

Survey, Population Dynamics and Estimation of Damage of Common Land Snail Species on Some Vegetable Plants and Egyptian Clover at Some Regions at Kafr El-Sheikh Governorate

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ABSTRACT

Survey and population dynamics were carried out in two regions, Abu-Abdalla village, Sedi Salem District and Salait village, Quallen district at Kafr El-Sheikh Governorate during two successive seasons from 2015 to 2017 on Egyptian clover, lettuce, and cabbage. The survey revealed the existence of four species of land snails, *Monacha cantiana*, *Succinea putris*, *Theba pisana* and *Cochlicella acuta* were predominant on Egyptian clover and two vegetable crops. The population densities of these land snail species were studied on soil, stems and leaves of studied plants. The results showed that the highest population was recorded on leaves under field of vegetable plants during spring seasons except cabbage at Abu Abdalla, Sedi Salem district in 2015 and 2016. *T. pisana* presented in Lettuce and Cabbage on Abu-Abdalla village and was absent on all vegetable crops on the second village. While *M. cantiana*, *C. acuta* and *S. putris* snails were recorded with highest numbers on Egyptian clover. On the other hand, *S. putris* was in heavy infestation on lettuce and cabbage in the two regions. The damage caused by different snail species *M. cantiana* and *S. putris* was studied on Egyptian clover.

Keywords: land snails, *Monacha cantiana*, *Theba pisana*, *Succinea putris* and *Cochlicella acuta*.

INTRODUCTION

The land molluscs is one of the most important pests in all over world countries. These pests infest all growth stages of plants, so they caused yield reduction to vegetable, fruit crops and ornamental plants (Baur and Baur, 1993). They were known as destructive pests causing severe damage to vegetables and field crops that may be related to the secretion of the mucus and the particular structure of their mouth parts enabling scratching and crushing. (Ghamry *et al.* 1993, Kassab and Daud. 1964, El-Deeb *et al.* 1996, Hegab *et al.* 1999 and Mahrous *et al.* 2002). It was evident that, they have medical and veterinary importance as they are intermediate hosts to some parasitic worms infecting human and domestic animals (Godan, 1983). The herbivorous land snail species which were recorded on lettuce, cabbage and Egyptian clover. i.e. *M. cantiana*, *S. putris*, *T. pisana* and *C. acuta* which stated on vegetables and field crops at Kafr El-Sheikh Governorate. Ecological studies play an important role in determination their distribution and biology. So, the aim of present study was to detect the ecological factors that helps to design safety and successful control programs of these pests to avoid environmental chemical pollution, in addition to estimate the damage on three host plants i.e. Lettuce,; cabbage,; and Egyptian clover, caused by these species .

MATERIALS AND METHODS

1- Survey studies:

These studies of different land snail species were conducted under field conditions at Abu -Abdalla village, Sedi salem district and Salait village, Quallen district at Kafr El-Sheikh Governorate. In this respect, plantations of Egyptian clover (*Trifolium alexandrinum*) as a field crop, lettuce (*Lactuca sativa*) and cabbage (*Brassica oleracea*) as vegetable crops were chosen in these regions to estimate population density of different land snail species . monthly survey at period from September 2015 to August 2017 during two successive seasons. In each district, one feddan from each plant species was randomly chosen, 5% wetted bran baits were used as attractive bait and distributed beside and under plants before sun set as a land trap. The

snails were collected and transported to laboratory in white close bags to identified according to Godan (1983).

2- Population dynamics of certain land soil species on certain crops:

Population density of *M. cantiana*, *S. putris*, *T. pisana* and *C. acuta*. were monthly recorded at each region from September 2015 to August 2017 on lettuce, cabbage and Egyptian clover. Ten samples using the quadrat samples, each of 1m² were taken from one fadden as an experiment area and replicated three times in early morning.

3- Damage estimation of certain land snail species to Egyptian clover:

This experiment was carried out to estimate the damage caused by *M. cantiana*, *C. acuta* and *S. putris* on Egyptian clover during February, 2016. An area of (3x3m) cultivated with clover, 35-40cm in length, they were reduced to plants similar in size divided into groups each of them 30 plant were randomly chosen, each group was caged with wire box (30 cm length x 30 cm wide x 50 cm high). Soil under cages were cleaned from weeds and grass, snails and new hatching to obtain free- snail plants. An artificial infestation was induced with four levels of adult *M. cantiana*, *C. acuta* and *S. putris* (i.e 10, 15 , 20 and 25 individuals) in addition to cage was used as a check control without snails . Each treatment was replicated 3 times. One month after infestation, fresh weight of shoots (first cut) was detected. This repeated two times after one month cutting. Reduction percentage of fresh weight were calculated using the formula:

$$\text{Reduction \%} = \frac{\text{Average weight of control} - \text{Average weight of infested plants}}{\text{Average weight of control}}$$

RESULTS AND DISCUSSION

These ecological studies are very important to help us in design successful programs to protect crops from damage caused by different land snails.

Survey studies:

Although terrestrial molluscs (slugs and snails) seem poorly suited by their biology to become pests, they frequently cause problems. Land snail species infested Egyptian clover and vegetables at Abu-Abdalla village, Sedi salem district and Salait village, Quallen district at Kafr El-

Sheikh Governorate were surveyed. The data in Table (1) could be presented according to Godan (1983) as the following:

Data in Table (1) revealed that the herbivorous land snail species belonging to families, Helicidae and Succinidae which were found on different plants. These species were *M. cantiana*, *S. putris*, *T. pisana* and *C. acuta* (Muller). These species varied in level of infestation according to each locality and host type. The snail, *S. putris* was recorded in all surveyed localities, with heavy infestation on the three crops in the two localities. Generally, the listed hosts can be classified into three categories according to the degree of infestation. These were; heavy, moderate and light infestation.

The majority of the examined crops were found with heavy infestation of the three species *M. cantiana*, *S. putris* and *C. acuta* on egyptain clover in the two localities. Cabbage was infested at range from heavy to moderate at Abu-Abdalla village, Sedi Salem district. Heavy infestation

on Lettuce according to the high infestation of two species, *S. putris* and *T. pisana* in Abu-Abdalla village. The other species showed limited distribution, *T. pisana* was found on cabbage with moderate infestation in Abu-Abdalla village.

In Salait village, Quallen district, *C. acuta* was found with moderate infestation on *cabbge* and high infestation on egyptian clover fields. Heavy infestation with *S. putris* snails were found on egyptian clover and most of vegetables crops in all surveyed localities. Also, the data of the table (1) showed that absence of *T. pisana* snails in Salait village. *M. cantiana* snails were found with heavy infestation on all crops which surveyed especially egyptian clover which becomes problem to farmers and their animal. Ismail et al.(2011) found that *Monacha cartusiana* (Muller) and *S. putris* snails at Hehia and Meniet El-Kamh. Also, they reported that *M. cartusiana* was found heavy infestation on the majority of examined crops and higher density than *S. Putris* on agricultural crops and weeds.

Table 1. Survey and distribution of land snail species at different localities of Kafr El- Sheikh Governorate .

Location	Snail species	Host plant
Abu-Abdalla village	<i>Monacha cantiana</i>	<i>Brassica oleracea</i> (++)
		<i>Trifolium alexandrinum</i> (+++)
	<i>Cochlecilla acuta</i>	<i>Trifolium alexandrinum</i> (+++)
		<i>Brassica oleracea</i> (+++)
	<i>Succinea putris</i>	<i>Lactuca sativa</i> (+++)
		<i>Trifolium alexandrinum</i> (+++)
<i>Theba pisana</i>	<i>Lactuca sativa</i> (+++)	
	<i>Brassica oleracea</i> (++)	
Salait villag	<i>Monacha cantiana</i>	<i>Trifolium alexandrinum</i> (+++)
		<i>Lactuca sativa</i> (+++)
	<i>Cochlecilla acuta</i>	<i>Brassica oleracea</i> (++)
		<i>Trifolium alexandrinum</i> (+++)
	<i>Succinea putris</i>	<i>Trifolium alexandrinum</i> (+++)
		<i>Lactuca sativa</i> (+++)
<i>Theba pisana</i>	None	
(+++) Heavy infestation	(more than 30 snail/50x50cm)	
(++)Moderate infestation	(16-30 snail/50x50cm)	
(+) Light infestation	(1-15 snail/50x50cm)	

2- Population dynamics:

Data in Table (2) showed that, the tested crops were infected by all snail species and the population dynamics on lettuce, cabbage and Egyptian clover were recorded during the first season 2015-2016 at Abu Abdalla, Sedi Salem district. Results showed the total number of the snail *T. pisana* on lettuce recorded highest number 84.0 snail /m² followed by *S.putris* 68.9 snails /m². All snail species were found on lettuce from October 9.0, 5.3, 7.0 and 12.0 snail /m² for *M. cantiana*, *S. putris*, *T. pisana* and *C. acuta*. The infection continued to April to recorded 15.4, 14.0, 14.4 and 15.0 snails /m². Also, data in the same table showed the snails *M. cantiana*, *S. putris* and *T. pisana* were recorded on cabbage and infestation was started from September 14.0, 18.1 and 17.2 snail /m², respectively, then the population fluctuated to reach the maximum 15.3, 18.1 and 19.9 in April, September and October for *M. cantiana*, *S. putris* and *T. pisana*, respectively. The three species recorded the highest number during September 49.3 snail /m².

In the same table, results showed that the Egyptian clover was infected by three snail species from December

to May. The number of *M. cantiana* was the highest number 415.2 snail /m² followed by *C. acuta* which recorded 264.0 snail/m² then *S. putris* recorded 132.0 snail /m². The total number of *M. cantiana* increased to reach 151.2 snails /m² during April, while *S. putris* recorded 44.0 during March and *C. acuta* 122.0 during April. Maha and Awad (2008) concluded that the highest figures of the population density of the tested snails, *Succinea putris* and *Succinea elgans* was observed during April and May due to the suitable climatic conditions of temperature and humidity during this period which confirm these results. Also, Ismail (1997) and El-Deeb et al. (1999) reported that the highest population density values of *Monacha cartusiana* (Muller) were found during spring months as compared with the other ones. Also, Abdel-Aal (2001) indicated that the population density of *M. cartusiana* increased during spring months. In addition to, Samy et al. (2015) recorded that the highest population densities were in March and April on lettuce, cabbage and onion plantations at El-Riad and Sidi- Salem district.

Data in Table (3) showed that, *M. cantiana*, *S. putris*, *T. pisana* and *C. acuta* were recorded on lettuce and cabbage and Egyptian clover plants during all months of second season growth 2016- 2017 at Abu Abdalla, Sedi Salem district. *C. acuta* were found on lettuce and Egyptian clover only and absent in cabbage. The infection was beginning in October and December continued to end of growth season on lettuce and Egyptian clover, respectively. The snail species reached their peak during April on lettuce (76.0, 41.6, 39.0 and 16.4 snails /m²) of *M. Cantiana*, *S. Putris*, *T. pisana* and *C. acuta* respectively. Ghamry *et al.*, 1993; Arafa, 1997; Ismail, 1997; El-Masry, 1997; and Hegab *et al.* 1999 recorded that *M. cartusiana*, *Eobania vermiculata*, *C.acuta* and *Helicella Vestalis* in certain localities in Sharkia Governorate attacking field and vegetable crops, fruit trees and ornamental plants. Data obtained showed that in lettuce, the snail *M. cantiana* reached total numbers of counted snails were 188.4 during the whole season followed by *T.*

pisana 127.0 snails /m² and *S. putris* was 108.9 snails/m² while *C. acuta* was the lowest number 43.0 snail/m². In cabbage, *S.putris* snails infested the plants during the growth season with total number 124.7 snails/m² followed by *T. pisana* 112 snails/m² and *M. cantiana* 49.1 snails /m² . Peaks of *T. pisana* and *S. putris* were 32.0 and 31.0 snail /m², during March respectively, while *M. cantiana* recorded its peak during April 27.0 snails/m². In the same table data showed that *M. cantiana*, *S. putris* and *C. acuta* were found on clover from December,2016 until May,2017. The highest infestation was recorded by *M. cantiana* 616.0 snails /m² followed by *C. acuta* 273.0 snails /m² and *S. putris* 236.0 snails/ m². The highest population density of these snails was recorded during April 273.0, 77.0 and 100.0 snails /m² for *M. cantiana*, *S. putris* and *C. acuta*, respectively. The minimum was 8.0 and 3.0 snails /m² for *M. cantiana* and *S. putris* during December 2016and 5.0 snails/m² for *C. acuta* during January,2017.

Table 2. Population dynamics of species on plants at Abu Abdalla, Sedi Salem district, Kafr El-Sheikh Governorate 2015- 2016 season.

p	Average number of snail species on different crops												
	Lettuce					Cabbage				Egyptian clover			
	M	S	T	C	Total	M	S	T	Total	M	S	C	Total
Sep.	-	-	-	-	-	14.0	18.1	17.2	49.3	-	-	-	-
Oct.	9.0	5.3	7.0	12.0	33.3	13.0	16.0	19.9	48.9	-	-	-	-
Nov.	7.0	10.0	14.4	7.5	38.9	10.9	12.0	16.4	39.3	-	-	-	-
Dec.	5.0	12.0	8.0	-	25.0	-	18.0	19.0	37.0	21.0	18.0	9.0	48.0
Jan.	9.0	9.4	10.0	-	28.4	13.7	17.4	11.0	42.1	34.0	19.0	17.0	70.0
Feb.	9.5	7.2	13.0	6.0	35.7	12.0	13.0	13.0	38.0	65.0	23.0	23.0	111.0
Mar.	13.0	11.0	17.2	11.0	52.2	10.0	17.0	17.0	44.0	132.0	44.0	93.0	269.0
Apr.	15.4	14.0	14.4	15.0	58.8	15.3	12.0	12.0	39.3	151.2	28.0	122.0	301.2
May.	-	-	-	-	-	-	-	-	-	12.0	-	-	-
Jun.	-	-	-	-	-	-	-	-	-	-	-	-	-
Jul.	-	-	-	-	-	-	-	-	-	-	-	-	-
Aug.	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	67.9	68.9	84.0	51.5	272.3	88.9	123.5	125.5	337.9	415.2	132.0	264.0	811.2
Mean	5.32	5.6	7.0	4.3	220.4	5.5	10.3	10.6	28.5	36.3	11.0	22.0	95.1

M.: *Monacha cantiana* C.: *Cochlecilla acuta* T.: *Theba pisana* S.: *Succinea. putris*

Table 3. Population dynamics of snail species on different crops at Abu-Abdalla village, Sedi Salem district, Kafr El-Sheikh Governorate during 2016-2017 season.

Months	Average number of snail species on different crops/m ²												
	Lettuce					Cabbage				Egyptian clover			
	M	S	T	C	Total	M	S	T	Total	M	S	C	Total
Sept	-	-	-	-	-	2.3	5.0	6.0	13.3	-	-	-	-
Oct	4.2	4.1	9.0	2.6	19.9	6.0	7.2	8.0	21.2	-	-	-	-
Nov	8.0	7.2	13.0	5.0	33.2	5.0	10.0	9.0	24.0	-	-	-	-
Dec	12.1	9.6	11.0	-	36.6	-	8.7	7.7	16.4	8.0	3.0	7.2	18.2
Jan	13.5	12.7	15.0	4.0	45.2	7.6	12.1	14.0	33.7	29.0	14.0	5.0	48.0
Feb	34.2	13.6	13.0	9.0	69.8	9.0	24.0	25.0	58.0	79.1	45.0	39.0	163.1
Mar	40.9	20.1	27.0	9.0	97.0	12.2	31.0	32.0	75.2	118	69.0	37.0	224.9
Apr	76.0	41.6	39.0	16.4	173.0	27.0	14.0	13.0	54.0	273	77.0	100.0	450.0
May	-	-	-	-	-	-	-	-	-	108	28.0	85.0	221.0
Jun	-	-	-	-	-	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-	-	-	-
Aug.	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	188.4	108.9	127.0	43.0	474.7	49.1	124.7	112.0	285.8	616.0	236.0	273.0	1125.2
Mean	13.7	9.1	10.6	3.6	39.0	4.1	10.4	9.3	21.6	51.3	19.7	22.8	93.8

M.: *Monacha cantiana* C.: *Cochlecilla acuta* T.: *Theba pisana* S.: *Succinea. Putris*

Data in Table (4) indicated that, *M. cantiana*, *S. putris* and *T. pisana* snails were recorded on lettuce while cabbage and clover was free from *T. pisana* snails

infestation during 2015-2016 growing season. Data in table (4) showed that, the highest population of *S. putris* per 1m² was detected on lettuce with range between 9.5 snails in December to 17.1 snails /m² in November with 94.6 snails

/m² total number, followed by *T. pisana* 4.0 snails /m² in October to 20.1 snails /m² in April with 78.5 snails /m² total number and *M. cantiana* was the least ranged between 3.0 snails /m² in December and 16.0 snails/m² in April with 58.7 snails total number . On the other hand *M. cantiana*, found on cabbage with range of 12.0 snail/m² in December to 23.0 snails/m² in October and April followed by *S. putris* 9.0 snails /m² in September to 24.0 snails /m² in March with total population of 148.5 and 116.2 snails/m² for *M. cantiana* and *S. putris* respectively, while *T. pisana* snails was absent. On Egyptian clover, the highest population density of *M. cantiana* snails were recorded with range of 12.0 snails/m² in December and 215.1 snails/m² in April followed by *C. acuta* 9.0 snails/m² in December and 96.0 snails/m² in April and *S. putris* was the lowest 11.3 snails in December to 75.5 snails/m² in April while the total population density was 463.3, 241.0 and 182.3 individuals /m², for *M. cantiana*, *C. acuta* and *S. putris* respectively.

In the second growing season 2016- 2017, results in table (5) showed that the previous snail species, *M. cantiana*, *S. putris*, *T. pisana* and *C. acuta* were recorded on lettuce. The population values revealed that highest population density of *M. cantiana* per m² was detected on lettuce with range of 4.0 snails /m² to 78.1 in December and April,

respectively with 193.7 total number was followed by *S. putris* 6.0 to 31.0 snails/m² in October and February, respectively with 153.0 snails /m² total number while *T. pisana* was 5.0 snails/m² to 43.0 snails /m² in October and April, respectively with 121.9 snails /m² total number. On the other hand, *C. acuta* was the least 6.2 to 15.0 in December and March, respectively with total number 57.5 snails/m². On cabbage, *M. cantiana* snails were found at range of 5.0 snails /m² in September to 41.0 snails /m² in March followed by *C. acuta* was in range 3.0 snails /m² in September to 29.0 snails/m² in March, while *S. putris* which in range 2.0 snails /m² in April to 19.0 snails /m² in May. The total number for the three species was 126.9, 102.9 and 61.3 snails /m² for *M. cantiana*, *C. acuta* and *S. putris*, respectively. Concerning field crops, the highest population density of *M. cantiana* snails were recorded on Egyptian clover with range of 21.0 to 360.0 snails/ m² in December and April, respectively, followed by *S. putris* snails which at range 9.0 to 75 .0 in December and May, respectively, while *C. acuta* snails were the lowest in occurrence 9.0 to 36.0 snails/ m² in January and May, respectively, total population as 248.0, 211.0 and 117.0 individuals /m² for *M. cantiana*, *S. putris* and *C. acuta*, respectively.

Table 4. population dynamics of snail species on different crops at Salait village ,Quallen district during 2015-2016 season .

Months	Average number of snail species on different crops /m2												
	Lettuce				Cabbage				Egyptian clover				
	M	S	T	C	Total	M	S	T	Total	M	S	C	Total
Sep.	-	-	-	-	-	19.0	9.0	-	28.0	-	-	-	-
Oct.	7.3	13.0	4.0	-	29.3	23.0	11.0	-	34.0	-	-	-	-
Nov.	5.0	17.1	12.0	-	34.1	19.7	15.0	-	34.7	-	-	-	-
Dec.	3.0	9.5	10.0	-	22.5	12.0	11.1	-	23.1	12.0	11.3	9.0	32.3
Jan.	4.4	14.5	8.6	-	27.5	15.7	13.0	-	23.7	23.0	18.0	15.0	56.0
Feb.	10.0	11.6	6.3	-	27.9	17.1	17.2	-	34.3	64.0	16.0	19.0	99.0
Mar.	13.016	13.9	12.5	-	39.4	19.0	24.0	-	43.0	115.8	25.8	27.0	186.0
Apr.	.0	15.6	20.1	-	51.1	23.0	15.9	-	38.9	215.1	75.5	96.0	386.1
May	-	-	-	-	-	-	-	-	-	33.4	36.2	75.0	144.6
Jun.	-	-	-	-	-	-	-	-	-	-	-	-	-
Jul.	-	-	-	-	-	-	-	-	-	-	-	-	-
Aug.	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	58.7	94.6	78.5	-	231.8	148.5	116.2	-	246.7	463.3	182.3	241.0	886.6
Mean	4.9	7.9	6.5	-	19.3	12.4	9.7	-	22.1	38.1	15.2	20.1	73.8

M.: *Monacha cantiana* C.: *Cochlecilla acuta* T.: *Theba pisana* S.: *Succinea putris*

Table 5. population dynamics of snail species on different crops at Salait village, Qullen district during 2016-2017 season.

Months	Average numbers of snail species on different crops /m2												
	Lettuce				Cabbage				Egyptian clover				
	M	S	T	C	Total	M	S	C	Total	M	S	C	Total
Sep	-	-	-	-	-	5.0	4.0	3.0	12.0	-	-	-	-
Oct	11.0	6.0	5.0	8.0	26.0	8.0	3.0	6.0	17.0	-	-	-	-
Nov	7.0	11.0	7.1	11.0	30.1	9.0	5.0	7.0	21.0	-	-	-	-
Dec	4.0	23.0	10.2	6.2	41.2	7.0	-	7.9	14.9	21.0	9.0	11.0	41.0
Jan	13.0	25.0	12.0	7.3	58.0	12.0	6.1	12.0	30.1	26.0	15.0	9.0	50.0
Feb	28.0	31.0	13.6	10.0	82.0	24.0	8.0	22.0	54.0	91.0	53.0	13.0	157.0
Mar	52.6	26.0	31.0	15.0	121.6	41.0	10.2	29.0	80.2	125.0	46.0	20.0	191.1
Apr	78.1	30.0	43.0	-	166.0	20.9	19.0	16.0	55.9	360.0	75.0	28.0	463.0
May	-	-	-	-	-	-	-	-	-	24.6	22.0	36.0	82.6-
Jun	-	-	-	-	-	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-	-	-	-
Ag	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	193.7	153.0	121.9	57.5	475.6	126.9	61.3	102.9	291.6	248.0	211.0	117.0	804.6
Mean	16.1	12.8	10.2	4.8	39.6	10.6	5.1	8.6	24.3	20.7	17.6	9.75	75.0

M.: *Monacha cantiana* C.: *Cochlecilla acuta* T.: *Theba pisana* S.: *Succinea putris*

The results showed that the snails *M. cantiana* and *S. putris* were recorded in all examined crops, lettuce, cabbage and egyptian clover on the two localities. This conclusion was confirmed by Maha and Awad (2008) who stated that *Succinea putris* and *S. elgans* are the most dominant species at Dumyat Governorate especially in field and on vegetable crops. These species of snails chiefly inhabit the rich places with damp soil as crops and orchards. They prefer areas covered with crops or the grassy ground (Baker and Hawke, 1990; Drake and Arias, 1995).

Estimation of damage caused by certain land snails to Egyptian clover:

Data in table (6) indicated that infestation of Egyptian clover plants with different levels of *M. cantiana* which reduced the fresh weight of variable values of reduction. At 10 snails levels, damage level were 57.1, 62.7 and 55.6 % at first, second and third cutting, respectively. These values of damage were gradually increased with increased infestation level to reach 73.2, 79.7 and 73.6 % for 25 snail level at first, second and third cutting, respectively. Average reduction was 58.5, 57.4, 64.5 and 75.5 % at 10, 15, 20 and 25 snails/plant level of infestation

during the three cuttings. Data in table (7) showed the reduction caused by different levels of *S. putris* snails at 10 snails level, %reduction in shoot weight were 61.4, 67.7 and 60 % at first, second and third cutting respectively. When the level increased to 25 snail/30 plant, reduction in shoot weight reached to 63.1, 85.3 and 89 % at first, second and third cutting respectively. From these results, %reduction which caused by all levels of infestation by two snail species were changed from cutting to another, it increased in first cut in any level of infestation where average respective reduction values caused by all levels of infestation at the first, second and third cutting were 62.5, 62.8 and 66.7 % for *M. cantiana* and 64.1, 74 and 76.7 % for *S. putris*. The percentage of weight reduction of Egyptian clover plants were higher in third cutting compared to the other two cuttings. Therefore, it could be concluded that different levels of infestation of *M. cantiana* and *S. putris* resulted in damage to Egyptian clover. The general means of reduction in plants weight were 47, 52, 54 and 60.7 and 87.4, 98.6, 100 and 109 gm/30 plants of *M. cantiana* and *S. putris*, respectively when caged plants infested by 10, 15, 20 and 25 snails/30 plants.

Table 6. Reduction of weight in clover plants caused by different infestation levels of *M. cantiana* snails under field conditions during 2017 season.

Level of infestation	First cut			Second cut			Third reduction			Average			L.S.D 0.05
	Weight	Reduction	% Reduction	Weight	Reduction	% Reduction	Weight	Reduction	% Reduction	Weight	Reduction	% Reduction	
10 snails	48	64	57.1	22	37	62.7	32	40	55.6	34	47	58.5	12.7
15 snails	41	71	63.4	24	35	39.3	22	50	69.4	29	52	57.4	4.9
20 snails	39	73	56.1	18	41	69.5	23	49	68	26.7	54	64.5	9.1
25 snails	30	82	73.2	12	47	79.7	19	53	73.6	20.3	60.7	75.5	8.4
Control	112			59			72						
Mean		72.5	62.5		40	62.8		48	66.7				

Table 7. reduction of weight in clover plants caused by different infestation levels of *S. putris* snails under field conditions during 2017 season.

Level of infestation	First cut			Second cut			Third cut			Average			L.S.D 0.05
	Weight	Reduction	% Reduction	Weight	Reduction	% Reduction	Weight	Reduction	% Reduction	Weight	Reduction	% Reductio	
10 snails	64	86	61.4	48.5	104.4	67.7	50.2	74.8	60	54.2	87.4	63	10.1
15 snails	36.6	103.4	74	50.6	99.4	66.3	32	93	74.4	39.7	98.6	71.6	12.3
20 snail	59	81	58	35	115	76.7	21	104	83.2	38.3	100	72.6	9.6
25 snails	51.6	88.4	63.1	22	128	85.3	14	111	89	29.2	109	79.1	8.1
Control	140			158			125						
Mean		89.7	64.1		109.4	74		96	76.7				

The land snails causing great damage to Egyptian clover at different growth stages as a result of the mucous and the particular structure of the mouth parts which enabling scratching and crushing (El-okda, 1980 and Sharshir *et al.*, 1996). Zidan *et al.* (2005) reported that the mean reduction caused by *M. cartusiana* in frish weight of shoots for three cutting of egyptian clover were 38.22, 33.59, 35.12% and the general mean loss was 35.65% .

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حصر وتذبذب التعداد وتقدير الضرر للقواقع الأرضية السائدة على بعض الخضراوات ومحصول البرسيم المصري في منطقتين بمحافظة كفر الشيخ

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أجرى هذا البحث في مركزى سيدى سالم وقلين بمحافظة كفر الشيخ خلال موسمى 2016/2015 و2017/2016 وكان الهدف من هذا البحث هو إجراء بعض الدراسات الإيكولوجية وتقدير الضرر نتيجة الإصابة بالقواقع الأرضية على بعض محاصيل الخضر وقد أشارت النتائج إلى الحصر أوضحت نتائج الحصر للقواقع الأرضية على محاصيل الخضر في مركزى سيدى سالم وقلين وجود أربعة أنواع من القواقع الأرضية هذه القواقع هي *Monacha cantiana*، *Cochlicella acuta*، *Succinea putris* and *Thipa pesana* وقد تم تسجيل القواقع *Monacha cantiana* بكثافته عالية في كل الأماكن التي بها الحصر على عوائل نباتية مختلفة تشمل محاصيل الخضر ووجد القواقع *Cochlicella acuta* بكثافته عالية على أشجار البرسيم بالحقول في سيدى سالم وعلى الكرنب في قطين. أيضا وجد القواقع *Succinea putris* بكثافته عالية على الكرنب والخس والبرسيم في سيدى سالم بينما كانت الإصابة عالية على المحاصيل السابقة في مركز قطين. أما القواقع *Thipa pesana* فسجل أصابه عالية على الخس في سيدى سالم. ديناميكية التعداد على نباتات الخس والكرنب كمحاصيل خضر والبرسيم كمحصول حقل سجلت القواقع الأرضية أعلى تعداد وخاصة أواخر الشتاء وبداية الربيع حيث سجل قواقع *M. cantiana* أعلى تعداد في شهر ابريل 15.4 قواقع/م² و14.0 و15.0/م² لقويعي *S. putris* and *C. acuta* بينما سجل قواقع *T. pisana* 17.2 قواقع /م² وذلك في الموسم الأول وسجل الأربعة أنواع أعلى تعداد في شهر ابريل 173.0 قواقع /م² خلال الموسم الثاني أما محصول الكرنب فقد تغيبت عنه قواقع *C. acuta* وسجلت الأنواع الثلاثة الأخرى أعلى تعداد لها 44.0 و75.2 قواقع /م² خلال الموسمين. في البرسيم تغيبت قواقع *T. pisana*، وسجل قواقع *M. cantiana* 151.2 و273.0 قواقع /م² خلال الموسمين يليه *C. acuta* الذي سجل 122.0 و100 قواقع /م². تقدير الضرر الملاحظات الحقلية أوضحت أن القواقع الأرضية تسبب ضرر كبير للمحاصيل الاقتصادية في محافظه كفر الشيخ. أشارت النتائج أن القويعين *M. cantiana* و *S. putris* سبب إصابة عالية في الحصاد الثالث بمقارنته للحصاد الثاني والأول في نبات البرسيم نتيجة التغذية.