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CONTROL OF CERTAIN LAND SNAILS UNDER FIELD CONDITIONS IN SHARKIA GOVERNORATE, EGYPT

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ABSTRACT: Seven pesticides were tested to evaluate their molluscicidal activity as poisonous baits against *Monacha cartusiana* Müller in Zagazig district, Sharkia Governorate during the activity period in April, 2000.The obtained results indicated that the molluscicidal efficiency of the tested pesticides at 15 days after treatment could be arranged as follows: fenamiphos > sethoxydim > oxamyl > monocrotophos > butachlor > Biofly and Seeds gard. The parallel values of percent reduction were 48.81, 43.01, 36.01, 33.52, 29.08, 20.01 and 11.09%, respectively. On the other hand, carrier or attractive materials usually used in poisonous baits showed insignificant effect on the molluscicidal activity of fenamiphos in controlling *M. cartusiana*. Moreover, hand collection of *M. cartusiana* and *Helicella vestalis* Preiffer in a selected navel orange orchard highly infested with both species in Belbies district, Sharkia Governorate during aestivation period in July, 1999 significantly reduced populations of the two species. General means of percent reduction during four weeks after collection were 56.59 and 51.51%, respectively.

Key words: Land snails, control, carrier materials, attractive materials, hand collection, Sharkia Governorate, Egypt.

INTRODUCTION

In recent years, land snails cause considerable damage to field and vegetable crops, fruit trees and ornamental plants in Egypt (El-Okda, 1980; Hashem *et al.*, 1993 and El-Deep *et al.*, 1996).

On the other hand, reports of host plants infested with land snails in Sharkia Governorate indicated that, the glassy clover snail *Monacha cartusiana* was almost found in field and vegetable crops, while the small sand snail *Helicella vestalis* occurred chiefly on fruit trees Ghamry *et al.*, 1993; Ismail, 1997 and Mahrous *et al.*, 2002). Chemical control using poisonous baits can be considered one of the most effective methods available at present to reduce numbers of land snail species (Crowell, 1967; El-Sebae *et al.*, 1982; Gaulliard and laverrier, 1989; Ghamry *et al.*, 1994 and Arafa, 1997). However, environmental and health risks caused by these chemicals enhanced to find other alternative methods.

The present study aims to evaluate molluscicidal effect of seven pesticides against *M. cartusiana*. In addition, the influence of carrier or attractive materials on the efficiency of fenamiphos was also studied. Moreover, hand collection method was evaluated in reducing populations of *M. cartusiana* and *H. vestalis*.

MATERIALS AND METHODS

1-Pesticides Used:

Seven pesticides commonly applied in controlling diferent pests on field and vegetable crops as well as orchard trees were used in the experiments. Some of these compounds are applied in the soil to control nematodes or weeds. Classes of pesticides, common name, trade name, formulation type and chemical or scientific name for these pesticides were as follows:

A: Nematicides:

A.1-Fenamiphos (Nemacur24%L.)
Ethyl-4-methylthio-m-tolyl isopropylphosphoramidate.

A.2 Oxamyl (Vydate 24% E.C.)
S-methyl N',N'-dimethyl-N-(methylcarbamoyloxy)-1-thio-oxamimidate.

B: Herbicides:

B.1 Butachlor (Machete 60% E.C.)
N-(butoxymethyl)-2-chloro-2', 6' diethylacetanilide.

B.2 Sethoxydim(Nabu12.5% E.C.)
(±)-2-(1-ethoxyiminobutyl)-5-{2-(ethyl thio) propyl} -3-hydroxycyclohex-2- enone.

C: Insecticides:

Monocrotophos (Azodrin 40% L.) Dimethyl(E)-1-methyl-2-methylcarbamoyl vinyl phosphate.

D: Biocides:

D.1 The entomofungus, *Beauveria bassiana* (Biofly) Insecticide, the formulation of this compound contained 3×10^7 conidia of the fungus *B. bassiana*/ml.

D.2 The fungus, *Trichoderma harzianum* (Seeds gard) Insecticide, the commercial product of this compound contained 2.3×10^7 conidia of *T. harzianum*/gm.

2-Efficacy of Certain Pesticides against *Monacha cartusiana*:

The molluscicidal activity of fenamiphos, oxamyl, butachlor, sethoxydim, monocrotophos, Biofly and Seeds gard were tested in an Egyptian clover field highly infested with *M. cartusiana*, in Kafr Attalah locality, Zagazig district during the activity period in April, 2000. The area of this study was divided into plots, each of about 50 m^2,. also about the same area was lifted between each other in a randomized block design. The field was irrigated one day before treatment. The tested toxicants were applied as poisonous baits at concentration of 1% a.i. (a part of toxicant +5 parts of sugar-cane syrup +94 parts of bran) for each chemical compound, 6×10^7 conidia +5 parts of sugar-cane syrup +93 parts of bran for Biofly and 4.6×10^7 conidia +5 parts of sugar-cane syrup +93 parts of bran for Seeds gard. Control treatment was designed by the same manner without pesticides. Treatments of pesticides and control were replicated three times. Baits were offered on plastic trays each one contained about 100gm two days after cutting clover plants to avoid pesticidal pollution upon this edible cattle crop. Number of dead and alive snails were counted using $0.25m^2$ quadrate placed adjacent to the bait one day after application and then at intervals of two days during the experimental time of 15days. Reduction percentages were calculated according to the formula of Henderson and Tillton (1955) previously used for mites and adapted here for snails as follows:

$$\% \text{ Reduction} = \left(1 - \frac{t_2 \times r_1}{t_1 \times r_2}\right) \times 100$$

where:

r_1 = number of alive snails before treatment in untreated plots.

r_2 = number of alive snails after treatment in untreated plots.

t_1 = number of alive snails before treatment in treated plots.

t_2 = number of alive snails after treatment in treated plots.

3-Effect of Carrier or Attractive Materials Commonly Used in Baits Technique on the Efficacy of Fenamiphos against *Monacha cartusiana* under Field Conditions:

This experiment was conducted in an Egyptian clover field heavily infested with *M. cartusiana*, in El-Swaleh locality, Fakous district, Sharkia Governorate, Egypt during the activity period in April 1999. The tested carrier materials used in poisonous baits were ash, crushed maize, rice hulls, saw dust and wheat bran. The tested carriers were applied as poisonous baits at concentration of 1% a.i., (a part of fenamiphos +5 parts of sugar-cane syrup +94 parts of each carrier separately). Each treatment was replicated 3 times. On the other hand, the tested attractive materials used in poisonous baits were blood powder, boiled potatoes, milk powder, sugar-cane syrup and vanilia. The tested attractants were applied as poisonous baits at concentration of 1% a.i. (a part of fenamiphos +5 parts of each attractant separately +94 parts of bran). Each treatment was replicated three times. Baits were offered on plastic trays each one contains about 100gm two days after cutting clover plants. Reduction percentages were calculated according to the abovementioned methods using the formula of Henderson and Tillton (1955).

4-Influence of Hand Collection Control Method in Reducing Populations of *Monacha cartusiana* and *Helicella vestalis* :

This trial was undertaken in an orchard of navel orange highly infested with *M. cartusiana* and *H. vestalis* in El-Saadoon village, Belbies district, Sharkia Governorate during the aestivation period of such snails. An area of

about half feddan was chosen to measure the effect of hand collection technique in diminishing populations of the two snail species. This area was divided to ten plots each of 8 trees. Five plots were subjected to hand collection by five workers while the others were left without collection as control. Individuals of aestivated snails were counted in a quadrate of 0.25m^2 under one tree randomly chozen in each plot and on the lower portion in the trunk of the same tree to about one meter height. Population counts were entailed 24 hours before and after hand collection and then at weakly intervals during the period from 1 to 30 July, 1999. Percent reduction in population density of each snail species was calculated according to the formula of Henderson and Tillton (1955).

RESULTS AND DISCUSSION

1-Efficiency of Certain Pesticides in Controlling the Land Snail *Monacha cartusiana*:

Data presented in Table (1) showed that one day after treatment, the effect of the tested pesticides in reducing population of *M. cartusiana* differed from one pesticide to another. Fenamiphos and sethoxydim proved to be the most effective compounds among all pesticidal treatments recording reduction percentages of 50.69 and 50.15%, respectively. On the other hand, oxamyl, butachlor and monocrotophos gave moderate effect in decreasing population of *M. cartusiana* with percent recuction of 36.58, 31.09 and 32.06%, respectively. Biofly and Seeds gard were the least effective compounds with percent reduction of 19.04 and 16.08%, respectively. Three days after application, percent reduction in numbers of *M. cartusiana* were increased with most of the tested compounds, except sethoxydim and Seeds gard. However, at 7 and 15 days after treatment, the toxicity of the tested pesticides was slightly decreased. Generally, the molluscicidal efficiency of the tested pesticides could be arranged as follows: fenamiphos > sethoxydim > oxamyl > monocrotophos > butachlor > Biofly and Seeds gard. The respective values of percent reduction at 15 days after treatment were 48.81, 43.01, 36.01, 33.52, 29.08, 20.01 and 11.09%, respectively. In general, fenamiphos and sethoxydim were the most effective compounds

Table (1): Efficacy of certain pesticides in controlling the land snail, *Monacha cartusiana* under field conditions.

Classes of pesticides	Common name and formulation type	% Reduction after treatment (in days)			
		1	3	7	15
Nematicides	Fenamiphos 24 % (L.)	50.69 a	59.36 a	50.50 a	48.81 a
	Oxamyl 24 % (E.C.)	36.58 b	43.79 bc	42.30 b	36.01bc
Herbicides	Butachlor 60 % (E.C.)	31.09 bc	39.41 c	30.73 cd	29.08 c
	Sethoxydim 12.5 % (E.C.)	50.15 a	49.06 b	43.89 ab	43.01ab
Insecticides	Monocrotophos 40 % (L)	32.06 bc	40.08 c	36.64 bc	33.52 c
Biocides	Biofly 3×10^7 conidia / ml	19.04 d	22.01 d	29.06 e	20.01 d
	Seeds gard 2.3×10^7 conidia / gm	16.08 d	16.05 e	22.09 e	11.09 e

* Data in the columns followed by the same letter(s) were not significantly differed ($P < 0.05$) according to Duncan's multiple range test.

against *M. cartusiana*, while butachlor, Biofly and Seeds gard gave the lowest effect in this respect.

Discussing the foregoing results, it is worthy to mention here that, the obtained results are in agreement with the finding of Fox (1964) who found that herbicides were effective against land snails. Mode of action was as contact over long period of time with snails or as direct feeding on treated plants. These herbicides may persist in the soil or in the plant for considerable time and may even accumulate in gastropods. Furthermore, Godan (1983) also mentioned that using herbicides not only kill weeds but also molluscs either through the animal skin or by ingestion through the intestine. Radwan *et al.* (1992) found that the bran toxic baits (0.5% w/w) of five oxime carbamate pesticides including oxamyl gave highly toxic effect against *Theba pisana* under laboratory conditions. Ismail (1997) assured that organophosphorous compounds, gave highest efficiency in controlling *M. cartusiana* under field conditions. Moreover, Abdallah *et al.*, (1999) tested twenty-four compounds belonging to carbamates; orgarophosphates, chlorinated hydrocarbons and fungicides against *Eobania vermiculatat* and *T. pisana*. They illustrated that, aldicarb, methomyl, monocrotophos and paraquat were the most toxic compounds against both the tested snails.

2-Effect of Carrier or Attractive Materials on the Efficiency of Fenamiphos in Controlling *M. cartusiana*:

Data presented in Table (2) indicated that, the tested carrier materials gave insignificant effect on the molluscicidal activity of fenamiphos against *M. cartusiana*. Since, general means of percent reduction at 15 days after treatment using ash, crushed maize, rice hulls, saw dust and wheat bran as a carriers were 19.09, 25.19, 24.87, 23.79 and 27.56%, respectively. On the other hand, data presented in Table (3) revealed that none of the tested attractive materials showed significant effect on the efficiency of fenamiphos when used as poisonous baits in controlling *M. cartusiana*. Whenever, general means of percent reduction at

Table (2): Effect of carrier materials commonly used in baits technique on the efficiency of fenamiphos against the land snail, *M. cartusiana* under field conditions:

Carrier material	% Reduction after treatment (in days)				General mean
	1	3	7	15	
Ash	23.46	22.19	18.46	12.28	19.09
Crushed maize	33.97	33.51	19.63	13.64	25.19
Rice hulls	49.75	19.80	18.25	11.67	24.87
Saw dust	35.52	24.29	22.90	12.45	23.79
Wheat bran	33.11	32.62	29.10	15.41	27.56

* F. test for carrier materials was not significant.

Table (3): Effect of attractive materials commonly used in baits technique on the efficiency of fenamiphos against the land snail, *M. cartusiana* under field conditions:

Attractive material	% Reduction after treatment (in days)				General mean
	1	3	7	15	
Blood powder	70.45	65.69	44.24	28.23	52.15
Boiled potatoes	76.51	75.06	64.10	47.40	65.77
Milk powder	62.26	58.43	58.09	49.77	75.14
Sugar-cane syrup	70.21	62.26	55.56	51.75	59.95
Vanilia	63.28	53.49	42.44	39.45	49.67

* F. test for attractive materials was not significant.

15 days after treatment using blood powder, boiled potato, milk powder, sugar-cane syrup and vanilia as attractants were 52.15, 65.77, 57.14, 59.95 and 49.67%, respectively. Generally, it was found that neither the tested carrier materials nor the attractive ones showed significant increase in reducing numbers of *M. cartusiane* when they were applied with fenamiphos as poisonous baits under field conditions. El-Sebae *et al.* (1982) found that, bran baits containing raddish and ragee el-kone gave higher percent mortality to snails than nokhalah and germah. Godan (1983) mentioned that molasses and wheat bran were considered the most effective in mixtures with molluscicides in addition to the main role of boiled potatos, dry milk powder, rice bran which were added to act as attractants and as carrier bases in poisonous baits techniques. Asran (1994) indicated that bran was the most preferable bait to the brown garden snail, *H. aspersa* followed by crushed wheat and crushed maize. On the other hand, she revealed the important role of food attractant on the acceptability and consumption of brain bait by snails. Since, sugar-cane syrup proved to be the most attractive additive substance followed by molasses, while vanillia was the lowest attractant in this respect. Finally, Mohamed (1994) showed that sugar-cane syrup and molasses are considered the most promising additives mixed with poisonous baits in controlling snails and slugs.

3-Effect of Hand Collection as a Mechanical Control Method in Reducing Populations of *Monacha cartusiana* and *Helicella vestalis*:

In the search for alternatives to chemical control of land snails, the obtained data presented in Table (4) clearly indicated that hand collection method obviously decreased populations of *M. cartusiana* and *H. vestalis*. Since, one day post collection, numbers of *M. cartusiana* were reduced from 32.4 to 12.6 snails/sample recording 70.02% reduction, while the corresponding numbers for *H. vestalis* were reduced from 31.4 to 16.4 individuals/sample recording 57.85% reduction. One week after hand collection, the percent reduction in populations of *M. cartusiana* and *H. vestalis* were

Table (4): Influence of hand collection control method in reducing populations of *M. cartusiana* and *H. vestalis* infesting navel orange trees at El-Saadoon locality, Belbies district, Sharkia Governorate:

Period after hand collection	Mean number of *M. cartusiana* per sample		% Reduction in collected area	Mean number of *H. vestalis* per sample		% Reduction in collected area
	Uncollected area	Collected area		Uncollected area	Collected area	
One day	32.4	12.6	70.02	31.4	16.4	57.85
One week	28.5	14.8	59.97	40.1	22.6	54.51
Two weeks	25.6	13.4	59.66	33.7	20.1	51.86
Three weeks	30.6	20.1	49.37	38.6	23.9	50.03
Four weeks	26.4	19.2	43.94	26.9	18.9	43.29
General mean	28.7 **a**	16.1 **b**	56.59	34.14 **a**	20.38 **b**	51.51

* Data in the final row not followed by the same letter were significantly differed ($P < 0.05$) according to Duncan's multiple range test.

59.97 and 54.51%, respectively. The same trend was observed 2 and 3 weeks after collection with slightly decrease in percent reduction of both species. However, after the fourth weak percent reduction in numbers of both species were obviously decreased to 43.94 and 43.29% for *M. cartusiana* and *H. vestalis*, respectively. Generally, hand collection method showed significant reduction in populations of *M. cartusiana* and *H. vestalis*. General means of percent reduction in populations of *M. cartusiana* and *H. vestalis* during four weeks after collection were 56.59 and 51.51%, respectively. When discussing the foregoing results, it is worthy to mention here that chemicals used in controlling land snails caused environmental pollution, hazards to man and toxic residues in agricultural production. Therefore, search for alternative methods which can be used safety in controlling land snails, has been become a matter of immediate concern. On the other hand, collection method was recommended by many authors. i.e. Carman (1965); Bishara *et al.* (1968); Wouters (1970); Shah (1992) and Tillier *et al.* (1995).

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مكافحة بعض أنواع القواقع الأرضية تحت الظروف الحقلية فى محافظة الشرقية – جمهورية مصر العربية

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تم إختبار سبعة مبيدات شائعة الإستخدام وذلك لتقييم كفاءتها كمبيدات قواقع باستخدام طريقة الطعوم السامة لمكافحة قوقع البرسيم الزجاجى *Monacha cartusiana* Müller فى مركز الزقازيق بمحافظة الشرقية خلال شهر إبريل ٢٠٠٠م حيث أظهرت النتائج المتحصل عليها ما يلى:

إمكانية ترتيب المبيدات المختبرة وفقاً لنسبة الإنخفاض فى تعداد الأفراد بعد ١٥ يوم من المعاملة كما يلى : الفينـاميفوس > السيبـوكزيديم > الأوكسـاميل > المونوكروتوفوس > بوتـاكلور > بيوفلاى ثم سيدس جارد. حيث سجلت نسب انخفاض عن المقارنة مقدارها ٤٨,٨١، ٤٣,٠١ ، ٣٦,٠١ ، ٣٣,٥٢، ٢٩,٠٨ ، ٢٠,٠١ و ١١,٠٩ ٪ على الترتيب.

كذلك تم دراسة تأثير المواد الحاملة أو الجانبة شائعة الإستخدام فى الطعوم السامة على كفاءة مبيد الفيناميفوس لمكافحة قوقع البرسيم الزجاجى تحت الظروف الحقلية. هذا وقد أوضحت النتائج المتحصل عليها عدم وجود تأثيرات معنوية على زيادة كفاءة المبيد عند استعمال المواد الحاملة أو الجانبة محل الدراسة.

وفى تجربة لتقييم عملية الجمع اليدوى كإحدى طرق المكافحة الميكانيكية لتقليل تعداد كلا من قوقع البرسيم الزجاجى *M. cartusiana* و قوقع الرمال الصغير *Helicella vestalis* Preiffer و ذلك فى إحدى بساتين البرتقال بسرة بمركز بلبيس أثناء فترة البيات الصيفى خلال شهر يوليو ١٩٩٩. أظهرت الدراسة أن متوسط نسبة الانخفاض فى تعداد كلا النوعين عن المقارنة كان ٥٦,٥٩ و ٥١,٥١ ٪ وذلك بعد أربعة أسابيع من جمع قوقع البرسيم الزجاجى وقوقع الرمال الصغير على الترتيب.