

Ecological studies on some terrestrial snails and slugs at Sohag governorate, Egypt

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Abstract

This study was carried out on certain districts at Sohag governorate, Egypt to survey and population density of some species of land snails and slugs infesting field crops, vegetable, fruit trees and ornamental plants. Results revealed that most crops highly infested with *Monacha obstructa* snail, while *Eobania vermiculata*, *Oxyloma elegans*, *Deroceras laeve* and *Lehmannia valentiana* had moderately to low infestation. As in the case of *O. elegans*, *D. laeve*, *L. valentiana* and *L. flavus*, they were recorded for the first time at Sohag governorate. Seasonal fluctuation of *M. obstructa* was obvious that the highest numbers of were recorded during Spring season (March, April and May) on fruit trees (mandarin, orange and mango), as compared to population density during the other seasons (Winter, Autumn and Summer).

Keywords: survey, population density, land snails, slugs.

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1. Introduction

Terrestrial gastropods considered as a group of serious pests attacking agricultural crops around the world. They attack plants causing great damage to the cultivated plants (Godan, 1983). Economic damage caused by these molluscs is due to not only feeding but also to contamination with their bodies, faeces or slime leading to a deterioration of the product quality (Heiba *et al.*, 2018). On the other hand, many authors surveyed the terrestrial molluscs infesting different crops in Egypt. In Sharkia governorate surveyed the terrestrial molluscs at 14 localities representing 7 districts, 5 herbivorous land snails' species were found on different host plants, these species were *Monacha cartusiana*, *Helicella vestalis*, *Eobania vermiculata*, *Cochlicella acuta* and *Succinea putris*, (Shetaia, 2005). Also the land snails were recorded on several field crops *i.e.* wheat, egyptian clover, broad bean, barley, maize and sugar beet and vegetable crops *i.e.* lettuce, cabbage, cucumber, kidney bean, eggplant, onion, okra, tomato, garlic, dill and parsley in 12 villages follow three districts in Sharkia governorate (Abed, 2017). Recently, some different land snails and slugs have been recorded in Assiut governorate (Abdelrheem, 2018; Abo-El-Naser, 2013; Ramzy, 2009). Also, in Sohag governorate, Egypt (Desoky *et al.*, 2015). The present study was to throw light on identity, survey and population density some species of terrestrial snails and slugs at Sohag governorate, Egypt.

2. Materials and methods

Survey study of terrestrial gastropods

(land snails and slugs) attacking numerous host plants were carried out in some localities at Sohag governorate, Egypt (Tahta, Akhmim, El-Balyana and Dar El-Salam districts) during two successive years (November 2018 till October 2020). Three villages were randomly chosen as representatives of each district. The villages were Arab Sabha, Naga Ahmed Ali and Alkhiam (DarEl-Salam), Shatora, Sheikh Zaineddin and Jazirat alkhuznadaria (Tahta), Alkulih, Alahayuwh Bihary and Alahayuwh Kubly (Akhmim) and El-Sahel Kubly, El-Sahel Bahary and Nugoa Bardies (El-Balyana). Survey and population density were undertaken on many host plant species including field crops *i. e.* egyptian clover, *Trifolium alexandrinum*; maize, *Zae mays*; wheat, *Triticum aestivum* and broad bean, *Vicia faba*, vegetable crops *i.e.* cabbage, *Brassica oleracea*; lettuce, *Lactuca sativa*; garlic, *Allium sativum*; onion, *A. cepa*; okra, *Abelmoschus esculentus*; eggplant, *Solanum melongena*; tomato, *S. lycopersicum*; pepper, *Capsicum annuum* and green beans *Phaseolus vulgaris*, fruit trees *i.e.* mandarin, *Citrus reticulata*; orange, *C. xsinensis* and mango, *Mangifera indica* and ornamental plants *i.e.* yucca, *Yucca aloifolia*; basil, *Ocimum basilicum*; kalanchoe, *Kalanchoe marmorata*; crassula, *Crassula arborescens* and cloves, *Syzygium aromaticum*. The field crops and vegetables samples were taken in early morning from each crop by using the quadrat sample size 50×50 cm (Staikou *et al.*, 1990). Five random

samples of ornamental plants were taken from under shrubs and plant pots. Five fruit trees were randomly chosen from each orchard. Snails and slugs were counted one time every month in the early morning in mean number of three areas of 50×50cm, under each of the examined trees, on five branches of the different direction of the tree 1m high of the tree trunk (Awad, 1994). Snails and slugs from each host plant in the different host plant were collected and transfer in a plastic box to laboratory for identification using keys given by Godan (1983). Population density for each snails or slugs was calculated according to Norton (1978). The population fluctuation of the predominant species of land snails were recorded monthly and seasonal in Arab Sabha village (Dar El-Salam district) at Sohag governorate during the period from November 2018 till October 2020. The predominant glassy clover land snail of *M. obstructa* was recorded on mandarin (*C. reticulata*), orange (*C. xsinensis*) and mango, (*M. indica*). Ten fruit trees were randomly chosen to count snails one time every month during two seasons the snails on both tree and on soil surface around the tree (50×50 cm) were recorded (Eshra, 2013). Data concerning temperature and relative humidity during the period of study were obtained from the central laboratory for Agricultural climates at Egypt. Obtained data were subjected to statistical analysis as correlation coefficient between population of snails and temperature and relative humidity according to SPSS statistics version 22.

3. Results and Discussion

Data in the Table (1) indicated that, the terrestrial snails and slugs' species recorded during the study period six species of land snails and slugs were found on different host plants, were as follow, order: Stylommatophora. Three snails species were classified according to their families as follow: (1) family Hygromiidae was represented by one species was glassy clover, *Monacha obstructa*, (2) family Succineidae was represented by one species was the amber snail, *Oxyloma elegans*, (3) family Helicidae was represented by one species was the brown garden snail, *Eobania vermiculata*, (4) family Limacidae was represented by two slugs species were the tawny garden slug *Limax flavus* and the three band garden slug, *Lehmannia valentiana*, (5) family Agriolimacidae was represented by one species was the march slug, *Deroceras laeve*. Data in the same Table showed that the infested localities and infested plants with terrestrial gastropods in four districts of Sohag governorate during the period from November 2018 till October 2020. It is clear that the glassy clover snail (*M. obstructa*), recorded in all surveyed areas, as well as it was found on all examined plants. On the other hand, the brown garden snail *E. vermiculata* and *L. valentiana*, were recorded on ornamental plants in Shatora village at Tahta district only. The amber snail, *O. elegans* was observed, on Egyptian clover, mandarin and orange in Arab Sabha village at Dar

El-Salam district. March slug, *D. leave* was recorded on Egyptian clover, mandarin, orange, lettuce and cabbage in Arab Sabha village at Dar El-Salam district, while it was recorded on ornamental plants in Shatora village at Tahta district. The tawny garden slug *L. flavus*, was recorded on ornamental plant (basil and cloves) in Alkhiam village at Dar El-Salam district.

Table (1): Survey of some species of terrestrial snails and slugs associated with field crops, vegetable crops, fruit trees, and ornamental plants in four districts at Sohag governorate, Egypt during 2018 till 2020.

Districts	Village	Field crops				Vegetable crops								Fruit trees			Ornamental plants					
		Egyptian clover	Broad bean	Wheat	Maize	Pepper	Onion	Garlic	Egg plant	cabbage	Bean	Tomato	Okra	Lettuce	Orange	Mango	Mandarin	Cloves	Kalanchoe	Crassula	Basil	Yucca
Dar el-Salam	Arab Sabha	M,O,D	M	M	M	M	-	M	M	M, D	M	M	M	M,D	M,O,D	M	M,O,D	-	-	-	-	-
	Nag Ahmed Ali	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Alkhiam	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	LL, M	-	-	LL, M	-
Tahta	Shatora	M	M	M	-	-	M	M	-	-	-	-	-	-	M	-	M	M,L2,D,E	M,L2,D,E	M,L2,D,E	M,L2,D,E	M,L2,D,E
	Sheikh Zainuddin	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jazirat Alkhuznadaria	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Akhmim	Alkulih	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Alahayuwh Bihary	M	M	M	-	-	-	M	-	-	-	-	-	-	M	-	M	-	-	-	-	-
	Alahayuwh Kubly	M	M	M	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
El-Balyana	Aissahil Kubly	M	M	M	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aissahil Bihary	M	M	M	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nugoa Bardies	M	M	M	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-

L1= *Limax flavus*, L2=*Lehmania valentiana*, E=*Eobania vermiculata*, M= *Monacha obstructa*, O= *Oxyloma elegans*, D= *Deroceras leave*.

The results revealed that four species of snails and slugs were recorded the first time in Sohag governorate, these snails and slugs were *O. elegans*, *D. leave*, *L. valentiana* and *L. flavus*. Data in Table (2 and 3) revealed that the mentioned species previously varied in their incidence and level of infestation according to locality and host plant. The listed hosts can be classified according to the degree of infestation into three categories. These categories were heavy, moderate and light infestation. Heavy infestation was found with *M. obstructa* especially Egyptian clover, in Akhmim district. Egyptian clover, cabbage, lettuce, mandarin and orange, were recorded with moderate infestation, also light infestation was recorded with maize, broad bean, wheat,

bean, eggplant, garlic, lettuce, okra, tomato, mango and ornamental plants in other study areas. While *O. elegans* was recorded the moderate infestation on orange and light infestation on mandarin and egyptian clover in Dar El-Salam district. As for *D. leave*, it noticed that, light infestation on cabbage, egyptian clover, mandarin, orange and ornamental plants in Dar El-Salam and Tahta districts. On the other hand, *L. flavus* was recorded light infestation on basil and cloves in Dar El-Salam district. Regarding *E. vermiculata* and *L. valentiana* were found light infestation on ornamental plants in Tahta district. Generally, It obvious that *M. obstructa* snail has the upper hand of terrestrial gastropods incidence compared with the other snails and slugs recorded in

the study areas. The majority of the examined plants were liable to be infested with this snail. While *D. leave*, *O. elegans*, *L. valentiana*, *E. vermiculata* and *L. flavus* were found on different localities at Sohag governorate. In respect to *D. leave*, *O. elegans*, *L. valentiana*, and *L. flavus* for the first time at Sohag governorate. Also, the results indicated that infestation levels for all terrestrial gastropods observed were medium on Egyptian clover, cabbage, and lettuce, while it was light on other infested crops. The terrestrial gastropods were found at different governorates attacking many economic crops. Ramzy (2009) found that, nine land snail species in Assiut governorate, Egypt namely, *E. vermiculata*, *M. obstructa*, *O. elegans*, *Vallonia pulechella*, *Thepa pisana*, *Vitrea pygmaea*, *Helicodiscus singleyanus inermis*, *Pupoides coenopictus* and *Cecilioides acicula*. The first three species are accessory species while the accidental species include the other six snail species. In addition, *O. elegans*, *V. pygmaea*, *P. coenopictus* and *C. acicula* were recorded for the first time in Egypt. Also, Rady et al. (2014) revealed that, five species were found infesting different crops in Ismailia and Sharkia governorates. These species were *M. cartusiana*, *C. acuta*, *S. putris*, *D. laeve* and *D. reticulatum*. The last species was recorded for the first time in Ismailia governorate. Moreover, Abo-El-Naser (2013) cleared that four terrestrial snails include three land snails and slugs were found in the main investigated sites in Assiut governorate. The three land snail

species are *Monacha obstructa*, *Eobania vermiculata* and *Oxyloma elegans*, while a slug is *Limax flavus*. All terrestrial snails and slugs *M. obstructa*, *E. vermiculata*, *O. elegans* and *L. flavus* were recorded in the Experimental Farm, Faculty of Agriculture, Assiut University, Egypt, while *M. obstructa* was recorded only in El-Wasta in Assiut governorate, during the investigation period. *L. flavus* was recorded for the first time in Assiut governorate. Abdelrheem (2018) found that eight species of terrestrial gastropoda belonging to order: Stylommatophora were found different localities of Assiut governorate. These species were: the glassy clover snail, *Monacha obstructa* the white garden snail, *Thepa pisana* the brown garden snail *Eobania vermiculata* and amber snail, *Oxyloma elegans*. While the slug species were the march slug, *Deroceras laeve*, the brown field slug, *Deroceras panormitanum*, the three-band garden slug, *Lehmannia valentiana* and the tawny garden slug, *Limax flavus*. Finally, Desoky (2018) showed that, the present study concluded the occurrence of two species of land snails, *Monacha obstructa* and *Eobania vermiculata* in the Sohag governorate, it was also he found that the spread of land snails was increased from previous periods. Regarding, Seasonal fluctuation of glassy clover *Monacha obstructa* on certain fruit trees. Survey studies showed that the glassy clover snail *M. obstructa* was the predominant species on major economic crops. Therefore, population density of such snail was studied on mandarin,

orange and mango in Arab Sabha village, during the two successive years Dar El-Salam district, Sohag governorate 2018/2019 and 2019/2020.

Table (2): Level infestation of some terrestrial gastropods on field crops and vegetable crops at certain districts at Sohag governorate, Egypt during 2018 till 2020.

Districts	Villages	Species	Average number of snail's / 0.25 m ²								Average number of snail's / 0.25m ²							
			Field crops				Vegetable crops				level of infestation on host plants				level of infestation on host plants			
			Egyptian clover	Broad bean	Wheat	Maize	Bean	Onion	Cabbage	Egg plant	Pepper	Garlic	Lettuce	Okra	Tomato			
Dar el-Salam	Alkhiam	<i>Monacha obstructa</i>	29.00	6.40	9.60	-	-	-	-	-	-	-	-	-	-	-		
		<i>Limax flavus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	Arab Sabha	<i>Monacha obstructa</i>	23.60	10.80	10.40	-	-	-	18.60	-	-	-	22.40	-	-	-		
		<i>Monacha obstructa</i>	27.80	7.60	8.60	8.60	7.40	-	19.60	10.60	9.60	5.60	21.60	5.80	11.80	-		
		<i>Oxyloma elegans</i>	10.60	-	-	-	-	-	-	-	-	-	-	-	-	-		
Tahta	Shatora	<i>Deroceras leave</i>	1.60	-	-	-	-	-	1.80	-	-	-	-	-	-	-		
		<i>Monacha obstructa</i>	24.60	8.40	1.40	-	-	11.60	27.40	-	-	12.40	29.60	-	-	-		
		<i>Eobania vermiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		<i>Deroceras leave</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		<i>Lehmania valentiana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	Sheikh Zainuddin	<i>Monacha obstructa</i>	21.60	6.40	7.60	-	-	-	-	-	-	-	-	-	-	-		
	Jazirat Alkhuznadaria	<i>Monacha obstructa</i>	25.80	9.80	5.80	-	-	-	-	-	-	-	-	-	-	-		
Akhmim	Alkulih	<i>Monacha obstructa</i>	41.40	9.60	8.40	-	-	-	-	-	-	-	-	-	-			
	Alahayuwih Biharaa	<i>Monacha obstructa</i>	34.40	8.60	9.80	-	-	-	-	-	-	4.40	-	-	-			
	Alahayuwih Qublaa	<i>Monacha obstructa</i>	49.80	10.40	10.60	-	-	-	-	-	-	3.60	-	-	-			
El-Balyana	Alssahil Alqublaa	<i>Monacha obstructa</i>	21.60	8.40	8.40	-	-	-	-	-	-	-	-	-	-			
	Alssahil Albhra	<i>Monacha obstructa</i>	27.40	9.40	7.40	-	-	-	29.40	-	-	-	-	-	-			
	Nugoa Bardies	<i>Monacha obstructa</i>	18.60	9.60	9.60	-	-	-	25.60	-	-	-	-	-	-			

(-) = No snails, low infestation (less than 15 snails /0.25 m²), moderate infestation (between 15-30 snails /0.25 m²), heavy infestation (more than 30 snail /0.25 m²).

Table (3): Level infestation of some terrestrial gastropods on fruit trees and ornamental plants at certain districts at Sohag governorate, Egypt during 2018 till 2020.

Districts	Villages	Species	Average number of terrestrial gastropods /Streets			Average number of terrestrial gastropods / 5 Shrubs and plant pots				
			Fruit trees			Ornamental plants				
			Level of infestation on host plants			level of infestation on host plants				
			Mandarin	Mango	Orange	Basil	Crassula	Kalanchoe	Yucca	Cloves
Dar el-Salam	Alkhiam	<i>Monacha obstructa</i>	-	-	-	1.80	-	-	-	1.8
		<i>Limax flavus</i>	-	-	-	1.60	-	-	-	0.6
	Arab Sabha	<i>Monacha obstructa</i>	-	-	-	-	-	-	-	-
		<i>Monacha obstructa</i>	19.00	13.60	19.00	-	-	-	-	-
		<i>Oxyloma elegans</i>	13.60	-	19.40	-	-	-	-	-
Tahta	Shatora	<i>Deroceras leave</i>	1.80	-	1.40	-	-	-	-	-
		<i>Monacha obstructa</i>	16.40	-	17.80	1.60	2.60	1.40	2.40	1.80
		<i>Eobania vermiculata</i>	-	-	-	1.40	1.80	0.40	0.60	0.80
		<i>Deroceras leave</i>	-	-	-	1.80	1.60	0.60	0.80	0.60
		<i>Lehmania valentiana</i>	-	-	-	1.40	0.60	0.80	0.60	0.40
	Sheikh Zainuddin	<i>Monacha obstructa</i>	-	-	-	-	-	-	-	-
	Jazirat Alkhuznadaria	<i>Monacha obstructa</i>	-	-	-	-	-	-	-	-
Akhmim	Alkulih	<i>Monacha obstructa</i>	-	-	-	-	-	-	-	-
	Alahayuwih Bahary	<i>Monacha obstructa</i>	-	-	-	-	-	-	-	-
	Alahayuwih Kubly	<i>Monacha obstructa</i>	-	-	-	-	-	-	-	-
El-Balyana	Alssahil Kubly	<i>Monacha obstructa</i>	-	-	-	-	-	-	-	-
	Alssahil Albhry	<i>Monacha obstructa</i>	-	-	-	-	-	-	-	-
	Nujue Biradis	<i>Monacha obstructa</i>	-	-	-	-	-	-	-	-

For ornamental plants: (-) = No snails, low infestation (less than 15 snails /0.25 m²), moderate infestation (between 15-30 snails /0.25 m²), heavy infestation (more than 30 snail /0.25 m²). For fruit trees: (-) = No snails, low infestation = 1:7, moderate infestation = 76:200, heavy infestation = over 200 individuals /tree.

Data in Table (4) showed that, the highest numbers of snail was recorded on mandarin trees during months March (37 and 37.6), April (61.4 and 42.4) and May (54.2 and 45.2) average number of snails sample /5 tree during the two years 2018/2019 and 2019/2020, respectively. While it was lowest values during January (6.8 and 8.9), August (6.4 and 8.5), September (2.4 and 3.4) and October (2.2 and 4.2), average number of snail's sample /5 tree during the two tested growing years 2018/2019 and 2019/2020, respectively. For instance, orange maximum snail numbers were recorded during months March (33.8 and 26.2), April (54 and

42.6) and May (39.6 and 41.4) average number of snail's sample /5 tree during the two tested growing years 2018/2019 and 2019/2020, respectively. While, it was lowest values during January (6.4 and 8.4), September (3.6 and 2.8), October (2.6 and 1.6) average number of snail's sample /5 tree during the two tested growing years 2018/2019 and 2019/2020, respectively. Whereas, mango was recorded highest numbers of snail during March (20 and 23.8), April (33.6 and 29) and May (32.8 and 30) average number of snail's sample /5 tree during the two tested growing years 2018/2019 and 2019/2020, respectively.

Table (4): Population dynamics of glassy clover snail *M. obstructa* on some fruit trees at Sohag governorate, Egypt during two successive growing seasons 2018/2019 and 2019/2020 in relation to temperature and relative humidity.

Months	Average number of snail's /5 tree						Temperature (°C)		Relative humidity (%)	
	Mandarin		Orange		Mango		2018/2019	2019/2020	2018/2019	2019/2020
	2018/2019	2019/2020	2018/2019	2019/2020	2018/2019	2019/2020				
November	11	12.2	12	14.4	7	6.4	19.81	17.67	41.96	37.73
December	11.4	13.8	9	13.4	9.2	8.2	13.98	14.89	52.74	47.78
January	6.8	8.9	6.4	8.4	6.8	10.8	12.5	11.5	36.2	52.35
February	16.2	18.6	18.8	22.2	15.4	17	14.57	14.5	41.61	42.7
March	37	37.6	33.8	26.2	20	23.8	16.99	19.14	29.73	31.22
April	61.4	42.4	54	42.6	33.6	29	21.91	22.21	23.49	26.56
May	54.2	45.2	39.6	41.4	32.8	30	29.91	28.18	13.57	20.15
June	13.4	30	27.8	32.4	15.4	20	31.94	30.74	19.86	18.58
July	9.8	12.2	9.8	16.8	12.6	17.8	31.89	32	19.98	20.79
August	6.4	8.5	9.4	12.6	5.2	6.2	31.67	31.73	22.28	21.64
September	2.4	3.4	3.6	2.8	2.6	2	29.49	32.25	26.84	22.81
October	2.2	4.2	2.6	1.6	3.6	2.6		27.24	29.89	29.95
Total	232.2	237	226.8	234.8	164.2	173.8				
Mean	19.35	19.75	18.9	19.56	13.68	14.48				

While it was lowest values during August (5.2 and 6.2), September (2.6 and 2) and October (3.6 and 2.6) average number of snail's sample/5 tree during the two tested growing years 2018/2019 and 2019/2020, respectively. Generally, the population density in the next growing year 2019/2020 was highly compared with the first growing year 2018/2019. On the other hand, mean numbers of snail on

mandarin, orange and mango were (19.35 and 19.75), (18.9 and 19.56), (13.68 and 14.48) average number of snail's sample /5 tree during the two successive growing years, respectively. The population dynamics mandarin, harbored the highest numbers of snail, followed by orange and mango during March, April and May. it could be concluded that the population density of *Monacha obstructa* was

obvious that highest numbers were recorded during spring (March, April and May) on fruit trees (mandarin, orange and mango), as compared to population density during the other seasons (Winter, Autumn and Summer).

Table (5): Effect of temperature and relative humidity on population dynamics of *M. obstructa* on different fruit trees at Sohag governorate, Egypt during 2018 till 2020.

Host plant	Temperature (°C)		Relative humidity (%)	
	2018/2019	2019/2020	2018/2019	2019/2020
Mandarin	-0.151ns	-0.059 ns	-0.372ns	-0.238 ns
Orange	0.005ns	-0.010ns	-0.409ns	-0.270 ns
Mango	0.011ns	-0.057ns	-0.423ns	-0.215 ns

Each value represents correlation coefficient. ns = non-significant.

The correlations between some climatic factor *i.e.* temperature, relative humidity and population density of *M. obstructa* during the two successive growing seasons were subjected to statistical analysis. Data presented in Table (5) revealed that temperature and relative humidity showed a variable effect on population density of *M. obstructa* since correlation coefficient values differed from one host to another in the two seasons of the experiment. For instance, correlation between population density of *M. obstructa* and temperature on mandarin, the correlation was non-significant negative during the two successive seasons. For orange and mango, the correlation was non-significant negative during season 2019/2020 and positive during season 2018/2019. Also, the correlation was non-significant negative between the population density and relative humidity on mandarin, orange and mango during the two successive seasons. Obtained results of population dynamics on different crops at Arab Sabha village, Dar

El-Salam district at Sohag governorate, were agreement results reported by many authors, Mahrous *et al.* (2002) reported that the population density of *M. cartusiana* was obviously increased during Spring months (March, April, and May) as compared to low or moderate values during Winter and Autumn months at Sharkia governorate. Shetaia *et al.* 2(009) showed that population dynamics, it found that *M. cartusiana* snail was recorded with high density at the tested winter crops during Spring (March, April and May) as compared with Winter or autumn seasons. Ismail *et al.* (2011) showed that population dynamics of *M. cartusiana* at Abo-Kapeer district, Sharkia governorate was recorded with high density during Spring months (March, April and May) as compared with Winter or fall months.

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