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ecological studies on some mealybug species infesting grapevine trees and their associated predatory insects at mansoura district.

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ABSTRACT

The present investigation was carried out in farm of the Agriculture Research Center belonging to Faculty of Agriculture Mansoura University to study the population density of the common mealybug species attacking grapevine trees and their associatrd predators at Mansoura district, also to evaluate the effect of certain weather factors on these insects. The obtained results showed that four mealybug species belong to order: Homoptera were recorded. These species namely, *Icerya seychellarum* (Westwood); *Planococcus vitis* (Risso); *Pseudococcus longispinus*(targion,tozzetti) and *Maconellicoccus hirsutus* Green. The results cleared that the dominant species was *I. seychellarum* during the two years of study as it formed 47.85% in 2009 and 39.63 % in 2010 of the total number of these insects respectively. Five predatory insects belong to three orders Coleoptera, Neuroptera and Hemiptera with a total number of 701 individuals in 2009 and 853 individuals in 2010 were recorded. Order Coleoptera was the most dominant order in the two years of study as it formed 56.78% of the total insect numbers in 2009 and 60.5% in 2010. The results revealed that five peaks for *P. vitis* were found during the two years of investigation the highest average numbers for *P. vitis* was recorded in the second week of October in the first year and in the last week of November in the second year of study There were four peaks for *P. longispinus* were recorded during the two years of study. The highest average numbers for *P. longispinus* was found in the last week of October in the first year while that was in the second week of October in the second year of investigation. The obtained results revealed that there were three peaks for *I. seychelarum* during the two years of study, the highest average numbers for *I. seychellarum* was recorded in last week of October in the first year, while that was in the second week of November, in the second year of study, respectively. The results showed that there were two peaks for *M. hirsutus* during the two years of study. The highest average numbers for *M. hirsutus* in the third week of September in the first year and in the end of August in the second year of study respectively. The obtained results assured that the maximum, minimum and average temperature affected greatly on the population density of *P. vitis*; *I. seychelarum*; *P. longispinus* and *M. hirsutus* during the two years of study and the maximum, minimum, average of relative humidity affected positively or negatively on the population density of these insects. The statistical correlation coefficient between the population density of *Rodolia cardinalis* (Mulsant); *Nephus includencs* Kirsh; *Exocomus flavipes* (Thnb.); *Chrysoperla carnea* (Steph.) and *Orius albidipennis* Reut and temperature and relative humidity showed a highly or slightly significant positively or negatively effect on population density of these insect during the two years of investigation.

Keywords: Survey *Icyrea seychelarum* (Westwood); *Planococcus vitis* (Risso); *Pseudococcus longispinus*; *Maconellicoccus hirsutus* Green. Nautral enemies *Rodolia cardinalis* (Mulsant); *Nephus includencs* Kirsh; *Exochomus flavipes* (Thnb.); *Chrysoperla carnea* (Steph.) and *Orius albidipennis* Reut.

INTRODUCTION

In Egypt, grapevine is considered as economically important crop for the both consumption and exportation. About 140 thousand feddans are covered with vineyards. These areas concentrated at Behira; Dakahlia; Gharbbia; Fayoum and Minya Governorates. The native common varieties in Egypt are Thompson seedless, Flame Seedless, Moscat. Alexandria and Fayoumi (Mohamed1996). Many insects' pests are attacking grape shrubs, some of these cause serious damage, hence effect quantity and quality of the fruits and cause economic loss in the crop. The different mealybug species are very injurious insect pests infesting grapevine cause serious damage and finally affecting quantity and quality of the fruits and causes economic loss in the crop (Mani and Thontadarya 1987b; Ali and Ahmed 1990; Youssef (1991); Balikai 1999b Soares *et al*. 1999; Ibrahim 2005 ; Bakry 2009 ; Abdel-Mageed 2011 and Ghanim *et al.* 2013). The role of predatory insects in controlling the mealybug species in different fruit orchards had been studied by several investigagtors (Prasad 1990; El-Sherbenie (2004); Canhilal *et al*. 2001; Ibrahim 2005; Grafton *et al*. 2005 ; Ramadan 2011 and Awadalla 2013).

For integrated pest management program needs the evaluation of the definite role of the natural enemies of the mealybug species and knowledge of the population relationships of these insects and their natural predatory insects. Therefore the objective of the present study was aimed to surveying the common mealybug species attacking grapevine and their associated predators, the population density of these insect pests species and their predators and the influence of certain weather factors on the population density of the mealybug species and their associated predatory.

MATERIALS AND METHODS

Survey and the population density of common mealybug species infesting grapevine trees and their associated predatory insects.

The present investigation was carried out in the farm of agriculture Research Center belonging to Faculty of Agriculture, Mansoura University to study the effect of some ecological factors on the common mealybug species infesting grapevine trees and their associated predators during the two successive years 2009 and 2010 at Mansoura district. No insecticides were applied during the period of study. The area of study was about ½ feddan cultivated with the variety Thompson seedless. For studying the population density of common mealybug species and their associated predators under field conditions, five trees of the same age and size from grapevine were chosen and used as replications. Samples were collected weekly during the two successive years from the beginning of March till the end of December. Each sample consisted of 100 leaves and 25 branches were randomly collected (20 leaves and 5 branches from each tree for the four directions and the middle of each tree). The collected leaves and branches from tree were taken to the laboratory in polyethylene bags. The number of the mealybug

species and their associated predators were counted. The predatory insects which observed on each sample in spot close to the colonies of the colonies of mealybugs were collected by an aspirator and counted. Also the predator-prey ratio was calculated. To study the effect of some weather factors, i.e. temperature and relative humidity on the population density of the mealybug species and their predators, the temperature and relative humidity were obtained from the Agrometeorological station at El-Mansoura region. Biweekly averages of temperature and relative humidity were calculated.

Data analysis

Costat software program (2004) was used to compute the effect of these weather factors on the population densities of the common mealybug species and their predators. The simple correlation coefficients of the relationships between the biweekly average number of these insects and their predators and the biweekly average of temperature and relative humidity components were computed.

RESULTS AND DISCUSSION

I: Surveying the common mealybug species infesting grapevine trees and their associated predators.

A: Mealybug species

Data represented in Table (1) showed that the total number of the common mealy bug species and their percentages to the total recorded catch on grapevine trees during the two years of study 2009 and 2010. The obtained results showed that four mealybug species belong to the one Order: Homoptera were recorded. These species namely, *I. seychellarum*; *P. vitis*; *P. longispinus* and *M hirsutus*. The results cleared that the dominant species was *I*. *seychellarum* during the two years of study as it formed 47.85% in 2009 and 39.63 % in 2010 of the total number of these insects respectively. The data revealed that *P. vitis* came in the second place as it formed 26.16 % in 2010 of the total numbers of all recorded mealy bug species. On the other hand *P. longispinus* came in third category and represented by 23.24 % of the total numbers of mealybug species in 2009, while *M. hirsutus* came in the last place and represented by 12.96% and 14.45% during the two years of investigation respectively.

Table (1) Total numbers of the common mealybug species attacking grapevine and their percentages to the total numbers during the two successive years 2009 and 2010 at Mansoura district.

Years / Species	2009		2010	
	Total	%	Total	%
I. seychelarum	2370	47.85	3556	39.63
P. vitis	790	15.95	2347	26.16
P. longispinus	1151	23.24	1773	19.76
M. hirsutus	642	12.96	1297	14.45
Total numbers	4953	100	8973	100

B: Predatory insects

Data arranged in Table (2) revealed that the abundance numbers and percentages of the common predators found associated with mealybug species on grapevine trees during the two years of study. As shown in this table, five predatory insects belong to three order with a total number of 701 individuals in 2009 and 853 individuals in 2010 were recorded. Order Coleoptera was the most dominant order in the two years of study as it formed 56.78% of the total insect numbers in 2009 and 60.5% in 2010. The obtained results indicated that three predator's species belong to this order these species namely; *R. cardinalis*; *N. includens* and *E. flavipes* were recorded. The most abundant species was *R. cardinalis* during the two years of investigation as it formed 26.25% in 2009 and 31.54% of the total number of all insects in 2010. Order Neuroptera was represented only by one species, *C. carnea* as it formed 22.11% in 2009 and 21.45% in 2010 of the total numbers of these insects during the two years of study. Order Hemiptera was represented only by one species namely *O. albidipennis* as it formed 21.11% in 2009 and 18.05% in 2010 respectively. Ibrahim (2001) recorded one mealybug species infesting grapevine trees. This species is namely *M. hisutus*.

Table (2) Total numbers of the predatory insects and their percentages to the total numbers during the two successive years 2009 and 2010 at Mansoura district.

Years / Order and species	2009		2010	
	Total	%	Total	%
Order: Coleoptera				
R. cardinalis	184	26.25	269	31.54
N. includens	106	15.12	108	12.66
E. flavipes	108	15.41	139	16.3
Order: Neuroptera				
C. carnea	155	22.11	183	21.45
Order: Hemiptera				
O. *albidipennis*	148	21.11	154	18.05
Total numbers	701	100	853	100

II: Population density of the mealybug species attacking grapevine trees and their associated pedators

A- Mealybug species

1: *Planococcus vitis*

The data represented in Figure (1) showed that the population density of *P. vitis* during the two years of study. The obtained results recorded five peaks for this insect on grapevine trees during the two years of investigation. In the first year (2009) theses peaks were found in the last week of April (18 individuals); in the second week of June (45 individuals) in the first week of August (60 individuals); in the second week of October (80 individuals); and in the last week of November (79 individuals) respectively. While these peaks were recorded in the second week of May (107 individuals) in the first week of July (176 individuals) in the third week of August (187 individuals) in the

last week of September (167 individuals) and in the last week of November (188 individuals) during the second year of study respectively. As a conclusion the highest peak for *P. vitis* was recorded in the second week of October in the first year and in the last week of November in the second year of study.

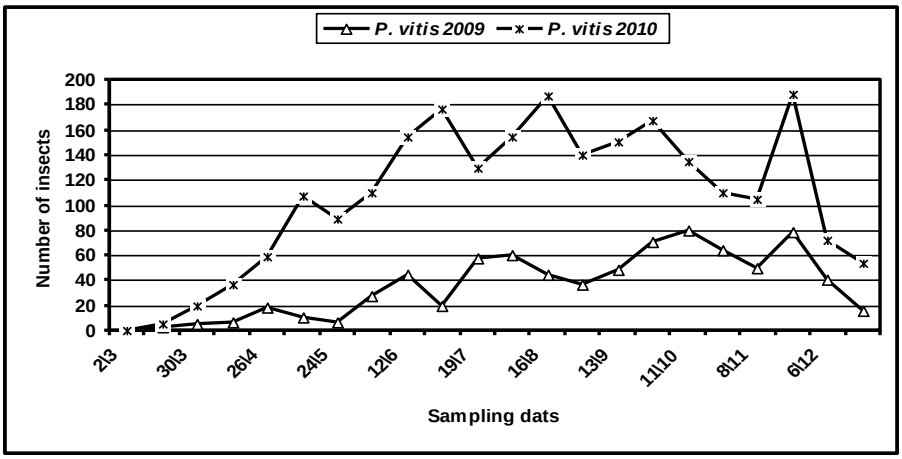

Figure (1): Population density of *P. vitis* on grapevine trees during the two successive years 2009 and 2010 at Mansoura district.

2: *Pseudococcus longispinus*

The results illustrated in Figure (2) recorded that the population density of *P. longispinus* during the period of investigation. It can be noted that, there were four peaks for this insect during the two years of study. These peaks were found in the second week of May (41 individuals) in the first week of July (62 individuals); in the end of August (96 individuals) and in the last week of October (106 individuals) during the first year of study respectively. Meanwhile, these peaks were recorded in the last week of April (140 individuals) in the second week of June (115 individuals) in the third week of August (120 individuals) and the second week of October (189 individuals) during the second year of study respectively. As a conclusion, the highest peak for *P. longispinus* was found in the last week of October in the first year while that was in the second week of October in the second year of investigation.

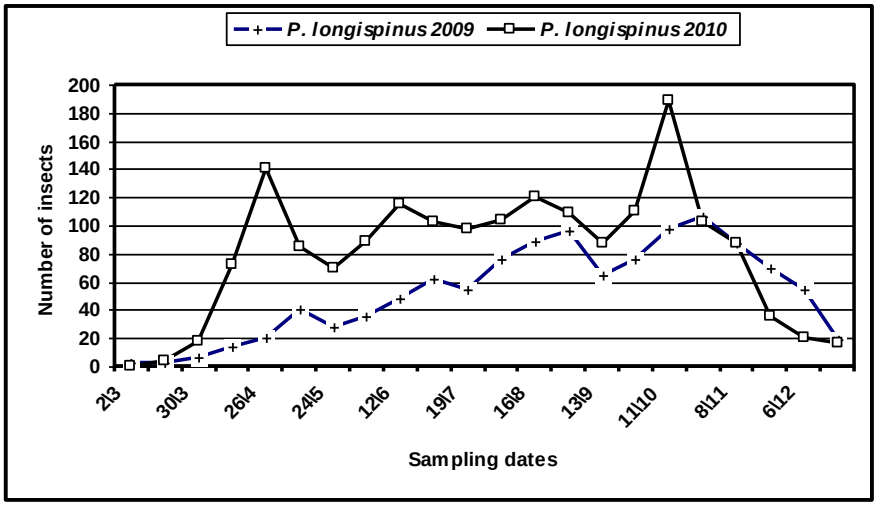

Figure (2): Population density of *P. longispinus* on grapevine trees during the two successive years 2009 and 2010 at Mansoura district.

3: *Icyrea seychellarum*

The data represented in Figure (3) showed that the population density of *I. seychelarum* during the two years of study. The obtained results revealed that there were three peaks for *I. seychelarum* during the two years of study. These peaks were recorded in the last week of May (194 individuals) in the third week of September (201 individuals) and last week of October (230 individuals) in the first year of study respectively. While that were found in the last week of May (247 individuals) in the end of August (280 individual) and in the second week of November (256 individuals) during the second year of investigation respectively. As a conclusion, the highest peak for *I. seychellarum* was recorded in last week of October in the first year, while that was in the second week of November, in the second year of study, respectively. These results are in harmony with those by other authors in Egypt on other host plants i.e Assem (1990) on sago palm trees, Osman (2005) on mulberry trees in Qulyubia Governorate and Sayed (2008) on Mango trees in Ismailia, while Hassan and Radwan (2008) reported four annual generation on persimmon Diospynes kaki trees in Qulyabia Governorate, Mesbah *et al.* (2012), Moustafa (2012); Salman and Bakry (2012) and Nabil *et al.* (2013) had the same results. These results are also closely related to the findings of Mangoud (2000) who stated that this mealybug species recorded 2-3 peak of seasonal abundance on apple trees in Egypt. These peaks were occurred during late June; late October and Mid-December. Tawfik and Mohammed (2001) recorded two peaks of seasonal abundance per year for this species on mulberry trees in Egypt.

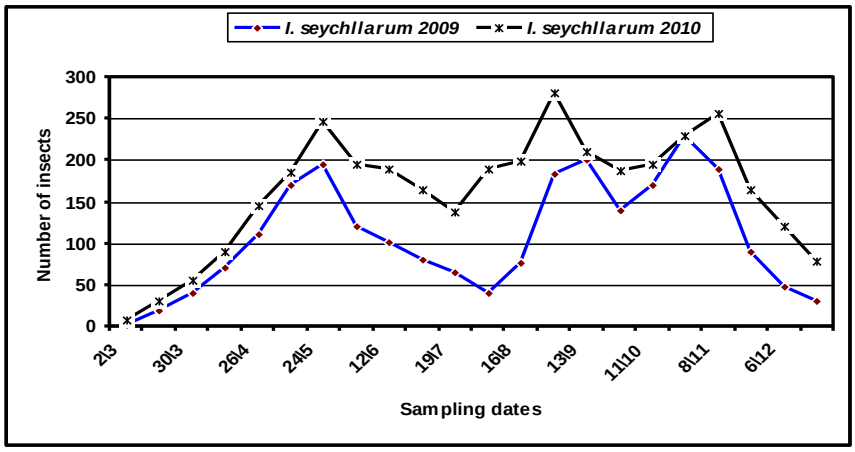

Figure (3):Population density of *I. seychellarum* on grapevine trees during the two successive years 2009 and 2010 at Mansoura district.

4: *Maconellicoccus hirsutus*

The data illustrated in Figure (4) showed that the population density of *M. hirsutus* during the two years of study. It can be seen that there were two peaks for this insect during the period of investigation these peaks were recorded in the first week of June (52 individuals) and in the third week of September (86 individuals) in the first year of study respectively. Meanwhile, these peaks were recorded in the second week of June (78 individuals) and in the end of August (144 individuals) in the second year of investigation respectively. As a conclusion, the highest peak for *M. hirsutus* in the third week of September in the first year and in the end of August in the second year of study respectively. Youssef (1991) in Egypt reported that this insect is an important pest on grapevine in several vineyards.

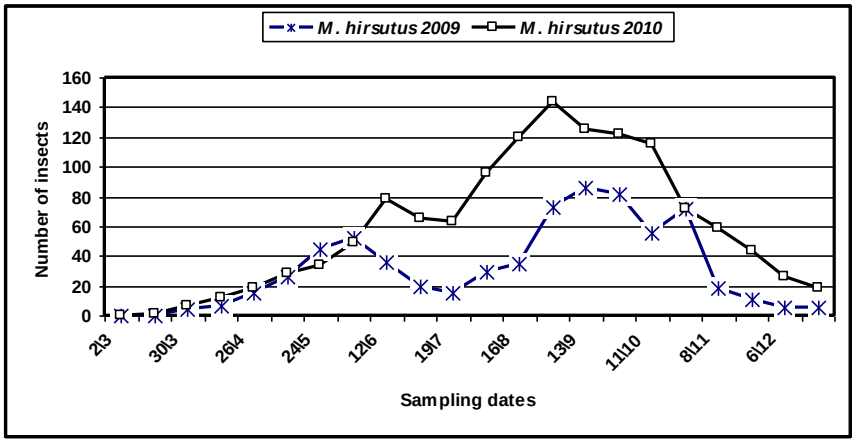

Figure (4):Population density of *M. hirsutus* on grapevine trees during the two successive years 2009 and 2010 at Mansoura district.

B: Predatory insects

1: *Rodolia cardinalis*

Figure (5) indicated that *R. cardinalis* has been appeared in the third week of April in 2009 and in the first week of March in 2010 respectively. It recorded three peaks in the first year, and fourth peaks in the second year of study. In the first year these peaks were found in the first week of July, in the end of August and in the last week of October, while that were occurred in the last week of April, in the first week of July; in the end of August and in the last week of October in the second year of study respectively. The present findings are in accordance with those obtained by Abd-Allah (1988) who found that this predator had three generations on citrus trees.

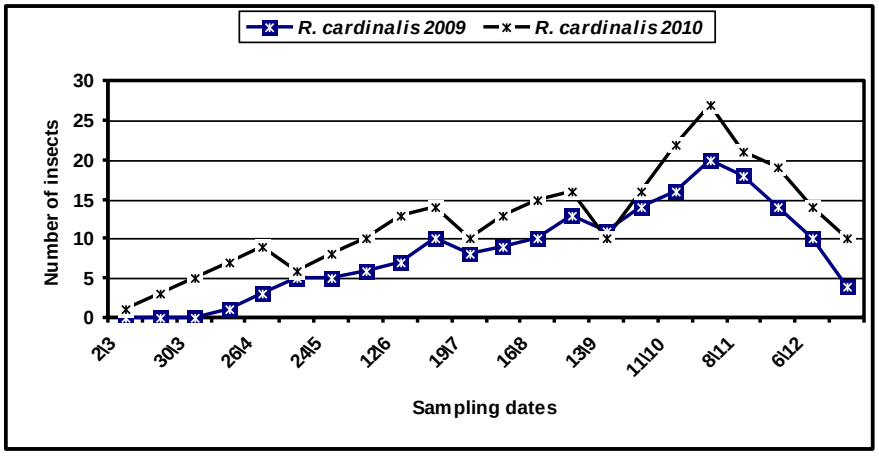

Figure (5):Population density of *R. cardinalis* on grapevine trees during the two successive years 2009 and 2010 at Mansoura district.

2:*Nephus includens*

Figure (6) revealed that, *N*. *includens* start to appeared in the of March in the first year, while that was in first week of March in the second year of study. It recorded four peaks per year during this investigation. In the first year these peaks were found in the last week of May in the third week of July in the end of August and in the second week of October while that were recorded in the fourth week of April. In the first week of June in the third week of July and in the third week of September in the second year of study respectively. Ghanim *et al.* (2013) recorded that this predator associated with the mealybug species and had three peaks in Mandarin trees at Mansoura district.

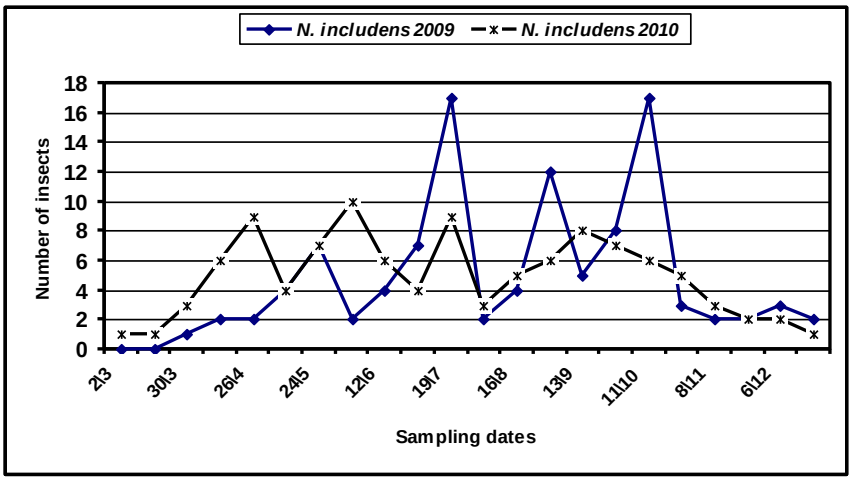

Figure (6):Population density of *N. includens* on grapevine trees during the two successive years 2009 and 2010 at Mansoura district.

3: *Exocomus flavipes*

Figure (7) indicated that *E. flavipes* has been appeared in the third week of March during the two years of investigation. It recorded four perks in the first year and five peaks in the second year of study. In the first year these peaks were occurred in the third week of April in the fourth week of May, in the first week of August and in the third week of September, while that were found in the third week of April, in the last week of May, in the first week of August in the third week of September and the last week of October, in the second year of investigation, respectively.

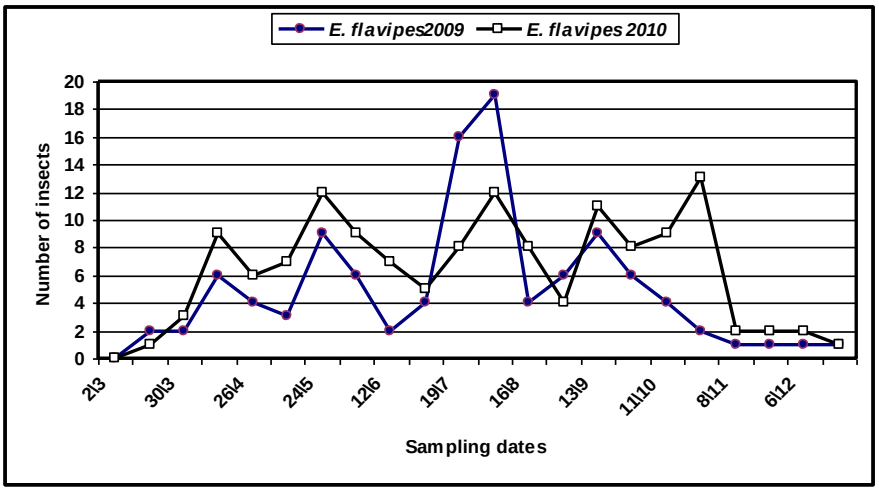

Figure (7):Population density of *E. flavipes* on grapevine trees during the two successive years 2009 and 2010 at Mansoura district.

4: *Chrysoperla carnea*

Figure (8) shows that *C. carnea* in the third week of March during the two years of study. It recorded four peaks per year during this investigation. In the first year these peaks were occurred in the second week of May in the first week of July in the third week of August and in the fourth week of October, while that were found in the second week of May, in the first week of July in the end of August and in the second week of October during the second year of study respectively. Awadalla (2013) reported that *C. carnea* was associated with some mealybug species and had three peaks at Mansoura distract.

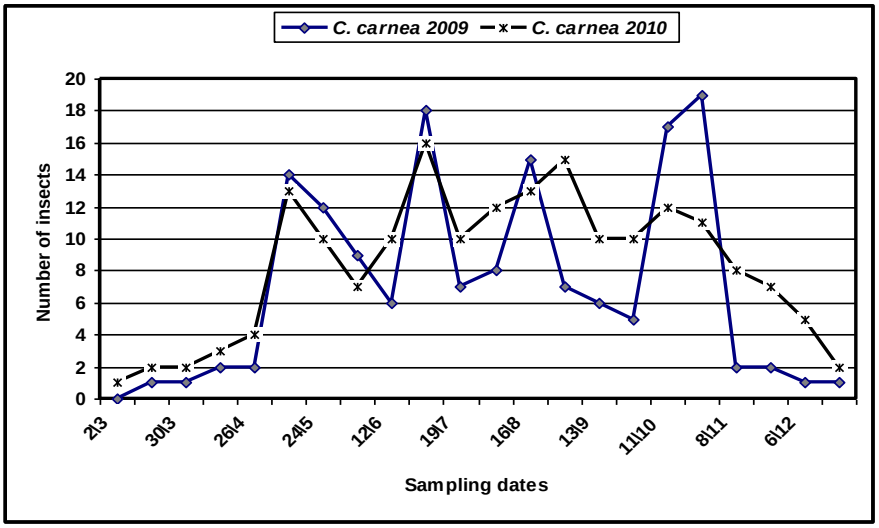

Figure (8):Population density of *C. carnea* on grapevine trees during the two successive years 2009 and 2010 at Mansoura district.

5: *Orius albidipennis*

Figure (9) indicated that *O. albidipennis* has been appeared in the first week of March during the two years of study. It recorded five peak in 2009 and four peaks in 2010 respectively. In the first year these peaks were recorded in the second week of April in the last week of may in the first week of July, in the second week of September and in the second week of November, while that were occurred in the second week of April, in the first week of July, in the end of August and in the second week of October in the second year of study respectively. These results are in harmony with those obtained by Ibrahim (2005).

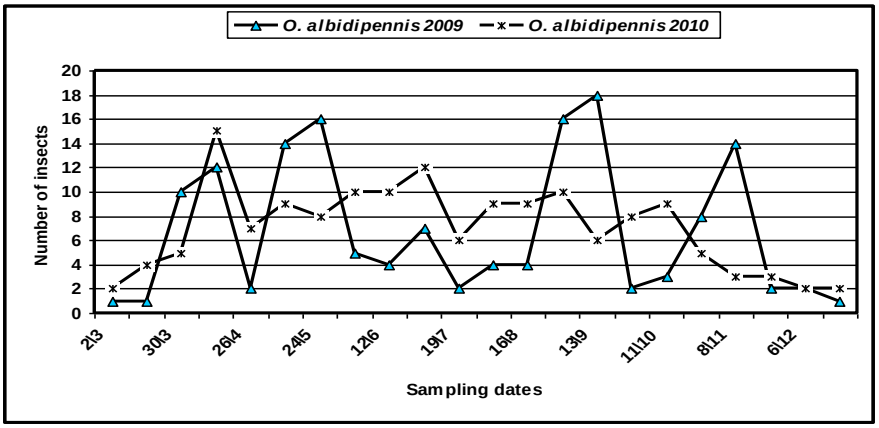

Figure (9): Population density of *O. albidipennis* on grapevine trees during the two successive years 2009 and 2010 at Mansoura district.

III: The relation ship between the mealybug species and their associated predatory insects on grapevine trees during 2009 and 2010 year at Mansoura district.

The relation ship between the mealybug species and their associated predatory insects Figure (10) shows the calculated predator prey ratio during the two years of study. It can be seen in this figure that this ratio was about (1:4) at the beginning of study in the first year (2009) and reached its maximum about (1:13) by the last week of April and about (1:2) by the last week of November, afterwards this ratio began narrowed till the end of this year. In the second year of study the predator prey ratio was about (1:2) at the beginning of study and reached its maximum about (1:14) by the second week of may and in the second week of November afterwards this ratio began narrowed till the end of this study which may reflex that the increase numbers of the predatory insects.

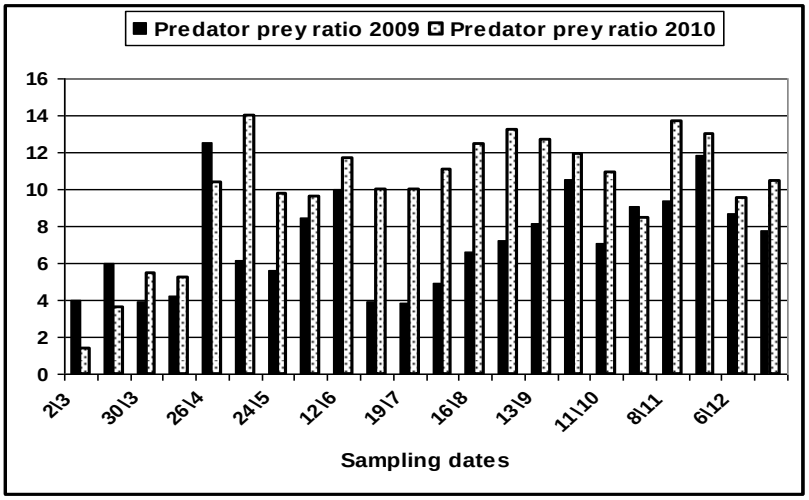

Figure (10): The predator prey ratio of the mealybug species and their associated predatory insects on grapevine trees during the two successive years 2009 and 2010 at Mansoura district.

IV Effect of some weather factors on the population desity of certain mealybug species attacking grapevine and their associated predator

A: Mealybug species

Data in Table (3, 4) cleared that the statistical correlation coefficient between the population density of the common mealybug species infesting grapevine and temperature degrees and relative humidity during 2009 and 2010. The obtained results assured that the maximum, minimum and average temperature affected greatly on the population density of *P. vitis*; *I. seychelarum*; *P. longispinus* and *M. hirsutus* during the two years of study (Table 3,4). From these tables it can be seen that, the maximum, minimum, average of relative humidity affected positively or negatively on the population density of these insects.

B. Predatory insects

Table (3,4) showed that the simple correlation coefficient values between biweekly numbers of *R. cardinalis; N.encludens* ; *E. flavipes C. carnea* and *O. albidipennis* and some weather factors on grapevine trees during the two successive years 2009 and 2010. The data cleared that there were a highly or slightly significant positively or negatively effect between the population density of these insects and maximum; minimum and average temperature during the two years of investigation. The same effect was found with the maximum; minimum and average of relative humidity during the two years of study.

Table (3): Simple correlation coefficient between the population density of mealybug species and their associated predatory insects and the temperature and relative humidity components in grapevine trees during 2009 at Mansoura district.

Year / Insect specis	2009					
	Temperature			Relative humidity		
	maximum	minimum	average	maximum	minimum	average
P. vitis	0.5211*	0.4509*	0.5019*	0.2685ns	0.2006ns	0.4626*
P. longispinus	0.4293*	0.5948**	0.5270*	0.3977ns	0.3939ns	0.4370*
I. sechelarum	0.5018**	0.4617*	0.5539**	0.5985**	- 0.4275ns	- 0.6098**
M. hirsutus	0.5091*	0.5503**	0.5407**	- 0.5152*	- 0.1966ns	0.0114ns
R. cardinalis	0.5268**	0.5137*	0.5375**	0.5054*	0.6145**	0.5576*
N.encludens	0.4701*	0.5071*	0.5044*	0.4583*	0.4177*	0.5744**
E. flavipes	0.7314***	0.6591***	0.7087***	0.4555ns	-0.5100**	0.4138ns
C. carnea	0.7855***	0.7748***	0.7896***	0.5249*	-0.5209*	-0.1355ns
O. albidipennis	0.5139*	0.6165**	0.5734**	0.4994*	-0.6590**	0.5636**

ns =non significant *= significant with varied degree where R = Correlation coefficient P= Probability S = significant sign.

Table (4): Simple correlation coefficient between the population density of mealybug species and their associated predatory insects and the temperature and relative humidity components in grapevine trees during 2010 at Mansoura district.

year / Insect species	2010					
	Temperature			Relative humidity		
	maximum	minimum	mean	minimum	maximum	mean
P. vitis	0.7001***	0.7557***	0.7712***	-0.6552***	-0.1070ns	-0.4872*
P. longispinus	0.6483**	0.5843**	0.6732***	-0.2090ns	-0.3351ns	-0.3612ns
I. sechelarum	0.6043**	0.6471**	0.6674***	-0.5647**	-0.0826ns	-0.4148ns
M. hirsutus	0.7404***	0.8629***	0.8227***	-0.3430ns	0.1418ns	-0.1223ns
R. cardinalis	0.5643**	0.6289**	0.5094**	-0.2946ns	0.2054ns	-0.0466ns
N.encludens	0.5947**	0.5282*	0.5630**	-0.2407ns	-0.3687ns	-0.4021ns
E. flavipes	0.6450**	0.5729**	0.6008**	-0.3425ns	-0.4047ns	-0.4913*
Ch. Carnea	0.7510***	0.7389***	0.8063***	-0.5231*	-0.1952ns	-0.4627*
O. albidipennis	0.8035***	0.5866**	0.7606***	-0.3408ns	-0.5104*	-0.5620**

ns =non significant *= significant with varied degree where R = Correlation coefficient P= Probability S = significant sign.

These results are in agreement with those obtained by El-Borollsy *et al.* (1990) who stated that the change in the population density of *I. seychlarum* on sago palm were significantly affected by the changes in both temperature and relative humidity. Abdel-Rahman *et al.* (2007) showed significant positive correlation with mean temperature and significant negative correlation with mean percentage of relative humidity on mango trees in Egypt. The same results were recorded by Osman(2005); Nabil (2013) and Ghanim *et al.* (2013).

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دراسات بيئية على بعض أنواع البق الدقيقى التى تصيب أشجار العنب و والمفترسات الحشرية المرتبطة بها في منطقة المنصورة

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أجريت هذه الدراسة فى مزرعة مركز التجارب الزراعية- كلية الزراعة جامعة المنصورة لمدة عاميين متتاليين٢٠٠٩ ، ٢٠١٠ لحصر أنواع البق الدقيقى الشائعة التى تصيب أشجار العنب و الكثافة العددية لها و الأعداء الحيوية المرتبطة بها، كذلك تقييم تأثير بعض العوامل البيئية على أنواع البق الدقيقى و المفترسات الحشرية المرتبطة بها، و أظهرت النتائج المتحصل عليها أربعة أنواع من البق الدقيقى تتبع رتبة متشابهة الأجنحة و هذه الأنواع هى:

Icyrea seychellarum(Westwood); *Planococcus vitis* (Risso); *Pseudococcus longispinus* , *Maconellicoccus hirsutus* Green

و أوضحت النتائج أن النوع *I. seychlarum* كان الأكثر شيوعا خلال سنتى الدراسة حيث كانت النسبة المئوية لتواجدة إلى الأنواع الأخرى ٤٧,٨٥%فى عام ٢٠٠٩ ، ٣٩,٦٣% فى عام ٢٠١٠ على التوالى و لقد تم تسجيل خمسة أنواع من المفترسات الحشرية المصاحبة لأنواع البق الدقيقى و التى تتبع ثلاث رتب هى غمدية الأجنحة ، معرقة الأجنحة و نصفية الأجنحة هى:

Rodolia cardinalis Mulsant; *Nephus includencs* Kirsh; *Exocomus flavipes* (Thnb.); *Chrysoperla carnea* (Steph.) and *Orius albidipennis* Reut.

و كان جملة الأعداد التى تم تسجيلها من تلك المفرسات الحشرية ٧٠١ و ٨٦٣ حشرة خلال عام ٢٠٠٩ ، ٢٠١٠ على التوالى و كانت المفترسات التابعة لرتبة غمدية الأجنحة الأكثر شيوعا حيث كانت النسبة المئوية لهذه الحشرات تمثل ٥٦,٦٨% ، ٦٠,٥ % من التعداد الكلى للمفترسات الحشرية التى تم جمعها خلال عامى الدراسة ٢٠٠٩ و ٢٠١٠ على التوالى و لقد أوضحت دراسة الكثافة العددية لأنواع البق الدقيقى أن النوع *P. vi*tis كان له خمسة ذروات أو قمم خلال عامى الدراسة و أن أعلى متوسط لتعداد هذه الحشرة كان فى الاسبوع الثانى من أكتوبرفى السنة الأولى و فى الاسبوع الأخير من نوفمبر فى العام الثانى من الدراسة أما بالنسبة للنوع *P. longisinus* فكان له أربعة قمم خلال عامى الدراسة و كان أعلى متوسط للتواجد لهذا النوع فى الاسبوع الأخير من اكتوبر فى السنة الأولى أما فى السنة الثانية فكان أعلى تواجد له فى الاسبوع الثانى من اكتوبر، أما بالنسبة للنوع *I. seychelarum* فكان له ثلاثة ذروات أو قمم للتواجد خلال عامى الدراسة و أن أعلى متوسط تعداد له كان فى الاسبوع الأخير من اكتوبر فى عام ٢٠٠٩ بينما كان ذلك فى الاسبوع الثانى من نوفمبر فى عام ٢٠١٠ على التوالى ، و أوضحت النتائج أن النوع *M. hirsutus* كان له ذروتين للتواجد خلال عامى الدراسة و كان أعلى متوسط للأعداد خلال الاسبوع الثالث من سبتمبر فى العام الأول و فى نهاية أغسطس فى العام الثانى على التوالى و بالنسبة لتأثير درجات الحرارة و الرطوبة النسبية على الكثافة العددية لأنواع البق الدقيقى الأربعة و المفترسات الحشرية المرتبطة بها فأظهر التحليل الإحصائى أن هناك تأثير موجب عالى المعنوية أو معنوى على الكثافة العددية لأنواع البق الدقيقى و المفترسات الحشرية المرتبطة بها أما بالنسبة للرطوبة النسبية الصغرى و العظمى و المتوسطة فكان لها تأثير موجب أو سالب على الكثافة العددية للحشرات موضوع الدراسة خلال عامى الدراسة.

قام بتحكيم البحث

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