

Ecological studies on the common land snails species in North western coast of Egypt

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ABSTRACT

Survey and distribution of land snail species at North western coast, Egypt were carried out, five species of terrestrial snails belonging to order Stylommatophora were found in different localities. These species were the glassy clover snail, *M. cartusiana* (Müller) the small sand snail, *H. vestalis* (Preiffer) the brown garden snail, *Eobania vermiculata* (Müller) The conical snail, *C. acuta* (Müller) and white garden snail *T. pisana* (Müller). The highest values determined with *T. pisana* in Maruit, Burg Elarab, Elhmmam area and, Nassora Manor as compared to low values in other districts. Seasonal population dynamics of *C. acuta* was studied on pear, fig and pomegranate during two succession years from March 2013 to February 2014 in North western coast. Data showed that individuals of *C. acuta* were found in the tested orchards throughout the year months. The lowest values of population density were detected during January and February. After then, numbers were gradually increased after winter months to reach the maximum values during summer months. Fig harbored the highest numbers followed by pear while pomegranate was the least one in this respect. The highest average of *T. pisana* was recorded on fruit trees, pear, fig, pomegranate and guava. Snails were active during all study periods, and it was obvious that maximum snail numbers were recorded in July.

INTRODUCTION

In recent years, land snails had become a real threat to field crops, vegetables and fruit orchards as well as ornamental plants. They cause severe damage and decreased the marketing values of infested crops especially those of consumed leaves or ornamental plants where they attack leaves or flowers and cause decline in its price or rejection when export (Baker, 1989). These pests attack seeds, seedlings, roots and tuber crops. The more succulent row leafy vegetable, fruits and buds were extraordinary attacked in addition to flower damage when land snails became abundant. Furthermore, these land molluscs leave unpleasant slimy traces on the injured parts (El- Okda, 1980). In north western coast, the previous studies indicated that the *T. pisana* and *C. acuta* were more abundant mainly in the gardens or ornamental plants and cause severe damage to all plant parts (Mortada 2002, Genena 2003 and Abd El-Maboud, 2008). The present study aims to throw some light on host list, level of infestation and seasonal population dynamics of *T. pisana* and *C. acuta* on pomegranate, guava, fig and pear at north western coast of Egypt.

MATERIALS AND METHODS

1. Survey of land snails species at North western coast, Egypt.

Land snails infesting various floral including field and horticultural crops, were monthly surveyed during the period from January 2013 to December 2014, at North western coast.

In each district, five replicates, each of one feddan, were randomly chosen for each of the tested crop. The tested plant species were field crops (Egyptian clover (*Trifolium alexandrinum*), broad bean (*Vicia faba*), wheat (*Triticum aestivum*), maize (*Zea mays*) and tomato (*Solanum lycopersicum*); fruit trees (guava (*Psidium guajava*), pear (*Pyrus communis*), date palm (*Phoenix dactylifera*), navel orange (*Citrus sinensis*), mandarin (*Citrus reticulata*), apple (*Malus*

domestica), grape (*Vitis vinifera*), Jujube (*Ziziphus jujube*), pomegranate (*Punica granatum*), olive (*Olea europaea*) and fig (*Ficus Carica*). For field crops, 10 samples of 50×50 cm were randomly chosen from each feddan and the numbers of snails were counted. In case of fruit trees, ten trees were chosen randomly from each feddan (replicate) and the snails population was estimated according to the method described by El-Okda (1980). The collected snails from any tested crop were identified on the basis of external features of shell and gastropod according to the keys given by Godan (1983) and El-Okda (1984).

2. Population dynamics of the *C. acuta* and *T. pisana* infesting pear, guava, pomegranate and fig fruit trees.

The population dynamics of the *C. acuta* and *T. pisana* infesting pear, guava, pomegranate and fig trees were studied during 2013 and 2014 years at North western coast of Egypt. In this respect, ten-trees of six years old were randomly chosen from each orchard and marked with white paint left far from any pesticide treatments.

Snails were counted one time every month in the early morning in mean number of four areas of 50×50cm. Under each of the tested trees, on five branches of the different direction of the tree 1m high of tree trunk, (for guava, pear, fig and pomegranate) and on five leaves of the different direction (Awad 1994). The average of temperature and relative humidity were calculated and recorded monthly. Relationship between simple correlation coefficient, partial regression coefficient and explained variance and the population of land snails under mean temperature and relative humidity during two years (2013 and 2014) were also studied.

RESULTS AND DISCUSSION

This study comprise the identify of land molluscs infesting crops in north western coast and characterize their communities throughout determination of

occurrence and level of infestation. Moreover, some ecological aspects i.e. population dynamics and incidence were investigated for the prevalent species on the heavily infested hosts.

1. Incidence studies:

An extensive survey was carried out on mollusca fauna infesting different crops at 17 localities (villages) representing five counties of north western coast. Data presented in Table (1) revealed that five species of herbivorous land snails were found on different host plants at north western coast of Egypt (2013). These species were *M. cartusiana*, *E. vermiculata*, *T. pisana*, *C. acuta* and *H. vestalis*.

The identified species varied in their incidence and level of infestation according to locality and host type. It is manifest *T. pisana* has the upper hand on snails incidence compared with the other species, since it was recorded in all surveyed localities. Moreover, the majority of the considered plants were liable to be infested by *T. pisana*. The listed hosts can be classified into three categories according to the degree of infestation i.e. heavy, moderate and light infestation. The majority of the examined crops were found with heavy infestation especially Egyptian clover and guava. Whereas, pear, fig, apple and wheat were detected in

moderate infestation, While, bean and maize were found in light infestation In Burg –Elarab, snails showed limited distribution since they were detected in few localities. Whereas *M. cartusiana* was counted with a relatively high numbers (heavy infestation) on certain field crops i.e. clover in Maruit, On the other hand, *H. vestalis* was abundantly found on the soil in pear, fig and apple orchards at white Mosque area, while. *E. vermiculata* was recorded with light infestation on the soil in apple (*Pyrus malus*) orchards at Abdelbaset Abd elsamad village. On the other side, *C. acuta* were abundantly found on pear and apple in Ayoop village Table (1).

Data in Table (2) revealed that five species of snails were found on various host plants at north western coast (2014) i.e. *M. cartusiana*, *E. vermiculata*, *C. acuta*, *T. pisana* and *H. vestalis*. The majority of the inspect fruit trees were recorded with heavy infestation especially pomegranate, guava, clover and apple. Whereas, bean and fig were discovered with medium infestation. However, tomato and olive were observed with light infestation in area Alpolice. Whereas, *T. pisana* was recorded with relatively high numbers on fruit trees i.e. pomegranate, guava and clover apple in Maruit county. (Table 2)

Table (1): Survey of terrestrial snails associated with different host plants in north western coast. Egypt (2013)

Districts	Snail Species	Host plant& level of infestation
Maruit	<i>T.pisana</i>	Pomegranate (+++), Guava (+), Jujube (+), Olive (+), Fig (+), Palm trees(++), Apple (++) Clover (+++), Bean (++) , Tomato (-)
	<i>C.acuta</i>	Pomegranate (+), Guava (+), Jujube (-), Olive (-), Fig (-), Palm trees (-) , Apple (-), Clover (++) , Bean (-), Tomato (-)
	<i>M. cartusiana</i>	Pomegranate (-), Guava (-), Jujube (-), Olive (-), Fig (-),Palm trees(-), Apple (-), Clover (++) , Bean (+), Tomato (-)
Burg Elarab	<i>T.pisana</i>	Pear (++), Fig(++), Apple(++), Guava(+++),Clover (+++), Wheat(++), Bean(+),Maize(-)
	<i>C.acuta</i>	Pear(+),Fig(++),Apple(++),Guava(++),Clover(++),Wheat(-),Bean(-),Maize(-)
	<i>E. vermiculata</i>	Pear(-),Fig(-),Apple(+),Guava(-),Clover(-),Wheat(-),Bean(-),Maize(-)
	<i>M. cartusiana</i>	Pear(-),Fig(-),Apple(+),Guava(-),Clover(+++),Wheat (+),Bean(+),Maize(-)
Elhmmam Area	<i>H. vestalis</i>	Pear(-),Fig(-),Apple(-),Guava(-),Clover(-),Wheat(+),Bean(-),Maize(+)
	<i>T.pisana</i>	Guava(+++), Fig(+++), Grape(+), Olive(-), Clover(+++), Bean(++)
White mosque	<i>M. cartusiana</i>	Guava(-), Fig(-), Grape(-), Olive(-), Clover(+++), Bean(-)
	<i>T.pisana</i>	Pear(-),Fig(+),Apple(+),
Nassora Manor	<i>H. vestalis</i>	Pear(+),Fig(+),Apple(+),
	<i>T.pisana</i>	Fig(+++),Clover(+++)
AbuGashwh Manor	<i>M. cartusiana</i>	Fig(-),Clover(+++)
	<i>T.pisana</i>	Fig(+++), Pear(++)
alsnafra Manor	<i>T.pisana</i>	Fig(++),
Hammodabridge	<i>T.pisana</i>	Fig(++),
alchatory Manor	<i>T.pisana</i>	Fig(+),
V.abdelbaset	<i>E.vermiculata</i>	Mandarin(+), Guava(-), Navel orange(-)
Abdelsamad	<i>T.pisana</i>	Mandarin(+), Guava(+), Navel orange(++)
V Dauod	<i>T.pisana</i>	Pear(++), Apple(+),
V Ayoop	<i>T.pisana</i>	Pear(++),Apple(+),
	<i>C. acuta</i>	Pear(+),Apple(+),
Elalameen	No Snails	Plum(-), Pear(-), Apple(-), orange(-)
Seedy Kreir	No Snails	Fig(-),
El dabaa	No Snails	Fig(-),
Tmooh	No Snails	Fig(-), Olive(-),
Marsamatroh	No Snails	Fig(-), Olive(-),

For Fruit trees: (-) = No Snails, (+) =1:75, (++) = 76:200, (+++) = over 200 individuals / tree
For filed crops: (-) = No Snails, (+) = 1:20, (++) = 21:40, (+++) = over 40 individuals /m2

While, *H. vestalis* was recorded with soaring infestation on Pear, Fig and Apple in Elhmmam White mosque area. The obtained results were in agreement of those obtained by El-okda(1980), Who recorded *Deroceras reticulatum* and *Limax flavus* slugs and *E. vermiculata* and *T. pisana* snails on thirty two vegetable crops at Alexandria, Also he found that *H. vestalis* and *M. obstructa* were more abundant than cactus followed by *Rumina decollate* and *oxychilus* sp. snails. Awad (1994), mentioned that *M. cartusiana* was the supreme roomy distributed species found on most field crops, especially Egyptian clover. Besides, Mohamed (1994) who found that *E. vermiculata* and *M. obstructa* were more widely distributed on seedlings of citrus and ornamental plants as compared to *H. vestalis* and nurseries of great Cairo. El-Deeb *et al.* (1996) recorded *M. cartusiana* on Egyptian clover and *E. vermiculata* on ornamental plants, while, *C. acuta* was detected on

lemon and naval orange trees at Dakahlia, Kafr-elsheikh and Demiatta Governorates. Also, Al-Akra (2001) stated that the occurrence of land snails varied from one species to one another, since *M. cartusiana* was the most predominant species. It was found in (41) localities compared to four localities for *C. acuta* and three localities for each of *H. vestalis*, *E. vermiculata* and *Succinia* sp. at Sharkia Governorate. Mortada (2002) detected the land snails, *E. vermiculata*, *Helix aspersa* (Born), *Cepaea hortensis* (Muller), *M. cartusiana* and *C.acuta*, (Family: Helicidae), *Succinea oblonga* (Draparnand) and *Succinia putris* Linnaeus, (Family :Succineidae), *Oxychillus alliarius* (Müller), (Family: Zonitidae), *Rumina decollate* (Linnaeus) , (Family: Achatinidae) and slugs, *Limax flaus* (Linnaeus), *Lehmannia marginata* (Muller), *Deroceras reticulatum*,(Müller) and *Deroceras Laeve* (Müller), (Family: Liacidae) at Dakahlia Governorate.

Table (2): Survey of terrestrial snails associated with different host plants in north western coast, Egypt(2014)

Districts	Snail Species	Host plant& level of infestation
Maruit	<i>T.pisana</i>	Pomegranate(+++),Fig(++),Guava(+++),Apple(++), Clover(+++),Tomato(-), Bean(++),
	<i>C.acuta</i>	Pomegranate(+),Fig(-),Guava(-),Apple(+), Clover(+++),Tomato(-), Bean(-),
	<i>M. cartusiana</i>	Pomegranate(-),Fig(-),Guava(-),Apple(-), Clover(+++),Tomato(-), Bean(+),
Burg Elarab	<i>T.pisana</i>	Pear(++), Fig(+++),Guava(++),Apple(++),Olive(-), Wheat(+),Clover(+++), Bean(+),
	<i>C.acuta</i>	Pear(+), Fig(++),Guava(-),Apple(++),Olive(-), Wheat(-),Clover(+++), Bean(-),
	<i>M. cartusiana</i>	Pear(-), Fig(-),Guava(-),Apple(-),Olive(-), Wheat(-),Clover(+++), Bean(-),
Elhmmam Roaysat	<i>H. vestalis</i>	Pear(-), Fig(-),Guava(-),Apple(+),Olive(-), Wheat(-),Clover(-), Bean(-),
	<i>E. vermiculata</i>	Pear(-), Fig(-),Guava(+),Apple(-),Olive(-), Wheat(-),Clover(-), Bean(-),
	<i>T.pisana</i>	Guava(+++), Grape(+), Fig(++),Olive(-), Clover(+++), Bean(+)
Area Alpolic	<i>C. acuta</i>	Guava(-), Grape(-), Fig(++),Olive(-), Clover(+++), Bean(-)
	<i>T.pisana</i>	Grape(+),Guava(++),
White mosque	<i>T.pisana</i>	Fig(++), Apple(+), Clover(+++),
	<i>T.pisana</i>	Fig(++), Pear(++),
Abo gashwa Manor Village No.3	<i>C. acuta</i>	Fig(-), Pear(+),
	<i>T.pisana</i>	Clover(+++),Bean(+), Fig(+++), Apple(+++),Tomato(-),
Village No.4	<i>M. cartusiana</i>	Clover(+++),Bean(-), Fig(-), Apple(-),Tomato(-),
	<i>T.pisana</i>	Apple (+++),
Village No.15	<i>C. acuta</i>	Apple (+),
	<i>T.pisana</i>	Apple (+++),
Village No.20	<i>M. cartusiana</i>	Apple (+),
	<i>E. vermiculata</i>	Apple (+),
Village No.1	<i>T.pisana</i>	Plum(+), Grape(+),
	<i>C. acuta</i>	Plum(+), Grape(-),
Village No.1	<i>T.pisana</i>	Apple(+++), Tomato(-), Maiza(-) Bean(+), Gourd(-)
	<i>C. acuta</i>	Apple(+), Tomato(-), Maiza(-) Bean(+), Gourd(-)
	<i>M. cartusiana</i>	Apple(-), Tomato(-), Maiza(-) Bean(+), Gourd(-)
	<i>H. vestalis</i>	Apple(-), Tomato(-), Maiza(+), Bean(-), Gourd(-)

For Fruit trees: (-) = No Snails, (+) =1:75, (++) = 76:200, (+++) = over 200 individuals / tree

For filed crops: (-) = No Snails, (+) = 1:20, (++) = 21:40, (+++) = over 40 individuals /m²

2- Seasonal population behavior of *C.acuta* on certain fruit trees:

Seasonal population dynamics of *C. acuta* was studied on pomegranate, pear and fig during two years from March 2013 to February 2014 in north western coast. The effect of temperature and relative humidity on population behavior was also recorded Data in Table (3) revealed that individuals of *C. acuta* were found in pomegranate, fig and pear orchards throughout the year months. The lowest values of population density were determined during January or February in all of the tested orchards. On pomegranate, snail numbers counted per sample were 7(2) and 7(5) during January and

February of 2013 and 2014, respectively. While on pear the parallel values were 2(8) and 12(20), respectively, however, these values on fig were 9(9) and 15(15), respectively, In general, values of population density were gradually increased after winter months to reach the maximum values during summer months. On the other hand, peaks of *C. acuta* differed from host plant to another and from year to another. On pomegranate, the highest population densities were detected in July 2013 (42 snails / sample) and July 2014 (70 snails / sample). The parallel values on pear were 145 and 177 snails/sample, in July 2013 and July 2014, respectively. However, on fig, these values were 178 and 149 snails/

sample in July 2013 and July 2014, respectively. Comparing number of *C. acuta* during the two years, it was found that in all tested orchards infestation in the later season of 2013 were Convergent than that found in of 2014. Generally means of population density on

pomegranate, pear and fig during 2013 were 42, 145 and 178, respectively, while the parallel values during 2014 were 70, 177and 149,respectively.

Table (3) Population dynamics of the conical snail *C.acuta*, infecting pomegranate, pear and fig at north western coast during two years in relation to temperature and relative humidity.

Months	pomegranate		Pear		Fig		Temperature(°C)		Humidity (%)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
March	12	21	18	27	60	23	17.8	17.3	64.2	68.6
April	18	32	96	43	123	90	19.4	19.8	62.9	68.3
May	28	59	122	150	150	105	23.5	22.9	68.0	64.8
June	36	62	136	163	167	145	25.6	25.4	68.4	68.0
July	42	70	145	177	178	149	26.6	27	71.4	71.4
August	39	39	142	136	177	135	27.8	28.1	72.1	70.6
September	28	30	132	113	122	119	26.3	26.7	67.4	66.6
October	19	25	130	55	86	103	22.7	23.6	66.5	63.2
November	11	18	14	26	67	58	20.4	20.1	73.4	63.3
December	1	11	3	16	39	48	14.9	16.4	72.9	68.0
January	7	2	2	8	9	9	13.7	14.7	74.9	79.3
February	7	5	12	20	15	15	15.1	15.6	71.8	74.0

Temperature and Humidity = Average valve per months

On the other hand, Fig harbored a relatively higher number of *C. acuta* followed descendingly by pear and pomegranate was the least one in this respect. Total number of counted snails during the two years of 2013 and 2014 on fig, pear and pomegranate were (1183&1001),(952&934)and (246&374) respectively.

3- Seasonal population behavior of *T.pisana* on certain fruit trees:

The population dynamics of the land snail *T.pisana* on fruit trees i.e. pomegranate, pear, fig and guava were studied. This study was carried out near north western coast during successive growing seasons 2013 and 2014. Data presented in Table (4). It was obvious that maximum snail numbers were recorded during summer on fruit trees pomegranate, pear, fig and guava where the available weather conditions were

suitable for their distribution. Regarding to the population density, it was obvious that the average numbers recorded the highest averages of (682 – 574), (420 – 406), (362 – 396), (398 – 418), individuals on guava - fig – Pear - and pomegranate trees during July 2013 and 2014, respectively, while the lowest values of (16 – 9), (10 – 12), (3 – 8), (14 – 11) individuals on guava - fig – Pear - and pomegranate trees in January. 2013 and 2014 respectively. The peak which appeared in July with 682 the average recorded individuals at (26.6 °C and 71.4 R.H. %) – (27 °C and 71.4 R.H. %). These results were harmony with that obtained by Eshra 2004, lush 2007, Remondah 2009, Reham 2011 and Hassan 2013.

Table (4) Population dynamics of the white garden snail *T.pisana* infecting pomegranata, pear, fig and guava at north western coast during two years in relation to temperature and relative humidity.

Months	pomegranate		Pear		Fig		Guava		Temperature (°C)		Humidity(%)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
March	260	223	11	62	195	151	276	113	17.8	17.3	64.2	68.6
April	290	288	134	251	282	159	346	286	19.4	19.8	62.9	68.3
May	376	374	192	303	364	210	375	305	23.5	22.9	68	64.8
June	388	408	275	361	372	359	626	567	25.6	25.4	68.4	68
July	398	418	362	396	420	406	682	574	26.6	27	71.4	71.4
August	384	342	350	321	397	318	666	573	27.8	28.1	72.1	70.6
September	295	315	246	268	299	291	334	235	26.3	26.7	67.4	66.6
October	208	295	240	178	203	231	252	205	22.7	23.6	66.5	63.2
November	171	252	117	155	139	157	138	178	20.4	20.1	73.4	63.3
December	16	53	20	88	39	80	79	60	14.9	16.4	72.9	68
January	14	11	3	8	10	12	16	9	13.7	14.7	74.9	79.3
February	22	23	24	30	119	137	118	94	15.1	15.6	71.8	74

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دراسات بينية علي بعض القواقع الارضية الشائعة في الساحل الشمالي الغربي في مصر
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اسفرت دراسة تواجده وانتشار الانواع المختلفة من القواقع الارضية في الساحل الشمالي الغربي ما يلي :-أولاً:وجود خمسة انواع من القواقع الارضية تابعة لرتبة Stylommatophora تنتشر في العديد من النجوع والقرى في الساحل الشمالي الغربي، وهذه الانواع هي قوقع البرسيم الزجاجي *M. cartusiana* وقوقع الرمال الصغير *H. vestalis* وقوقع الحدائق البني *E. vermiculata* والقوقع الحلزوني *C.acuta* وقوقع الحدائق الابيض *T.pisana* هذا وقد قدر العدد الكلي للاماكن المصاحبه في الساحل الشمالي الغربي باثني عشر منطقة وهذا من الاهميه بمكان لإقتراح نظام مناسب للحجر الزراعي لتجنب نقل الاصابة من مكان الي اخر.ويختلف ظهور وتواجد هذه القواقع الارضية تبعاً للنوع حيث اظهر قوقع الحدائق الابيض اعلي نسبة انتشاراً في الساحل الشمالي الغربي حيث سجل في اثني عشر منطقة ونجع مقارنه بأربعه مناطق فقط لقوقع البرسيم الزجاجي وثلاثة قري للقوقع المخروطي ومنطقتان لكلا من قوقع الرمال الصغير وقوقع الحدائق البني وعلي الجانب الاخر فان نسبة الاصابة بالقواقع الارضية تختلف من منطقة الي اخرى.ثانياً: دراسة ديناميكية التعداد للقوقع المخروطي علي اشجار بعض انواع الفاكهه :- في هذه الدراسه تم إختيار اشجار الكمثرى والرمان والتين لدراسة التغيرات الموسمية للكثافة العددية لافراد القوقع المخروطي خلال عامين وذلك في منطقة مريوط - ومنطقة برج العرب بالساحل الشمالي الغربي حيث اسفرت النتائج التي تحصل عليها من تواجده لافراد القوقع المخروطي علي الاشجار المختبره طوال اشهر الدراسه، حيث سجل اقل تعداد لهذه الافراد خلال شهري يناير وفبراير وبعد ذلك يزداد التعداد تدريجياً إثر إنتهاء فصل الشتاء ليصل الي قمته خلال اشهر الصيف وعلي الجانب الاخر يمكن ملاحظة الاختلاف في تعداد هذه الافراد وفقاً لنوع العائل النباتي وكذلك فترات الدراسه. كذلك تم تسجيل اقصى تعداد لافراد القوقع المخروطي علي اشجار التين يليه في ذلك اشجار الكمثرى بينما تأتي اشجار الرمان في المؤخره. ثالثاً :- دراسه ديناميكية التعداد للقوقع الحدائق الابيض علي اشجار الكمثرى والرمان والتين والجوفه في منطقة مريوط - ومنطقة الحمام لمدة عامين متتاليين 2013-2014 واسفرت الدراسه ان اعلي معدل سجل في يوليو واقلها في يناير وتبين أن اعلي معدل لقوقع الحدائق الابيض قد سجل علي شجر الجوفه - التين - الكمثرى - الرمان وكان متوسطات الأعداد (682 - 574)، (420 - 406)، (362 - 396)، (398 - 418) . بينما اقل تعداد قد سجل علي شجر الجوفه - التين - الكمثرى - الرمان في يناير وكان متوسطات الأعداد (16 - 9)، (10 - 12)، (3 - 8)، (14 - 11) . على التوالي . وقد لوحظ ان الجوفه هي اكثر الأشجار اصابة بليها التين والرمان وكانت اقل الأشجار إصابة الكمثرى.