ppm for metaldehyde, abamectin, methomyl, profenofos,copper hydroxyl, chlorfenapyr and imidacloprid, respectively.

Table2. *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±3399	51416-150706	1.96±0.13
Chlorfenapyr 36% SC	24812±761	16143-39202	72377±1131	49875-160112	2.41±0.08
Imidacloprid 35% SC	33792±837	23423-46529	76741±1435	49719-168973	3.77±0.16

Notes: ***LC_{50}*** *lethal concentration that kills 50% of the exposed snails.* ***LC_{90}****lethalconcentration that kills 90% of the exposed snalis.****SE*** *standard error (all values are mean of four replicates).* ***LCL*** *lower confidence limit.****UCL*** *upper confidence limit.****Slope*** *RegressionCoeff.*

As shown in Table (3) similar resultswere obtained to tested pesticides by using baits of bran with molasses against land snails, *M. obstracta.* LC_{50} values were 60, 271, 14078, 15690, 23645, 27562 and 36789 ppm and LC_{90} values were 182, 1193, 41836, 56116, 85375, 127864 and 151609 ppm for metaldehyde, abamectin, methomyl, profenofos,copper hydroxyl, chlorfenapyr and imidacloprid, respectively.

Table3. *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: ***LC_{50}*** *lethal concentration that kills 50% of the exposed snails.* ***LC_{90}****lethalconcentration that kills 90% of the exposed snalis.****SE*** *standard error (all values are mean of four replicates).* ***LCL*** *lower confidence limit.****UCL*** *upper confidence limit.****Slope*** *RegressionCoeff.*

When discussing the foregoing results, it is worthy to mention here that may be due to toxicity of metaldehyde increasingduring 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 Triebskorn, 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 thatmortality 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 andHamed (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 Mesurol 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 Mesurol 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.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. *andOxychilus* sp.,they found that aldicarb, methomyl, oxamyl and du-pont-1642 showed the highest toxicity, on the other hand methiocarb and metaldehyde wereless toxicity. **Ghamry*et al.* (1994)** evaluated fourteen insecticides against tow land snails; *M. contiana* and*E. vermiculata*. Results from bait testes revealed that, methomyl, dithiocarb, carbaryl,chlorpyrifos and dimethoate were effective for killing snails after 12 days under laboratoryconditions. On the other hand, the same trend was observed with those insecticides underfield conditions. **El-Okda *et al.* (1989)** evaluated the efficacy of the formulated local 0.5 %, aldicarb, oxamyl ,methiocarb, Lannat and metaldhyde in controlling the land molluscs; *H. aspersa, Eobania* sp., *Theba* sp., *Rumina* sp. and *oxychilus* sp. The results indicated that, aldicarb, oxamyl andLannat gave the highest toxicity against the most snails and slugs species, while methiocarband metaldehyde were less toxic.

3.2. 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 evaluation seven pesticides as metaldehyde, abamectin, methomyl, profenofos, copper hydroxyl, chlorfenapyr and imidacloprid, against land snails, *M. obstracta*under laboratory conditions.Results presented in fig. 10&11 indicated that toxicity of any tested compound was varied according to the method of application.Notes that method of

BBMB was the mosteffective with metaldehyde, following: BBM and DLL. LC_{50} values were 52, 60 and 151 ppm and LC_{90} values were 127, 182 and 384 ppm, respectively. Also, Notes that method of BBMB was the mosteffective with abamectin, following: DLL and BBM. LC_{50} values were 170, 260 and 271 ppm and LC_{90} values were 491, 924 and 1193 ppm, respectively. Also, Notes thatmethod of BBMB was the mosteffective with methomyl following: DLL and BBM. LC_{50} values were 3154, 5743 and 14078 ppm and LC_{90} values were 8342, 18651, and 41836 ppm, respectively. Also, Notes thatmethod of BBMB was the mosteffective with profenofos following: DLL and BBM. LC_{50} values were 8897, 8906 and 15690 ppm and LC_{90} values were 25738, 34647, and 56116 ppm, respectively. While, notes that method of DLL was the mosteffective with copper hydroxyl, following: BBMB and BBM. LC_{50} values were 11414, 22450 and 23645 ppm and LC_{90} values were 38239, 70210 and 85375 ppm,respectively. Also,method of BBMB was the mosteffective with chlorfenapyr following: DLL and BBM. LC_{50} values were 24812, 26968 and 27562 ppm and LC_{90} values were 72377, 120820, and 127864 ppm, respectively. Also, method of BBMB was the mosteffective with imidacloprid following: DLL and BBM. LC_{50} values were 33792, 36111 and 36789 ppm and LC_{90} values were 76741, 124534, and 151609 ppm, respectively.

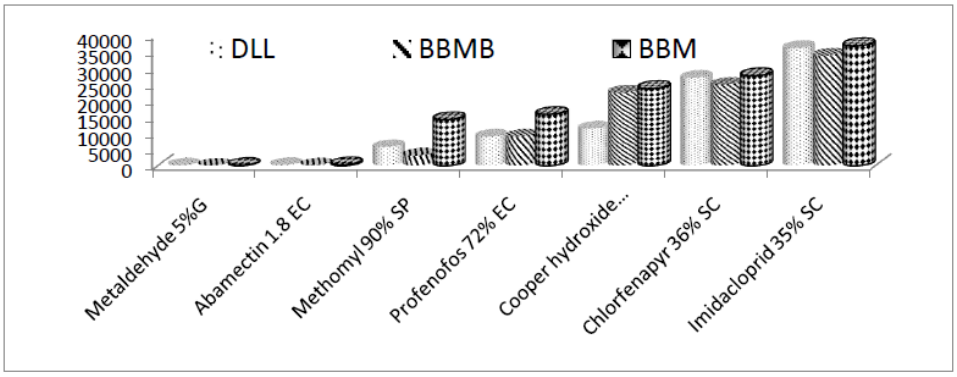

Fig1. *Comparison of three Methods Treatment by using LC_{50} to Seven Pesticides after 72 Hour from Treatment against the Glassy Clover Snail, Moncha Obstructa under Laboratory Conditions*

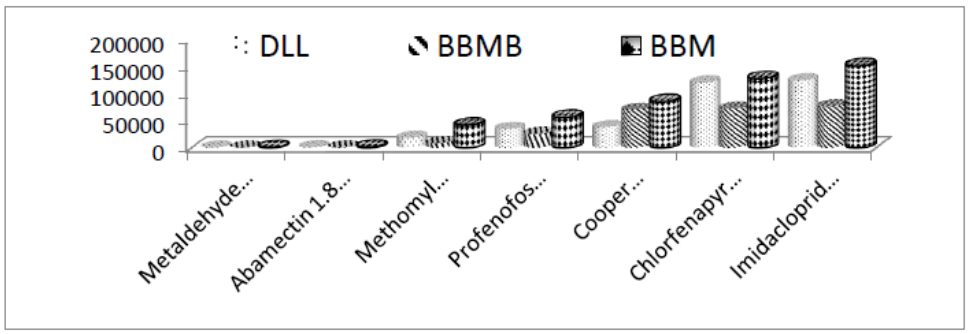

Fig2. *Comparison of three Methods Treatment by using LC_{90} to Seven Pesticides after 72 Hour from Treatment against the Glassy Clover Snail, Moncha Obstructa under Laboratoryconditions*

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

When discussing the foregoing results, it is worthy to mention here that,method of BBMB was the mosteffective 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 mosteffective with copper hydroxylthismay 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 can 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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