

UTILIZATION OF SOME MECHANICAL AND
CULTURAL CONTROL MEASURES
AGAINST TERRESTERIAL
SNAILS

El-Deeb, H.I*; A.K.Sobeiha**, Maha.M. Fouad* and
Fawkyia, D.A.Asran*

*Harmful Animal Research Dept., Plant Protection Res.Inst.,
Agric.Res .Center, Dokki – Egypt.

** Faculty of Agric., Ain Shams Univ, Egypt.

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ABSTRACT : The performance of some plant traps ,tillage process and hand collection on population reduction of two species of land snails namely *Eobania vermiculata* and *Monacha obstructa* under semi - field conditions was studied throughout the present study .The tested plants used as traps i.e., lettuce , cabbage, broad bean and sweet potato, nearly abated the snail population of both species to the half number. Lettuce plants proved to be the most attractive to land snails compared with the other plant traps ,followed by cabbage and broad bean ,while sweet potato was the least one . The efficacy of tillage process as cultural control method is dependent on land snail species and period after tillage. It was more effective against *M. obstructa* than *E. vermiculata* with reduction percentages in population density, two months after tillage , reaching to 86.96 & 73.91 %, respectively. Hand collection of the two land snails was an efficient practice as cultural control measure with reduction percentages of 61.54 & 72.6 %, three months after treatment, for *E. vermiculata* and *M. obstructa*, respectively.

Key words : Mechanical and cultural control, terrestrial snails, *Eobania vermiculata* and *Monacha obstructa*

INTRODUCTION implementation of novel and environmentally safe approaches in pest management. To achieve this goal, the factors considered were plant traps ,tillage and hand collection processes on two land snails population under semi-field conditions .

In recent years, in Egypt, the great damage of mollusca to many agricultural and horticultural crops has become increasingly apparent over the last four decades. This attracted the attention of many researchers in Egypt. Kassab and Daoud (1964) initiated the interest in this field of study, after that very few work was done by Bishara *et al.* (1968) and El-Okda (1979, 1980 & 1984); Nakhla *et al.*, 1993 ; El-Deeb *et al.*, 1996 & 1999). Until now, these pests were mostly controlled chemically by using molluscicides or insecticides (Crowell, 1967; Goden,1983 and Baker, 1988). These chemical compounds are giving rise to insure chemical residues in foods and fruits and general environmental contamination (Ghamry, 1994); hazards to human, animal, and plants; and high toxicity to natural enemies. Referring to the problems due to the wide and unwise use of pesticides; therefore, it has been universally agreed that best possible method for controlling these harmful snails, is integrated pest management which is important and essential to avoid and/or minimize the problem size (Goden, 1983; Ghamry, 1997;). Azzam, Karima, 1995 and El-Masry, 1997

The present study aimed to throw light on the evaluation and

MATERIALS AND METHODS

Experiments were carried out under semi-field conditions at Plant Protection Research Institute, Dokki, Giza governorate, to clarify the performance of chosen cultural control (plant traps and tillage process) and mechanical (hand collection process) methods as a part of integrated snail management (ISM) of *Eobania vermiculata* and *Monacha obstructa* in Egyptian clover (*Trifolium alexandrinum*) .

1- Effect of plant traps :

Four plant traps were tested; *i.e.* lettuce (*Lactuca sativa*), cabbage (*Brassica oleracea*), broad bean (*Vicia faba*) and potatoes (*Ipomoea batatas*). For each plant trap, a plot (5 x 5 m) was prepared and cultivated with Egyptian clover surrounded with two rows of the candidate trap

plant. Another plot was cultivated with Egyptian clover only as a check for comparison. After the complete germination of both Egyptian clover and associated trap plant, one hundred individuals of healthy adult snails of nearly equal shell diameter were introduced if each plot tested snail species were released in the center of the plot and left for one month. The snails were starved for 24 hours before releasing in the plot. Thereafter, the numbers of snails were counted one time per a month in the early morning on both clover and associated trap plant until harvesting, in quadrat sample (25 x 25 cm²) according to Staikou and Lazaridou - Dimitriadou (1990) Three replicates were used for each treatment. The ratio of attractions of the snail was estimated and data were subjected to statistical analysis using Duncan's multiple range test.(Duncan,1955).

2- Efficacy of tillage process :

In this respect, three plots (5 x 5m²) were subjected to tillage process (before cultivation) and the fourth was left without tillage as untreated check. Three replicates were used for each treatment. The population of snails were assessed in the early morning (El-Okda, 1980), one month after the complet germination in

quadrat sample (25 x 25 cm²) (Staikou and Lazaridou-Dimitriadou 1990), then continued monthly until harvesting. All snails found on plants or on soil surface were counted. The percent reduction in population density of the two land snails species was calculated by using Henderson and Tilton formula (1955).

3- Effect of hand collection :

Five heavy infested plots (2 x 1 m²) planted with Egyptian clover were chosen. Snails were handly collected according to El-Okda *et al* (1990), one month after planting during early morning. All snails found on plants or on soil surface were counted (El-Okda, 1980). Counted snails were removed from four plots. In the remained plot, the snails were counted and left in their initial places (Baker, 1988). This process was repeated two times/month. The final snail numbers were counted at the end of the trial in the five plots . The reduction in snail population was calculated by using Henderson and Tilton formula (1955).

RESULTS AND DISCUSSION

1- Effect of some plant traps :-

Table (1) : Effect of tested plant traps on *Eobania vermiculata* infestation in Egyptian clover, under semi- field conditions.

Average number of snails on Egyptian clover and plant traps													
Months	Clover	Lettuce	% Ratio of attra- ction	clover	cabbage	% Ratio of attra- ction	Clover	Broad bean	% Ratio of attra- ction	Clover	Sweet potato	% Ratio of attra- ction	Clover without traps
Jan.	2	5	71.5	2	4	66.7	3	4	57.14	3.0	0.0	0.0	6.0
Feb.	3	6	66.67	4	6	60.0	4	5	55.56	5.0	2.0	28.57	9.0
Mar.	5	11	68.75	5	9	64.29	5	8	63.63	6.0	3.0	33.3	11.0
Apr.	5	13	72.22	5	10	66.67	6	11	64.70	7.0	4.0	36.36	13.0
May	2	6	75.0	2	5	71.42	2	4	66.67	3.0	2.0	40.0	7.0
Mean	3.4	8.2		3.6	6.8		4.0	6.4		4.8	2.2		9.2

Table (2) : Effect of tested plant traps on *Monacha obstructa* infestation in Egyptian clover, under semi- field conditions.

Months	Average number of snails on Egyptian clover and plant traps												
	Clover	Lettuce	% Ratio of attra- ction	clover	cabbage	% Ratio of attra- ction	Clover	Broad bean	% Ratio of attra- ction	Clover	Sweet potato	% Ratio of attra- ction	Clover without traps
Jan.	2	4	66.7	2	4	66.7	3	4	57.14	4.0	0.0	0.0	8.0
Feb.	4	7	63.63	4	6	60.0	4	5	55.6	5	1	16.67	10.0
Mar.	5	10	66.7	5	9	64.29	5	7	58.33	7	2	22.22	12.0
Apr.	5	11	68.75	6	10	62.5	7	12	63.17	8	3	27.27	15.0
May	2	4	66.67	2	3	60.0	2	3	60	3	1	25.0	7.0
Mean	3.6	7.2		3.8	6.4		4.2	6.2		5.4	1.4		10.4

Table (3) : Effect of tillage process on population reduction of two land snail species under semi- field conditions.

Period after tillage process	Average number of snails					
	<i>Eobania vermiculata</i>			<i>Monacha obstructa</i>		
	Untilled area	Tilled area	Population reduction %	Untilled area	Tilled area	Population reduction %
One month	15	5	66.67	18	4	77.78
Two months	23	6	73.91	23	3	86.96
Three months	28	12	57.14	30	10	66.96
“ F “ test	12.9	19.30**		15.21	28.67**	
L.S.D. 0.05	5.841	2.653		4.945	2.262	

Table (4) : Effect of hand collection of snails on their population density, under semi- field conditions.

Period after tillage process	Average number of snails					
	<i>Eobania vermiculata</i>			<i>Moncha obstructa</i>		
	Untilled area	Tilled area	Population reduction %	Untilled area	Tilled area	Population reduction %
One month	15	10	33.33	22	15	31.81
Two months	35	20	42.86	45	20	55.56
Three months	65	25	61.54	73	20	72.60
" F " test	55.81***	25**		114.72***	20.59***	
L.S.D. 0.05	8.56	5.84		6.87	5.39	

Data in Tables (1 & 2) illustrated the effect of four plant traps on *E. vermiculata* and *M. obstructa* infestation in Egyptian clover fields when surrounded with tested plant traps. It is clear that planting these plant traps diminished the numbers of snails on clover as from 9.2 individuals as average of *E. vermiculata* when Egyptian clover cultivated alone to 3.4, 3.6, 4.0 and 4.8 individuals as average /sample when clover plants were surrounded with lettuce, cabbage, broad bean and sweet potato, respectively, (Table, 1). It is evident to notice that lettuce plants showed more attraction to snails when compared with the other plant traps. The ratio of attraction reached 71.5, 66.7, 57.14 and 0.0 % one month after planting, while showing 75.0, 71.42, 66.67 and 40.0 % attraction after four months, for lettuce, cabbage, broad bean and sweet potato, respectively.

The same trend was noticed when these plant traps were used for *M. obstructa*, (Table 2). The average number of snails decreased from 10.4 individual as average sample when clover was planted alone, to 3.6, 3.8, 4.2 and 5.4 individuals when surrounded with lettuce, cabbage, broad bean and sweet potato, respectively. The percent of attraction reached 66.7, 66.7, 57.14

& 0.0 one month after plantation, compared with 66.67, 60.00 and 25.00 % after four months. Thus, lettuce was the more attractive plant (66.67 %) when used as a trap, while sweet potato exhibited the least attractive one 25 %.

Statistical analysis of the data revealed a significant difference between the collected numbers of snails among the tested plant traps and the Egyptian clover.

Generally, it is obvious that all tested plants, used as traps, nearly abated the snail population on clover plants to the half either with *E. vermiculata* or *M. obstructa*. The results are in agreement with the findings of Arafa (1997) who showed that the lettuce fresh leaves were more preferable to *Monacha* sp. followed by cabbage. Also, agree with EL-Deeb *et al* (1999) and Shahawy, Wafaa (1998).

2 - Effect of tillage process :-

Data in Table (3) showed considerable variation in snail number of each species during the different investigated periods. Tillage process drastically reduced the snail population to 66.67 & 77.78 % one month after process for *E. vermiculata* and *M. obstructa*, respectively. This reduction in snail

population reached the maximum of 73.91 & 86.96 % after two months, then decreased to 57.14 & 66.67 % three months after tillage for the two species, respectively.

Generally, it is clear that efficacy of tillage as a cultural control method is dependent on land snail species and period after tillage. It was more effective against *M. obstructa* than *E. vermiculata*, showing 77.78 & 66.67, 86.96 & 73.91 and 66.67 & 57.14 % reduction after one, two, three months from treatment respectively. Statistical analysis of the data showed significant difference between most of the used treatments. As conclusion, the tillage process proved the simplest and effective method for reducing the number of individuals of the two land snail species before and after planting the target crops. These results are in harmony with those obtained by Wouters (1970) who mentioned that rough ploughing of the soil before sowing seeds of winter wheat protected seeds from damage caused by land snails. El-Masry (1997) mentioned that the ploughing process decreased the population of *Helicella vestalis* immediately after one day.

areas their numbers appeared again and gradually increased to reach 65.0 and 25.0 individuals of *E. vermiculata* in 25 x 25 cm² in uncleaned and cleaned areas with population reduction of 61.54%. Also, the same trend was observed in clover areas infested with *M. obstructa*. Snail numbers reached 73.0 and 20.0 individuals in 25 x 25 cm² with population reduction of 72.6 %. It is concluded that hand collection of the two land snails species, proved to be efficient practice as cultural control. It is a useful and simple process for controlling the snails, in the small area such as garden or greenhouse.

These results agree with those reported by Goden (1983) and El-Okda (1990). In India, Shah (1992) reported that collecting and destroying the land snail *Acatina fulica* especially during aestivation between January and April gave good control and reduced its population density.

3- Effect of hand collection : -

Data in Table (4) indicated that after the complete collection of snails from the two infested clover

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استخدام بعض الطرق الميكانيكية والزراعية فى مكافحة نوعين من القواقع الأرضية

حسن ابراهيم الديب*، أمجد كامل صبيحة**، مها فؤاد محمود*، فوقية ضوى عسران*

* معهد بحوث وقاية النباتات-مركز البحوث الزراعية ، الدقى - مصر .

** كلية الزراعة - جامعة عين شمس . شبرا - مصر .

أجريت هذه الدراسة بهدف تقييم بعض الطرق الآمنة بيئياً فى مكافحة القواقع الأرضية دون إحداث خلل فى التوازن البيئى...وقد أسفرت الدراسة عن النتائج التالية :-
تم زراعة بعض النباتات مثل الخس والكرنب والفول والبطاطا حول نبات البرسيم تحت الظروف شبه الحقلية وذلك لدراسة تأثير هذه النباتات كمصائد للقواقع لتقليل التعداد والإصابة بقوقع الحدائق البنى ذو الشفة *E. vermiculata* وقوقع البرسيم الزجاجى *M. obstructa* فى زراعات البرسيم. أوضحت النتائج أن الخس كان أفضل المصائد فى جذب أعداد القواقع وتقليل نسب الإصابة، يليه الكرنب ثم الفول وكانت البطاطا أقل العوائل جذبا للقواقع. إتضح أن زراعة هذه النباتات كمصائد حول البرسيم أدت إلى إنخفاض تعداد القواقع إلى النصف بالمقارنة بزراعة البرسيم بدون مصائد.

أوضحت النتائج أن عملية العزيق كانت من العمليات الزراعية البسيطة التى لها دور كبير فى خفض تعداد القواقع وبالتالي إنخفاض الإصابة. حيث وصلت نسبة الخفض فى التعداد إلى ٧٣,٩١، ٨٦,٩٦ % بعد شهرين من الزراعة لكل من قوقع الحدائق البنى ذو الشفة *E. vermiculata* وقوقع البرسيم الزجاجى *M. obstructa* على التوالي.

أوضحت النتائج أن عملية جمع القواقع باليد لعبت دوراً فى تقليل التعداد حيث كانت نسبة الإنخفاض فى التعداد ٦١,٥٤، ٧٢,٠٦ % بالنسبة لقوقع الحدائق البنى ذو الشفة *E. vermiculata* والبرسيم الزجاجى *M. obstructa* على التوالي وذلك بعد ٣ شهور.