

**DIFFERENT CONTROL MEASURES FOR
CONTROLLING CERTAIN LAND
SNAIL SPECIES IN SHARKIA
GOVERNORATE , EGYPT**

**Salem, A. A. , M. E. Mahrous , Mervat H. Ibrahim,
and E. M. Abd El-Aal**

Plant Protection Dept., Faculty of Agric., Zagazig Univ., Egypt

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ABSTRACT : Trial through four steps was designed for controlling the brown garden snail, *Eobania vermiculata* Müller and the glassy clover snail, *Monacha cartusiana* Müller in navel orange orchard highly infested with mixed populations of the two snail species in Anshas locality, Belbies district, Sharkia Governorate during the period from January to July, 2004. The program beginning with ploughing process as a mechanical control method during egg-laying period in January and February. It obviously decreased the populations of the two snail species. Since, general means of percent reduction in populations of *E. vermiculata* and *M. cartusiana* during six weeks after ploughing were 52.3 and 43.3%, respectively.

The second step was planting lettuce as a plant traps to attract snails from the trees as a cultural control method in February and March. It diminished the populations of the two species during six weeks after planting. Reduction percentages in numbers of *E. vermiculata* and *M. cartusiana* recorded values of 50.4 and 56.1%, respectively.

The third step was application of certain pesticides including the biopesticide Protecto as poisonous baits in April during the activity period of land snails. In this respect, the highest values of percent reduction were detected with methomyl and glyphosate with general means of 61.35 and 52.70 % for *E. vermiculata* and 67.25 and 57.55 % for *M. cartusiana* respectively, while fenamiphos , sethoxydim and malathion gave moderate effect . However, Protecto was the least effective one in this respect.

Finally, hand collection as a one of mechanical control methods was conducted whenever, snails were aestivated in certain cites i.e. on

lower portion of navel orange trees and on weeds growing in the orchard. This method significantly lowered numbers of *E. vermiculata* and *M. cartusiana* by 40.5 and 35.4% as general means of counting snails during six weeks after collection. Generally, we recommend application of this program to avoid damage caused by land snails and minimizing the adverse effect caused by pesticides.

Key words : Land snails , control , molluscicidal effect , *E. vermiculata* , and *M. cartusiana*.

INTRODUCTION

Recently in Egypt, land snails have increased greatly in economic importance. They cause great damage to vegetable and field crops, fruit orchards and ornamental plants (Kassab & Daoud, 1964 and El - Deeb *et al.*, 1996). In Sharkia Governorate, *Monacha cartusiana* Müller and *Eobania vermiculata* Müller were considered to be the most common species. They also were known as destructive pests causing damage to economic crops (Arafa, 1997; Ismail, 1997; Hegab *et al.*, 1999; Mahrous *et al.*, 2002 and Ismail, 2004). Currently these pests are controlled chemically by using molluscicides or insecticides. These compounds may be responsible for chemical residues in foods and fruits as well as general environmental contamination. Therefore, it has been universally agreed that the best possible method for controlling pest snails, is through an integrated pest management program to avoid or minimize the use of pesticides (Azzam , 1995 ; El-Masry, 1997 and Ghamry,

1997). This is in agreement with the main aim of this study for controlling *E. vermiculata* and *M. cartusiana*, in navel orange orchard highly infested with mixed populations of the two snail species in Anshas locality, Belbies district, Sharkia Governorate during the period from January to July, 2004.

Accordingly , the design of the proposed program was as follows ;

Firstly, trying ploughing during egg- laying period in January and February, then, plant lettuce, *Lactuca sativa* as traps in February and March, followed by application of certain pesticides as poisonous baits during activity period of the snails in April and finally, applying hand collection during the aestivation period in June and July.

MATERIALS AND METHODS

Effect of Ploughing Process as a Mechanical Control Method in Reducing Populations of *E. vermiculata* and *M. cartusiana*

This trial was undertaken in an area of about half feddan chosen to measure the effect of ploughing in diminishing populations of the two snail species. This area was divided into ten plots each of 8 trees. Five plots were subjected to ploughing, while the others were left without ploughing as a control treatment. Individuals of the two species were counted in the early morning in a quadrat of 50 X 50 cm² under one tree randomly chosen in each plot and on the lower portion in the trunk of the same tree to about one meter height in plowed and unplowed plots. Population counts were entailed 24 hours before ploughing and then at weekly intervals during six weeks beginning in January, 2004. Percent reduction in population density of each snail species was calculated at weekly intervals according to the formula of Henderson and Tielton (1955) as follows :

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

Where ;

r1 = number of alive snails before treatment in untreated plots.

r2 = number of alive snails after treatment in untreated plots.

t1 = number of alive snails before treatment in treated plots.

t2 = number of alive snails after treatment in treated plots.

Influence of Planting Lettuce Traps as an Agricultural Control Method on Percent Reduction of *E. vermiculata* and *M. cartusiana*

This experiment was conducted in another adjacent area of about half feddan randomly chosen to measure the effect of planting lettuce, *Lactuca sativa* as traps in decreasing populations of the two snail species upon navel orange trees as the main crop. This area was divided to ten plots each of 8 trees. Five plots were cultivated with lettuce at rate of 8 plants between two trees, while the others were left without planting as control. Individuals of each snail species were counted in the early morning in 50 x 50 cm² under one tree randomly chosen in each plot and on the lower portion in the trunk of the same tree to about one meter in cultivated and control plots. Population counts were entailed 24 hours before cultivation and then at weekly intervals during six weeks beginning from mid-February, 2004. The aggregated snails on lettuce plants were collected every two days during the period of experimentation. Percent reduction in population density of each snail species was calculated according to the formula of Henderson and Tielton (1955).

Efficiency of Certain Pesticides in Controlling *E. vermiculata* and *M. cartusiana*

Pesticides used

Six pesticides commonly applied against different pests in field and horticulture crops were used in this experiment. 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 tested formulations were as follows:

A: Insecticides :

A.1-Malathion (Malathion 57 %E.C.)
O, O -dimethyl S- (1,2
dicarbethoxy ethyl)
phosporodithioate

A.2 -Methomyl (Lannate 90 % S . P.)
S- methyl - N - [(methyl
carbamoyl) oxy] thio
acetimidate

B : Nematicide :

Fenamiphos (Nemacur 10 % G.)
Ethyl - 4 - methyl thio - m
- tolyl isopropyl
phosphoramidate

C: Herbicides :

C. 1 - Glyphosate (Lancer 48 % W. Sc)
N (phosphate methyl) glycine

C. 2 - Sethoxydim (Nabu 12.5 % E. C.)
(±) - 2 - (1- ethoxy iminobutyl)
- 5 - [2 - (ethyl thio) propyl] - 3
- hydroxycyclohex - 2 - enone

D : Biocide :

Protecto (Insecticide) 10 % W. P.
Bacillus thuringiensis

Molluscicidal activity

The molluscicidal activity of malathion, methomyl, fenamiphos, glyphosate, sethoxydim and Protecto were tested during the activity period of the snail species. The area of this experiment was divided to 10 plots , each of about 8 trees. Five plots were treated with the tested toxicants while, the others were left without treatment as a control. The toxicants were applied as poisonous baits at concentration of 1.5 % a.i. (1.5 parts of toxicant + 5 parts of sugar-cane syrup + 93.5 parts of wheat brane) for each chemical compound, and 2 parts of Protecto + 5 parts of sugar-cane syrup + 93 parts of wheat brane. Control treatment was designed by the same mannar without pesticides.

Pesticides and control treatments were replicated three times. Baits were offered on plastic trays each one contained about 100 gm in rate of 4 baits between two trees. Snails of each species were counted early morning in 50 x 50 cm² under one tree randomly chosen 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 application and then, at intervals of two days during the experimental period of 15 days in mid-April, 2004. Finally, reduction percentages in population density of each snail species were calculated according to the formula of Henderson and Tielton (1955).

Efficacy of Hand Collection Control Method in Reducing Populations of *E. vermiculata* and *M. cartusiana*

This trail was undertaken during the aestivation period in an area of about half feddan randomly chosen to measure the effect of hand collection in reducing populations of the two snail species. This area was divided as previously mentioned before. Five plots were subjected to one hand collection application by five workers during the day hours from 10 am to 4 pm , six days after irrigation especially, on the lower portion in the trunk of the trees while, the others were left without collection as a control treatment. Snails were counted in 0.25 m² under one tree randomly chosen 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 weekly intervals during six weeks in the end of June, 2004. Percent reduction in population density of each snail species was

calculated according to the formula given by Henderson and Tielton (1955).

RESULTS AND DISCUSSION

Effect of Ploughing Process in Reducing *E. vermiculata* and *M. cartusiana*

Data presented in Table 1 clearly indicated that, ploughing method obviously decreased populations of *E. vermiculata* and *M. cartusiana* . Since, one week after ploughing numbers of *E. vermiculata* and *M. cartusiana* per sample in control treatments were ; 20.6 and 17.9 snails ,respectively. While, the parallel values in plowed treatments were ; 8.9 and 7.4 , respectively. Two weeks after ploughing , the percent reduction in populations of *E. vermiculata* and *M. cartusiana* were 60.4 and 50.4 % , respectively.

The same trend was observed at four and five weeks after ploughing with slightly increase in percent reduction of both snail species. However, after six weeks percent reduction in numbers of both species were decreased recording 37.8 and 28.8 % for *E. vermiculata* and *M. cartusiana*, respectively. Generally, ploughing showed significant reduction in populations of *E. vermiculata* and *M. cartusiana*.

Table 1 . Effect of ploughing process as a mechanical control method in reducing populations of *E. vermiculata* and *M. cartusiana* infesting navel orange trees in Belbies district , Sharkia Governorate during January and February, 2004.

Weeks after ploughing	Mean number of <i>E. vermiculata</i> per sample		(%) Reduction in plowed area	Mean number of <i>M. cartusiana</i> per sample		(%) Reduction in plowed area
	Unplowed area	Plowed area		Unplowed area	Plowed area	
1	20.6	8.9	61.7	17.9	7.4	63.1
2	21.9	9.8	60.4	19.4	10.8	50.4
3	23.7	11.3	57.8	20.8	12.6	45.9
4	25.4	14.1	50.8	22.3	15.2	39.2
5	26.2	15.7	46.9	23.6	17.9	32.4
6	27.9	19.6	37.8	24.8	19.8	28.8
General mean	24.3 A	13.2 B	52.3	21.5 a	13.9 b	43.3

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

Moreover, reducing in numbers of egg clutches had been observed or damaged. These results are in agreement with those obtained by Wouters (1970) who mentioned that, rough ploughing of the soil before sowing of winter wheat protected seeds from damage caused by land snails. Moreover, El-Masry (1997) illustrated that, the ploughing process decreased individuals of the land snail *H. vestalis* by 87.8 % after one day post ploughing while, the highest reduction percentage reached 91.60 % after 15 days post ploughing.

Influence of Planting Lettuce Traps on Percent Reduction of *E. vermiculata* and *M. cartusiana*

Data in Table 2 revealed that, planting lettuce plants under navel orange trees as attractive traps to land snails decreased populations of *E. vermiculata* and *M. cartusiana*. Since one week after planting, numbers of *E. vermiculata* were reduced from 20.5 to 17.2 snails per sample recording 25.6 % reduction, while the corresponding numbers for *M. cartusiana* were reduced from 22.6 to 16.2 individuals per sample recording 32.2 % reduction. Three weeks after planting, percent reduction in populations of *E. vermiculata* and *M. cartusiana* were increased to 48.1 and 57.2 %, respectively. The same trend was

observed at four and five weeks after planting with gradually increase in percent reduction of both snail species. However, after the sixth week, percent reduction in numbers of both species recorded relatively higher values of 67.2 and 73.1 % for *E. vermiculata* and *M. cartusiana*, respectively. On the other hand, percent reduction in populations of *E. vermiculata* and *M. cartusiana* during the experimental period were 50.4 and 56.1 % , respectively. So, it could be concluded that planting lettuce traps as cultural control method showed significant reduction in populations of *E. vermiculata* and *M. cartusiana*.

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 leave toxic residues in agricultural production (Ghamry *et al.* ,1994). On the other hand , Staikou and Lazaridou-Dimitriadou (1989) showed that, the snail *Helix lucorum* fed on lettuce showed higher assimilation efficiency than those fed on *Urtica dioica* while, Arafa (1997) recorded that, leaves of sweet pea and lettuce were the most preferable food for *M. cartusiana*. Moreover, Ismail (1997 & 2004) and Abd El-Aal (2001) reported that, leaves of lettuce and cabbage were the most

Table 2 . Influence of planting lettuce as an cultural control method on percent reduction of *E. vermiculata* and *M. cartusiana* infesting navel orange trees in Belbies district, Sharkia Governorate during February and Marsh, 2004.

Weeks after planting lettuce	Mean number of <i>E. vermiculata</i> per sample		(% Reduction	Mean number of <i>M. cartusiana</i> Per sample		(% Reduction
	Control treatment	Lettuce-planted area		Control treatment	Lettuce-planted area	
1	20.5	17.2	25.6	22.6	16.2	32.2
2	22.1	15.8	36.3	24.9	14.8	43.8
3	23.3	13.6	48.1	26.3	11.9	57.2
4	24.6	10.7	61.3	26.5	10.4	62.9
5	24.9	10.1	63.9	28.4	9.9	67.1
6	25.8	9.5	67.2	30.2	8.6	73.1
General mean	23.5 A	12.8 B	50.4	26.5 a	11.9 b	56.1

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

preferable food for *E. vermiculata* and *M. cartusiana* as compared to all the tested plant leaves.

Efficiency of Certain Pesticides and Biocides in Controlling *E. vermiculata* and *M. cartusiana* under Field Conditions

Data presented in Table 3 showed that, the tested pesticides reduced populations of *E. vermiculata* and *M. cartusiana*. Since, all pesticides exhibited varying degrees of percent snail reduction compared to the control. For instances, methomyl and glyphosate showed the highest values of percent reduction in populations of *E. vermiculata* and *M. cartusiana* with general means of 61.35, 52.70 % and 67.25, 57.55 %, respectively. On the other hand, fenamiphos, sethoxydim and malathion gave moderate effect in decreasing populations recording 50.78, 47.28 and 41.98 % for *E. vermiculata* and 53.08, 51.25 and 45.18 % for *M. cartusiana*, respectively. While, Protecto was the least effective compound with percent reduction of 32.73 and 33.63 % for *E. vermiculata* and *M. cartusiana*, respectively. Generally, the molluscicidal efficiency of the tested pesticides according to general means of percent reduction for the two snail species could be arranged as follows : methomyl > glyphosate > fenamiphos

> sethoxydim > malathion and Protecto.

Our results are in accordance with the findings of Fox (1964) who found that herbicides were effective against land snails and could be persist in the soil or in the plant for considerable time and may even accumulate in gastropods. Also, Godan (1983) 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 of five oxime carbamate pesticides gave highly toxic effect against *Theba pisana* under laboratory conditions as well as 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, organo-phosphates, chlorinated hydrocarbons against *E. vermiculata* and *T. pisana*. They illustrated that; aldicarb, methomyl, monocrotophos and paraquate were the most toxic compounds against both tested snail species. Also, similar results had been recorded by many authors i.e. Lokma and Al-Harpy (1999), Aioub *et al.* (2000) and Mahrous *et al.* (2002).

Table 3 . Efficacy of certain pesticides in controlling the land snails ; *E. vermiculata* and *M. cartusiana* infesting navel orange trees in Belbies district, Sharkia Governorate during April, 2004.

Compounds	(% Reduction of <i>E. vermiculata</i> after treatment (in days)				General mean	(% Reduction of <i>M. cartusiana</i> after treatment (in days)				General mean
	(1)	(3)	(7)	(15)		(1)	(3)	(7)	(15)	
Malathion 57 % (E.C.)	16.1	27.4	56.8	67.6	41.98 D	21.4	28.4	61.2	69.7	45.18 d
Methomyl 90 % (S. P.)	32.7	42.8	75.3	94.6	61.35 A	38.9	50.2	83.4	96.5	67.25 a
Fenamiphos 10 % (G.)	22.5	35.2	59.9	85.5	50.78 BC	26.6	37.2	70.1	78.4	53.08 bc
Glyphosate 48 % (W.SC.)	25.9	38.4	71.7	74.8	52.70 B	31.5	38.9	74.7	85.1	57.55 b
Sethoxydim 12.5% (E.C.)	20.6	33.8	63.3	71.7	47.28 C	19.4	40.6	65.2	79.8	51.25 c
Protecto 10 % (WP)	7.9	37.1	40.5	45.4	32.73 E	15.4	16.3	49.2	53.6	33.63 e

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

Table 4 . Effect of hand collection control method in reducing populations of *E. vermiculata* and *M. cartusiana* infesting navel orange trees in Belbies district, Sharkia Governorate during the period from June to July, 2004.

Weeks after hand collection	Mean number of <i>E. vermiculata</i> per sample		(% Reduction	Mean number of <i>M. cartusiana</i> per sample		(% Reduction
	Control treatment	After hand collection		Control treatment	After hand collection	
1	28.4	11.6	63.1	19.8	10.8	48.9
2	29.8	15.4	53.2	21.3	12.6	44.6
3	30.2	18.9	43.4	21.6	13.9	39.7
4	30.9	21.3	37.6	22.5	16.4	31.7
5	31.4	26.6	23.3	23.7	18.3	27.6
6	31.9	27.4	22.3	24.5	20.9	20.1
General mean	30.4 A	20.2 B	40.5	22.2 a	15.5 b	35.4

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

Effect of Hand Collection Control Method in Reducing Populations of *E. vermiculata* and *M. cartusiana*

The obtained data in Table 4 clearly indicated that, hand collection obviously decreased populations of *E. vermiculata* and *M. cartusiana*. Since, one week post collection, numbers of *E. vermiculata* were reduced from 28.4 to 11.6 snails per sample recording 63.1% reduction while the corresponding numbers for *M. cartusiana* were reduced from 19.8 to 10.8 snails per sample recording 48.9 % reduction. The same trend was recorded after two to five weeks post collection with slightly decreased in percent reduction of both species. However, after the sixth week percent reduction in number of both species were obviously decreased to 22.3 and 20.1 % for *E. vermiculata* and *M. cartusiana*, respectively. Finally, hand collection method showed significant effect on percent reduction for each of *E. vermiculata* and *M. cartusiana* recording 40.5 and 35.4 % reduction as a general mean during the experimental period for the two snail species, respectively.

Hand collection method was recommended for controlling land mollusks by many authors i.e. Carman (1965), Bishara *et al.* (1968) , Wouters (1970), Shah (1992), Tillier

et al. (1995), Abd El-Aal (2001) and Mahrous *et al.* (2002).

REFERENCES

- Abdallah, E. M., F. A. Kassem, H. B. El-Wakil , and Y. Abo-Baker .1999. Molluscicidal potentiality of several pesticides against *Eobania vermiculata* and *Theba pisana*. Annals Agric. Sci. Cairo, 1 : 263-276.
- Abd El-Aal, E. M. 2001. Studies on certain land snails at Sharkia Governorate. M. Sc. Thesis, Fac. Agric. Zagazig Univ.; 160 pp.
- Aioub, A. A., S. A. Ismail , and A. A. Mohamdein .2000. Toxicological and histological studies on some pesticides-treated land snails. Proc. I. C. B. S., 1(2) : 19 – 38.
- Arafa, A. A. 1997. Studies on some land molluscs at Sharkia Governorate. M. Sc. Thesis, Fac. Agric., Al-Azhar Univ. ; 137 pp.
- Azzam, Karima M. 1995. Studies on some malacophagous insects in Egypt. Ph. D. Thesis, Fac. Agric., Cairo Univ.; 296 pp.
- Bishara , S. I., M. S. Hassan , and A. S. Kalling .1968. Studies on some land snails injurious to agriculture in U. A. R. Rev. Zool. Bot. Afr., 77 (3-4) : 239 – 252.

- Carman, G. E. 1965. Electrical trapping device for land snail. J. Econ. Entomol., 58: 786 – 787.
- El-Deeb, H. I., E. M. Ghamry, N. El-Hawashy , and N. Essa .1996. Relative abundance of some land snails in certain Governorates of Egypt. J. Agric. Sci. Mansoura Univ., 21 (8) : 2922-2933.
- El-Masry, S. A. 1997. Studies on control of some land snails infesting certain fruit trees. Ph. D. Thesis, Fac. Agric., Zagazig Univ.; 150 pp.
- Fox, C. J. 1964. The effect of five herbicides on the numbers of certain invertebrates in grass land soil. Can. J. Plant Sci., 44 : 405 – 409.
- Ghamry, E. M. 1997. Bioassay for two strains of bacteria *Bacillus thuringiensis* against central land snails, under laboratory conditions. Egypt J. Appl. Sci., 12 (5): 661 – 672.
- Ghamry, E. M., Y. A. Kokab , and B. M. Wilson .1994. Screening test of some insecticides against two land snails, *Monacha contiana* and *Eobania vermiculate* in Sharkia Governorate. Zagazig J. Agric. Res., 21 (5): 1539-1545.
- Godan, D. 1983. Pest slugs and snails, biology and control. Springer-Verlag, Berlin, Heidelberg , 445 pp.
- Hegab, A. M., E. M. Ghamry , S. A. El-Masry , and A. I. Hassan .1999. Ecological studies on certain land snails in some localities at Sharkia Governorate. Zagazig J. Agric. Res., 26(3) : 787-795.
- Henderson, C. F. , and E. W. Tielton .1955. Test with acaricides against the brown wheat mite. J. Econ. Entomol., 48: 157-161.
- Ismail, S. A. 1997. Ecology, biology and control of certain terrestrial snails infesting some vegetable and field crops in Sharkia Governorate. Ph. D. Thesis, Fac. Agric., Zagazig Univ.; 130pp.
- Ismail, S.A. 2004. Ecobiological studies on the brown garden snail, *Eobania vermiculata* Müller under laboratory and field conditions in Sharkia Governorete. Zagazig. J. Agric. Res., 31(1): 293-305.
- Kassab, A. and H. Daoud .1964. Notes on the biology and control of land snails of economic importance in the U.A.R.J. Agric. Res .Rev. Cairo, 42 : 77-98.
- Lokma, H. E. and F. N. Al-Harpy .1999. Effect of *Bacillus thuringiensis* on two land snails, *M. cartusiana* (Müller) and *Rumina decollata* (Linne).

- Zagazig J. Agric. Res., 26(2) : 429-435.
- Mahrous , M. E. , H. I. Mervat , and E. M. Abd El-Aal .2002 . Control of certain land snails under field conditions in Sharkia Governorate . Zagazig J. Agric. Res. , 29 (3) :1041-1054.
- Radwan, M. A., H. B. El-Wakil , and K. A. Osman .1992. Toxicity and biochemical impact of certain oxime carbamate pesticides against terrestrial snail, *Theba pisana* (Müller). J. Environ. Sci. & Health, B , 27 (6): 759-773.
- Shah, S. 1992. Management of the giant African snail. Rev. Agric. Entomol., 81 (7) : 744.
- Staikou, A. and M. Lazaridou-Dimitriadou .1989. Feeding experiments and energy flux in a natural population of edible snails *Helix lucorum* (L.). (Gastropoda: Pulmonata: Stylommatophora) in Greece. Malacologia, 31 (1): 217-227.
- Tillier, S., G. V. Jackson , and R. Macfarlane .1995. Giant African snail. Rev. Agric. Entomol., 85 (5): 457.
- Wouters, L. 1970. Schneckenbekämpfung in oost flevoland. Pflanzen Schutz. Nachr, Bayer, 23:173-177.

استخدام طرق مختلفة لمكافحة بعض أنواع القواقع الأرضية في محافظة الشرقية - جمهورية مصر العربية

احمد عبد المجيد سالم - مصطفى النوي محروس -
مرفت حسن إبراهيم - السيد محمد عبد العال

قسم وقاية النبات - كلية الزراعة - جامعة الزقازيق - جمهورية مصر العربية

تم وضع تصور لتتابع بعض من طرق مكافحة المختلفة وذلك لمكافحة قوقع الحدائق البني *Eobania vermiculata* Müller وقوقع البرسيم الزجاجي *Monacha cartusiana* Müller وذلك في أحد بستين الفاكهة والمزرع بأشجار السبرتقال بسرة والمصالب بشدة بكل النوعين وذلك في قرية أشخاص بمركز بليس محافظة الشرقية في الفترة الممتدة من شهر يناير إلى شهر يوليو عام ٢٠٠٤م حيث بدء تنفيذ البرنامج بعملية الحرث كإحدى طرق مكافحة الميكانيكية وذلك خلال فترة وضع البيض في شهري يناير وفبراير حيث أسفرت النتائج عن انخفاض ملحوظ في تعداد أفراد كلا النوعين مسجلة انخفاضاً في التعداد بمتوسط مقداره ٥٢,٣ و ٤٣,٣ % لكلا من قوقع الحدائق البني وقوقع البرسيم الزجاجي على الترتيب وذلك بعد ستة أسابيع من المعاملة مع ملاحظة تقليل أعداد كتل البيض أو تدميرها.

يلي ذلك الخطوة الثانية بزراعة مصائد نباتية من نباتات الخس كإحدى طرق مكافحة الزراعية حيث جذبت أفراد القواقع بعيداً عن أشجار الفاكهة في شهري فبراير ومارس وأظهرت انخفاضاً ملحوظاً في تعداد الأفراد مسجلة بذلك أعلى نسبة انخفاض في متوسط تعداد الأفراد مقدارها ٥٠,٤ و ٥٦,١ % لكلا من قوقع الحدائق البني وقوقع البرسيم الزجاجي على الترتيب وذلك بعد ستة أسابيع من عملية الزراعة.

يلي ذلك الخطوة الثالثة وتشمل تطبيق مكافحة الكيماوية وذلك خلال شهر أبريل حيث النشاط المتردد للأفراد وقد سجل أعلى متوسط نسبة انخفاض بعد ١٥ يوم من المعاملة بطريقة الطعوم السامة مع كلا من مبيد الميثوميل والجليفوزات مسجلة بذلك نسبة انخفاض في التعداد مقدارها ٦١,٣٥ و ٥٢,٧٠ ، ٦٧,٢٥ و ٥٧,٥٥ % لكلا من قوقع الحدائق البني وقوقع البرسيم الزجاجي على الترتيب.

وأخيراً ينتهي البرنامج بعملية الجمع اليدوي كإحدى طرق مكافحة الميكانيكية وذلك خلال شهري يونية و يوليو حيث تتواجد الأفراد في البيات الصيفي وذلك بجمعها من أماكن البيات والتي تم تحديدها مسبقاً وخاصة عند قواعد الأشجار وأظهرت هذه الطريقة انخفاضاً معنوياً ملحوظاً في تعداد الأفراد لكلا النوعين مسجلة بذلك نسبة انخفاض مقدارها ٤٠,٥ و ٣٥,٤ % لكلا من قوقع الحدائق البني وقوقع البرسيم الزجاجي على الترتيب.