Zagazig J. Agric. Res., Vol. 36 No. (1) 2009 185 - 194

EFFECT OF TILLAGE PROCESS ON SOME BIOLOGICAL AND ECOLOGICAL ASPECTS OF LAND SNAIL *EOBANIA VERMICULATA* (MüLLER)

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Accepted 13/1/2009

ABSTRACT: **The present work was carried out under semi-field conditions to study the efficacy of tillage process on some biological aspects, growth and population density of the land snail, *Eobania vermiculata* (Müller) in lettuce plots in El-Qanater district at Qualyobiya Governorate during the egg laying period from October 2007 to March 2008. Tillage process of the soil can lead directly to some biological and ecological aspects which affect the entire fecundity pattern as a result of the reduced vitality of the snail individuals. Snail fecundity was highest in untreated area (mean number of clutches was 17.2 and 110.5 eggs/ clutch after six months) compared to 7.2 clutches and 69.2 eggs /clutch in treated area. It was observed that egg clutches laid deeper in treated area (4.2 cm) than in untreated area (2.7 cm). Also, mean hatching percentage of eggs laid in untreated area increased reaching 92.2%, while in the treated area it recorded 67.2% only. Although the effects of tillage process on incubation period was statistically insignificant. It was noticed that as the time elapsed weight and shell diameter of juveniles increased in untreated area more than in treated one. Tillage process is an effective method for reducing the numbers of the land snail *E.vermiculata*. It is clear that the number of snails was slightly increased till reached the maximum in March (3232.5 individual/plot) of untreated area as compared to populations density in the same monti (218.33 individual /plot) of treated area.**

Key words: **Tillage process, biology and ecology, *Eobania vermiculata*.**

INTRODUCTION

Recently, the terrestrial snails has been become one of the most dangerous agricultural pests in different localities of Egypt, particularly in coastal areas due to high humidity. These animal pests cause a considerable damage to the majority of vegetables, fruit crops, field crops and ornamental plants. So, that pests have become known for most of the Egyptian farmers because of the damage they cause to the crops (Baker, 1991).

Until now, these pests were mostly controlled chemically by using molluscicides or insecticides (Crowell, 1967; Godan, 1983 and Baker, 1989). These chemical compounds are giving rise to insure chemical residues in foods and fruits as well as general environmental contaminations (Ghamry, 1994); hazards to human, animals, 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 (Ghamry, 1997; Azzam, 1995 and El-Masry, 1997).

The present investigation aimed to clarify the possibility of the role played by tillage process on some biological aspects, growth and population density of the land snail *Eobania vermiculata* (Müller).

MATERIALS AND METHODS

This experiment was carried out under semi- field conditions, to study the efficacy of tillage process on some biological aspects, growth pattern and population density of the land snail *Eobania vermiculata* (Müller) on lettuce plants in El-Qanater district at Qualyobiya Governorate during the egg laying period from October 2007 to March 2008.

In this respect, six plots (3x3m) were prepared and cultivated with lettuce plant. Three plots were subjected to tillage process before cultivation (15 September 2007), the another three plots were left without tillage (El Deeb *et al.*, 2003). All the plots were shielded by a cage (3.5x3.5x2m) covered with plastic screen to avoid escaping of snails (Jyoti Mahobe, 1991).

Forty adult snails of *E. vermiculata* of equal shell size were placed in the center between the plots of each cage after marking with white paint (Ismail, 1997). Snails were collected from highly infested lettuce plants in El- Qanater district.

Effect of Tillage Process on Some Biological Aspects

The eggs were left in the holes to avoid damage. These holes of egg- deposition were prepared after 10 hours of copulation. During this time the snail was relatively conspicuous as the shell remained visible at the surface of the nest. At that time it was covered with wired boxes (30x30x30cm) until hatching. Soil under cages was examined carefully and number of clutches and eggs in each plot were counted during the breeding season as well as percent of hatching, incubation period and depth of clutches were recoded (Griglione, 1990 and Asran, 2001).

Effect of Tillage Process on Snail Growth

The hatchling weight and shell diameter of each one was measured monthly until March 2008 (Baur, 1988 a,b,c).

Effect of Tillage Process on Population Density

All juveniles (new hatch) found on plants or on soil surface in the cages were counted once every month in the early morning (Awad and Fouad, 2007). The increase percentage in snail population was calculated using the following formula.

$$\%\text{Reduction} = \frac{\text{untreated} - \text{treated}}{\text{untreated}} \times 100$$

All data were analyzed using F test and the least significant differences between treatments were calculated.

RESULTS AND DISCUSSION

Effect of Tillage Process on Some Biological Aspects of *E. vermiculata* Snail under Semi-Field Conditions

Data in Table 1 revealed that snails of *E. vermiculata* laid clutches during six months started from October 2007 to March 2008.

Number of clutches and number of eggs per plot were changed during the investigated period. Tillage process reduced the number of clutches. Mean number of clutches after six months was 7.2 clutches, and mean number of

Table 1. Effect of tillage process on some biological aspects of snail *E.vermiculata* under semi-field conditions during the period from October 2007 to March 2008

Months	No. of clutches/plot		No. of eggs/clutch		Depth of egg laying (cm)		Hatchability %		Incubation period(days)	
	Untreated area	Treated area	Untreated area	Treated area	Untreated area	Treated area	Untreated area	Treated area	Untreated area	Treated area
October	14.6	5.0	104.0	56.5	2.3	3.8	88.3	61.2	17.6	17.9
November	19.2	5.6	111.3	66.3	2.5	4.2	93.7	69.2	16.2	17.2
December	22.5	8.3	116.9	76.2	3.1	4.5	98.6	73.6	16.3	16.5
January	24.2	11.6	120.0	84.0	3.2	4.8	98.2	76.5	16.9	17.0
February	13.6	8.8	114.2	79.5	2.9	4.1	91.3	69.2	17.3	17.3
March	9.1	3.9	96.5	52.9	2.4	4.0	82.9	53.4	17.2	17.5
Mean	17.2	7.2	110.5	69.2	2.7	4.2	92.2	67.2	16.9	17.3
"F" value	14.43		42.78		48.68		34.28		ns	
L.S.D 0.5	5.86		14.05		0.479		9.51			

egg/ clutch was 69.2 eggs in treated area. At the same time mean number of clutches and eggs increased to 17.2 clutches and 110.5 egg/clutch in the untreated area. The highest number of clutches and eggs (24.2 clutches and 120 eggs/clutch) was recorded for snail in January in untreated area compared to 11.6 clutch and 84.0 eggs/clutch in treated area, while the number of clutches and eggs were relatively low during March in treated area (3.9 clutches and 52.9 eggs) compared to 9.1 clutches and 96.5 egg /clutch in untreated area.

It is clear from the above mentioned data that the tillage process is an effective method for reducing the number of clutches and eggs of the land snail.

Data given in Table 1 recorded that the mean depth of egg laying in soil (cm) by the land snail *E. vermiculata* varied according to the tillage process under semi- field conditions. It was observed that egg clutches laid deeper in treated area (4.2cm) than in untreated once (2.7cm).

Also, the effect of tillage process on percentage of egg hatching and incubation period was studied under semi-field conditions. Mean hatching percentage of eggs laid in untreated area increased till reached 92.2 %, while that of treated area recorded 67.2% only after six months, it had approximately similar values (98.6 and 98.2%) in December and January of untreated area, while it was 73.6 and 76.5% in the same months of treated area. Hatching was affected significantly by tillage process. From data, it was found that tillage process played great role on reducing hatching since, it was decreased from month to another in treated area. The lowest one was recorded in March (53.4%) in treated area, although the effects of tillage process on incubation period was statistically insignificant. In case of treated area, mean of incubation period was 17.3 days and shortened to 16.9 days in untreated area.

Effect of Tillage Process on Growth of *E. vermiculata*

The effect of tillage process on growth of *E. vermiculata* as indicated by snail weight and shell diameter was investigated during the period from October 2007 to March 2008 under semi-field conditions.

Data in Table 2 showed that the growth pattern was significant with both untreated and treated areas.

Weight and shell diameter of hatchlings were gradually increased in November (1.9 mg, (3.5mm) and 0.7mg, (2.6mm) of untreated area and treated area, respectively) and the maximum weight and shell diameter were 28.4 mg, (13.9 mm) and 17.3 mg, (12.2 mm) with frequencies of March of untreated area and treated area, respectively.

It was noticed that as the time elapsed weight and shell diameter of juveniles increased in untreated area more than in treated one.

Effect of Tillage Process on Population Density of *E. vermiculata*

Date presented in Table 3 showed that the untreated area favor movement of snails below the plant surface. Tillage process had unfavorable effect on population growth, it is clear that the number of snails slightly increased till reached the maximum numbers in March (3232.5 individuals) on lettuce plants of untreated area as compared to populations density in the same month (342.0 individuals) of treated area. The rate of increased population density was significantly affected by tillage process. The highest value was detected in March, February and January (89.42, 88.84 and 88.2%, respectively), while this rate was slightly decreased in December, November and October (83.33, 79.47 and 72.98%, respectively).

Discussing the foregoing results, it could be concluded that the tillage process influences the activity of snails. In untreated area, the decrease in temperature of soil together with the rise in humidity stimulate feeding, locomotion and egg laying habits. While in treated area, the snail congregate inside the heads of lettuce escaping from the high temperature and become inactive.

These results are in agreement with the finding of Arafa (1997) who studied the effect of food type on weight of *Monacha* sp. at monthly intervals. He found that the highest values of weight increment were recorded during spring months and leaves of sweet peas gave the highest weight average /month followed by lettuce while cabbage leaves gave the lowest values. El-Masry (1997) mentioned that ploughing process decreased the population of *Helicella vestalis* immediately after one day.

Table 2. Effect of tillage process on growth pattern of *E. vermiculata* as indicated by weight and shell diameter under semi- field conditions

Months	Untreated area		Treated area	
	Weight (mg)	Shell diameter (mm)	Weight (mg)	Shell diameter (mm)
October	0.4	2.1	0.4	1.6
November	1.9	3.5	0.7	2.6
December	10.2	6.2	3.4	4.8
January	15.6	9.0	8.2	6.5
February	22.3	11.6	12.6	7.9
March	28.4	13.9	17.3	9.0
Mean	13.13	7.72	7.1	5.4
"F" value	85.30	18.16	71.82	15.87
$L.S.D_{0.5}$	7.53	3.21	6.62	3.02

Table 3. Effect of tillage process on population density of *E. vermiculata* under semi -field conditions

Months	Number of snails /plot		
	Untreated area	Treated area	Rate of reduction %
October	378.5	102.6	72.89
November	746.2	153.2	79.47
December	1132.0	189.6	83.25
January	1968.7	232.3	88.20
February	2602.2	290.3	88.84
March	3232.5	342.0	89.42
Mean	1676.68	218.33	
"F" value	10.21		
L.S.D 0.5	1016.95		

El –Deeb *et al.* (2003) reported that the tillage process proved the simplest and most effective method for reducing the number of individuals of Eobania vermiculata and *Monacha obstructa* before and after planting the target crops.

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تأثير عملية الحرث على بعض الظواهر البيولوجية والبيئية لقوقع الحدائق البني *Eobaina vermiculata*

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تمت هذه الدراسة تحت الظروف شبه الحقلية في مساحات ٣×٣م مزروعة بـالخس لمعرفة تأثير عملية الحرث على: إنتاجية القوقع من البيض: كان لعملية الحـرث تـأثير مباشر ومعنوي على إنتاجية القوقع من كتل البيض حيث وصل إلى١٧,٢ كتلـة/ معاملـة، وكان متوسط عدد البيض في كل كتلة ١١٠,٥ بيضة/كتلة بعد ٦ شهور من بداية التجربـة في حالة القطع التجريبية التي لم يتم بها عملية الحرث وكانت ٧,٢ كتلـة بمتوسـط ٦٩,٢ بيضة/ كتلة في حالة القطع التجريبية التي تم بها عملية الحـرث. عمق كتلة البيض فـي التربة: وضعت القواقع البيض على أعماق كبيرة وصت إلى ٤,٢سم في حالـة المسـاحات التي تم بها الحرث وقلت إلى ٢,٧سم في المساحات التي لم يجر بها الحرث. نسبة فقـس البيض: وجد أن لعملية الحرث تأثير كبير على نسبة فقس البيض حيث كانت٩٢,٢% فـي حالة المعاملة التي لم يتم بها الحرث وكانت ٦٧,٢% في المعاملة التي تم بهـا الحـرث. فترة حضانة البيض: لم تتأثر كثيراً فترة حضانة البيض بعملية الحرث حيث لا توجد فروق معنوية بين فترة الحضانة في القطع التجريبية التي تم بها الحرث والتي لم يتم بها الحرث. وزن الجسم وقطر الصدفة: أوضحت النتائج أن وزن الجسم وقطر الصدفة يتـأثر بعمليـة الحرث وكان معدل الزيادة يزداد تدريجيا إلى أن وصل وزن الجسـم إلـى ٢٨,٤ مليجـرام وقطر الصدفة ١٣,٩مم في المساحات التي لم يجر بها عملية الحرث وكانت١٧,٣ مليجـرم و٩,٥مم في القطع التجريبية التي تم بها عملية الحرث وذلك بعد ٦ شهور من الفقس.

الكثافة العددية: أوضحت النتائج أن لعملية الحرث دور كبير في خفض تعداد القوقع حيث زاد تعداد القواقع في المساحات التي لم يتم بها الحرث بكميات كبيرة إلـى أن وصـل ٣٢٣٢,٥ قوقع/ معاملة بعد ٦ شهور من بداية التجربة بالمقارنـة بـ ٢١٨,٣٣ قوقـع/ معاملة في القطع التجريبية التي تم بها الحرث.

مما يدل على أهمية الدور التي تلعبه عملية الحرث في خفض إنتاجية وتعداد قوقع الحدائق البني.