

# Survey and Distribution of Terrestrial Snails in Fruit Orchards and Ornamental Plants at Alexandria and EL-Beheira Governorates, Egypt

EL-Sayed H.Eshra<sup>1</sup>

## ABSTRACT

Terrestrial snails were surveyed at Alexandria and EL-Beheira governorates in northwestern Egypt. Five land snail species at Abees region on grape orchard including *Eobania vermiculata*, *Theba pisana*, *Helicella vestalis*, *Monacha obstructa* and *Oxychillus alliarius*; while two species at EL-Mamoura region on ornamental plants including *E. vermiculata* and *T. pisana* were recorded in Alexandria governorate. In EL-Beheira governorate, three land snail species including *T. pisana*, *H. vestalis* and *M. obstructa* were recorded on navel orange and apple trees at Kafr EL-Dwar center and *E. vermiculata*, *T. pisana* and *C. acuta* were found on ornamental plants at Abulmatamir center. The most abundant species were *T. pisana* and *E. vermiculata* at Alexandria (71.4 and 25.5%) and EL-Beheira (65.6 and 14.2%) respectively, while the lowest found were *O. alliarius* (0.5%) at Alexandria and *M. obstructa* (4.1%) at EL-Beheira.

**Key words:** Terrestrial snails, Survey, Distribution, Alexandria, EL-Beheira, Egypt.

## INTRODUCTION

The terrestrial mollusks are considered as major pests of a wide range of agricultural and horticultural crops in temperate and humid habitats worldwide (Speiser and Kistler 2002). They attack plants causing great damage to the cultivated plants (Godan 1983). Economic damage caused by these mollusks is due to feeding and to contamination with their bodies, faces or slime leading to deterioration of the product quality, in addition the financial loss (Iglesias *et al.* 2003). Furthermore, some gastropods work as intermediate hosts for many parasitic worms infesting man and his domestic animals (Barker 2002). In Egypt terrestrial snails attack vegetables, field crops, orchard trees as well as ornamental and medical plants (Bishara *et al.* 1968, EL-Okda 1980, EL-Wakil *et al.* 2000). The land snails *Eobania vermiculata*, *Theba pisana*, *Helicella vestalis*, *Monacha obstructa*, *Cochlicella acuta* were recorded in many Egyptian governorates attacking various plantations (Kassab and Daoud 1964, EL-Okda 1979, El-Deeb *et al.* 1996, Abu-bakr 1997, Eshra 2004). The main aim of this work is to get more information about survey, population density and distribution of land snails in four different localities at

Alexandria and EL-Beheira Governorates on various plants.

## MATERIALS AND METHODS

The field experiments were conducted in Abees and EL-Mamoura regions at Alexandria Governorate and Kafr EL-Dwar and Abulmatamir regions at EL-Beheira Governorate during the two spring seasons 2011 and 2012. At Alexandria, grapes (*Vitis vinefera*) orchard in Abees region and some ornamental plants including crinum onion (*Crinum thaianum*), royal poinciana (*Delonix regia*) rose (*Rosa* spp.), ficus (*Ficus elastica*), gerbera (*Gerbera* spp.), copperleaf (*Acalypha* spp.) and silver dust (*Senecio cineraria*) in EL-Mamoura region were exposed to survey. At EL-Beheira, navel orange (*Citrus sinensis*) and apple (*Pyrus malus* L.) orchards in Kafr EL-Dwar region as well as ornamental plants, santolina (*Artemisia* sp.), ornamental palm (*Latania vershaffeltii*), jasmine (*Jasminum grandiflorum*), rose (*Rosa* spp.) and hibiscus (*Hibiscus* spp.) in Abulmatamir region were involved in this study. Land snail species were identified according to the terminology, given by (Godan 1983 and EL-Okda 1984). Samples were taken in early morning by using the quadrat sample (50×50 cm) in ornamental plants (Staikou *et al.* 1990). Ten samples were randomly taken from each crop. The snails were recorded on both plant and soil surface in quadrat. Moreover, ten fruit trees were randomly chosen to count snails one time every month through two consecutive spring seasons. The snails on both tree and on soil surface around the tree (50×50 cm) were recorded. The population density and percentage of frequency values as well as distribution of the identified snail species were recorded.

## RESULTS AND DISCUSSION

### Population density and occurrence of the land snails at Alexandria and EL-Beheira Governorates.

Land snail samples were collected from some ornamental plants and fruit trees at Alexandria Governorate (Abees and EL-Mamoura regions) and EL-Beheira Governorate (Kafr EL-Dwar and the Abulmatamir regions). The results in Table (1) revealed that, six land snail species; *Eobania vermiculata*, *Theba pisana*, *Helicella vestalis*, *Cochlicella acuta* and *Monacha obstructa* belonging to super family:

<sup>1</sup> Plant Protection Research Institute, Agriculture Research Center, Alexandria, Egypt.

Email: eheshra@yahoo.com

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Helicoidea, family: Hellicidae and sub family: Helicellinae and *Oxychillus alliarius* belonging to super family: Limacoidea, family: Zonitidae and sub family: Zonitinae were recorded in the two governorates.

The land snail species *T. pisana* and *E. vermiculata* were the most abundant in all regions. The calculated total average of population densities and frequencies of occurrence were 9832 and 69.8% for *T. pisana* and 3173 and 22.6% for *E. vermiculata*, respectively. Higher population densities of *T. pisana* (14772, 71.4%) and *E. vermiculata* (5286, 25.5%) were recorded at Alexandria than those at EL-Beheira regions (4893, 65.6%) and (1060, 14.2%), respectively. It is interesting to notice that, the snail *C. acuta* disappeared in this survey from Alexandria regions, while *O. alliarius* snail was not found in EL-Beheria regions.

Data in Table (2) showed that there are five land snail species at Abees region and two species at EL-Mamoura region of Alexandria Governorate. EL-

Mamoura region was highly infested with *T. pisana* (13930, 74.7%) snail in comparison with Abees region (842, 41.0%). *E. vermiculata* exhibited relatively moderate population densities and frequencies of occurrence in Abees and EL-Mamoura localities (576, 28.1%) and (4710, 25.3%), respectively. On the other hand, in Abees region, *H. vestalis*, *M. obstructa*, *O. alliarius* snails were found in relatively low population densities and frequencies of occurrence with (341, 16.6%), (189, 9.2%) and (107, 5.2%) respectively. The land snail *C. acuta* was not recorded in the two regions at Alexandria Governorate. Also species of *H. vestalis*, *M. obstructa* and *O. alliarius* snails were not found in EL-Mamoura region. At EL-Beheria Governorate, data showed that the presence of three land snail species; *T. pisana*, *H. vestalis* and *M. obstructa* in Kafr EL-Dwar region and *E. vermiculata*, *T. pisana* and *C. acuta* were found in the Abulmatamir region. *T. pisana* was the most abundant species in Kafr EL-Dwar and Abulmatamir localities with high population densities

**Table 1. Population density of common land snail species infested fruit orchards and ornamental plants at Alexandria and EL-Beheira Governorates**

Land snails	Governorates				Total average	
	Alexandria		EL-Beheira		P.D.*	F.O.%**
	P.D.*	F.O.%**	P.D.*	F.O.%**		
<i>Eobania vermiculata</i>	5286	25.5	1060	14.2	3173	22.6
<i>Theba pisana</i>	14772	71.4	4893	65.6	9832	69.8
<i>Helicella vestalis</i>	341	1.7	500	6.7	420	3.0
<i>Cocheccella acuta</i>	---	---	700	9.4	350	2.5
<i>Monacha obstructa</i>	189	0.9	300	4.1	245	1.7
<i>Oxychillus alliarius</i>	107	0.5	0	0.0	54	0.4
Total	20695	----	7453	----	14074	---

P.D.: Population density\*

\*\*F.O.: Frequency of occurrence

**Table 2. The distribution of population density of some land snail species at Alexandria and EL-Beheira Governorates**

Land snails	Governorates							
	Alexandria				EL-Beheira			
	Abbes		EL-Mamoura		KafrEL-Dwar		Abulmatamir	
	P.D.*	F.O.%**	P.D.*	F.O.%**	P.D.*	F.O.%**	P.D.*	F.O.%**
<i>Eobania vermiculata</i>	576	28.0	4710	25.3	---	---	1060	21.4
<i>Theba pisana</i>	842	41.0	13930	74.7	1713	68.2	3180	64.4
<i>Helicella vestalis</i>	341	16.6	---	---	500	19.9	---	---
<i>Cocheccella acuta</i>	----	----	---	---	---	---	700	14.2
<i>Monacha obstructa</i>	189	9.2	---	---	300	11.9	---	---
<i>Oxychillus alliarius</i>	107	5.2	---	---	---	---	---	---
Total	2055	---	18640	---	2513	---	4940	---

P.D.: Population density\*

F.O. : Frequency of occurrence

and frequencies of occurrence (1713, 68.2% and (3810, 64.4%), respectively, followed by *H. vestalis* (500, 19.9%) and *M. obstructa* (300, 11.9%) at Kafr EL-Dwar, however *E. vermiculata* (1060, 21.4%) and *C. acuta* (700, 14.2%) became after *T. pisana* in ranking in Abulmatamir region. In general, the results revealed that the land snails *T. pisana* and *E. vermiculata* were the most predominant species in Alexandria and EL-Beheira Governorates.

These results were in harmony with those reported by several researchers (Kassab and Daoud 1964, Bishara *et al.*, 1968, EL-Okda 1980 and Eshra 1997). It could be concluded that *E. vermiculata*, *T. pisana* and *H. vestalis* snails were the most presented species in the agricultural fields (EL-Deeb *et al.*, 1998). Moreover, Hashem *et al.* (1992) found that *T. pisana* and *C. acuta* were the dominating species recorded on citrus orchards at EL-Amryia region Alexandria Governorate.

#### Survey of land snails in fruit orchard and ornamental plants at Alexandria Governorate.

Survey and distribution of terrestrial gastropods have been studied in different locations in Alexandria Governorate. Data in Table (3) revealed that, land snail

species *E. vermiculata*, *T. pisana*, *H. vestalis*, *M. obstructa* and *O. alliarius* were recorded in grape orchard at Abees region during two spring seasons of 2011 and 2012. The highest percentages of snails were recorded for *T. pisana* snail (39.9% and 41.9%) followed by *E. vermiculata* (26.6% and 29.3%) and *H. vestalis* (19.1% and 14.3%), while the lowest percentages of snails were recorded for *M. obstructa* (10.0% and 8.5%) and for *O. alliarius* (4.4% and 6.0%).

Table(4) shows the survey of land snails on ornamental plants in EL-Mamoura region, Alexandria Governorate during two spring seasons (2011 and 2012). Results showed that *E. vermiculata* and *T. pisana* were recorded on *C. thaianum*, *D. regia*, *Rosa* spp., *F. elastica*, *Gerbera* spp., *Acalypha* spp. and *Senecio cineraria*. A higher density was recorded for *T. pisana* snail in the two spring seasons (832, 561 snails) than that for *E. vermiculata* (281, 190 snails) on the chosen plants. On the other hand, *C. thaianum* plants were highly infested with the species of *T. pisana* (31.8, 27.4%) and *E. vermiculata* (25.8, 25.3%) along the two seasons, respectively.

**Table 3. Survey of Land Snails in grape orchard at Abbas region, Alexandria Governorate during two spring seasons**

Land Snails	Season 2011		Season 2012	
	snail / tree*	% snail	snail / tree*	% snail
<i>Eobania vermiculata</i>	25.8	26.6	31.8	29.3
<i>Theba pisana</i>	38.6	39.9	45.6	41.9
<i>Helicella vestalis</i>	18.5	19.1	15.6	14.3
<i>Monacha obstructa</i>	9.7	10.0	9.2	8.5
<i>Oxychilus alliarius</i>	4.2	4.4	6.5	6.0
Total count	96.8		108.7	

\*Each values is an average of 10 trees.

**Table 4. Survey of Land Snails on ornamental plants at El-Mamoura region, Alexandria Governorate during two spring seasons**

Ornamental plants	2011				2012			
	<i>Eobania vermiculata</i>		<i>Theba pisana</i>		<i>Eobania vermiculata</i>		<i>Theba pisana</i>	
	Snail/plant*	% snail	Snail /plant*	% snail	Snail /plant*	% snail	Snail/ plant*	% snail
<i>Crinum thaianum</i>	72	25.8	265	31.8	48	25.3	154	27.4
<i>Delonix regia</i>	24	8.5	86	10.3	27	14.2	56	10.0
<i>Rosa</i> spp.	35	12.4	105	12.7	38	20.0	127	22.0
<i>Ficus elastica</i>	58	20.6	133	15.9	22	11.6	85	15.1
<i>Gerbera</i> spp.	28	9.9	74	8.9	10	5.3	36	6.4
<i>Acalypha</i> spp.	12	4.3	57	6.8	34	17.9	75	13.4
<i>Senecio cineraria</i>	52	18.5	112	13.8	11	5.7	28	5.1
Total count	281		832		190		561	

\*Each values is an average of 10 quadarted sample size 50x50cm

In the first season, *F. elastica* plants were attacked with *E. vermiculata* and *T. pisana* (20.6% and 15.9%) followed by *S. cineraria* plants (18.5% and 13.8%) and *Rosa* spp. plants (12.4% and 12.7%), respectively. *E. vermiculata* snail was the most abundant snail (9.9%) on *Gerbera* spp. plants followed by *T. pisana* snail (8.9%); however, *T. pisana* was the most abundant snail on *D. regia* (10.3%) and *Acalypha* spp. (6.8%) followed by *E. vermiculata* snail with relatively values 8.5% and 4.3% respectively. In the second season, *Rosa* spp. plants were highly infested by *T. pisana* snail followed by *E. vermiculata* snail with infestation values of 22.0% and 20.0%, respectively. The highest infestation with *E. vermiculata* was observed in *Acalypha* spp. followed by *D. regia* then *S. cineraria* with infestation percentages of 17.9, 14.2 and 5.7%, respectively. *F. elastica* and *Gerbera* spp. plants were infested by land snails *T. pisana* (15.1% and 6.4%) followed by *E. vermiculata* (11.6% and 5.3%).

#### Survey of land snail species in fruit orchard and ornamental plants at EL-Beheira Governorate.

Land snail species were surveyed on certain fruit trees including navel orange (*C. sinensis*) and apple (*P. malus*) orchards at Kafr EL-Dwar, EL-Beheira Governorate, during the two spring seasons (2011 and 2012). The obtained data revealed that *H. vestalis*, *M. obstructa* and *T. pisana* species were common in all fruit trees (Table 5). The mean number of snails differed according to the kind of fruit trees and the season of survey, where they recorded 73.1 and 48.4 snail/tree on *C. sinensis*, and 75.8 and 54.0 snail/tree on *P. malus* during 2011 and 2012, respectively. *T. pisana* snail was the most abundant species during the two spring seasons (2011 and 2012) on *C. sinensis* (64.7 and 70.3%) and on *P. malus* (73.1 and 64.1%), followed by *H. vestalis* and *M. obstructa*.

Data in Table (6) show the survey of land snails on ornamental plants at the Abulmatamir region, EL-Beheira Governorate during the two spring seasons 2011 and 2012. The land snails; *C. acuta*, *E. vermiculata* and *T. pisana* species were recorded on

*Artemisia* sp., *L. vershaffeltii*, *J. grandiflorum*, *Rosa* spp. and *Hibiscus* spp. plants. In the first season, *T. pisana* snail was recorded with high density (139 snail/plant) followed by *E. vermiculata* and *C. acuta* (58 and 45 snail/plant). On the other view, *Artemisia* sp. and *L. vershaffeltii* were highly infested by *E. vermiculata* snail that recorded 29.5 and 24.1%, respectively, followed by *Rosa* spp. (18.9%), *J. grandiflorum* (17.2%) and *Hibiscus* spp. (10.3%). *T. pisana* snail was abundant on *Hibiscus* spp. followed by *Rosa* spp. > *L. vershaffeltii* > *Artemisia* sp. > *J. grandiflorum*. *Hibiscus* spp. and *Rosa* spp. plants were highly infested with *C. acuta* (31.2 and 26.8%) followed by *J. grandiflorum*, *Artemisia* sp. and *L. vershaffeltii* plants with infestation percentages of 17.8, 13.1 and 11.1%, respectively. In the second season, also *T. pisana* snail was recorded with high density (79 snail/plant) followed by *E. vermiculata* (48 snail/plant) but *C. acuta* snail recorded the lowest number (25 snail/plant) on the studied ornamental plants. On the other hand, both *Artemisia* sp. and *L. vershaffeltii* plants were highly infested by *E. vermiculata* with percentages of 31.2 and 25.0% followed by *J. grandiflorum*, *Rosa* spp. and *Hibiscus* spp. with values of 16.7, 14.6 and 12.5%, respectively. The ornamental plants infestations with *T. pisana* snail could be arranged as follow: *Hibiscus* spp. > *Artemisia* sp. > *Rosa* spp. > *J. grandiflorum* > *L. vershaffeltii* (Table 6). The highest number of *C. acuta* snail was found on *L. vershaffeltii* and *Rosa* spp. (28.0 and 24.0%) followed by *Hibiscus* spp. and *Artemisia* sp. (20.0 and 16.0%), while the lowest number was found with value 12.0% on *J. grandiflorum* plants.

These results are in agreement with those reported by the findings of EL-Okda (1980 and 1984) at Alexandria Governorate. Baker and Hawake (1990) reported that the land snail *C. acuta* was more common in pastures than in crops especially in spring and summer. Hashem *et al.* (1993) studied abundance of *C. acuta* on fruit orchards at EL-Beheira Governorate.

**Table 5. Survey of Land Snails in fruit orchard at Kafr EL-Dwar center, EL- Beheira Govrnorate during two spring seasons**

Land Snails	Navel orange		Navel orange		Apple		Apple	
	2011		2012		2011		2012	
	snail/tree	% snail	snail /tree*	% snail	snail /tree*	% snail	snail /tree*	% snail
<i>Helicella vestalis</i>	16.9	23.1	9.4	19.4	12.2	16.1	11.5	21.3
<i>Monacha bstructa</i>	8.9	12.2	5.0	10.3	8.2	10.8	7.9	14.6
<i>Theba pisana</i>	47.3	64.7	34.0	70.3	55.4	73.1	34.6	64.1
Total count	73.1	-	48.4	-	75.8	-	54.0	-

\*Each value is an average of 10 trees.

Table 6. Survey of Land Snails in ornamental plants at Abulmatamir region, EL-Beheira Governorate during two spring seasons

Ornamental plants	Season 2011						Season 2012					
	<i>Cochecella acuta</i>		<i>Eobania vermiculata</i>		<i>Theba pisana</i>		<i>Cochecella acuta</i>		<i>Eobania vermiculata</i>		<i>Theba pisana</i>	
	Snail /plant*	% snail	snail /plant*	% snail	snail /plant*	% snail	snail /plant*	% snail	Snail /plant*	% snail	snail /plant*	% snail
<i>Artemisia</i> sp.	6	13.1	17	29.5	23	16.5	4	16.0	15	31.2	38	21.2
<i>Latania vershaffeltii</i>	5	11.1	14	24.1	25	18.0	7	28.0	12	25.0	26	14.5
<i>Jasminum</i> sp.	8	17.8	10	17.2	17	12.2	3	12.0	8	16.7	28	15.6
<i>Rosa</i> spp.	12	26.8	11	18.9	26	18.7	6	24.0	7	14.6	35	19.5
<i>Hibiscus</i> spp.	14	31.2	6	10.3	48	34.6	5	20.0	6	12.5	52	29.2
Total count	45		58		139		25		48		79	-

\*Each values is an average of 10 quadrat sample size 50 x 50 cm

The obtained results showed that the fruit orchards are exposed to snail attacking. These findings are paralleled with that reported by many investigators (Hassanien and Hamed, 1989 and Nakhla *et al.*, 1993). Moreover, Sweet basil species as ornamental and aromatic plants were highly infested by *C.acuta* and *T.piana* in Alexandria Governorate, Egypt (Hassan, 1999).

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*T. pisana* *vermiculata* ( )

*E. vermiculata* *T. pisana*

(% , % , )

(% , % , )

*T. pisana* *E. vermiculata*

*O. alliarius* *M. obstructa* *H. vestalis*

*O. alliarius*

(% , )*M. obstructa*

(% , )

. *T. pisana* *E. vermiculata*

*M.* *H. vestalis* *T. pisana*

*E.* *C. acuta*

*obstructa*