

Efficacy of methomyl and copper sulphate against *Eobania vermiculata* (Muller) and *Helicella vestalis* (Preiffer) snail under laboratory and field conditions

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Abstract

The effect of methomyl and copper sulphate on *Eobania vermiculata* and *Helicella vestalis* snails under laboratory and field conditions was evaluated at Sharkia Governorate. Results under laboratory conditions revealed that, mortality percentages increased with increasing the concentration values and the duration of exposure. All concentrations of methomyl, exhibiting the highest mortality percentages for *Eobania vermiculata* where recorded 85, 92.5, 100 and 100% with 1, 3, 5 and 7% concentrations after 7 days post-treatment, while the parallel values of copper sulphate were recorded 65, 70, 80 and 85%, respectively. It noticed that the concentrations of methomyl were more effective against *H. vestalis* snail were recorded 100-100% mortality comparing with the same concentrations of copper sulphate which recorded 47.6- 72.5% mortality 7 days post-treatment, respectively.

Regarding field experiment it noticed that the initial reduction percentages for two tested compounds were very low where gave 7.55 and 1.13 % for methomyl and copper sulphate against *E. vermiculata* snail, respectively. The residual effect of the tested compounds was 47.77 and 7.74 % for methomyl and copper sulphate, respectively.

Key words: Efficacy, Methomyl, Copper Sulphate, Snail, mortality

Introduction

The land snails, *Eobania vermiculata* and *Helicella vestalis* are considered economic land pests which attack the plants in gardens, crops, vegetables, fruits, seeds, seedlings, plant roots and orchard trees. These pests have chewing mouth parts so they cause very noticeable bores in the leaves of the plant on which they feed and in some cases they bore into other parts of the attached plant **Getzin (1965) and Crowell (1967)** mentioned that baits are a suitable method for the control of land mollusca.

The harmful land snail species as *Monacha cartusiana*, *Helicella vestalis* and *Eobania vermiculata* cause direct bad effect on the economy resulting from their feeding on various plants, daily activity (**Foad, 2005**). Many investigators have drawn the attention to control of the land snails using chemical compounds (**Kassab and Daoud, 1964; El-Okda, 1978, 1980, 1982b; Hegab, 1998; Hegab, 2003; Ebenso et al., 2005; Ismail and Hegab, 2006; Ismail, 2008 and Hilmy, A. and Hegab (2010)**). On the other hand, edible baits containing a toxicant are the principal means of delivery of molluscicides in terrestrial gastropod control programs (**Getzin (1965) and Crowell (1967)**). So, certain chemicals were investigated as poisonous baits against land molluscs where this technique was the preference chemical control methods in this respect. The present work was conducted to study the efficacy of methomyl and copper sulphate on *Eobania vermiculata* and *Helicella vestalis* under laboratory and field conditions at Sharkia Governorate.

Material and Methods

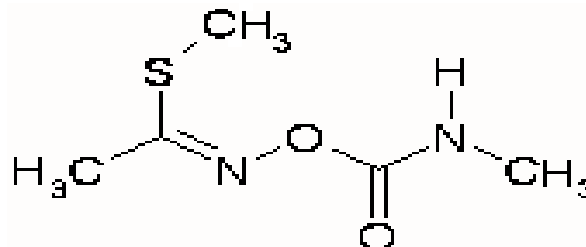
1- Tested compounds:

A- Carbamate compounds.

-Trade name: Lannate 90% W.P.

-Common name: methomyl

-Structure formula:



B- Copper sulphate.

$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

The pesticide used was supplied from the Central Laboratory for Pesticides, Agricultural Research Center, Giza, Egypt.

Copper sulphate was obtained from El-Gamhouria Company for Chemical, Zagazig branch, Egypt.

2- Tested snails:

Healthy adults of brown garden snails, *E. vermiculata* with shell breadth (26-28 mm) were collected from the ornamental plants in small garden at Zagazig city. The land snails *H. vestalis* healthy with shell breadth (14-18 mm) were collected from date palm farm at Belbies district, Sharkia Governorate. The snails were transported directly to laboratory in muslin cloth bags and put in glass container (50x30x30 cm).

Two containers with conditions similar the natural habitat and were fed on wheat bran for

acclimatization at least four weeks under laboratory conditions (El-Okda, 1981).

3- Laboratory experiments:

Tested compounds were used with four concentrations 1, 3, 5 and 7% (a.i) as poisonous baits for pesticide, while for inorganic salt they were applied at the concentration 1, 3, 5 and 7% (W/W). The baits were prepared by incorporating the appropriate amount of compound and added wheat bran to give 100 parts of poisonous baits. In all cases, about 10 grams of poisonous baits were spread into each plastic box (3/4 kg. capacity) and 10 snails were introduced. The boxes were closed with musline clothes and secured with rubber band to prevent snails from escaping (El-Okda, 1981). Each treatment was replicated 4 times. Control treatment was prepared using wheat bran baits without any compounds. Mortality percentages were recorded after 1, 3, 7 and 15 days for two compounds according to (El-Okda, 1981)

4- Field experiment:

Two compounds were tested under field conditions in ornamental small garden (15 years old) and infested with *E. vermiculata* snails at Zagazig city, Sharkia Governorate, during the growing season 2011/ 2012. An area about 700m² was selected for this study. Chemicals were used with one concentration as follow: methomyl (Lannate 90%) was used at the concentration of 1% while the Copper sulphate was used at the concentration of 7% as poisonous baits. Baits were prepared by incorporating the appropriate amount with wheat bran and added sugar cane syrup 5% as attractant substance to give 100 parts from poisonous baits. Baits were distributed on plastic pieces (100 g for each) and around tree trunk before the sundown. Control treatment was designed by the same manner without any chemicals. Each treatment was replicated 5 times. Alive snails were recorded in check and treatments areas before application and after 1, 3, 7 and 15 days post-treatment. Reduction percentages were calculated according to the formula giving by Henderson and Tilton (1955).

Results and Discussion

Data in Table (1) showed the mortality percentages using methomyl and copper sulphate as poison baits against *E. vermiculata* snails under laboratory conditions.

Mortality percentages increased gradually with increasing the concentration values and the duration of exposure. The highest mortality percentages of methomyl compound were 85, 92.5, 100 and 100% with 1, 3, 5 and 7% concentrations 7 days post-treatment, respectively while the parallel values of copper sulphate were 65,70, 80 and 85% with the same concentrations 7 days post-treatment,

respectively. The lowest mortality percentage were (35, 37.5, 45 and 72.5 %) and (10, 15, 20 and 32.5%) for methomyl and copper sulphate, respectively with all concentrations after 1 day of pos-treatment.

Finally, mortality percentages were ranged between 100 – 100 and 95 – 97.5 after 15 days for methomyl and copper sulphate with all concentrations, respectively. Regarding general mean, the highest concentration (7%) of methomyl and copper sulphate were gave 91.25 and 68.13% as general mortality against of *E. vermiculata*

Data in Table (2) illustrated the mortality percentages using methomyl and copper sulphate as poison baits against *H. vestalis* snail under laboratory conditions. Results revealed that In 3th day the concentrations of methomyl and copper sulphate exhibiting the mortality percentages were (95, 97.5, 97.5 and 97.5%) and (37.5, 40, 47.5 and 60%) against *H. vestalis* snail after post-treatment, respectively.

The highest mortality percentages of the concentration of methomyl compound was the most effective against *H. vestalis* snail comparing with *E. vermiculata* snail in the 7th day, it was (100, 100, 100 and 100%) , respectively, while copper sulphate was the lowest effect against *E. vermiculata* snail comparing with *H. vestalis* snail in 7th day, it was (65, 70, 80 and 85) and (47.5, 52.5, 65 and 72.5), respectively.

After 15 days, mortality percentages were 100 % for all concentrations of methomyl, while it reached 70, 60, 72.5 and 80% for copper sulphate with all concentrations. The highest concentration (7%) of methomyl and copper sulphate gave 96.67 and 59.38% as general mortality against *H. vestalis*.

In conclusion, higher sensitivity of *E. vermiculata* and *H. vestalis* observed to wards the carbamate compound methomyl while, inorganic salt (copper sulphate) appeared to be the least toxic one against two the tested land snails.

Data in Table (3) show the effect of methomyl and copper sulphate against *E. vermiculata* snails under field conditions. Results revealed that the initial reduction percentages for two tested compounds were very low where gave 1.13 and 7.55 % for copper sulphate and methomyl, respectively. By the time elapsed, reduction percentages increased obviously for methomyl and copper sulphate to reach 78.32 and 11.29 after 15 day, respectively.

Regarding the residual effect of the tested compounds it was 47.77 and 7.79% for methomyl and copper sulphate, respectively, Generally, it could be reported that methomyl have high molluscicidal activity against *E. vermiculata* comparing with inorganic salt (copper sulphate) which gave low effect under field conditions.

These results are in agreement with the findings of Ismail 1997, found that eight pesticides belonging to different groups; i.e. aldicarb, carbofuran, oxamoyl G., oxamoyl E.C., fenamiphos, fenthion,

ethoprop and bromoxynil were chosen to evaluate their molluscicidal effect against *Monacha cartusiana* under laboratory and field conditions. Regarding the laboratory trial, data revealed that oxamyl E.C. proved to be the highest toxic one followed by aldicarb, fenthion, ethoprop, oxamyl E.C., bromoxynil and carbofuran, while fenamiphos showed the lowest effective one. However, when these compounds were evaluated under field conditions the opposite was found where the organophosphorous compounds induced the highest effect in this respect. **Hegab, et al. (2006)** found that the highest concentration of metaldehyde gave 100% mortality after 7 days compared with the other pesticides which gave 75, 30 and 17.5% for methomyl, abamactin and alpha -cypermethrin, respectively under laboratory conditions. Metaldehyde and methomyl gave highly reduction percentages either during the initial or residual effect under field conditions. **Ismail and Hegab, 2006** studied the response of juveniles and adults of terrestrial snails *Eobania vermiculata* for certain chemicals under laboratory and field conditions. Results revealed that juveniles were more sensitive than adults to inorganic salts, where mortality percentages for copper sulfate were higher than the tested inorganic salts. Regarding the susceptibility to pesticides the

juveniles were more sensitive than adults for abamectin and methomyl. **Hilmy and Hegab, 2010** found that *M. cartusiana* were more sensitive towards the tested pesticides than *E. vermiculata* at laboratory 7 days /LC₅₀ values for *M. cartusiana* were 474, 6329, 13612 and 17028 ppm when treated with nemacur, lebaycid, sencor and antracol, respectively. The population reduction percentages after seven days post-treatment were 89.3, 73.8, 29.7 and 25.0 for *M. cartusiana* treated with lebaycid, nemacur, sencor and antracol, respectively. **Ismail et al. (2010)** reported that metaldehyde recorded highly efficacy than the other tested pesticides (copper hydroxide, methomyl and diazinon). However, high mortality percentage (100%) was obtained after 7 days at concentration 2% under the laboratory conditions, while under field conditions, methomyl induced a higher effect on the population reduction (73.19%) than metaldehyde. Copper hydroxide was found to be the lowest effective one against *M. cartusiana* snail under both laboratory and field conditions. Finally, **Shetaia et al. (2013)** reported that agrinate 24% S. L. (methomyl) gave the highest effect against *Monacha cartusiana* snail either under laboratory and field conditions where mortality percentage reached 86.33 and 77.17, respectively.

Table 1. Mortality percentages of *Eobania vermiculata* using methomyl and copper sulphate as poison baits under laboratory conditions.

Compounds	Conc. %	% Mortality after indicated days				General mean
		1 day	3 days	7 days	15 days	
methomyl	1	35	67.5	85	100	71.87
	3	37.5	75	92.5	100	76.25
	5	45	82.5	100	-	81.87
	7	72.5	92.5	100	-	91.25
Copper sulphate	1	10	45	65	95	53.75
	3	15	50	70	90	56.25
	5	20	52.5	80	95	61.88
	7	32.5	57.5	85	97.5	68.13

Table 2. Mortality percentages of *Helicella vestalis* using methomyl and copper sulphate as poison baits under laboratory conditions.

Compounds	Conc. %	% Mortality after indicated days				General mean
		1 day	3 days	7 days	15 days	
methomyl	1	60	95	100	100	88.75
	3	65	97.5	100	100	90.62
	5	70	97.5	100	100	91.87
	7	92.5	97.5	100	100	97.5
Copper sulphate	1	12.5	37.5	47.5	70	41.88
	3	15	40	52.5	60	41.88
	5	17.5	47.5	65	72.5	50.63
	7	25	60	72.5	80	59.38

Table 3. Efficacy of methomyl and copper sulphate against *E. vermiculata* snails under field conditions at Sharkia Governorate.

Compounds	% reduction after indicated days		Initial effect (during the first three days) %	% reduction after indicated days			Residual effect (during the rest period) %
	1	3		5	7	15	
	Methomyl	0.80	14.30	7.55	29.30	35.69	78.32
Copper sulphate	0.58	1.68	1.13	3.42	8.67	11.29	7.79

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كفاءة الميثوميل وكبريتات النحاس ضد قوقعى إيوبانيا فيرميكولاتا وهيليسللا فيستاليس تحت الظروف المعملية والحقلية

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Eobania هدف هذا البحث هو دراسة تأثير مركبي الميثومايل وكبريتات النحاس ضد قوقعى الحدائق البنى وقوع الرمال الصغير *vermiculata, Helicella vestalis* تحت الظروف المعملية والحقلية. ولقد أظهرت النتائج المعملية أن نسب الموت تزداد تدريجيا مع زيادة قيم التركيزات ومدة التعرض وقد وجد أن جميع تركيزات مركب الميثوميل كانت أكثر كفاءة حيث سجلت نسب موت كالتالي 85، 92.5، 100، 100% بعد سبعة أيام من المعاملة بينما وجد أن تركيزات كبريتات النحاس انحصرت تأثيرها من 65، 70، 80، 85% موت بعد نفس الفترة ضد قوقع *E. vermiculata* ومن ناحيه أخرى تركيزات مركب الميثومايل ضد قوقع *H. vestalis* سجلت 100% موت مقارنة بتركيزات كبريتات النحاس التى سجلت من 47.6-72.5% موت بعد متوسط الموت كان يزداد تدريجيا مع زيادة قيمة التركيزات ومدة التعرض ضد قوقعى *E. vermiculata, H. vestalis* لكل من مركب الميثومايل وكبريتات النحاس على التوالي بعد المعاملة معملياً. وبالنسبة للتجربة الحقلية فقد وجد أن نسبة الانخفاض الأوليه لهذين المركبين كانت ضعيفة جداً حيث كانت 1.13، 7.55% لكل من مركب كبريتات النحاس ومركب الميثومايل ضد قوقع *E. vermiculata* تحت الظروف الحقلية. بينما التأثير الباقي للمركبات المختبرة كانت 77، 47، 79، 7% لمركب الميثومايل وكبريتات النحاس على التوالي.