

## Dispersal of the Land Snail *Eobania vermiculata* in Citrus Orchards in Sharkia Governorate.

Ismail, Sh. A. A.; M. A. Issa; S. Z. S. Shetaia and M. M. Khattab  
Plant Protection Institute, Agric. Res. Cent. Dokki, Giza, Egypt.



### ABSTRACT

Vertical and horizontal dispersals of the land snail *Eobania vermiculata* (Müller, 1774) were investigated in citrus orchards cultivated with navel orange surrounded with casuarina trees at Inshas locality, Belbies district, Sharkia Governorate during the growing season 2014\2015. Results revealed that in vertical distribution, the population density of snails decreased by increasing distances on navel orange trees. Spring season harbored the highest population densities followed by summer and winter. Regarding vertical distribution on casuarina trees, it was noticed that summer season has the highest population densities followed by spring and winter. The same trend was observed for the three levels where population densities decreased by increasing high distances on casuarina trees. Regarding, horizontal distribution on navel orange trees, it was noticed that population density slightly decreased by increasing distances from the adjacent orchards for the growing seasons. Population density of the snails didn't clearly differ during the three growing seasons.

### INTRODUCTION

The most serious gastropod pests of certain crops are those widely dispersal by human activity, mostly in association with movement of soil and plant materials. In crops where there is much physical disturbance, such as soil cultivation, gastropods of slug form tend to predominate, while in the more stable situations, both slugs and snails form are generally present (Barker, 2002). Land snails have been rapidly increased in the last few years and many species were recorded in the majority of governorates (Ghamry *et al.*, 1993, El-Deeb *et al.*, 1997, El-Masry, 1997, Mahrous *et al.*, 2002, Ismail, 1997, Arafa, 2006, and Abed, 2017). Locomotory activity cares only under particular vesical conditions i.e. temperature, photoperiod and air humidity. Which can be considered as important determinates (Cameron, 1970). The snail *Eobania vermiculata* (Mollusca-Helicidae) is an important introduced pest to orchards and ornamental plants at Sharkia Governorate (Ismail, 1997 and 2004). Ismail *et al.*, (2003) demonstrated that *E. vermiculata* is essentially nocturnal and its activity is closely associated with moisture according to the habitat, daily movement of such snails differed from place to another.

Successful control of land snails commonly by chemical, cultural, mechanical or biological means require an understanding of the species disperse ability (Baker, 1988). Moreover *Monacha cartusiana* (Müller, 1774) snail moves more distances in fallow land than cultivated which it reached 2.46 m and 0.95 m/day, respectively (Ismail, 2008).

The aim of this study is to through light on the dispersal of *E. vermiculata* snails in citrus trees as well as windbreaks casuarina trees around orchard (vertical and horizontal distribution).

### MATERIALS AND METHODS

#### 1-Study area:

The present study was conducted in citrus orchards navel orange *Citrus sircenses* (L. Osbeck) at Inshas locality, Belbies district, Sharkia Governorate. An orchard divided into Basins each 10 feddans surrounded with casuarina trees more than 30 meters. The main irrigation system was sprinkler irrigation

system. Interspaced between trees rows was heavy infested with different types of weeds.

#### 2-Vertical dispersal:

##### On orange trees:

Population density of *E. vermiculata* snails were measured during three successive growing seasons (winter, spring and summer) on orange trees during 2014/2015. Three levels for each tree were chosen as follow one, two and three meters for each. All live snail adults and juveniles were counted and recorded on trunk or shrubs of orange citrus and left in their initial places.

##### On Casuarina trees:

Population density of *E. vermiculata* snails were counted during three growing seasons as previously mentioned. Casuarina trees were divided into three levels 2<sup>m</sup>, 4<sup>m</sup>, more than 4<sup>m</sup>. All live snail adults and juveniles on trunk were recorded and left in their initial places.

#### 3-Horizontal dispersal:

This study was carried out on citrus orchards only. Population density of *E. vermiculata* snails were counted on soil surface at the three distances 5, 10 and 15 m from adjacent. All live snail adults and juveniles were recorded and left in their initial places as mentioned before.

#### Statistical analysis:

The data were Statistically analyzed using ANOVA test (L.S.D.,  $P \leq 0.05$ ) using SAS program (SAS institute, 1988).

### RESULTS AND DISCUSSION

#### A- Vertical dispersal on navel orange trees:

Data in Table (1) and Fig. (1) showed that population density of *E. vermiculata* snails different from level to another and from season to another. For instance, population density regarding levels, it showed decreasing in numbers with increasing distances for orange trees, where averaged 14.2, 6.6 and 3.4 snails for winter; 38.4, 15, 7.6 snails for spring and 28.2, 19.2, 10.8 snails for summer, respectively.

The same trend was observed regarding general means where averaged 26.9, 13.6 and 7.2 for the three levels, respectively. By way the statistical analysis showed the detected significant differences between the

different seasons in the same level and the different levels in the same season.

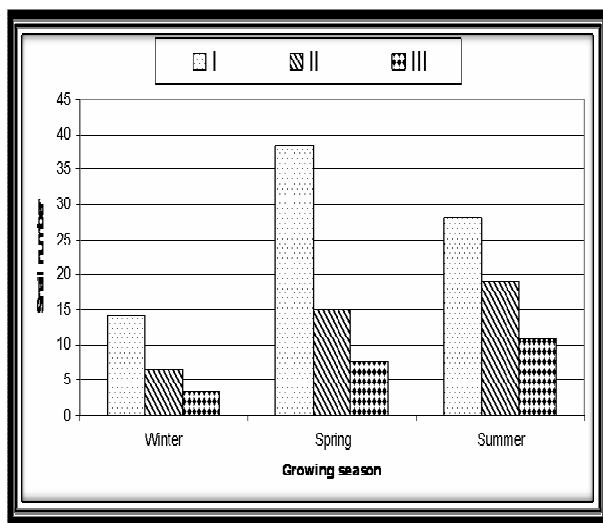
Generally it could be concluded that population density regarding vertical distribution on navel orange was decreased by increasing distances.

**Table 1. Population density of *E. vermiculata* snail on navel orange trees in different levels during the growing season 2014/2015.**

Level	Population density in different seasons				
	Winter	Spring	Summer	Mean	L.S.D. <sub>0.05</sub>
I	14.2	38.4	28.2	26.9	2.13
II	6.6	15	19.2	13.6	1.87
III	3.4	7.6	10.8	7.2	1.74
L.S.D. <sub>0.05</sub>	1.65	2.12	1.96		

Statistically analyzed using ANOVA test (L.S.D., P ≤ 0.05) using SAS program.

- I - Population density of *E. vermiculata* snails at 1 m.
- II - Population density of *E. vermiculata* snails at 2 m.
- III - Population density of *E. vermiculata* snails at 3 m.



**Fig 1. Vertical dispersal of *E. vermiculata* snail on navel orange trees in different levels during the growing season 2014/2015.**

**b- Vertical distribution on Casuarina trees:**

Vertical distribution on Casuarina trees was determined on navel orange orchards at Inshas locality, Belbies district, Sharkia Governorate during the growing seasons 2014/2015. Data illustrated in Table (2) and Fig. (2) revealed that when distances increasing, population density were decreasing. It noticed that summer season harbored the highest population density for the three levels where recorded for the first level 51.2, 40.0 and 23.2 snails, respectively. The third level (more than 4 m high) gave the lowest population density where reached 2.4, 5.8 and 8 snails for winter, spring and summer, respectively.

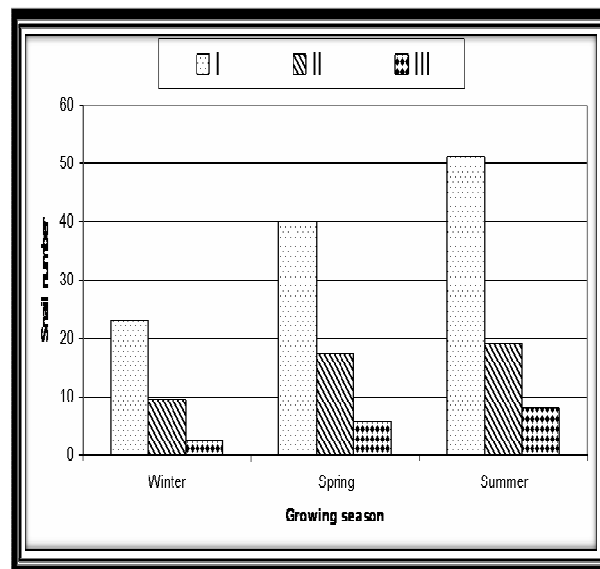
Regarding general mean, the first levels recorded high density while the third levels recorded the lowest one where gave 38.1 and 5.4 snails, respectively. It could be concluded that vertical distribution was intensity on the first 4 M from casuarina trees surrounded navel orange orchards. Also the followed statistical analysis demonstrated the significant differences between the different season and levels.

**Table 2. Population density of *E. vermiculata* snail on Casuarina trees in different levels during the growing season 2014/2015.**

Level	Population density in different seasons				
	Winter	Spring	Summer	Mean	L.S.D. <sub>0.05</sub>
I	23.2	40	51.2	38.13	2.24
II	9.4	17.6	19.2	15.4	1.83
III	2.4	5.8	8	5.4	2.03
L.S.D. <sub>0.05</sub>	1.92	2.10	2.09		

Statistically analyzed using ANOVA test (L.S.D., P ≤ 0.05) using SAS program

- I - Population density at 2 m distance.
- II - Population density at 4 m distance.
- III - Population density at more than 4 m distance.



**Fig. 2. Vertical dispersal of *E. vermiculata* snail on Casuarina trees in different levels during the growing season 2014/2015.**

**c- Horizontal distribution on navel orange orchards:**

Horizontal distribution on navel orange orchards was investigated during the growing seasons of 2014/2015 at Inshas locality, Belbies district, Sharkia Governorate. Results tabulated in Table (3) and Fig. (3) demonstrated that population density was slightly decreased by increasing distances from the adjacent orchards for the three growing seasons. For example, it reached 20.8, 20 and 19.6 snails for winter, 31.0, 29.8 and 28.0 snails for spring and 28.2, 26.2 and 26.4 snails for summer. The same trend was observed for general mean where population density recorded 26.7, 25.3 and 24.7 for the three levels (5, 10 and 15 m), respectively. It's necessary mentioned that the population density on soil surface did not clearly differences during the three growing season (winter, spring and summer). The statistical analysis demonstrated that there were no significant difference between the different levels at winter season, on contrast there were a significant difference between the different levels in spring and summer seasons, and between the different seasons in the same level.

**Table 3. Population density of *E. vermiculata* snail on navel orange orchards in different levels during the growing season 2014/2015.**

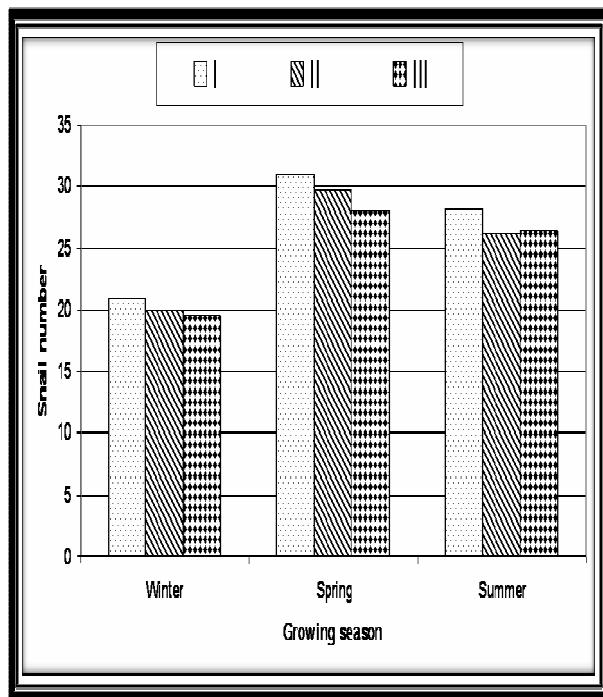
Level	Population density in different seasons				
	Winter	Spring	Summer	Mean	L.S.D. <sub>0.05</sub>
I	20.8	31	28.2	26.7	2.37
II	20	29.8	26.2	25.3	1.47
III	19.6	28	26.4	24.7	2.77
L.S.D. <sub>0.05</sub>	NS	2.13	2.35		

Statistically analyzed using ANOVA test (L.S.D., P ≤ 0.05) using SAS program.

I - Population density of *E. vermiculata* snails at 5 m.

II - Population density of *E. vermiculata* snails at 10 m.

III - Population density of *E. vermiculata* snails at 15 m.



**Fig. 3. Horizontal distribution of *E. vermiculata* snail on navel orange orchards in different levels during the growing season 2014/2015.**

Many authors discussed the daily movement and activity of snails during day hours. Baker (1988) revealed that *Theba pisana* (Müller, 1774) snails moved out of a well-grazed permanent pasture to adjacent weedy roadside vegetation in early summer. They returned to the pasture in autumn. Average movements varied between 0.1 and 0.4 m day<sup>-1</sup>. Some snails moved more than 25 M in one month in spring-summer and 50 m in 3 months in autumn-winter. On the other hand, the same author (1988) reported that average movement of *Theba Pisana* snails varied between 0.1 and 1.1 m per day. Some snails moved 55 m in 1 month in spring-summer and 75 m in autumn-winter.

In Egypt, Ismail *et al.*, (2003) noticed that number of active snails *E. vermiculata* on soil were obviously higher than those on trunk where numbers of counted on one meter heights on the trunk of trees were 1.6 and 0.4 snails, respectively. This phenomenon could be attributed to the breeding season of snails which extended from mid autumn until the end of winter season. As for spring the active snails on soil were

lower than those on trunk. At 4 o'clock 23.6 and 98.4 snails per sample were determined on soil and trunk, respectively. Regarding summer season a limited activity of snails was noticed between 2 to 6 o'clock numbers of active snails on soil and trunk, were 1.4 and 0.2 active snails per sample, respectively. Daoud (2004) reported that the snail movement depends on the crops and active season. The distance moved by *M. cartusiana* ranged between 5 and 40 m/month and 55 and 60 m/month during November and March, respectively. Arafa (2006) reported that the distance moved by *M. cantiana* during two days in cultivated and fallow lands ranged between 0.5 and 6 m. Awad (2014) revealed that the population fluctuations of land snails varied according to crop, temperature, relative humidity and season to another. The snails more active during spring & autumn and lower in winter. Abdel kader *et al.*, (2016) reported the highest average of *Theba Pisana* was recorded on fruit trees Pear, Fig, Pomegranate and Guava. Fig harbored the highest numbers followed by Pear while Pomegranate was the least once in this respect. Therefore, from the previous results it can be concluded that it is recommended to carry out pest control operations near the tree trunks and near the surface of the soil.

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**انتشار قواقع الحدائق البني (ايوبانيا فيرميكولاتا) في حدائق الموالح بمحافظة الشرقية.  
شحاته احمد علي اسماعيل ، محمد عبد الله عيسي ، سباعي زياد سليمان شيتية و محمد محمود درويش خطاب  
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - جيزة - مصر**

تم دراسة التوزيع الأفقي والراسي لقواقع الحدائق البني (ايوبانيا فيرميكولاتا) في حدائق الموالح المنزرعة بالبرتقال ابوصرة والمحاطة بأشجار الكازورينا بمنطقة انشاص مركز بلبس بمحافظة الشرقية خلال موسم 2014-2015. وأوضحت النتائج أن التوزيع الراسي لكثافة تعداد القواقع يتناقص بزيادة الارتفاع علي أشجار البرتقال ابوصرة. موسم الربيع سجل اعلي كثافة تعداد بلية فصل الصيف ثم الشتاء علي التوالي. بالإشارة إلي التوزيع الراسي علي أشجار الكازورينا فقد لوحظ أن الكثافة العددية للقواقع تقل كلما زاد الارتفاع عن سطح الأرض وأن فصل الصيف كان اعلي كثافة بليه الربيع ثم الشتاء. ذات السياق لوحظ للثلاث مستويات حيث قلت كثافة التعداد كلما زاد الارتفاع علي أشجار الكازورينا. كذلك لوحظ انه في التوزيع الأفقي علي أشجار البرتقال أبوسرة يتناقص التعداد بوضوح كلما زادت المسافة من الحقول القريبة من البساتين في مواسم النمو. كثافة تعداد القواقع لم تتغير بشكل واضح خلال مواسم الدراسة الثلاثة.