

POPULATION DENSITY OF CERTAIN LAND SNAIL AND SLUG SPECIES AND THEIR DAMAGE TO SOME FIELDS AND VEGETABLE CROPS

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Abstract

The population density and damage percentages of the land snail *Succinea Putris* and *Succinea elgans* and land slug *Limax maximus* and *Deroceras reticulatum* were estimated to some fields and vegetable crops at Dumyat governorate during 2004 to 2006.

The results showed that the lowest population densities were recorded in October, November and December on clover , wheat, lettuce, cabbage and potato, while the population of the four snail and slug species increased gradually in January, February and March. The highest figures of the population density of the tested snails and slugs was observed during April and May due to the suitable climatic conditions (temperature 18.7 to 20.6 °C & relative humidity 50.7-51.3%) during this period. Also, the damage of both snail and slug for cabbage, lettuce, clover and wheat after three months from date of the plantation was more than in the second month and was lowest at the first month.

INTRODUCTION

In recent years, the land molluscs has become one of the serious pests in most of world countries especially those with moist or rainy climate. They are essentially vegeterian and feed on a wide variety of plant materials both wild and cultivated including field crops , vegetable and fruit crops as well as ornamental plants (Baur and Baur, 1993). About 128.000 species of living mollusca were estimated and those include approximately 12.000 species of pulmonata, both Basmatophora and Stylomatophora (Ismail, 1997).

Land snails attack raw succulent vegetable and favorite soggy parts. Nature of damage is manifested by chewing soft vegetative growth, flowers and fruit, besides eating roots and tubers after sowing or during ripening stages. Furthermore, the fruit quality and flower beauty are reduced and got poorer marketing ratings (El – Masry, 1997 and El - Deeb , *et al* 1999). The snails *Succinea putris* and *S. elgans* and slugs *Limax maximus* and *Deroceras reticulatum* are the most dominant species at Dumyat governorate especially in field and on vegetable crops. These species of snails and slugs chiefly inhabit the rich places with damp soil as in gardens and orchards. They prefer areas covered with crops or the grassy ground (Baker and Hawke , 1990 , Drake and Arias, 1995).

The present work was carried out in Dumyat governorate to throw light on population density and damage percentage of land snails *S. putris* and *S. elgans* and slugs *L. maximum* and *D. reticulatum* to certain field and vegetable crops.

MATERIALS AND METHODS

1- Population density of Mollusca on certain plants at Dumyat governorate

The population density of the predominant gastropods species were estimated at Faraskour and Kafr saad districts, Dumyat governorate, throughout the experimental period (November 2004 - October 2006) for certain field crops such as clover , wheat and vegetable crops such as lettuce, cabbage and potato . An area of about one feddan was selected for each crop. Ten replicates of quadrature sample size (1×2m²) from each field and vegetable crops were randomly chosen, then left far from any pesticide contamination. (Fawkyia, 2001). All species of gastropods found within a quadrature (regardless of vegetation height) were recorded and counted in the field according to their species, the snails and the slugs were replaced where they were found. Sampling was carried out during the morning in the absence of rain and sunrise (Staikou *et al*, 1990) . Numbers of tested snails and slugs were counted one time per a month (Baker, 1988). Averages of temperature and relative humidity were recorded monthly. The obtained data were subjected to statistical analysis using F .test.

2-Mollusca damage assessment

A field trial has been conducted to estimate the damage caused by snails and slugs to cabbage, lettuce, clover and wheat after one, two and three months from the plantation. An area of about one feddan was selected for each crop. 50 replicates of quadrature sample – size (1×1m²) were cultivated with cabbage, lettuce, clover and wheat.

The replicates of quadrature sample-size (1×1m²) were inspected for three times the first time was after one month of the plantation and the others were after two and three months. The whole inspections were done at the same places. Numbers of the infested and intact plant, for each, crops were recorded. The damage percentage was calculated according to the next formula

$$\text{Damage percentage} = \frac{\text{No. of infested plants}}{\text{Total No. of inspected plants}} \times 100$$

RESULTS AND DISCUSSION

In Dumyat governorate, continuous observations in field and vegetable crops were conducted precisely to determine the most occurrence mollusca species. This primary work proved that *Succinea putris*, *Succinea elgans*, *Limax maximus* and *Deroceras reticulatum* were found on each of clover, wheat, lettuce, cabbage and potato.

1- Population density of snails and slugs

Data in Tables (1&2) reveal that , different land snail and slug species were recorded in field of each of clover , wheat, lettuce, cabbage and potato during the period of growth of each (November – May), meanwhile they appeared on potato all the year round.

S. putris, *S. elgans*, *L. maximus* and *D. reticulatum* were recorded in clover field and appeared from the beginning of cultivation. *S. putris* was inhabiting clover plants in a bigger number than the other species. The number of snails and slugs on clover plants showed a gradual increase to reach its summit during April (45.7 , 31.4 , 35.6 and 24.6 individuals for *S. putris*, *S. elgans*, *L. maximus* and *D. reticulatum* respectively) . The same species were found in a few numbers during November, December and January on clover crop as follows, 27.5 , 20.3 and 20.9 individuals for *S. putris* , 10.3, 11.7 and 18.4 individuals for *S. elgans*, 12.2 , 10.0 and 11.4 individuals for *L. maximus* and 4.8, 6.2 and 7.4 individuals for *D. reticulatum* respectively. Low values of population density during October were 21.7, 8.7, 12.7 and 3.0 individuals for the same species which mentioned before respectively. In addition the numbers of snail and slug species in wheat fields increased gradually paralleled to the plant growth stages .These numbers went to its top during April (34.7, 27.0, and 16.2 individuals) and 21.4 individual respectively.

The obtained data in the same tables showed that the four land snail and slug species, which mentioned before, were observed on lettuce and cabbage at the beginning of plantation (October) until the harvest time (May) .The population density of *S. putris* and *S. elgans* & *L. maximus* and *D. reticulatum* were, (12.5 and 12.4 individuals), (8.4 and 8.0 individuals), (11.2 and 8.8 individuals) and (7.8 and 8.4 individuals) during October. These figures increased during May on lettuce and cabbage, respectively, while it was (35.4 and 29.2 individuals), (31.7 and 26.3 individuals), (20.6 and 25.6 individuals) and (20.0 and 24.0 individuals) during April on lettuce and cabbage, respectively.

Also, the compiled data in Tables 1 and 2 added that the four tested species were recorded in different population density throughout the whole months of the year on potato plants. Concerning the occurrence of these land snail and slug species

on potato plants, all of them appeared with high density during March, April, May and June because of the low temperature during these months than the other ones. While the lowest numbers were recorded in August, September and October. The four snail and slug species reached its summit during April with 26.5, 22.4, 36.8 and 30.2 individual, for *S. putris* and *S. elgans* & *L. maximus* and *D. reticulatum* respectively.

Generally, data in Tables (1&2) cleared that the land snails *S. putris* and *S. elgans* & *L. maximus* and *D. reticulatum* showed their lowest population densities in October, November and December which may have resulted from being in dormancy while the increase in density noticed in January, February and March may have been due to the newly hatched snail and slug species entering the population. High values of density were recorded during April and May because the habitat changes due to variations in climate caused by the correlation between some environmental factors (temperature and relative humidity) and population density of snail and slug species on the above hosts, also the study area was fenced, the decline of snails and slugs population may have been caused by the dense vegetation due to the fact that April and May are the most favorable months for animals activity.

These results are in agreement with the findings of Asran- Fawkyia (2001) who mentioned that the population density of *Monacha obstructa* obviously increased during spring months (March, April and May) compared with winter and autumn months, while population decreased during summer months. Also, El- Masry (1997) found that the population dynamic of the land snail *Helicella vestalis* started with low number in January for tested crops, then increased gradually till reached the first peak in March. The second period started in July and extended till December recording its peak in September. Therefore Ismail (1997) found that the population density of *Monacha cartusiana* was obviously increased during spring months as compared to the population density during winter and autumn, while the infestation did not appear during summer months.

2- Damage caused by snails and slugs on certain field and vegetable crops

Data presented in Table (3) indicate infestation of cabbage, lettuce, clover and wheat plants with snails and slugs after one, two and three months from germination under field conditions. Damage percentages in number of samples were 28.13, 26.93, 24.60 and 20.13 % in cabbage, lettuce, clover and wheat, respectively after one month with snails, these values gradually increased after two months (62.87, 57.33, 39.53 and 24.33 %) respectively, they reached the maximum after three months (71.07, 64.60, 59.53 and 43.20%) on cabbage, lettuce, clover and wheat respectively.

Regarding damage percentages of same plants by slugs, it was noticed that damage percentages were changed from one, two and three months. It was obviously increased after three month at all plants (54.87, 49.47, 22.13 and 20.00 %) on four plants, respectively, then decreased to 34.4 , 29.93, 19.6 and 15.33% after two months and 21.47, 13.07 , 10.87 and 10.6% after one months on cabbage, lettuce, clover and wheat, respectively. Discussing the foregoing results, it could be concluded that the damage percentages were gradually increased to reach maximum values after three months from germination. The damage percentages of all tested plants increased with the snails than the slugs.

Ismail (1997) assessed the damage caused by different levels of *Monacha cartusiana* on Egyptian clover plants. The reduction in the three cuttings were 39.3, 42.3, 48.9, 52.4 and 61.4 gm when 20 plants were infested with 5 , 10 , 15 , 20 and 25 snails , respectively. The damage was greater in the third cut compared to first and second ones.

Table 1. Population density of *Succinea putris* and *Succinea elgans* infesting certain field and vegetable crops at Dumyat governorate throughout two successive years (November 2004- October 2006).

Months	Average number of snails / sample										Mean Temp. °C	Mean R.H %
	Field crops				Vegetable crops							
	Clover		Wheat		Lettuce		Cabbage		Potato			
	<i>S. putris</i>	<i>S. elgans</i>	<i>S. putris</i>	<i>S. elgans</i>	<i>S. putris</i>	<i>S. elgans</i>	<i>S. putris</i>	<i>S. elgans</i>	<i>S. putris</i>	<i>S. elgans</i>		
November	27.5	10.3	-	-	20.4	15.0	22.0	17.7	23.7	15.0	18.8	48.1
December	20.3	11.7	11.3	8.8	13.2	11.9	13.0	13.3	11.0	10.5	15.2	50.2
January	20.9	18.4	12.7	12.9	14.8	13.3	13.7	12.4	13.4	12.0	12.7	53.0
February	32.0	18.5	23.3	18.0	25.4	21.3	21.9	19.5	16.3	15.5	12.8	52.2
March	41.0	23.0	29.3	21.4	33.7	26.3	25.7	24.0	20.7	19.5	14.0	51.0
April	45.7	31.4	34.7	27.0	35.4	31.7	29.2	26.3	26.5	22.4	18.7	50.7
May	43.7	21.0	32.2	21.2	22.7	25.2	20.7	19.7	24.2	20.9	20.6	51.3
June	-	-	-	-	-	-	-	-	17.5	17.4	26.0	52.0
July	-	-	-	-	-	-	-	-	13.2	11.7	28.0	58.0
August	-	-	-	-	-	-	-	-	12.4	9.4	27.9	56.0
September	-	-	-	-	-	-	-	-	11.4	9.1	26.2	54.0
October	21.7	8.7	-	-	12.5	8.4	12.4	8.0	13.7	9.0	25.2	52.0
Total	252.8	143.0	143.5	109.3	178.1	153.1	158.6	140.9	204.0	172.4		
Mean	31.60	17.88	23.92	18.22	22.26	19.14	19.83	17.61	17.0	14.37		
L.S.D 0.5	2.86	3.88	1.78	1.84	2.71	3.32	2.18	2.92	2.45	2.57		

Table 2. Population density of *Limax maximus* and *Deroceras reticulatum* infesting certain field and vegetable crops at Dumyat governorate throughout two successive year (November 2004 - October 2006).

Months	Average number of slugs / sample										Mean	Mean %
	Field crops				Vegetable crops							
	Clover		Wheat		Lettuce		Cabbage		Potato			
	<i>L.maximus</i>	<i>D.reticulatum</i>	<i>L.maximus</i>	<i>D.reticulatum</i>	<i>L.maximus</i>	<i>D.reticulatum</i>	<i>L.maximus</i>	<i>D.reticulatum</i>	<i>L.maximus</i>	<i>D.reticulatum</i>		
November	12.2	4.8	-	-	15.4	9.8	17.2	14.8	17.6	13.6	18.2	48.6
December	10.0	6.2	5.4	4.4	14.2	9.2	16.8	13.0	19.8	10.4	15.3	50.5
January	11.4	7.4	6.8	5.4	15.0	10.2	20.8	16.0	20.6	12.2	12.0	51.5
February	15.0	10.2	9.6	11.6	19.2	13.4	21.2	20.0	21.2	15.6	12.6	53.8
March	25.2	15.4	15.4	18.4	19.6	17.2	24.8	21.0	32.4	25.6	14.5	53.3
April	35.6	24.6	16.2	21.4	20.6	20.0	25.6	24.0	36.8	30.2	18.0	58.7
May	32.4	11.8	13.8	13.4	18.2	15.3	19.8	15.8	36.4	27.0	21.5	52.3
June	-	-	-	-	-	-	-	-	25.2	22.8	26.4	52.8
July	-	-	-	-	-	-	-	-	19.6	20.4	27.6	52.5
August	-	-	-	-	-	-	-	-	13.2	12.6	27.3	51.5
September	-	-	-	-	-	-	10.8	-	10.0	7.2	25.1	51.0
October	12.0	3.0	-	-	11.2	7.8	8.8	8.4	14.6	10.4	24.1	51.3
Total	153.8	83.4	67.2	74.6	133.4	102.9	155.0	133.0	267.4	208.0		
Mean	19.23	10.43	11.2	12.43	16.68	12.86	17.22	14.78	22.28	17.33		
L.S.D 0.5	2.93	1.48	1.71	1.55	2.16	1.57	2.50	1.96	3.19	2.17		

Table 3. Damage percentages by land snails and slugs on certain field and vegetable crops under field conditions at Dumyat governorate.

Plant species	Control	Damage caused by											
		Land snails						Land slugs					
		One month		Two months		Three months		One month		Two months		Three months	
		Damaged samples	Damaged %	Damaged Samples	Damaged %	Damaged Samples	Damaged %	Damaged Samples	Damaged %	Damaged Samples	Damaged %	Damaged Samples	Damaged %
Cabbage	50	14.1	28.13	31.4	62.87	35.5	71.07	10.7	21.47	17.2	34.40	27.4	54.87
Lettuce	50	13.5	26.93	28.7	57.33	32.3	64.60	6.5	13.07	14.9	29.93	24.7	49.47
Clover	50	12.3	24.60	19.8	39.53	29.8	59.53	5.4	10.87	9.8	19.60	11.1	22.13
Wheat	50	10.1	20.13	12.2	24.33	21.60	43.20	5.3	10.6	7.7	15.33	10.0	20.00
L.S.D 0.5		2.14		3.71		1.50		1.37		1.98		1.32	

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الكثافة العددية لبعض أنواع القواقع والبزاقات وتقدير الضرر الناتج عنها على بعض محاصيل الحقل والخضر

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تتعرض الحقول الزراعية في مناطق مختلفة بمحافظة دمياط للأصابة الشديدة بالقواقع والبزاقات الأرضية ومن خلال الملاحظات الأولية للبحث تأكد أن أكثر الأنواع انتشارا وتواجدا في منطقة العمل هما القوقعين *Succinea putris* و *S. elgans* بالإضافة إلى نوعين من

البزاقات وهم *Limax maximus* و *Deroceras reticulatum*

وتم تتبع الأنواع الأربعة على البرسيم والقمح والكرنب والخس والبطاطس خلال عامين متتاليين من نوفمبر ٢٠٠٤ إلى أكتوبر ٢٠٠٦. لوحظ أن أقل تعداد للقواقع والبزاقات معا يتراوح ما بين شهر أكتوبر ونوفمبر وديسمبر ويزداد التعداد تدريجيا في شهور يناير وفبراير ومارس وسجل أعلى تعداد للقواقع والبزاقات في شهر إبريل ومايو وذلك لملاءمة الظروف الجوية من حرارة ورطوبة في هذه الفترة.

ومن الناحية الأخرى فإنه تم تقدير نسبة الإصابة والضرر الناتج بسبب نفس القواقع والبزاقات السابقة بكل من الكرنب والخس والبرسيم والقمح وذلك بعد شهر وشهرين وثلاث شهور من بداية الزراعة وكانت أعلى إصابة بعد ثلاث شهور عنها بعد شهرين وكانت أقل إصابة بعد شهر من بداية الزراعة وكانت الإصابة بالقواقع أعلى منها في حالة البزاقات وذلك لزيادة قدره القواقع على تسلق النباتات عن البزاقات.