

Field Trials on Land Gastropods Infesting some Ornamental Plants at Kafr EL-Sheikh Governorate

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ABSTRACT

Land molluscs became one of the most serious pests attacking many plants including ornamental plants. Occurrence of certain land gastropods associated with some ornamental plants at Kafr EL-Sheikh Governorate was conducted. Results revealed that the land snails, *Eobania vermiculata* and *Succinea putris* and the land slug *Deroceras reticulatum* were recorded on the tested plants. *E. vermiculata* was the predominant species while the other identified gastropods showed lower infestation levels. Therefore, the seasonal abundance of the predominant snail, *E. vermiculata* was studied and results showed that the population of *E. vermiculata* was increased during spring months (171.99 snails/ $\frac{1}{2}$ m²) as compared to summer and autumn (149,34 and 59,33), respectively whereas the infestation was the least during winter (40.67 snails/ $\frac{1}{2}$ m²). Malabar was superior among the tested plants since it attracted the highest number of snails with mean of (5.68 \pm 1.56) snails/ $\frac{1}{2}$ m² followed by Hibiscus, basil, kockia, Dusty Miller, Manitoaka and Royal palm, respectively. Both of Pricharida and Duranta were the least attractive to snails. Concerning the efficacy of certain pesticides against *E. vermiculata* under field conditions, Data revealed that Agrinate was more toxic to snails than the other pesticides, since it achieved the highest reduction percentage of snail population of (69.03 \pm 7.2) % followed by Vicarb with reduction of (55.87 \pm 6.8)% while Uphold was the least in this respect with reduction percentage of (25.41 \pm 2.6)%.

INTRODUCTION

Terrestrial snails and slugs have increased in their importance value and became dangerous pests. They cause considerable damage to wide variety of plants including horticultural and field crops (Heikal, 2015). Damage caused by these molluscs is due to feeding and contamination with their body, faces or slime leading to deterioration of the product quality, in addition the financial loss (Iglesias *et al.*, 2003).

In Egypt, land snails and slugs attack ornamental and medical plants and have a great effect on them. The land snails *E. vermiculata*, *Theba pisana* and *Cochlicella acuta* were recorded in Egyptian localities attacking various ornamental plants (Eshra, 2013). However, *E. vermiculata* was the most abundant species on ornamental plants (Mahrous, *et al.*, 2002). The population fluctuation of land snails differed from host plant to another and also, varied according to locality. Temperature, relative humidity and season affected the activity of land snails and slugs (Awad, 2014). Land snails were controlled by chemical molluscicides (Geasa *et al.*, 2013).

Molluscicides directed against terrestrial gastropods are only occasionally delivered as sprays or dust but are more usually deployed in baits (Barker, 2002) and (Ismail *et al.*, 2014). The low mammalian toxicity of the chemical compounds supports the save recommendation of using these chemicals by baiting technique not only to minimize pollution but also to keep natural enemies a live (Okka, 2005). Moreover, bait technique is simple for use, focal treatment not area wide, thus it is usually low costly (Mortada *et al.*, 2005). The objective of this work was to study the occurrence of terrestrial gastropods on some ornamental plants at Kafr EL-Sheikh Governorate and also to study the seasonal abundance and host preference of the land snail *E. vermiculata* attacking several ornamental plants. In addition, to evaluate the molluscicidal activity of three pesticides (Agrinate, Uphold and Vicarb) under field conditions.

MATERIALS AND METHODS

Ecological studies:

This study was undertaken during the period from March 2015 to February 2016 at a nursery of ornamental

plants at Kafr EL-Sheikh district, Kafr EL-Sheikh Governorate. The tested plants were: Basil, (*Osmium basilicum*), prichardia (*Washingtonia filifera*), Hibiscus (*Hibiscus sinensis*), Manitoaka (*Myoporum serratum*), Dusty Miller (*Senecio cineraria*), kockia (*Bassia scoparia*), Royal palm (*Roystonea regia*), Malabar (*Adhatada vasica*), Duranta (*Duranta repers*).

Occurrence of terrestrial gastropods attacking ornamental plants at Kafr EL-Sheikh district:

A monthly survey was conducted to study the population density of terrestrial gastropods attacking obvious ornamental plants. At each sampling date, three samples were taken randomly for each host plant (50 \times 50 cm²) each one. The collected land snails and slugs were transported to laboratory and identified on the basis of external features of shell and body according to (Godan, 1983).

The seasonal abundance of the land snail *E. vermiculata* on certain ornamental plants:

The seasonal abundance of the predominant land snail *E. vermiculata* was studied on the nine abovementioned host plants. Numbers of snails found on plants, pots and on soil surface in three plots half m² each were recorded on each host plant. The counted snails left in their initial places (Baker, 1988). Examination occurred in early morning.

Host preference of the land snail *E. vermiculata* to numerous ornamental plants:

Concerning the host preference of snails to different host plants, the total numbers of the land snail *E. vermiculata* which recorded monthly in sampling area 50 \times 50 cm² and replicated three times for each host plant was considered as an indicator for host plant preference.

Toxicological studies:

Efficacy of certain pesticides against *E. vermiculata* under field conditions.

Tested compounds:

Agrinate (methomyl 24 % W.P).

Vicarb (indoxacarb 15 % S.C).

Uphold (spinetoram 6 % + methoxyfenozide 30 %, 36 % S.C).

Pesticides tested were kindly offered by plant protection Research Institute, Agriculture Research center.

Preparation of baits:

The tested compounds were applied as poisonous baits prepared by the same method described by (Miller *et al.*, 1988) as follows: Poisonous baits consisted of (150 gm. of wheat brain mixed with 50 ml. water containing appropriate amount(0.25,0.03 and 0.025 ml for Agrinate, Uphold and Vicarb, respectively) of tested pesticides plus 30 ml of sugar cane honey to attract snails). Control treatments were designed without pesticides.

Field experiment:

The molluscicidal activity of baits of three pesticides was evaluated against the land snail *E. vermiculata* in an infested ornamental plants nursery at Kafr EL-Sheikh district during May 2018. The study area was divided into three plots each of about 50 m² and an area was left between each other (Mortada, 2002). Each plot was divided into three subplots represented three replicates for each treatment and another one was left without treatment as check control. Poisonous baits were offered on plastic pieces (each one contained about 150 gm.). Number of snails was counted in half meter placed adjacent to baits in check and treatments area before application and then after 1, 3, 7, 14 days post treatment (Ismail and Shetaia, 2009).

Reduction percentage was calculated according to the formula given by Henderson and Tilton (1955) as follows.

$$\% \text{ Reduction} = \left(1 - \frac{t_2 \times r_1}{t_1 \times r_2} \right) \times 100$$

Where:

- t₁ = number of a live snails before treatment in treated plots.
- t₂ = number of a live snails after treatment in treated plots.
- r₁ = number of a live snails before treatment in untreated plots.
- r₂ = number of a live snails after treatment in untreated plots.

RESULTS AND DISCUSSION

Ecological studies:

Occurrence of terrestrial gastropods attacking some ornamental plants at Kafr EL-Sheikh district.

Terrestrial gastropods (snails and slugs) species were subjected to an extensive occurrence survey on ornamental

plants at Kafr EL-Sheikh district. As illustrated in Table (1) three herbivorous species, two land snails and one slug species, were surveyed. The collected species were belonging to one order (Stylomatophora), which represented in the present work by three families. The first family was Helicidae which presented by the land snail *E. vermiculata*; while the second family: Succinidae was presented by the land snail *S. putris*. Finally, the third family was belonging to terrestrial slugs, Limacidae was presented by the slug *D. reticulatum*. It is clearly shown that the land snail *E. vermiculata* was the predominant species in the previous location on ornamental plants. Since, it had the upper hand on snail and slugs incidence compared to the other species. It was recorded on all surveyed plants with relatively high numbers. Moreover, the majority of the examined plants were liable to be infested by this snail while the other identified gastropods showed limited level of infestation. It also obvious that *E. vermiculata* snails were recorded all over the year round on the infested plants while, the species of *S. putris*. and *D. reticulatum*. were recorded in fewer numbers during months of spring and summer seasons only. From the foregoing results, it should be apparent that the occurrence of gastropod species differed according to plant species and weather conditions. These results agreed with those reported by EL-Deeb *et al.*, (1996) who recorded *E. vermiculata* on some ornamental plants at Dakahlia, Kafr EL-Sheikh and Dumyat Governorates. Mahmoud (1994) surveyed some nurseries in big Cairo. She found the land snails, *Monacha sp.*, *Cochlicella sp.* And *Eobania sp.* on some ornamental seedling plants i.e. cocus palm, ficus, rose and citrus seedlings. Shoieb (2008) recorded *E. vermiculata* only on ornamental plants in public gardens at Port Said Governorate Mahrous *et al.*, (2002) recorded *Succinea sp.* for the first time at Sharkia Governorate with low relative occurrence with (5.46%). Also, Ismail *et al.*, (2011) recorded *Deroceras sp.* for first time at Sharkia Governorate associated with agriculture crops and chicory with high infestation.

Table 1. Occurrence of terrestrial gastropods attacking certain ornamental plants at kafr El sheikh Governorate:

Season	Basil	Prichardia	Hibiscus	Manitoka	Dusty Miler	Kochia	Royal palm	Malabar	Duranta
Winter	---	E	E	E	-	E	E	E	E
Spring	E	E	E,S,D	E,S,D	E,S	E	E	E,S	E,D
Summer	E,S	E,S	E,S	E,S	E,S,D	E	E,D	E,S	E,D
Autumn	E	E	E	E	E	E	E	E	E

E=*Eobania vermiculata* S=*Succenia putris*. D=*Deroceras reticulatum*

The seasonal abundance of the predominant land snail *E. vermiculata* on certain ornamental plants:

Survey study showed that the brown garden snail *E. vermiculata* was the predominant species with a relatively high numbers on the tested plants. Therefore, population dynamics of such snail was studied monthly. Data in Table (2) revealed that the initial infestation of *E. vermiculata* in March was at a relatively low population density (33.66 snails per the quadrate sample size of 50 × 50 cm²). Malabar harbored the highest population in this month with 7.00 snails / 1/2 m², while Dusty Miller was the lowest with 1.33 snails / 1/2 m². It is clear that numbers of snails noticeably

increased to 71.99 snails / 1/2 m² during April. As March, Malabar harbored higher numbers of snails than the other plants with (17.33) snails / 1/2 m² However, a slight decrease in population was observed in May since the numbers reached to 66.34 snails/ 1/2 m². The maximum increase of snail population was recorded in June and the number of snails reached its peak since the total number of snails was 91.32 snails / 1/2 m² Later, the population of *E. vermiculata* sharply decrease during July to 34.68. This decreased continued gradually throughout the coming months and achieved 23.34, 25.33, 20.67 and 13.33 snails / 1/2 m² in August, September, October and November, respectively.

The snails were hardly detected during December and completely disappeared from Basil, Hibiscus, Dussty Miller, Malabar and Duranta. By January the infestation appeared again and the population began to increase and reached to 14.67 snails/ 1/2 m². Snail's density progressively increased towards February and recorded 22.66 snails /1/2 m².

Concerning the activity of snails all over the year seasons Data in Table (2) and Fig. (1) showed that snails were active during all study period. Generally, it could be concluded that the population of *E. vermiculata* was obviously increased during spring months (March, April and May) (171.99 snails/ 1/2 m²) as compared to population during summer (149.34 snails /1/2 m²) and autumn (59.33 snails /1/2 m²) where the weather conditions in spring were

suitable for the snail activity. Whereas the infestation was the least during winter (40.67 snails /1/2 m²). These results agree with (Mahmoud 1994) who reported that the population of *Eobania sp.* was active in the whole year months on most of surveyed nurseries of big Cairo especially in spring months. (EL-Deeb *et al.*, 1996) assured that the population of *Eobania sp.* Reached to the maximum during spring and autumn seasons in Domiat and Kafr EL-Sheikh Governorates. (Arafa, 1997) reported that little snail numbers were recorded mostly during autumn, while these numbers were recorded during summer and winter, he also recorded a peak of snail population during May on different ornamental plants i. e. seseveria, , date palm, hibiscus, pritchardia and stock.

Table 2. Relative abundance of the land snail *Eobania vermiculata* on certain ornamental plants at kafr El-Sheikh Governorate.

Months	No. of Snails/1/2m ²									
	Basil	Prichardia	Hibiscus	Manitoka	Dusty Miler	Kochia	Royal palm	Malabar	Duranta	Total
Mar.	2.67	2.33	5.33	5.00	1.33	4.33	2.00	7.00	3.67	33.66
Apr.	7.67	13.00	7.00	6.00	14.33	2.33	2.33	17.33	2.00	71.99
May	7.00	2.00	10.67	5.00	14.67	2.00	2.00	13.00	10.00	66.34
Total	17.34	17.33	23.00	16.00	30.33	8.66	6.33	37.33	15.67	171.99
Jun.	24.00	3.33	13.67	7.33	4.00	10.33	8.33	11.33	9.00	91.32
Jul.	10.00	0.33	6.67	2.67	1.67	5.67	0.67	5.00	2.00	34.68
Aug.	1.00	1.33	5.00	1.33	5.67	5.67	0.67	2.00	0.67	23.34
Total	35.00	4.99	25.34	11.33	11.39	21.67	9.67	18.33	11.67	149.34
Sep.	2.00	2.00	6.67	-	1.67	5.00	3.33	3.33	1.33	25.33
Oct.	3.76	1.67	4.00	0.33	-	5.67	1.33	3.67	0.33	20.67
Nov.	2.00	1.33	2.67	1.33	-	2.67	1.00	2.00	0.33	13.33
Total	7.67	5.00	13.34	1.66	1.67	13.34	5.66	9.00	1.99	59.33
Dec.	-	1.00	-	1	-	0.67	0.67	-	-	3.34
Jan.	-	1.33	2	3	-	2.67	3.67	1.33	0.67	14.67
Feb.	-	1.76	2.33	2.67	-	5.00	7.33	2.33	1.33	22.66
Total	-	4.00	4.33	6.67	-	8.34	11.67	3.66	2.00	40.67
Mean±SE	5.0±1.97	2.6±0.96	5.49±1.12	2.97±0.68	3.61±1.5	4.33±0.73	2.77±0.74	5.68±1.56	2.61±0.97	----

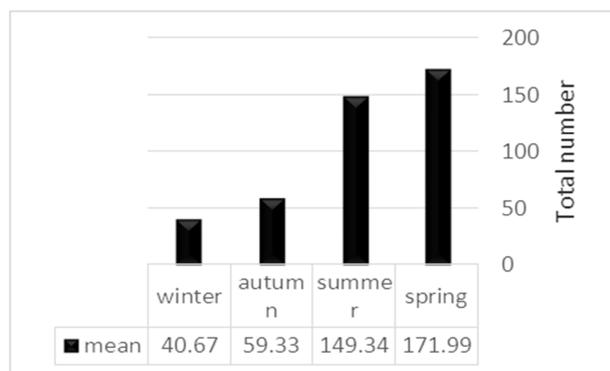


Fig. 1. The activity of *Eobania vermiculata* snails during year seasons

Host preference of the land snail *E. vermiculata* to numerous ornamental plants:

The relative occurrence of *E. vermiculata* on the different infested plants was considered as an indicator for host preference for the snail Fig (2). It's obvious that Malabar was more attractive to snails than the other tested plants. Since the mean number of snails recorded on it was (5.68 ± 1.56 snails /1/2 m²) followed by Hibiscus (5.49 ± 1.12 snails /1/2 m²) while Basil was the third in this category with mean number of (5.00 ± 1.97 snails /1/2 m²) followed by kochia which attracted (4.33 ± 0.73 snails /1/2 m²) . Dusty Miller was less attractive to snails than the obvious plants, it harbored (3.61 ± 1.5 snails /1/2 m²) followed by Manitoka

and Royal palm (2.97 ± 0.68 and 2.71 ± 0.74 snails /1/2 m²) respectively. Both of Pricharida and Duranta harbored close mean numbers (2.60 ± 0.96 and 2.61 ± 0.97 snails /1/2 m²). It is obvious that Malabar was superior among the other tested ornamental plants. (Mahrous *et al.*, 2002) reported that casuarinas was the most preferable host for *E. vermiculata* snails which infested ornamental plants at Sharkia Governorate with population density ranged from 2.1 on Malabar to 32.4 on Sasavaria. (AL-Akraa *et al.* 2010) studied the food preference of *E. vermiculata* and *T. pisana*, they reported that peganums and Hibiscus leaves were most preferred for both snail species while sansevaria and date palm leaves were less than the two previous ornamental plants.

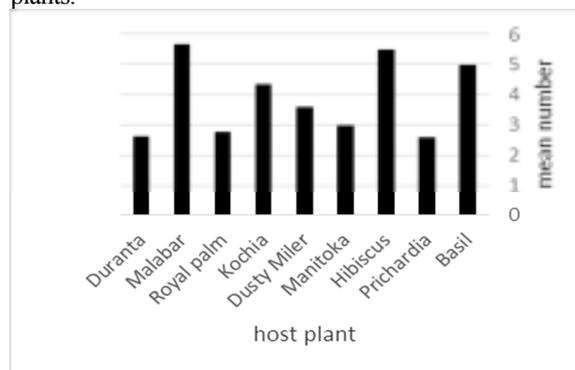


Fig. 2. Host preference of the land snail *E. vermiculata* to numerous ornamental plants.

2-Toxicological studies:**Efficacy of certain pesticides against *E. vermiculata* under field conditions.**

The molluscicidal efficiency of Agrinate, Vicarb and Uphold was evaluated as poisonous baits against *E. vermiculata* snails infested ornamental plants under field conditions of Kafr EL-Sheikh district during May 2018. Data in Table (3) revealed that Agrinate was more toxic than Vicarb and Uphold, since it gave a high residual effect on snail population with % reduction of $(82.38 \pm 3.7)\%$ followed by Vicarb $(49.63 \pm 4.3)\%$. On the other hand, Uphold was the least in this concern with low reduction percentages on snail population with value of $(28.59 \pm 3.1)\%$. Regarding the general means, Agrinate was the most in reducing the population density of *E. vermiculata*, it achieved $(69.03 \pm 7.2)\%$ reduction while Vicarb and Uphold gave (55.87 ± 6.8) and $(25.41 \pm 2.6)\%$ reduction of *E. vermiculata*, respectively. Generally, it could be reported that the recommended carbamate pesticide Agrinate (Methomyl) was the most effective in controlling *E. vermiculata* under field conditions. These findings agreed with (Okka, 2005) who reported that carbamate and

organophosphate pesticides were highly effective against the land snail *Monacha cantiana*. Carbamates were used as insecticides, herbicides and fungicides and they had also won a place as molluscicides (Godan,1983). Carbamate compounds had a wide range of effects and they are little affected by environmental conditions and their toxicity increase in humid surroundings, which are optimal for gastropods (Fouad *et al.*,2004) (Shahawy, 2018) reported that Agrinate affected the activity of aspartate Aminotransferases (Ast), alanine Aminotransferases (Alt), total lipid (TL) and total proteins (TP). Finally, carbamate compound were more effective against land snails under laboratory and field conditions (EL-Okda *et al.*, 1989; Fouly *et al.*, 2002; Ismail *et al.*, 2005., Mortada *et al.*, 2012; Geasa *et al.*, 2013;Abd EL-Wahed 2014 and Samy *et al.*, 2015). On the other hand, (Mortada *et al.*, 2005) and (Ismail and Shetaia, 2009) reported that metaldehyde was more effective than methomyl in controlling the land snail *M. cartusiana*. Also, (Mortada *et al.*, 2005) reported that Molotov 3 % and Gastrotox 5 % exhibited the highest toxic action against *M. cartusiana* while Neomyle 90 % and Vertimec appeared to be the least in this respect.

Table 3. Efficacy of certain pesticides in controlling the land snail *Eobania vermiculata* infested ornamental plants at kafr El sheikh district under field conditions.

Pesticides	%Reduction after treatment (in days)						General mean
	1 day	3 days	Initial effect	7 days	14 days	Residual effect	
Agrinate	71.43 \pm 1.30	39.90 \pm 0.57	55.67 \pm 2.60	82.85 \pm 1.45	81.90 \pm 0.57	82.38 \pm 3.70	69.03 \pm 7.20
Vicarp	69.97 \pm 2.30	54.25 \pm 2.30	62.11 \pm 4.30	26.73 \pm 2.90	72.53 \pm 1.40	49.63 \pm 4.30	55.87 \pm 6.80
Upholod	16.67 \pm 2.60	27.79 \pm 3.10	22.23 \pm 4.30	22.07 \pm 4.30	35.10 \pm 2.80	28.59 \pm 3.10	25.41 \pm 2.60

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بعض التجارب الحقلية على البطنقدميات التي تصيب نباتات الزينة في محافظة كفر الشيخ وفاء عبد المجيد شهاوي قسم بحوث الحيوانات الضارة - معهد بحوث وقاية النباتات - مركز البحوث الزراعية- الدقى - جيزة

أصبحت الرخويات الأرضية واحدة من أهم الآفات التي تصيب العديد من النباتات بما فيها نباتات الزينة. وقد تم في هذه الدراسة حصر العديد من الرخويات المرتبطة ببعض نباتات الزينة في محافظة كفر الشيخ. وقد أوضحت النتائج تواجد كلا من القوقعين الأرضيين إيوانيا فيرميكولاتا و ساكسينيا بيوترس والبراقة ديروسيرس ريتيكولاتم وكان القوقع إيوانيا فيرميكولاتا هو الأكثر شيوعا عن كلا النوعين الآخرين من البطنقدميات والذان تم تسجيلهما بأعداد قليلة. لذلك فقد تم دراسة التنديب الموسمي والتفضيل العوائل للقوقع الأرضي إيوانيا فيرميكولاتا حيث أوضحت النتائج أن تعداد القوقع قد إزداد بشكل ملحوظ خلال أشهر الربيع (171,99 قوقع/م²) وذلك مقارنة بفصل الصيف والخريف وقد كان التعداد أقل مايمكن في فصل الشتاء (40,67 قوقع/م²) وقد كان نبات البوستاشيا هو الأكثر جذبا للقوقع إيوانيا فيرميكولاتا حيث كان تعداد القوقع التي سجلت عليه (5,68±1,56 قوقع/م²) يليها نباتات الهيسكس والريحان والكوكيا والشيرانيا والبيروميا ونخيل الملوكى على التوالي. وقد كان نباتي البرتشارديا والدورانتا هي الأقل جذبا للقوقع فيما يتعلق بفاعلية بعض المبيدات للقوقع الأرضي إيوانيا فيرميكولاتا تحت الظروف الحقلية فقد أوضحت النتائج أن مبيد الأجرينيت هو الأكثر سمية حيث أعطى نسبة خفض في تعداد القوقع تقدر ب(7.2±69.03) % يليه مبيد فيكارب بنسبة خفض تقدر ب(6.8±55.87) % بينما كان مبيد أبهولد هو الأقل في هذا الشأن حيث تسبب في نسبة خفض قليلة في التعداد تقدر ب(2.6±25.41) % .