

Toxicity of certain pesticides on eggs and adult stage of land snail, *monacha cartusiana* muller.

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Abstract

The efficiency of five nematicides (Temik 14% G, Furdan 10% G, Vydate 10 % G, Vydate 24 % E.C and Nemacore 10 % G) and two herbicides (Brominal W 24% E.C and Topogard 50 % W.P) against the egg stage of *Monacha cartusiana* snail was evaluated as soil treatments under laboratory conditions. Data revealed that the two herbicides were the most effective, while the nematicide oxamyl 10% G. was the lowest one. In field trials as poisonous baits the obtained data showed that Gastrotax pesticide gave the highest reduction percentage, while Biogard was the lowest one. In addition to using spray technique against adult stage of *Monacha cartusiana* snail, the obtained results indicated that , Neomyl and Agrinate formulations were the superior and Biogard was the inferior one.

Keywords: pesticides, land snail, *monacha cartusiana* , Temik , Furdan

Introduction

Molluscs have been largely neglected in the pest control literature, yet gastropod molluscs species currently constitute some of the most significant and intractable threat to sustainable agriculture. An increase in the pest status has been associated with cultivation of new crops, intensification of agricultural production systems and the spreads through human trade and travel and species adapted to modified environment. Furthermore in some crops, the significance of gastropods is only now becoming apparent with the decline in the importance of other pest groups, such as insects, for which effective control strategies have been developed (Barker, 2002)

Most pesticides are applied in spray, dust or granular formulations but only occasionally as baits. In contrast, molluscicides directed against terrestrial gastropods are only occasionally delivered as spray or dusts but are more usually deployed in baits, for this reason, application technology is largely concerned with the composition of baits and how, where and when to apply them. (Barker *et al.*, 1991). In Britain, for example, bait products containing metaldehyde are used and 55% of the crop area treated with chemicals for gastropods control compared with 40% for methiocarb and 5% for thiodicarb containing baits (Garthwaite and Thomas. 1996). Recent studies indicated that the glassy clover snail *Monacha* spp was the most abundant snail in all localities at Sharkia Governorate (Ismail, 1997, Mahrous *et al.*, 2002). Abdel- Aal 2001, Lokma, 2013 and Rady *et al.*, 2014).

The chemical control through the application of molluscicides remained the most effective methods especially increased of the heavy infestations (Radwan *et al.*, 1992, Abdallah *et al.*, 1998, Hussein *et al.*, 1999, Ismail *et al.*, 2005,

Ismail *et al.*, 2014 and Ismail *et al.*, 2015). The present work aims to study the following points:

- 1- Effect of certain pesticides on eggs hatchability of *M. cartusiana*.
- 2- Toxic effect of some pesticides on the adult snails under field conditions using two different techniques.

Materials and Methods

1-Laboratory experiments

1-1 Egg tests: Eggs of *M. cartusiana* snails were obtained from adult snails collected from heavy infested field in the pre adult stages and fedding until reached maturity stage (Godan, 1983 and Ali, 1991). Eggs were daily collected from soil. Clutches were removed carefully, put in Petri dishes, washed with distilled water and then prepared for the Laboratory tests.

1-1-1- Soil treatment technique.

Clay soil was taken from the upper 25 cm surface layer of the field at Hehia district, Sharkia Governorate. Soil samples were air dried, cleaned from plant parts, thoroughly mixed, crushed, sieved through 2mm sieve and subjected to the pesticide treatments. Pesticides concentrations at recommended rates were mixed carefully with 0.5 kg of soil, put on plastic boxes (capacity 0.75kg) and irrigated to reach field capacity. Small holes were made by glassy needle and 25 eggs were put into it. Four replicates were used for each treatment and check control was prepared using soil free from any pesticides. Soil was remoisted as required. The boxes were tightly covered with cloth netting secured with a rubber band to prevent hatchlings from escaping. Boxes were examined daily and hatching percentages were recovered. Hatchlings produced were fed daily for three weeks post emergence. Pesticides used and

their rates of application (Kg/Fed) are given in Table (1).

2- Field tests.

2-1 pesticides used:

The formulations of Biogard (*Bacillus thurogensis*) 6.5% WP 500g/ 100L, Agrinate 24% SL (methomyl) 1L/F, Metarol 5% GR (metaldehyde) 2kg/F, Neomyl 20% SL (methomyl) 1L/F, Gastrotox 5% G (metaldehyde) 2kg/F and Mesarol 2 %RB (methiocarb) 4kg/F were supplied by Central Laboratory for Pesticides, Agricultural Research Center to study their effects against *M. cartusiana* under filed conditions at Hehia El Balad locality. Hehia district, Sharkia Governorates during 2014 season. The tested pesticides were applied with the recommended rates.

2-2- Adult snail experiment:

2-2-1 Poisonous baits technique:

The following pesticides Biogard, Agrinate, Gastrotox, Neomyl, Metarol and Mesarol were

examined as poisonous baits. Baits were prepared by incorporating the appropriate amount of each pesticide and added 5 parts of sugar can syrup then completed with wheat bran top give 100 parts from baits. Four replicates for every treatments were carried out and check control with out any pesticides were prepared. About 100gm poison baits were offered on plastic pieces

2-2-2- Spray Technique:

Three pesticides, (Biogard, Agrinate and Neomyl) were tested as spray technique against *M. cartusiana* under filed condtions at filed cultivated with cabbage and heavy infestation at Hehia El-Balid, Hehia country, Sharkia Governorate.

In all cases (poisonous baits and spray technique) the alive snails were recorded in check and treatments areas before application and after 1, 3, 5, 7, 14, 21 and 28 days. Reduction percentages were calculated according to the formula of **Henderson and Tilton (1955)**. Data were subjected to statistical analysis and treatment means were compares by LSD test using by **Duncan (1955)**.

Table 1. Pesticides used and rate of application in soil treatments.

Common name	Trade name	Rate of application
Aldicarb	Temik 15% G	17 kg/F
Carbofuran	Furidan 10% G	20 kg / F
Oxamyl	Vydet 10% G	20 kg/F
Oxamyl	Vydet 24% S.L.	3 L/ F
Fenamiphos	Nemacure 10%	20 kg/ F
Bromoxynil	Brominal w 24% S.L.	1L/ F
Terbuthylazine	Topogard 50%	1.5 kg/ F

Results and Discussion

1- Laboratory Experiments:

1-1- Effect on eggs:

Data presented in table (2) show the effect of soil treatments with certain pesticides (nematicides and herbicides) on the hatchability percentages of *M. cartusiana* snail eggs. Results revealed that hatching percentages differed from compound to another. Brominal w and Topogard proved to be the most effective on hatching inhibition indicating zero hatchability percentage when soil treated with them, whereas Vydate was the least effective (63% hatching), the tested compounds can be arranged descendingly according to its efficacy as follows: Brominal w, Topogard, Vydate 24% SL, Furidan 10% G, Nemacure 10% G, Temik 15%G and Vydate 10% G where gave hatching percentages (0.0, 7, 12, 17, 22 and 37%), respectively..

When newly hatched individuals remained until three weeks post emergence, it was noticed that survival individuals decreased by passing time. For instance, it decreased from 22 individuals to 14 in the third weeks for Temik 15%G, 17 to 9 for Nemacure

10% G, 12 to 7 for Furidan 10% G, 37 to 21 for Vydate 10% G and from 7 to 3 for Vydat24% S.L., respectively

It's necessary to mentioned that when nematicides or herbicides treated the crops infested with nematodes or weeds in the same times.

Zedan (1992) proved that the extract of *Ethulia conyzoides* (L) fam : Compositae inhibited egg hatching of *Biomphalaria alexandrinum* snails at 80 ppm. **El- Massry (1997)** found that all concentrations of the tested pesticides i. e (methamidophos. malathion and chloro pyrifos methyl) decreased significantly the percentages of eggs hatchability of *Helicella vestalis* snails. **Aioub et al., (2000)** found that carbofuran was the most effective while aldicarb was the least one.

On the other hand, they tested five pesitcides namely methomyl. oxamyl, malthion, briniphos methyl and tralkoxydim as dipping techniqne on the eggs of the same land snails previously mentioned, tralkoxydim was the most effective toxicant while oxamyl and malathion were the lowest effective to the eggs of two land snails.

Table 2. Effect of soil treatments with certain nemeatcides and herbicides on the hatchability of *M. cartusiana* snail eggs under laboratory conditions.

Treatments	1 week post emergence			2week post emergence		3 week post emergence	
	Total tested eggs	Emergence individual	% inhibition	Survival individual	Ihibition %	Survival individual	Ihibition %
Temik 15% G	100	22	78	19	81	14	86
Nemacure 10% G	100	17	83	15	85	9	91
Furdan 10% G	100	12	88	9	91	7	93
Vydate 10% G	100	37	63	28	72	21	79
Vydate 24% SL.	100	7	93	5	95	3	97
Brominal W 24% SL.	100	0	100	0	100	0	100
Topogarde 50% WP	100	0	100	-	-	-	-
Control	100	95	5	95	5	95	5

Finally, **Ismail et al., (2015)** found that Diesel oil gave completely inhibition of *M. cartusian* snail eggs at the three application rates 10, 20, 30 L/ F under laboratory conditions.

2-Field experiments

2-1 - As poison baits technique:

The efficacy of six tested compounds Agrinate, Metarol, Mezarol, Neomyl, Biogard and Gastrotox were determined under filed conditions as poisonous baits against *M. cartusiana* snail. Data in table (3) revealed that reduction percentages were increased by the time elapsed. Reduction percentages

after three days post treatment (initial effect) proved that Gastrotox have the highest effect while Biogard have the lowest effect where gave 55.99 and 3.91%, respectively.

The residual effect of the tested compounds revealed that Metarol gave the highest efficacy while Biogard gave the lowest efficacy where recorded 83.01 and 2.24% reduction, respectively. Regarding general mean, the tested compounds can be arranged descendingly according to their efficacy as follows: Gastrotox, Metrol, Neomyl, Mesarol, Agrinate and Biogard where gave 68.93, 66.28, 60.42, 53.11, 51.73 and 3.07% reduction, respectively.

Table 3. Efficacy of some pesticides as poison baits technique against land snails *Monacha cartusiana* under field conditions.

Pesticides	1	3	I.E	7	14	21	28	R.E	General mean
Agrinate	12.70	35.87	24.85d	64.45	71.76	83.99	94.30	78.62ab	51.73
Metarol	43.43	55.67	49.55ab	69.31	77.06	90.51	95.16	83.01a	66.28
Mesarol	19.13	44.96	32.04cd	58.52	65.15	82.02	91.08	74.19b	53.11
Neomyl	26.47	50.71	38.59bc	69.34	75.09	89.97	94.66	82.26ab	60.42
Biogard	3.32	4.50	3.91e	3.12	2.35	1.89	1.6	2.24c	3.07
Gastrotox	38.5	69.49	55.99a	71.4	80.71	86.75	88.67	81.88ab	68.93
LSD.			14.20					8.23	

I.E: Initial effect during three first days
R.E: Residual effect during the rest period
- Number followed by the same latter (S) was not significantly different ($P < 0.05$) according to Duncans multiple range test.

2.2. Spray technique:

The efficacy of three tested compounds Neomyl, Agrinate and Biogard were evaluated as spray technique under field conditions in cabbage filed which heavy infested with *M. cartusiana* snail.

Results in table (4) revealed that the initial effect of the three tested compounds was very low where gave 2.46, 9.33 and 14.5 0% reduction for Biogard, Agrinate and Neomyl, respectively. The

residual effects after four weeks were increased where reached to 0.82 60.01 and 55.55% reduction, respectively. General means of reduction percentages for the three tested compounds were 1.64, 34.67 and 35.03. Generally, its noticed that under filed conditions, poison baits technique gave high reduction percentages comparing with spray technique. The differences in toxicity of tested pesticides against snails could be explained on the basis of their chemical structure.

I.E: Initial effect during three first days
R.E: Residual effect during the rest period
- Number followed by the same latter (S) was not significantly different ($P < 0.05$) according to Duncans multiple range test.

Table 4. Efficacy of some pesticides as spray technique against land snails *Monacha cartusiana* under field conditions.

Pesticides	1	3	I.E	7	14	21	28	R.E	General mean
Biogard	3.13	1.80	2.46b	1	0.91	0.85	0.53	0.82b	1.64
Agrenate	2.58	16.09	9.33a	39.06	56.79	66.63	77.58	60.01a	34.07
Neomyl	14.55	14.50	14.52a	32.21	50.94	63.22	75.86	55.55a	35.03
LSD.			5.27					10.74	

The relationship between the chemical structure and the toxicity showed that among carbamate insecticides, thiocarb which is dimmer of the well know insecticide, methomyl containing N methyl group with the additional carbamoyl moiety had the highest molluscicidal activity (**Radwan and EL-Wakil 1991**) tested methomyl and oxamyl against *Monacha cartusiana* (Muller) and *Eobania vermiculata* (Muller) snails under field conditions, results revealed that methomyl was higher effect on the population reduction than oxamyl. **Ismail et al., (2010)** reported that methomyl gave high reduction percentages than metaldehyde against *Monacha cartusiana* snail under field conditions. **Shetaia et al., (2013)** assured that Agrinate more effective than any insecticides or biocides which tested against *Monacha cartusiana* snail under field conditions. Finally **Ismail et al., (2015)** reported that poisonous baits technique was more effective than spray technique in controlling *Monacha cartusiana* snail under field conditions.

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الملخص العربي

سمية بعض المبيدات علي طوري البيض و الأفراد البالغة للقوقع الارضي موناكا كارتوسيانا (مولر)

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تم دراسة تأثير خمسة مركبات نيماتودية هي التيمك المحبب 15%، الفيوريدان محبب 10%، الفايديت المحبب 10%، الفايديت السائل 24% بالإضافة الي النيماتور المحبب 10% وكذلك مركبان من مبيدات الحشائش هما برومينال دبليو والتوبوجارد وذلك بطريقة معاملة التربة علي معدل قفس البيض لأحد أنواع القواقع الأرضية وهو النوع موناكا كارتوسيانا. معمليا أوضحت النتائج المتحصل عليها أن كلا من مبيدي الحشائش هما الأكثر تأثيرا في حين كان مركب الفايديت المحبب 10% هو اقلهم تأثيرا.

وبالحقل تم دراسة تأثير ستة مركبات أخرى هي (أجرينيت، ميتارول، ميزارول، ميثوميل، بايوجارد والجاستروتوكس) بطريقة الطعوم السامة علي الأفراد البالغة لنفس القوقع كان مركب الجاستروتوكس هو الأكثر فاعلية بينما كان البيوجارد هو اقلهم فاعلية، وفي حالة استخدام ثلاث مركبات أخرى بطريقة الرش وهي (بايوجارد، اجرينيت و ميثوميل) وجد أن مركب الميثوميل و الأجرينيت هما الأكثر فاعلية بينما كان البيوجارد هو الأقل فاعلية.