

EVALUATION OF CERTAIN CHEMICALS AND INSECTICIDES AGAINST *Monacha cartusiana* SNAILS INFESTING SOME VEGETABLE CROPS AT SHARKIA, GOVERNORATE.

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ABSTRACT

The effect of seven chemicals namely, diafenthiuron, carbosulfan, spinosad, pirimicarb, chlorpyrifos, lufenuron and cyanophos were tested as poisonous baits against *M. cartusiana* snails under laboratory conditions. Results revealed that carbosulfan exhibited the highest efficacy, while chlorpyrifos was the lowest one. On the other hand, six chemicals namely, methomyl, chlorpyrifos, lufenuron, spinosad, copper sulfate and ferrous sulfate were evaluated against *M. cartusiana* snails under field conditions in two fields cultivated with onion and broad bean at Abo-Hakim village, Zagazig county. Results revealed that methomyl showed the highest effect while spinosad was the lowest one. On the other side, five chemicals namely, pirimicarb, carbosulfan, cyanophos, diafenthiuron and metaldehyde were evaluated in three fields at Hehia county cultivated with lettuce intercropping on pepper, eggplant and okra. Results revealed that metaldehyde was the highest toxic action while cyanophos was the lowest toxic one against *M. cartusiana* snails in the two fields, lettuce intercropping on pepper and lettuce intercropping on eggplant whereas the third trial; it noticed that metaldehyde gave the highest order of toxicity while pirimicarb exhibited the lowest one.

INTRODUCTION

Land snails have been increased rapidly in the last few years in most Governorates of Egypt especially Sharkia Governorate Ghamry *et al.* 1993; Arafa 1997, Ismail 1997; El-Massry 1997; Hegab *et al.* 1999; Abdel All 2001, Mahrous *et al.* 2002 and Ismail 2004. There are many laboratory and field experiments have been carried out to evaluate certain chemicals against *Monacha cartusiana* snails. Most pesticides were applied as a spray, dust or granular formulation but only occasionally as baits. In contrast, molluscicides directed against terrestrial gastropods are only occasionally delivered as sprays or dusts but are more usually deployed in baits (Barker, 2002). For this reason, application technology is largely concerned with the composition of baits and how, where and when to apply them. The present study aim to evaluate the activity of various chemicals against *M. cartusiana* snails infesting severally vegetables crops .

MATERIALS AND METHODS

1-Tested animals:

Adults glassy clover snails *M. cartusiana* were collected from heavy infested field cultivated with Egyptian clover at Hehia county, Sharkia Governorate. Collected snails were transferred in plastic bag to the laboratory and fed on wheat bran to acclimatization (El-Okda, 1981).

2-Chemicals used:

Carbosulfan (Marshal), methomyl (Neameal), chlorpyrifos (Dursban), cyanophos (Cyanox), spinosad (Tracer), lufenuron (Match), diafenthiuron (Polo), metaldehyde (Gastrotox 5), pirimicarb (Aphox), copper sulfate and ferrous sulfate were obtained from Central Laboratory for Pesticides, Agricultural Research Center and El-Gomhouria Company for Chemicals.

3-Laboratory tests:

Tested chemicals were used with three concentrations, 1.250, 2.500 and 5 % as poisonous baits. Five grams of poisonous baits were spread into each plastic jar (3/4 Kg capacity) and then 10 adults snails were introduced. Boxes were closed with musline cloth and secured with rubber band to prevent snails from escaping (El-Okda, 1981). Each concentration was replicated four times. Control treatment was prepared using bran bait only without any chemicals. Mortality percentages were recorded 1, 3, 7, 14 and 21 days post-treatment. Observation of mortality entailed using stainless steel needle according to El-Okda (1981). Dead snails were removed after testing and mortality percentages were calculated until the end of experiments.

4-Field tests:

The field trails were conducted at Abo-Hakim villige, Zagazig and Hehia counties. At Zagazig county, two fields were chosen heavy infested with *M. cartusiana* cultivated with broad bean and the other one cultivated with onion. The second trail carried out at Hehia county, where three fields heavy infested with *M. cartusiana* cultivated with lettuce intercropping on pepper, lettuce intercropping on eggplant and lettuce intercropping on okra. Six chemicals i.e. methomyl, spinosad, chlorpyrifos, lufenuron, copper sulfate and ferrous sulfate were applied at Abo-Hakim villige, Zagazig county, while in the second trail, five chemicals were evaluated i.e. pirimicarb, carbosulfan, cyanophos, diafenthiuron and metaldehyde. All chemicals were used with one concentration (5%) as poisonous baits. Baits were prepared by incorporating the tested chemicals with wheat bran and 5 % black sugar cane syrup was added (5 % as attractant substance). About 100 gm of the baits were offered on plastic pieces. Control treatment was designed by the same manner without any chemicals. Each treatment was replicated 4 times. Alive snails were recorded in check and treatment before and after 1, 3, 7, 14 and 21 days post-treatments. Reduction percentages were calculated according to Henderson and Tilton equation (1955). Data were subjected to statistical analysis and treatment means were compared by L.S.D. test according to Little and Hills (1978).

RESULTS AND DISCUSSION

1-Laboratory experiments:

Data in Table (1) demonstrated the effect of certain chemicals i.e. diafenthuron, carbosulfan, spinosad, pirimicarb, chlorpyrifos, lufenuron and cyanophos against *M. cartusiana* snails with three concentrations under laboratory conditions. Results revealed that all chemicals failed to exhibited molluscicidal activity during the first three days exception carbosulfan which gave 2.5, 5 and 7.5 mortality percentages for the three concentrations, respectively. On the other hand diafenthuron did not exhibit any molluscicidal activity against *M. cartusiana* during the experimental period. As for the other chemicals, mortality percentages after 21 days reached 52.5, 17.5, 10, 5, 10, 15 for carbosulfan, spinosad, pirimicarb, chlorpyrifos, lufenuron and cyanophos at the highest concentration (5%), respectively. It is obvious of that carbosulfan (carbamate compound) gave the highest mortality percentages while chlorpyrifos (organophosphorus compound) gave the lowest one after 21 days post-treatment. Generally, the carbamate compounds were most active against *M. cartusiana* under laboratory conditions.

Table (1): Efficacy of some compounds against *Monacha cartusiana* snails under laboratory conditions

Chemicals	Conc.	Mortality percentages after indicated days					
		1 day	3 day	5 days	7day	14 day	21 day
Diafenthuron	1.25	0 b	0 d	0 d	0 e	0 f	0 g
	2.50	0 b	0 d	0 d	0 e	0 f	0 g
	5	0 b	0 d	0 d	0 e	0 f	0 g
Carbosulfan	1.25	0 b	2.5 c	7.5 b	7.5 d	7.5 d	15 c
	2.50	0 b	5.0 b	7.5 b	10 c	12.5 c	20 b
	5	2.5 a	7.5 a	40 a	42.5 a	42.5 a	52.5 a
Spinosal	1.25	0 b	0 d	0 d	0 e	2.5 e	5 ef
	2.50	0 b	0 d	0 d	0 e	2.5 e	7.5 de
	5	0 b	0 d	5.0 c	12.5 b	17.5 b	17.5 bc
Pirimicarb	1.25	0 b	0 d	0 d	0 e	2.5 e	5 ef
	2.50	0 b	0 d	0 d	0 e	2.5 e	7.5 de
	5	0 b	0 d	0 d	0 e	2.5 e	10 d
chlorpyrifos	1.25	0 b	0 d	0 d	0 e	0 f	0 g
	2.50	0 b	0 d	0 d	0 e	2.5 e	2.5 fg
	5	0 b	0 d	0 d	0 e	2.5 e	5 ef
Lufenuron	1.25	0 b	0 d	0 d	0 e	0 f	2.5 fg
	2.50	0 b	0 d	0 d	0 e	0 f	5 e
	5	0 b	0 d	0 d	0 e	0 f	10 d
Cyanophos	1.25	0 b	0 d	0 d	0 e	0 f	0 g
	2.50	0 b	0 d	0 d	0 e	2.5	5 ef
	5	0 b	0 d	0 d	0 e	7.5	15 c
L.S.D _{0.05%}		0.36	0.623	2.002	1.137	1.588	3.911

2-Field experiments:

Two field trails were conducted to evaluate the activity of certain chemicals against *M. cartusiana* snails, the predominant land snails at Sharkia Governorate as follows:

2-1: At Abo-Hakim villige, Zagazig county:

Six compounds i.e. methomyl, chlorpyrifos, lufenuron, spinosad, copper sulfate, ferrous sulfate were evaluated under field conditions in two fields: the first one cultivated with onion while the other field cultivated with broad bean. Data illustrated in Table (2) showed the effect of these compounds against *M. cartusiana* infesting onion. Results revealed that the reduction percentages increased by passing the time. It noticed that methomyl exhibited the highest initial kill where gave 13.21 mortality percentage while ferrous sulfate was the lowest one where gave 1.49 mortality percentage. Regarding the residual effect of the previous mentioned compounds, showed that methomyl exhibited the highest reduction percentages (68.09) followed by with copper sulfate (44.21) while spinosad showed the lowest reduction percentage (11.65). Generally, the tested compounds can be arranged in descendingly order according to the general average of reductions as follow : 46.14, 31.82, 18.92, 14.41, 7.23 and 5.76, for methomyl, chlorpyrifos, lufenuron, spinosad, copper sulfate and ferrous sulfate respectively.

Table (2): Efficacy of some compounds against *Monacha cartusiana* snails infesting onion at Abo-Hakim villige, Zagazig county, Sharkia Governorate under field conditions

Compounds	Reduction percentages after indicated days							
	1 day	3 day	Initial effect	7day	14 day	21 day	Residual effect	General average
Methomyl	7.29	19.13	13.21a	48.31	70.97	85.00	68.09 a	46.14 a
Chlorpyrifos	4.58	11.20	7.86 b	16.69	18.80	20.76	18.75 d	14.41 d
Lufenuron	1.55	11.96	6.75 b	19.96	26.19	34.95	27.03 c	18.92 c
Spinosad	0.27	0.95	0.61 c	8.83	10.04	16.08	11.65 e	7.23 e
Copper sulfate	7.34	16.42	11.88 a	38.93	41.85	51.87	44.21 b	31.82 b
Ferrous sulfate	0.84	2.15	1.49 c	3.95	5.60	16.26	8.60 e	5.76 e
L.S.D _{0.05 %}			3.169				5.168	4.297

Data in Table (3) showed the efficacy of the same previous compounds on *M. carusiana* snails infesting broad bean at Zagazig County. Results revealed that the initial kill during the first three days were: 18.25, 9.09, 9.02, 3.06, 5.97 and 5.34 for methonmyl, chlorpyrifos, lufenuron, spinosad, copper sulfate and ferrous sulfate, respectively.

Table (3): Efficacy of some compounds against *Monacha cartusiana* snails infesting broad bean at Abo-Hakim villige, Zagazig County, Sharkia Governorate under field conditions

Compounds	Reduction percentages after indicated days							
	1 day	3 day	Initial effect	7day	14 day	21 day	Residual effect	General average
Methomyl	15.15	20.85	18.25 a	52.84	66.96	88.82	69.59 a	48.91 a
Chlorpyrifos	7.90	10.28	9.09 b	15.84	16.23	28.58	20.21 d	15.76 d
Lufenuron	0.41	17.63	9.02 b	23.78	26.94	39.68	30.13 c	21.69 c
Spinosad	1.91	4.22	3.06 d	7.16	12.23	19.45	12.94 e	8.99 e
Copper sulfate	6.71	5.23	5.97 c	34.21	36.97	50.88	40.68 b	26.80 b
Ferrous sulfate	2.78	7.90	5.34 c	13.30	17.07	24.66	18.34 d	13.14 d
L.S.D _{0.05 %}			2.179				4.926	4.044

On the other hand, the residual effects of the previous mentioned compounds were 69.59, 20.21, 30.13, 12.94, 40.68 and 18.34, respectively. The average reduction percentages of these compounds were, 48.91, 15.76, 21.69, 8.99, 26.80 and 13.14, respectively. Generally, it could be reported that methomyl (48.91%) was the most effective while spinosad (8.99%) was the lowest one.

2-2: At Hehia county:

Five chemicals i.e. pirimicarb, carbosulfan, cyanophos, diafenthiuron and metaldehyde were tested against *M. cartusiana* infested different vegetable crops. Data in Table (4) illustrated the efficacy of different chemicals against *M. cartusiana* infesting lettuce intercropping on pepper. Results revealed that mortality percentages were increased by increasing the time post-treatment. It noticed that metaldehyde exhibited the highest initial and residual effect with mortality percentages of 29.49 and 76.59 %, respectively. Regarding the general average, the tested compounds could be arranged descendingly as follow: metaldehyde, carbosulfan, diafenthiuron, pirimicarb and cyanophos. The reduction percentages were : 53.97, 38.42, 18.31, 14.58 and 7.91, respectively.

Table (4): Efficacy of some compounds against *Monacha cartusiana* snails infesting lettuce intercropping on pepper at Hehia county, Sharkia Governorate under field conditions

Compounds	Reduction percentages after indicated days							
	1 day	3 day	Initial effect	7day	14 day	21 day	Residual effect	General average
Pirimicarb	0	7.40	3.7 d	17.28	22.97	25.26	21.83 c	14.58 c
Carbosulfan	0	24.11	12.05 b	36.76	61.87	69.37	56.00 b	38.42 b
Cyanophos	0	2.7	1.35 d	7.09	9.38	20.40	12.29 d	7.91 d
Diafenthiuron	4.89	9.57	7.23 c	16.37	24.43	36.38	25.72 c	18.32 c
Metaldehyde	23.80	35.18	29.49 a	62.69	74.27	92.82	76.59 a	53.97 a
L.S.D _{0.05} %			2.711				4.228	4.456

Data tabulated in Table (5) revealed the efficacy of some chemicals against *M. cartusiana* snails infesting lettuce intercropping on eggplant. Results revealed that the reduction percentages increased with increasing the time. The initial effect of the tested compounds appeared to demonstrated that metaldehyde was the most effective compound, while pirimicarb was the lowest one where reduction percentages were : 27.09 and 1.13, respectively.

Regarding residual effect, metaldehyde proved to be the most effective compound while cyanophos appeared to be the lowest effectiveness which gave reduction percentages of : 82.31 and 15.47, respectively. Regarding general average reduction, the same trend was noticed, where reduction percentages were: 60.22 and 10.59, respectively. The tested compounds can be arranged descendingly according to general average reduction as follows: metaldehyde, carbosulfan, diafenthiuron, pirimicarb and cyanophos where reduction percentages: 60.22, 28.45, 19.38, 14.76 and 10.59, respectively.

Table (5): Efficacy of some compounds against *Monacha cartusiana* snails infesting lettuce intercropping on eggplant at Hehia County, Sharkia Governorate under field conditions

Compounds	Reduction percentages after indicated day							
	1 day	3 day	Initial effect	7day	14 day	21 day	Residual effect	General average
Pirimicarb	0	2.27	1.13 b	16.66	18.03	36.84	23.84 d	14.76 d
Carbosulfan	0	7.53	3.76 b	17.00	51.49	66.25	44.91 b	28.45 b
Cyanophos	0	6.53	3.26 b	10.41	14.95	21.05	15.47 e	10.59 e
Diafenthiuron	3.94	5.80	4.84 b	13.15	31.40	42.65	29.06 c	19.38 c
Metaldehyde	22.38	31.81	27.09 a	71.67	81.13	94.13	82.31 a	60.22 a
L.S.D _{0.05 %}			3.986				4.744	4.149

Data in Table (6) demonstrated the efficacy of certain compounds against *M. cartusiana* snails infesting lettuce intercropping on okra. Data revealed that all tested chemicals failed to exhibited molluscicidal activity against *M. cartusiana* snails after one day post-treatment except, metaldehyde which gave reduction percentage 16.66. The initial effect of the tested compounds revealed 16.66 that metaldehyde was the most effective compound while pirimicarb was the lowest one reduction percentages were: 24.83 and 1.96, respectively. Concerning the residual effect of the tested compounds, the same trend was observed where reduction percentages were 80.59 and 22.42, respectively. Regarding general average reduction the tested compounds can be arranged descendingly follows: metaldehyde, carbosulfan, cyanophos, diafenthiuron and pirimicarb values of reduction percentages were: 58.29, 25.91, 17.77, 16.39 and 14.24, respectively.

Generally, from the foregoing results, it can be concluded that metaldehyde and carbosulfan compounds were highly efficacy against *M. cartusiana* under field conditions while the organophosphorus compounds cyanophos appeared to be the least effect in this respect.

Table (6): Efficacy of some compounds against *Monacha cartusiana* snails infesting lettuce intercropping on okra at Hehia, Zagazig County, Sharkia Governorate under field conditions

Compounds	Reduction percentages after indicated day							
	1 day	3 day	Initial effect	7day	14 day	21 day	Residual effect	General average
Pirimicarb	0	3.92	1.96 b	17.64	20.23	29.41	22.42 c	14.24 c
Carbosulfan	0	7.51	3.75 b	26.00	46.01	50.05	40.68 b	25.91 b
Cyanophos	0	8.49	4.24 b	13.39	27.74	32.35	24.49 c	16.39 c
Diafenthiuron	0	6.44	3.22 b	7.56	26.68	33.19	22.47 c	14.77 c
Metaldehyde	16.66	33.00	24.83 a	64.05	82.65	95.09	80.59 a	58.29 a
L.S.D _{0.05 %}			2.301				5.397	4.095

Discussing the foregoing results, it is clear that our results are in harmony those obtained by many authors, Radwan and El-Wakil (1991) reported that thiodicarb, methomyl and cypermethrin were the most potent candidates whereas deltamethrin and cypermethrin were the least effective compounds against *Eobania vermiculata* snails when compared with other tested compounds.

Ghamry *et al.* (1993) revealed that metaldehyde compound was the most effective one against *M. cartusiana* and *E. vermiculata* followed by methiocarb, thiocarb, cyanophos and monocrotophos. Nakhla and El-Sisi (1995) assured that copper sulfate gave high mortality against the white garden snails, *Theba pisana* under laboratory conditions that the other inorganic salts (Sodium fluoride, Sodium chlorate, Sodium pyrophosphate and Potassium cyanate).

Aioub *et al.* (2000) reported that carbamate compounds appeared to be the most highly toxic in the laboratory tests. Ismail *et al.* (2001) revealed that aldicarb was the most efficacy of the tested inorganic salts (copper sulfate, aluminium sulfate and magnesium sulfate) under laboratory and field conditions.

Glen *et al.* (2003) reported that the control of slug (*Derouras reticulatum* and *Arion circumscriptus*) damage is difficult in lettuce, where the presence of slugs, faces damage or slug pellets in unacceptable in harvested produce. They found that the treatments applied in mid-February had valuable effects in significantly reducing slug damage close to harvest by 64% for molluscicide and 74 % for herbicide used alone and by 91 % for both used in combination.

Port *et al.* (2003) applied an IPM strategy for slug in vegetable and salad crops in U.K. They establish that the very low thresholds for slug damage in many vegetable crops mean that some growers use molluscicides pellets as a routine treatment. They investigated a number of control tactics in lettuce and Brussels sprout crops. These tactics from the components of an integrated pest management strategy for slug and include, improved detection of slug problems, prediction of population changes and rotational timing of treatments including both cultivations and molluscicide application.

Daoud (2004) reported that newmeal exhibited the highest toxic action against *M. cartusiana* snails followed by Vertimec, Marshal, Dursban while Curacron was the least one. In respect of the activity of the same tested compounds against *E. vermiculata* snails, it's clear that Vertimec and Newmeal seem to be the same order of activity and exhibited the highest toxic action followed by Marshal, Dursban and Curacron under laboratory conditions.

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تقييم بعض الكيماويات و المبيدات الحشرية ضد قوقع موناكا كارتوسيانا الذى
يصيب بعض محاصيل الخضر فى محافظة الشرقية
شحاته أحمد على اسماعيل - عاطف عبد الفتاح أحمد عبد الله -
سالم عبد الفتاح احمد المصرى وأحمد مصطفى إبراهيم حجاب
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - جيزة - مصر

اجريت عدة تجارب معملية لتقييم تاثير بعض المواد الكيماوية وهى مركبات النحاس و
كبريتات الحديدوز بالاضافة الى سبعة مبيدات حشرية وهى ديافينزيورون ، كاربوسلفان ،
سبينوساد، بيريمكارب ، كلوروبيريغوس ، ليفينورون وسيانوفوس ضد قوقع موناكا كارتوسيانا.
وقد أظهرت النتائج ان كاربوسلفان كان له تاثير سام على بينما كان كلوروبيريغوس اقل
المركبات المختبرة تأثيرا.

وفى المقابل اجريت تجربتان حقليةتان الاولى كانت فى قرية ابو حاكم - مركز الزقازيق
لتقييم تاثير ستة مركبات كيماوية وهى ميثوميل ، كلوروبيريغوس ، ليفينورون ، سبينوساد ،
كبريتات النحاس وكبريتات الحديدوز ضد نفس القوقع الذى يصيب كلا من محصولى البصل و
الفول الاخضر .. وقد اتضح من النتائج ان ميثوميل كان اعلى المركبات تأثيرا على القوقع بينما
كان سبينوساد اقلها تأثيرا وكانت التجربة الحقلية الاخيرة فى مركز ههيا بمحافظة الشرقية لتقييم
تاثير خمسة مركبات وهى بيريمكارب ، كاربوسلفان ، سيانوفوس ، ديافينزيورون وميتالدهيد ضد
نفس القوقع على كلا من الخس المحمل على الفلفل ، الخس المحمل على البانجان و الخس
المحمل على باميا فى ثلاث حقول مختلفة.

وقد اظهرت النتائج ان الميتالدهيد كان اعلى المركبات تأثيرا على الاطلاق بينما كان
سيانوفوس اقلها تأثيرا فى كلا من حقلى الخس المحمل على فلفل و الخس المحمل على بانجان ،
بينما كان بيريمكارب اقل المركبات تأثيرا ضد القوقع فى حقل الخس المحمل على باميا.
ولذا يمكن التوصية باستخدام كلا من الكاربوسلفان و الميثوميل و الميتالدهيد لمكافحة قوقع موناكا
كارتوسيانا ضمن برامج مكافحة المتكاملة على محاصيل الخضر.