

Survey, population dynamics and importance value of certain land snail species infesting different crops in sharkia governorate

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ABSTRACT

Survey, population dynamics and importance value of certain land snail species infesting some vegetable and field crops as well as fruit trees were determined at some localities in Sharkia Governorate. Results revealed that the glassy clover snail *Moncha. cartusiana* (Muller) and the amber snail, *Succinea. putris* (Linnaeus) were surveyed at Awlad- Sakr and Abo-Kapeer counties. *M. cartusiana* snails were found with higher density than *S. putris*. The majority of the examined crops were found with heavy infestation with *M. cartusiana* snail while *S. putris* were recorded with moderate or light infestation in the examined localities. Regarding population dynamics, it found that *M. cartusiana* snail was recorded with high density at the tested winter crops during spring months (March, April and May) as compared with winter or autumn months. Finally, when importance value was determined, it found that frequency occurrence and population density gave different results. The land snail species can be arranged descendingly, according to its importance values as follow: *E. vermiculata* >, *M. cartusiana* >, *C. acuta*, > *H. vestalis*. It may be useful to combine frequency of occurrence, population density and biomass in the form of importance value.

Keywords: Survey, land snail, Sharkia

INTRODUCTION

Molluscs are considered as a group of serious pests attacking agricultural crops around the world. Land gastropods cause costly damage to field crops, vegetables and fruit trees as well as ornamental plants. In addition, some gastropods work as intermediate hosts for many parasitic worms infesting man and his domestic animals (Godan, 1983 and Barker, 2002).

Economic serious molluscs has been recorded recently in Egypt (Kassab and Daoud, 1964; El-Okda, 1984 and El-Deeb *et al.* 1999). Occurrence, population dynamics and damage caused by such land snail gastropods in Sharkia Governorate has been investigated. (Ghamry *et al.*, 1993; Arafa, 1997; El-Masry, 1997; Ismail, 1997; Mahrous *et al.*, 2002; Lokma, 2007 and Abdel-Aal, 2007).

The cornerstone of any pest management depends mainly on information about its ecology and biology. The main aims of these studies were to get more information about survey, population dynamics and importance value of the land snail species in different Sharkia Governorate localities.

MATERIAL AND METHODS

1- Survey of land snails on different crops at Sharkia Governorate.

A survey was conducted to study the distribution and population density of land snail species attacking some host plants cultivated in two localities two

(counties) of Sharkia Governorate during the period from Sept. 2007 to Aug. 2008. These counties and localities were: Abo-Kapeer (Kafr-Elbaz and Al-Abazia) and Awlad Sakr (Bani-Hassan and Bani-Mansour). The survey included field crops (i.e. broad bean, Egyptian clover, wheat, maize, and cotton), vegetable crops (i.e. pea, egg plant, cabbage, tomato and lettuce) and fruit crops (i.e. mango and navel orange). Samples were taken from each crop area by using the quadrat sample size 50×50 cm (Staikou and Lazaridou 1990).

Snails from each host plant in each surveyed areas were transferred in muslin cloth bags to the laboratory and identified according to the keys given by Godan (1983).

2- Population dynamics of *Monacha cartusiana* (Muller) on certain field crops, vegetables and navel orange trees.

The seasonal population dynamics of the predominant glassy clover land snails *M. cartusiana* were studied at Awlad-Sakr county during two successive growing seasons (2007/2008 and 2008/2009). Certain field crops (i.e. Egyptian clover, wheat, and broad bean; vegetable crops as pea, cabbage and lettuce) and navel orange as fruit crop were chosen for this study. An area of about one feddan was selected for each crop. Five replicates of quadrat sample size (50×50 cm) were randomly examined biweekly during the growing season of each crop except navel orange which continued for 12 months. Examination was conducted during early morning before sunrise. All snails found on either plants or soil surface in the quadrat were counted and left in their initial places (Baker, 1988). Data concerning temperature and relative humidity during the period of study were obtained from metrological station of Abo-Kapeer. The obtained data were subjected to statistical analysis as correlation coefficient between snails population and each of temperature and relative humidity according to Costat (2005).

3- Importance value of herbivorous snails estimates:

A citrus orchard about 200 hectares located at Inshas county, Belbeis district, Sharkia Governorate was selected to measure some ecological parameters (i.e. frequency occurrence, population density and importance value).

A total of 105 samples were tested in such orchard during the activity period from Feb. 2007 to May 2008. All surveyed snails were counted and classified to their species according to the key given by Godan (1983). Ten adult snails from each identified species were weighted and the average biomass for each species was calculated. Importance values of land snail species were determined according to Norton (1978) as follows:

$$\text{Absolute frequency occurrence} = \frac{\text{Number of sample containing a species}}{\text{Number of samples examined}} \times 100$$

$$\text{Relative frequency occurrence} = \frac{\text{Absolute frequency occurrence of species}}{\text{Sum of frequency occurrence of all species}} \times 100$$

$$\text{Absolute density} = \frac{\text{Total number of individuals of a species}}{\text{Number of samples containing this species}}$$

$$\text{Relative density} = \frac{\text{Number of individuals of a species}}{\text{Sum of individuals of all species}} \times 100$$

$$\text{Absolute biomass} = \text{Weight of snail within its shell.}$$

$$\text{Relative biomass} = \frac{\text{Absolute biomass of a species}}{\text{Sum of biomass of all species}} \times 100$$

Importance value = Relative frequency + Relative density + Relative biomass.

RESULTS AND DISCUSSION

1- Survey studies:

A survey studies were carried out on molluscs fauna infesting different crops at two districts of Sharkia Governorate. Results presented in Table (1) revealed that the two species of herbivorous land snails were found on different host plants at Awlad-Sakr and Abo-Kapeer counties. These species were the glassy clover snail, *M. cartusiana* and the amber snail, *Succinea putris* (Linnaeus). The identified species varied in their incidence and level of infestation according to the locality and the host type. It is obvious that *M. cartusiana* represented the highest incidence compared to the other species, since it was recorded in all hosts. Generally, the listed hosts can be classified into three categories according to the degree of infestation with *M. cartusiana*.

Table (1): Survey of land snails on different crops at certain districts in Sharkia Governorate.

District	Village	Snail species	Host plant and level infestation
Awlad-Sakr	Bani-Hassan and Bani-Mansour	<i>M. cartusiana</i>	-Broad bean (++), Clover (+++), Wheat (++), Cotton (+), eggplant (+), Pea (+++), Cabbage (+++), Lettuce (+++), Grapes (+++), Orange (+++).
Abo-Kapeer	Alabzia and Kafr-Elbaz	<i>M. cartusiana</i> <i>S. putris</i>	-Broad bean (+), Clover (+++), Wheat (++), Maize (+), Cotton (+), eggplant (++), Tomato (++), Pea (+++), Cabbage (+++), Lettuce (+++), Mango (++), Orange (+++). -Brood bean (+), Clover (++), Wheat (+), Maize (++), Cotton (+), eggplant (+), Tomato (+), Pea (+), Cabbage (+), Lettuce (++), Mango (+), Orange (+).

(+) = light infestation (less than 15 snail /0.25 m²)

(++) = Moderate infestation (between 16 – 30 snails / 0.25 m²)

(+++)= heavy infestation (more than 30 snails / 0.25 m²)

These categories were heavy, moderate and light infestation. The majority of the examined crops were found with heavy infestation especially Egyptian clover, pea, cabbage, lettuce, grapes and navel orange. Broad bean, wheat, tomato and mango were detected with moderate infestation. Cotton, maize, eggplant and broad bean were found with light infestation at Awlad-Sakr and Abo-Kapeer counties. Regarding *S. putris* it was detected only at Alabzia and Kafr-ELbaz belonging to Abo-Kapeer with moderate or light infestation. For instance, it was recorded with moderate infestation at Egyptian clover, maize and lettuce. It was recorded on broad bean, wheat, egg plant, cotton, tomato, pea, cabbage, mango and navel orange with light infestation.

Many authors recorded that land snails act as a dangerous pest to agricultural crops at different Governorates in Egypt. In Sharkia Governorate terrestrial snails were found in different districts attacking many economic crops for instances, *M. cartusiana*, *S. putris* were recorded in Awlad-Sakr and Abo-Kapeer districts (Abdel-Aal, 2001). These results are in harmony with those reported by many investigators who surveyed land snails in Sharkia Governorate (Ghamry *et al.* 1993; Arafa, 1997; El-Masry, 1997; Ismail, 1997 and Hegab *et al.* 1999).

2- Population dynamics of *M. cartusiana* on certain field, vegetable, and fruit crops at Awlad-Sakr County.

The survey study revealed that *M. cartusiana* was the predominant species with a relatively high numbers on major economic crops. Therefore, population dynamics of this species was studied on Egyptian clover, wheat, broad bean, pea, cabbage, lettuce and navel orange in Bani-Hassan and Bani-Mansour villages, Awlad-Sakr county during two successive growing seasons (2007-2008 and 2008-2009). Resulted presented in Table (2) revealed that the initial infestation of *M. cartusiana* was recorded in Sept. on cabbage and navel orange with a relatively low population densities of (17.2, 16.6) and (17.2, 19.8) snails per quadrat sample size in the growing season of 2007–2008 and 2008–2009, respectively. On Egyptian clover, pea and lettuce the initial infestation appeared in the beginning of Oct. with low numbers of (11.8, 12.2), (10.4, 9.6) and (16.8, 17.6) snails in the two successive growing seasons, respectively. Moreover, the initial infestation of wheat and broad bean, appeared in Nov. with low numbers of (5.2, 4.4) and (9.2, 8.6), snails in the two successive growing seasons, respectively. Regarding the behavior of *M. cartusiana* population after the initial infestation appeared, it is clear that the number of snails increased until the end of growing seasons for every crop. The average numbers of snails per sample were (26.2, 27.4) and (19.0, 18.4) for Egyptian clover and cabbage in Jun. in the two successive growing season and (21.4, 21.8) and (18.2, 19.4) for wheat and lettuce in May. The snails numbers reached to (22.0, 21.2) and (21.0, 23.8) snail / sample in Apr. for broad bean and pea, respectively.

Table (2): Population dynamics of *M. cartusiana* on different crops at Awlad-Sakar district, Sharkia Governorate during 2007 – 2008 & 2008- 2009 seasons.

Date	Average number of <i>M. cartusiana</i>												Climate factors					
	Clover		Wheat		Broad bean		Pea		Cabbage		Lettuce		Orange		Temp. C		RH.	
	2007/08	2008/09	2007/08	2008/09	2007/08	2008/09	2007/08	2008/09	2007/08	2008/09	2007/08	2008/09	2007/08	2008/09	2007/08	2008/09	2007/08	2008/09
Sep.	-	-	-	-	-	-	-	-	17.2	16.6	-	-	17.2	19.8	25.8	26.6	39.9	37.1
Oct.	11.8	12.2	-	-	-	-	10.4	9.6	18.0	18.4	16.8	17.6	19.6	18.8	24.0	21.0	34.8	35.1
Nov.	14.6	15.4	5.2	4.4	9.2	8.6	18.2	16.8	20.0	18.2	20.4	19.8	19.8	27.2	21.1	18.2	50.8	36.4
Dec.	17.8	17.2	10.4	12.2	9.8	10.0	22.0	20.8	19.6	20.0	24.2	23.6	24.2	22.0	15.5	15.7	53.8	50.2
Jan.	24.2	23.2	10.8	13.2	12.0	13.2	24.0	24.4	20.2	21.2	24.0	25.2	24.6	18.2	13.9	13.1	39.6	42.7
Feb.	26.0	27.6	12.0	16.4	14.6	15.4	26.8	28.2	22.0	20.4	26.2	28.4	26.0	22.8	14.1	14.4	35.5	40.1
Mar.	30.4	31.4	18.6	19.2	17.0	18.6	28.8	29.6	23.2	22.2	29.4	28.6	25.2	27.2	15.8	16.4	35.0	34.0
Apr.	34.6	36.8	20.2	21.4	22.0	21.2	21.0	23.8	25.0	28.0	30.0	32.2	28.6	30.0	19.6	20.2	29.4	27.2
May	30.4	32.6	21.4	21.8	-	-	-	-	29.2	30.6	18.2	19.4	19.2	28.8	23.7	22.5	25.8	25.7
Jun.	26.2	27.4	-	-	-	-	-	-	19.0	18.4	-	-	22.0	24.6	25.9	26.4	35.2	34.7
Jul.	-	-	-	-	-	-	-	-	-	-	-	-	21.2	22.8	28.2	26.9	44.3	42.5
Aug.	-	-	-	-	-	-	-	-	-	-	-	-	21.8	22.6	30.1	28.6	43.6	44.5
Total	216.0	223.6	98.10	108.6	84.6	87.0	150.1	153.2	213.4	214.0	189.2	194.8	269.4	284.8				
Mean	24.0	24.8	14.0	15.5	14.1	14.5	21.4	21.8	21.3	21.4	23.6	24.3	22.4	23.7				

In general, navel orange harbored the highest numbers of *M. cartusiana* followed by Egyptian clover, cabbage, lettuce and pea and while wheat, broad bean showed the lowest numbers. The total counted snails on these crops in the two successive growing seasons were (269.4, 284.8), (216, 223.8), (213.4, 214.0), (189.2, 194.8), (150.1, 153.2), (98.6, 108.6) and (84.6, 87.0), respectively. Population density values, of *M. cartusiana* on the tested crops were higher than in the later growing season 2008–2009 compared to those counted in the first growing season of 2007–2008. Generally, it could be concluded that the population density of *M. cartusiana* obviously increased during spring months (Mar., Apr. and May) as compared to population density during winter and autumn months for winter crops.

Our results of population dynamics on different crops at Abo-Kapeer and Awlad-Sakr districts are very similar to results reported by many authors.

El-Deeb *et al.*, (1999) and Ismail (1997) indicated that the highest population density values of *M. cartusiana* were found during spring months as compared with other ones. Also, Abdel-Aal (2001) reported that the population density of *M. cartusiana* increased during spring months. Ismail (2004) recorded that the population density of *E. vermiculata* on navel orange fluctuated on soil surface and tree trunks during the year months.

The relation between population densities of *M. cartusiana* and both ambient temperature and relative humidity is presented in Table 3. Results revealed inconsistent and insignificant negative correlation values in most cases. These relations reflected increase of population densities in negative accordance with temperature decrease (which is not acceptable scientifically). In the mean time these densities can be correlated to winter crops growth pattern.

Table (3): Effect of temperature and relative humidity on population density of *M. cartusiana* on different crops at Awlad-Sakr district, Sharkia Governorate.

Host plant	Temperature		Relative humidity%	
	2007/2008	2008/2009	2007/2008	2008/2009
Egyptian clover	-0.135 ^{n.s}	0.162 ^{n.s}	-0.667*	-0.595 ^{n.s}
Wheat	0.324 ^{n.s}	0.392 ^{n.s}	-0.866*	-0.585 ^{n.s}
Broad bean	0.116 ^{n.s}	0.726 ^{n.s}	-0.316 ^{n.s}	-0.720 ^{n.s}
Pea	-0.897*	-0.813*	-0.121 ^{n.s}	0.123 ^{n.s}
Lettuce	-0.681 ^{n.s}	-0.416 ^{n.s}	-0.066 ^{n.s}	-0.037 ^{n.s}
Cabbage	-0.587 ^{n.s}	-0.069 ^{n.s}	-0.242 ^{n.s}	-0.624 ^{n.s}
Navel orange	-0.639*	0.021 ^{n.s}	0.088 ^{n.s}	-0.650*

Each value represents correlation coefficient.

n.s= nonsignificant.

* = significant at 0.05 level.

** =highly significant at 0.01 level.

3- Importance value of land snail species at Inshas locality, Belbeis district, Sharkia Governorate:

The object of this study was to characterize communities of land snail species infesting citrus orchard at Inshas locality, Belbeis district, Sharkia Governorate using some ecological parameters (i.e. frequency of occurrence, population density and biomass). Results in Table (4) indicated that according to frequency of occurrence, *M. cartusiana* was the most frequently species followed by *E. vermiculata* > *H. vestalis* > *C. acuta*. The percent absolute frequencies of occurrence were 93.30, 62.85, 34.28 and 28, 57, respectively.

Consequently, relative frequency of occurrence showed the same trend. Regarding population density it was found that *E. vermiculata* have the highest value (47.56) followed descendingly by *C. acuta* (27.03), *M. cartusiana* (21.45) and *H. vestalis* (3.95) snails per sample size.

According to biomass criteria *E. vermiculata* weighted 3.982 followed by *M. cartusiana* (0.475) > *H. vestalis* (0.425) > *C. acuta* (0.220) gm / snail. Consequently, relative biomass showed the same arrangement. Descending order of land snail species as evaluated by frequency occurrence, population density, biomass and importance value showed different arrangement. For example, *M. cartusiana* was the first one according to frequency of occurrence, while it was the third according to population density and the second according to biomass. On contrary, *C. acuta* jumping from the fourth to the second based on frequency occurrence and population density, respectively.

Moreover, *E. vermiculata* changed its position from the second according to frequency of occurrence to the first based on population density, biomass and importance value, respectively. Since frequency of occurrence, population density showed different results, they can combine together in hope of having a figure that would relate aspects of the

three parameters. Therefore, the relationship of the three parameters was calculated as importance value according to Norton (1978). It could be concluded that the land snail species at Inshas locality, Belbeis district could be arranged descendingly according to its importance value as follow: *E. vermiculata* > *M. cartusiana* > *C. acuta* > *H. vestalis*. Generally, to determine relative importance of many pest species with the same feeding habits and belonging to the same taxonomic group it may be useful to combine frequency of occurrence, population density and biomass in the form of important values. Our obtained results were in a broadly similar to the findings of Mahrous *et al.* (2002) who evaluate the different arrangement of land snail species by frequency of occurrence, population density and biomass. Therefore, the relationship of the three parameters was calculated as importance value.

Table (4): Importance value of certain land snails at Inshas locality, Belbeis district, Sharkia Governorate.

Snail species	Frequency of occurrence		Population density		Biomass (gm)		Importance value
	Absolute	Relative (%)	Absolute	Relative (%)	Absolute	Relative (%)	
<i>E. vermiculata</i>	62.85	28.69	13.30	47.56	3.982	78.03	154.3
<i>M. cartusiana</i>	93.30	42.60	4.04	21.45	0.475	9.32	73.37
<i>H. vestalis</i>	34.28	15.65	2.02	3.95	0.425	8.33	27.93
<i>C. acuta</i>	28.57	13.04	16.63	27.03	0.220	4.32	44.39

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ARABIC SUMMARY

حصر وديناميكية التعداد وقيمة الاهمية لبعض انواع القواقع الارضية التى تصيب المحاصيل المختلفة فى محافظة الشرقية

سباعى زياد سليمان شتية – شحاتة احمد على اسماعيل – سماح محمد عبد القادر
معهد بحوث وقاية النباتات – مركز البحوث الزراعية

اجريت دراسات الحصر وديناميكية التعداد وقيمة الاهمية على بعض انواع القواقع التى تصيب بعض محاصيل الحقل والخضر بالاضافة الى اشجار الفاكهة فى محافظة الشرقية. اوضحت النتائج وجود نوعين من القواقع الارضية فى مركزى اولاد صقر وابو كبير وهما قوقع البرسيم الزجاجى *M. cartusiana* وقوقع السكسينيا *Succinea putris* لوحظ وجود قوقع البرسيم الزجاجى بمعدل عالى نسبيا بينما قوقع السكسينيا وجد بمعدلات متوسطة ومنخفضة. وبخصوص ديناميكية التعداد وجد ان قوقع البرسيم الزجاجى يزداد خلال اشهر الربيع بالمقارنة باشهر الشتاء والخريف وعند تطبيق قيمة الاهمية على الانواع الاربع من القواقع وهى قوقع البرسيم الزجاجى وقوقع الحدائق البنى ذو الشفة المنعكسة وقوقع الرمال الصغير وقوقع النخيل وجد انه من المهم استخدام مقياس قيمة الاهمية على هذه الانواع حيث كان ترتيبها تنازليا كالاتى: قوقع الحدائق البنى ثم قوقع البرسيم الزجاجى ثم قوقع النخيل واخيرا قوقع الرمال الصغير. لذا من المفيد استخدام مقياس قيمة الاهمية للحكم على مدى اهمية القواقع موضوع الدراسة .