

OCCURRENCE, POPULATION DENSITY AND IMPORTANCE VALUE OF LAND SNAILS INFESTING DIFFERENT CROPS IN SHARKIA GOVERNORATE

Mahrous, M. E.; Mervat, H. Ibrahim and Abd El-Aal, E. M.
Plant Protection Dept., Faculty of Agric., Zagazig Univ., Egypt.

Received 12 / 3 / 2002

Accepted 6 / 4 / 2002

ABSTRACT: Five species of terrestrial snails were found infesting different crops in Sharkia Governorate. These species were *Monacha cartusiana* Müller, *Helicella vestalis* Preiffer, *Cochlicella acuta* Müller, *Eobania vermiculata* Müller and *Succinea* sp. The last species was recorded for the first time in Sharkia Governorate. Relative occurrence of infested localities for each species was calculated in relation to total infestations with all species. The highest value was detected with *M. cartusiana* (77.14 %), followed by, *C. acuta* (7.31 %), *E. vermiculata* (5.60 %), *Succinea* sp. (5.96 %) and *H. vestalis* (4.49 %).

Population density of land snail species was counted on host plants in a chosen localities at six districts of Sharkia Governorate. Generally, it was found that *M. cartusiana* was the predominant species on field and vegetable crops, while *C. acuta* and *H. vestalis* were detected mainly on fruit trees. However, *E. vermiculata* was the most abundant species on ornamental plants. On the other hand, population density of land snails differed from host plant to another and also from locality to another.

Descending order of land snail species as evaluated by frequency of occurrence, population density and biomass showed different arrangement. Therefore, the relationship of the three parameters was calculated as importance value. Generally, land snail species attacking agricultural crops in Sharkia Governorate could be

arranged according to their importance value as follows:
E. vermiculata > *M. cartusiana* > *C. acuta* > *H. vestalis* > *Succinea* sp.

Key words: land snails, occurrence, population density, importance value, Sharkia Governorate.

INTRODUCTION

In recent years, terrestrial snails have increased in economic importance. They cause considerable damage to field and horticultural crops in the world. The destructive of these pests is far greater today than in former times, since limits for their spread not only from one country to another but also from one province to another are not existent as a result of ever denser and faster transport and traffic.

In Egypt, land snails were detected in different Governorates attacking many economic crops. For instances, *H. vestalis*, *Theba pisana* and *M. cartusiana* were most injurious in northern Egypt (Kassab and Daoud, 1964); *Monacha* sp. and *Oxychilus* sp. were detected in El-Ismaelia Governorate (El-Okda, 1984) and *E. vermiculata*, *Succinea putris* and *Cepeae nemoralis* were determined in Kafr El-Shiekh; *M. cartusiana*, *C. nemoralis*, *C. acuta*, *O. alliarius* and *Helicella*

sp. in Damietta Governorate and *M. cartusiana*, *S. putris*, *E. vermiculata*, *C. acuta* and *C. nemoralis* in Dakahlia Governorate (El-Deep et al., 1996). On the other hand, many others surveyed land snails in Sharkia Governorate (Ghamry et al., 1993; Arafa, 1997; Ismail, 1997; El-Masry, 1997 and Hegab et al., 1999). They recorded *M. cartusiana*, *E. vermiculata*, *C. acuta* and *H. vestalis* in certain localities attacking field and vegetable crops, fruit trees and ornamental plants.

Finally, the cornerstone of any pest management dependent mainly on informations of its ecology and biology. Therefore, the present work aims to determine frequency of occurrence, population density and importance value of land snails species infesting economic crops in Sharkia Governorate.

MATERIALS AND METHODS**1-Occurrence and Distribution of Land Snail Species in Sharkia Governorate.**

A complete survey was carried out during two successive years started from April, 1998 to throw some light on distribution of terrestrial snails by determining percent of infested localities (villages) in all districts (counties) of Sharkia Governorate. Land snails were identified according to the terminology given by Godan (1983) and El-Okda (1984). Percent occurrence of infested localities in a district was calculated for each species as follows:

% occurrence of infested localities =

$$\frac{\text{Number of infested localities with a species}}{\text{Total number of localities in a district}} \times 100$$

Furthermore, percent of relative occurrence of infested localities with a species as compared with total infested localities with all species was calculated as follows:

% relative occurrence =

$$\frac{\text{Total occurrence of infested localities with a species}}{\text{Total occurrence of infested localities with all species}} \times 100$$

2-Population Density of Land Snails on Different Host Plants in Sharkia Governorate:

Population density of land snail species attacking the main host plants were detected in a selected localities at six districts of Sharkia Governorate during the activity period from February to May in 1998 and 1999. Numbers of snails were counted on certain field crops i.e. broad bean, *Vicia faba*; Egyptian clover, *Trifolium alexandrinum*; maize, *Zae mays*; sugar-cane, *Saccharrum officinarum* and wheat, *Triticum aestivum* and vegetable crops i.e. cabbage, *Brassica oleraceae var. cabitata*; lettuce, *Lactuca sativa*; pepper, *Capsicum annum*; pea, *Pisum sativum* and tomato, *Lycopersicon esculentum*. Samples were taken in early morning by using the quadrated sample size $50 \times 50 \text{ cm}^2$ (Staikou *et al.*, 1990). Five randomly samples were taken from each crop in the surveyed localities. All snails found on plants or on soil surface in the quadrated were counted. On the other hand, samples were also taken from fruit trees i.e. date palm, *Phoenix dactylifera*; grape, *Vitis vinifera*; guava, *Pisidium guajava*; mango, *Mangifera indica*

and navel orange, *Citrus sinensis* and ornamental plants i.e. adhatoda, *Adhatoda vasica*; sansevieria, *Sansevieria guinensis*; casuarina, *Casuarina equisetifolia*; kafor, *Eucalyptus* sp. and cocos, *Cocos plumosa*. Ten trees were randomly chosen from fruits and ornamental plants. Snails were counted in the early morning in mean number of four areas of 25×25cm² under each of the tested trees and on five branches of the different directions of the tree (Awad, 1994).

3-Importance Value of Herbivorous Snails in Sharkia Governorate:

A total of 120 samples were examined in the surveyed localities in Sharkia Governorate during the activity period from February to May in 1998 and 1999. Samples were taken according to Staikou *et al.* (1990) in field and vegetable corps and according to Awad (1994) in fruit trees and ornamental plants as previously mentioned before. Ten adult snails were collected from each of the surveyed districts, then weighed and average biomass for each species was calculated. Importantace value of land snail

species was determined according to Norton (1978) as follows:

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

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

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

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

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

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

$$\text{Importance value} = \text{Relative frequency} + \text{Relative density} + \text{Relative biomass.}$$

RESULTS AND DISCUSSION

1-Occurrence and Distribution of Land Snail Species in Sharkia Governorate:

Five species of terrestrial snails belonging to order: Stylommatophora were found in different localities of Sharkia Governorate. These species were the glassy clover snail, *Monacha cartusiana* Müller; the small sand snail, *Helicella vestalis* Preiffer; the brown garden snail, *Eobania vermiculata* Müller; the conical snail, *Cochlicella acuta* Müller and *Succinea* sp. (Fig. 1). The localities (villages) infested with land snail species in 12 districts (counties) of Sharkia Governorate are listed in Table (1). It is obvious that *M. cartusiana* was the most predominant species compared to other species which were detected in few localities at Sharkia Governorate. Whereas, *M. cartusiana* was found in 41 localities compared to four localities for *C. acuta* and three localities for each of *H. vestalis*, *E. vermiculata* and *Succinea* sp. It is necessary to mention here that *Succinea* sp. was recorded for the first time in Sharkia Governorate.

The identified species varied greatly in their incidence and level of infestation from one district to another. Percentage of infested localities with land snail species in each district was calculated and illustrated in Fig. (2). It was found that the highest values were determined with *M. cartusiana* in Abou-Kapper (18.52%), Abou-Hammad (14.71%), Hehia (14.29%), Zagazig (12.28%) and Belbies (12.24%). However, percent of infestation with *M. cartusiana* in other districts were relatively lower with range of 4.65 to 10.0%. It was not found in El-Hussania, Kafr Sakr and Mashtool El-Sook districts. Other land snail species were detected with low values of percent infestation. Percent of infested localities with *H. vestalis* was 6.12% in Belbies. While, for *E. vermiculata* percent of infestation were 2.04, 3.85 and 1.75% in Belbies, El-Hussania and Zagazig, respectively. However, for *C. acuta* the parallel values were 5.88 and 4.08% in Abou-Hammad and Belbies, respectively. Finally percent of infested localities with *Succinea* sp. were 4.0 and 3.45% in Fakous and Kafr Sakr, respectively.

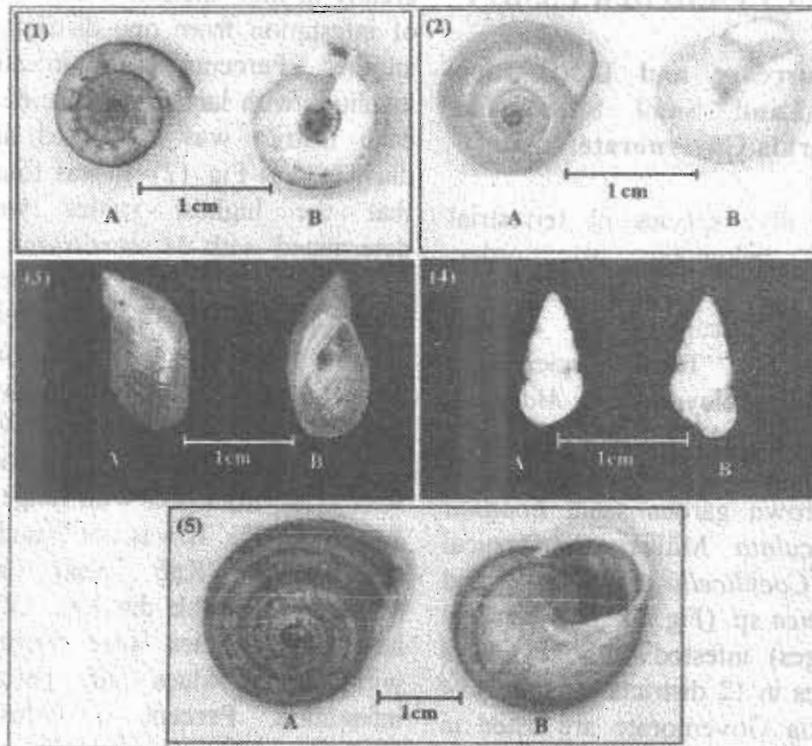


Fig. (1): Shell of land snail species infesting major crops in Sharkia Governorate:

- | | |
|----------------------------------|---------------------------------|
| 1 – <i>Helicella vestalis</i> . | 2 – <i>Monacha cartusiana</i> . |
| 3 – <i>Succinea</i> sp. | 4 – <i>Cochlicella acuta</i> . |
| 5 – <i>Eobania vermiculata</i> . | |

A: Dorsal view.

B: Ventral view.

Table (1): Localities infested with land snails in districts of Sharkia Governorate:

Districts	Species of land snails				
	<i>M. cartusiana</i>	<i>H. veralls</i>	<i>E. vermiculata</i>	<i>C. acuta</i>	<i>Succinea</i> sp.
Abou-Hammad	El-Helmia, El-Horia, El-Quroon and El-Setteen	—	—	El-Helmia El-Horia	—
Abou-Kapper	Abou-Amr, Abou-Kapper El-Balad, Bany Ayatt, El-Manasterly and El-Sawaky	—	—	—	—
Awlad Sakr	Hanoot	—	—	—	—
Belbies	Anshas, Dena queen Farm, El-Saadoon, El-Tahawia, Sekum Farm and Serage El-Deen	Dena queen Farm El-Saadoon Serage El-Deen	Anshas	Anshas Basateen Barakat	—
Diarb Nigm	El-Manahareet and Ikrash	—	—	—	—
El-Hussania	—	—	New Salhia	—	—
El-Ibrahemia	El-Hebsh	—	—	—	—
Fakous	Ekiad El-Bahria, El-Gaafra, El-Hysamia, El-Khattara, El-Sanagra and El-Sawaleh	—	—	—	El-Sanagra El-Sawaleh
Hehia	Abou-Frakh, Awlad Attia, El-Alakma and El-Mahdia	—	—	—	—
Kafr Sakr	—	—	—	—	Abou-Sharabia
Mashtool El-Sook	—	—	—	—	—
Menlet El-Kamh	Banadif, Bany Koriesh, El-Maymouna, El-Okda and Kardida	—	—	—	—
Zagazig	Banauos, El-Aslogy, Kafr Attalah, Kafr El-Geraia, Kafr El-Harimam, Mashtool El-Kady and Zagazig El-Balad	—	Zagazig El-Balad	—	—

— No infestation with land snail species.

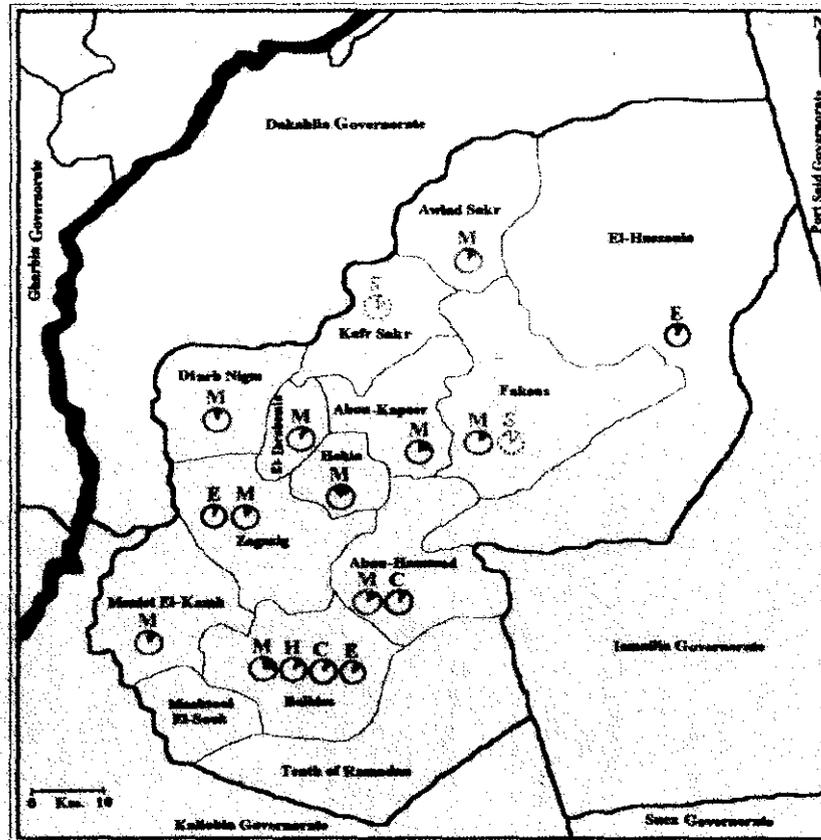


Fig. (2): Map of Sharkia Governorate showing localities infested with land snail species.

C = *Cochlicella acuta*.

E = *Eobania vermiculata*

H = *Helicella vestalis*

M = *Monacha cartusiana*

S = *Succinea* sp.

* Coloured areas in circles indicate percent of infested localities in each district.

To compare infestation with land snail species in Sharkia Governorate, relative occurrence for each one was calculated in relation to total infestations with all species. Generally, it was found that the highest value was detected with *M. cartusiana* (77.14%) followed descendingly by *C. acuta* (7.31%), *E. vermiculata* (5.60%), *Succinea* sp. (5.46%) and *H. vestalis* (4.49%).

Our results are in harmony with those reported by many authors who surveyed land snail species in Egypt (Kassab and Daoud, 1964; El-Okda, 1980 & 1984 and El-Deep *et al.*, 1996) and in Sharkia Governorate (Ghamry *et al.*, 1993; Arafa, 1997; El-Masry 1997; Ismail, 1997 and Hegab *et al.*, 1999). It is necessary to mention here that infested localities in each district were determined and percent of infestation with land snail species were detected for the first time in Sharkia Governorate. Therefore, it is of great importance to keep the non infested localities as long as possible clean from any probable infestation. Consequently, determination of the infested localities can be very useful in suggestion the necessary local quarantine to

prevent dispersal of land snails all over plantations of Sharkia Governorate. Moreover, during the last few years, land snails were dispersed quickly in Sharkia Governorate. For example, Ismail (1997) showed that 17 localities representing 7 districts were infested with land snail species. However, the present work indicated that 44 localities representing 12 districts were infested with land snails in Sharkia Governorate. Moreover, Hegab *et al.*, (1999) detected *M. cartusiana* and *E. vermiculata* in newly reclaimed lands of Salhia locality, Sharkia Governorate.

2-Population Density of Land Snail Species on Different Host Plants in Sharkia Governorate:

Data in Table (2) throw light on host plants infested with land snail species in a chosen localities at six districts of Sharkia Governorate during the activity period from February to May in 1998 and 1999. It is clear that *M. cartusiana* infested most of examined plants especially field and vegetable crops, while *H. vestalis* was distributed in Belbies district only infesting

Table (2): Land snail species infesting major crops in certain localities at six districts of Sharkia Governorate:

Districts	Localities	Field crops					Vegetable crops					Fruit trees					Ornamental plants				
		broad bean	Egyptian clover	maize	sugarcane	wheat	cabbage	lettuce	pepper	pea	tomato	date palm	grape	guava	mango	navel orange	adhatoda	sansiveria	casuarina	kafor	cocos
Abou-Hammad	El-Horia	M	M,C	M	-	M	M	M	-	-	-	C	-	-	C	C	-	-	C	-	-
	El-Qureen	M	M	-	-	-	-	M	-	-	-	M	M	M	M	M	-	-	M	M	-
	El-Setteen	M	M	-	-	-	M	M	-	-	-	M	M	M	M	M	-	-	M	M	-
Abou-Kapper	Abou-Arr	M	M	M	-	M	M	M	M	-	M	-	-	M	-	-	-	-	M	M	-
	El-Sawaky	M	M	M	-	M	M	M	-	-	-	M	-	-	M	-	-	-	M	-	-
Belbies	Dena queen	M,H	M,H	-	-	M,H	M,H	M,H	-	-	-	H	H	M,H	M,H	M,H	-	-	M,H	-	-
	El-Saadoon	M,H	M,H	M	-	M,H	M,H	M,H	-	-	-	H	-	M,H	M,H	M,H	-	-	M,H	-	-
	Anshas	-	-	-	-	-	E	E	-	-	-	C	M	-	C,E	C,E	-	-	M,C	M	-
	Serage El-Dcen	M,H	M,H	-	-	M,H	H	M,H	-	-	-	H	-	M,H	M,H	M,H	-	-	M,H	-	-
El-Hussania	New Salhica	E	E	E	-	E	E	E	-	-	-	-	-	E	-	E	-	-	-	-	-
Fakous	El-Hysamia	M	M	-	-	-	M	M	-	-	-	M	M	-	-	-	-	-	-	-	-
	El-Sansgra	M	M,S	M	-	M	M	M	-	-	-	M	-	M	-	M	-	-	-	-	-
	El-Sawalch	M	M,S	M	-	M	M	M	M	M	M	M	M	M	M	-	-	-	M	M	-
Zagazig	Kafr Aistalah	M	M	M	M	M	M	M	M	M	M	M	M	M	-	-	-	-	M	M	-
	Mashtool	M	M	M	M	M	M	M	M	M	-	-	-	-	-	-	-	-	M	M	-
	El-Kady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Zagazig El-Balad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	E	M,E	M,E	E	E	

M = *M. cartusiana*.H = *H. vestalis*.C = *C. acuta*.E = *E. vermiculata*.S = *Succinea* sp.

- = No infestation.

mainly fruit trees. On the other hand, *C. acuta* was found mainly on fruit trees and ornamental plants, whereas *E. vermiculata* was observed on ornamental plants in Zagazig district. Finally, *Succinea* sp. was recorded on Egyptian clover in Fakous district only.

Data in Table (3) revealed that population density of land snails differed according to host plant and locality. On field crops, the highest population density of *M. cartusiana* per 50×50 cm² was detected on Egyptian clover with range of (20.1-42.6) followed by broad bean (11.4-29.7), wheat (11.1-19.4), maize (6.1-12.3) and sugar-cane (6.6). On the other hand, *C. acuta* was found on Egyptian clover in Abou-Hammad district with population density of 24.4 snails per 0.25 m². While, *H. vestalis* was counted on Egyptian clover, broad bean and wheat with mean values of 21.1, 18.1 and 11.2, respectively. Moreover, population density of *E. vermiculata* on Egyptian clover, wheat, broad bean and maize were 10.1, 8.4, 6.2 and 3.2, respectively. Finally, *Succinea* sp. was found with population density of 4.1 on Egyptian clover.

Concerning vegetable crops, cabbage and lettuce harbored the highest numbers of land snail species. The highest population densities of *M. cartusiana* per 50 x 50 cm² were recorded on cabbage (18.9-28.2) and lettuce (14.2-22.2), as compared to low numbers on other vegetable crops with range of (4.6-16.4). On the other hand, *H. vestalis* and *E. vermiculata* were estimated on cabbage and lettuce with population density ranged from 10.4 to 18.1 snails. On fruit trees, *C. acuta* was the most abundant species. Since it was found on date palm, navel orange and mango with a relatively high numbers with range of (38.1-80.1) followed by *E. vermiculata* on navel orange, mango and guava (4.9-29.1). On the other hand, *H. vestalis* and *M. cartusiana* were detected on all fruit trees with a relatively low population density with minimum and maximum values of 6.2 (2.1) and 26.4 (21.1) on grape and navel orange, respectively. Finally, on ornamental plants, casuarina was the most preferable host, it was infested with *C. acuta* (31.4-70.4), followed by *E. vermiculata* (40.1), *H. vestalis* (20.1) and *M. cartusiana* (12.3-18.2). Other

Table (3): Population density of land snails on different crops in Sharkia Governorate:

District	Snail species	Field crops					Vegetable crops					Fruit trees					Ornamental plants						
		Wheat	Egyptian clover	Maize	Sorghum	Soybean	Chickpea	Beans	Peas	Garlic	Onion	Apple	Orange	Peach	Almond	Walnut	Plum	Fig	Rose	Geranium	Marigold		
Abou-Hotman	<i>M. orientalis</i>	11.4	20.1	4.1	-	11.1	18.9	14.3	-	-	-	14.9	6.4	10.3	13.2	16.1	-	-	-	-	12.9	4.1	-
	<i>C. cauda</i>	-	24.4	-	-	-	-	-	-	-	-	26.1	-	-	-	28.1	40.1	-	-	-	-	21.4	-
Abou-Kayser	<i>M. orientalis</i>	18.3	36.1	8.2	-	11.4	21.2	19.4	8.8	-	7.4	21.1	-	19.4	4.2	-	-	-	-	-	22.4	11.1	-
Batha	<i>M. orientalis</i>	20.2	30.9	11.1	-	14.2	20.1	14.3	-	-	-	-	2.1	11.2	16.4	21.1	-	-	-	-	13.2	10.1	-
	<i>E. vermiculata</i>	16.1	21.1	-	-	11.2	12.6	18.4	-	-	-	16.1	6.1	15.4	20.3	24.4	-	-	-	-	24.1	-	-
	<i>E. vermiculata</i>	-	-	-	-	-	13.1	15.4	-	-	-	-	-	-	-	12.9	29.1	-	-	-	-	-	-
	<i>C. cauda</i>	-	-	-	-	-	-	-	-	-	-	20.1	-	-	-	24.2	40.1	-	-	-	-	26.4	-
El-Manshara	<i>E. vermiculata</i>	4.2	10.1	3.2	-	8.4	16.1	11.1	-	-	-	-	-	4.9	-	14.1	-	-	-	-	-	-	-
Fahou	<i>M. orientalis</i>	13.2	21.2	22.1	-	19.2	20.4	22.2	9.4	16.4	9.1	20.2	4.1	11.4	18.4	11.4	-	-	-	-	18.2	9.1	-
	<i>Evadnia</i> sp.	-	4.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zagazik	<i>M. orientalis</i>	19.7	42.4	12.2	6.4	19.4	21.2	20.4	6.1	14.2	4.6	19.4	9.1	11.1	-	-	-	-	-	-	9.9	12.2	4.9
	<i>E. vermiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.1	32.4	40.1	28.4	28.6	12.9	-

* Each value represents the mean number of snails per sample.

ornamental plants were infested with *M. cartusiana* and *E. vermiculata* with population density ranged from 2.1 on adhatoda to 32.4 on sansevieria. These results are in agreement with those reported by many authors estimated population density of land snail species on their host plants (Kassab and Daoud, 1964; El-Okda, 1980; El-Okda *et al.*, 1990; Ghamry *et al.*, 1993 and Arafa, 1997).

3-Importance Value of Land Snail Species in Sharkia Governorate:

The objective of this study is to characterize communities of land snail species infesting major crops in Sharkia Governorate using some ecological parameters i.e. frequency of occurrence, population density and biomass. Data in Table (4) indicated that according to frequency of occurrence, *M. cartusiana* was the most frequently species followed descendingly by *E. vermiculata* > *H. vestalis* > *C. acuta* > *Succinea* sp. . Their percent absolute frequencies of occurrence were 58.33, 14.14, 9.17, 7.50 and 0.83%, respectively. Consequently, relative frequency of occurrence

showed the same trend. On the other hand, according to population density it was found that *C. acuta* gained the highest value (51.54) followed descendingly by *H. vestalis* (16.35), *E. vermiculata* (15.39), *M. cartusiana* (14.18) and *Succinea* sp. (4.1) snails per sample. The same result was obtained when relative population density was calculated for each species. According to biomass criterion *E. vermiculata* weighed 3.962 followed by *M. cartusiana* (0.485) > *H. vestalis* (0.421) > *C. acuta* (0.211) > *Succinea* sp. 0.191 (gm / snail). Consequently, relative biomass showed the same arrangement.

Descending order of land snail species as evaluated by frequency of 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 fourth and the second according to population density and biomass, respectively. On contrary, *C. acuta* processed from first to fourth based on population density and frequency of occurrence,

Table (4): Importance value of land snail species in Sharkia Governorate.

Snail species	Frequency of occurrence		Population density		Biomass (gm)		Importance value
	absolute (%)	relative (%)	absolute	relative (%)	absolute	relative (%)	
<i>M. cartusiana</i>	58.33	64.81	14.81	14.49	0.485	9.20	88.50
<i>H. vestalis</i>	9.17	10.19	16.35	16.00	0.421	7.89	34.18
<i>E. vermiculata</i>	14.17	15.75	15.39	15.06	3.962	75.18	105.99
<i>C. acuta</i>	7.50	8.33	51.54	50.44	0.211	4.01	62.78
<i>Succinea</i> sp.	0.83	0.93	4.1	4.01	0.191	3.62	8.56

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

respectively. Moreover, *E. vermiculata* changes its position from the third according to population density to the first based on biomass. Since frequency of occurrence, population density and biomass gave different results, they can be combined 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). 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 form of importance value.

REFERENCES

- Arafa, A.A. (1997). Studies on some land molluscs at Sharkia Governorate. M.Sc. Thesis, Fac. Agric., AL-Azhar Univ. 137 pp.
- Awad, M.H. (1994). Studies on agricultural moluscs at Domiat Governorate. M.Sc. Thesis, Fac. Agric., Mansoura Univ., 153 pp.
- El-Deep, H. I.; Ghamry, E. M.; El-Hawashy, N. and Essa, N. (1996). Relative abundance of some land snails in certain Governorates of Egypt. J. Agric. Sci. Mansoura Univ., 21 (8): 2922-2983.
- El-Masry, S.A. (1997). Studies on the control of some land snail infesting certain fruit trees. Ph. D. Thesis, Fac. Agric. Zagazig Univ. 150 pp.
- El-Okda, M.M. (1980). Land snails of economic importance on vegetable crops at Alexandria and neighbouring regions. Agric. Rev. 58 (1): 79-85.
- El-Okda, M.M. (1984). Land mollusca infestation and chemical control in El-Ismaelia Governorate. Agric. Res. Rev., 62 (1): 87-92.
- El-Okda, M.M.; El-Shahat, M. S.; Emara, M. M. and Hanafi, A.H. (1990). Cultural control of terrestrial mollusca and hand collection of rest sanils. Alex. Sci. Exch., 6(6): 492-501.

- Ghamry, E.M.; El-Deeb, H.I. and Kokab, Y. A. (1993). Ecological and morphological studies on certain land snails at Sharkia Governorate. Egypt. J. Appl. Sci., 8 (1): 213-225.
- Godan, D. (1983). Pest slugs and snails, biology and control. Springer-Verlag, Berlin, Heidelberg: 445 pp.
- Hegab, A.M.; Ghamry, E.M.; El-Masry, S.A. and Hassan, A.I. (1999). Ecological studies on certain land snails in some localities at Sharkia Governorate. Zagazig J. Agric. Res., 26 (3B): 787-795.
- Ismail, S.A. (1997). Ecology, biology and control of certain terrestrial snails infesting some vegetable and field crops in Sharkia Governorate. Ph.D. Thesis, Fac. Agric. Zagazing Univ., 130 pp.
- Kassab, A. and Daoud, H. (1964). Notes on the biology and control of land snails of economic importance in the U.A. R. J. Agric. Res. Rev. Cairo, 42:77-98.
- Norton, D.C. (1978). Ecology of plant-parasitic nematodes. Wiley, New York, 268 pp.
- Staikou, A.; Lazaridou-Dimitriadou, M. and Pana, E. (1990). The life cycle, population dynamics, growth and secondary production of the snail, *Bradybaena fruticum* in northern Greece. J. Moll. Stud., 6:137-146

التواجد و الكثافة العددية و درجة الأهمية لأنواع القواقع الأرضية التى تصيب
المحاصيل المختلفة بمحافظة الشرقية

مصطفى النبوى محروس- مرفت حسن إبراهيم- السيد محمد عبد العال
قسم وقاية النبات- كلية الزراعة- جامعة الزقازيق- جمهورية مصر العربية

تم تحديد خمسة أنواع من القواقع الأرضية التى تصيب المحاصيل المختلفة فى
محافظة الشرقية و هى قوقع البرسيم الزجاجى *Monacha cartusiana* و قوقع الرمال
الصغير *Helicella vestalis* و قوقع الحدائق البنى *Eobania vermiculata* و القوقع
المخروطى *Cochlicella acuta* و أخيرا قوقع *Succinea sp.* و الذى سجل لأول مرة فى
محافظة الشرقية. كما تم تحديد النسبة المئوية للمقري المصابة بكل نوع داخل كل مركز على
حدة و عموما إتضح ان قوقع البرسيم الزجاجى يمثل ٧٧,١٤ % من إجمالى مجموع النسب
المئوية للمقري المصابة بالمحافظة ككل يليه فى ذلك القوقع المخروطى بنسبة ٧,٣١ % ثم
قوقع الحدائق البنى ٥,٦٠ % و قوقع السكسينيا ٥,٩٦ % و أخيرا قوقع الرمال الصغير
٤,٤٩ % .

كما تم تحديد الكثافة العددية لأنواع القواقع الأرضية داخل ستة مراكز بمحافظة
الشرقية على المحاصيل المختلفة. و عموما يعتبر قوقع البرسيم الزجاجى هو الأكثر شيوعا
على محاصيل الحقل و الخضر. كما سجل القوقع المخروطى و قوقع الرمال الصغير أساسا
على أشجار الفاكهة. بينما يعتبر قوقع الحدائق البنى هو الأكثر وفرة على نباتات الزينة.
و عموما إختلفت الكثافة العددية من عائل إلى آخر و كذلك من منطقة إلى أخرى.

أعطت بعض المعايير الإيكولوجية مثل تكرار التواجد و الكثافة العددية و الكتلة
الحيوية تقييما مختلفا عند إستخدامها للتفرقة بين أنواع القواقع و لذلك فإنه من الأفضل الجمع
بينهم فى مقياس واحد يعرف بدرجة الأهمية و الذى على أساسه يمكن ترتيب القواقع تنازليا
كالتالى: قوقع الحدائق البنى ثم قوقع البرسيم الزجاجى ثم القوقع المخروطى ثم قوقع الرمال
الصغير و أخيرا قوقع السكسينيا .