

## **The Population Abundance of the Mealybug Species Infesting Pomegranate Trees and their Associated Insect Predators in Mansoura Region, Egypt**

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### **ABSTRACT**

Experiments were carried out in the experimental farm belonging to Faculty of Agriculture, Mansoura University during the two successive years 2014 and 2015 to study the population abundance of mealybug species attacking pomegranate trees and their associated predatory insects. The Seychelles fluted scale *Icerya seychellarum* (Westwood) recorded the highest peaks of abundance during the period of study and represented by 367 and 568 individuals/sample followed by the citrus mealybug *Planococcus citri* Risso which represented by 192 and 242 individuals, respectively. Meanwhile, the cottony-cushion scale *Icerya purchasi* (Maskell) recorded the lowest peaks of abundance during the two years of study and represented by 46 and 29 individuals followed by the Egyptian fluted mealybug *Icerya aegyptiaca* (Douglas) which represented by 58 and 98 individuals, respectively. *Vidalia* beetle *Rodolia cardinalis* (Mulsant) recorded the highest peaks during the two successive years and represented by 42 and 57 individuals followed by the green lacewing *Chrysoperla carnea* (Steph.) and represented by 32 and 29 individuals, respectively. Meanwhile, coccinellid predator *Nephus includens* (Kirsch) ranked last category, and represented by 12 and 16 insects in the two years, respectively. Statistical analysis between the four seasons for the mealybug species revealed that a highly significant differences during the two years. *I. seychellarum* recorded the highest average number 110.3 and 158.6 individuals/sample, followed by *P. citri* 74.2 and 87.9 individuals while *I. purchasi* came in the last category with an average of 9.4 and 6.0 individuals, during the two successive years, respectively. Regarding to the associated insect predators, *R. cardinalis* ranked the first category and represented by 60.6 and 69.4% followed by *C. carnea* 30.4 and 22.7 % while *N. includens* came in the last category with 9.0 and 7.9% during the two successive years, respectively. Predator-prey ratio was the best during the period from July till December and ranged between 1: 4.7 and 1: 10.6 during the two years.

**Keywords:** Mealybug species, Insect predators, Pomegranate, Population abundance, Predator-prey ratio.

### **INTRODUCTION**

Pomegranate (*Punica granatum* L.) considered one of the most main fruits and growing in Egypt extend from north coast to southern Egypt (Abd Rabou 1998 and Mesbah 2008). Recently, the pomegranate orchards are distributed in the newly reclaimed land, especially in the northern coast of Egypt (Khalifa 2010). Available literature in Egypt about the insect pests attacking pomegranate trees especially the mealybug species are very few (Abd Rabou 1998, Mesbah 2008 and Khalifa 2010). Many authors studied the mealybug species in different fruit trees as well as the associated predators inhabiting these orchards as on mango trees (El-Dash 1997, Abdel-Aleem 2008, Fahad 2015 and Awadalla and Ghanim 2016) on persimmon trees (Ibrahim 2005, Awadalla 2013 and Fahad 2015) on citrus orchards (Ghanim et al 2013), on grape vine (Mohamed 2013) and on ornamental plants (Ramadan 2011 and Mohamed 2015).

Therefore, the present study aimed to shedding light on the main species of mealybug infesting pomegranate trees and their associated predatory insects as well as their seasonal abundances in Mansoura region, Egypt.

### **MATERIALS AND METHODS**

The present studies were conducted at the Experimental farm of the Faculty of Agriculture, Mansoura University, Egypt. All agricultural practice were carried out except the insecticides applications.

To evaluate the seasonal abundance of the mealybug species and their associated predators, 100 pomegranate leaves and 25 twigs were taken from five

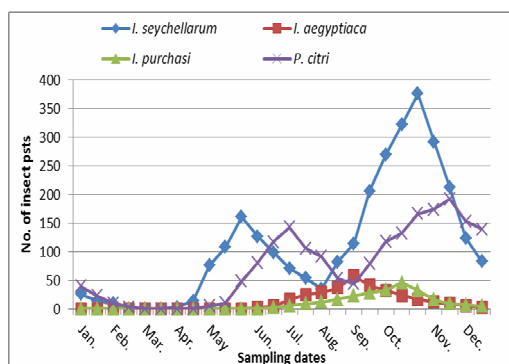
pomegranate trees of the same age and same size as biweekly sample (each tree was considered as a replicate and 20 leaves and five twigs were taken randomly from each tree representing the four cardinal directions). Samples were collected biweekly from early January till the end of December during the two years 2014 and 2015. The collected samples were transferred to the laboratory in polyethylene bags for examination by the aid of a binocular stereomicroscope. The mealybug species and their associated insect predators for each sample were identified and counted.

Statistical analysis for the data were analyzed by using one-way ANOVA by Costat software program (2004).

### **RESULTS AND DISCUSSION**

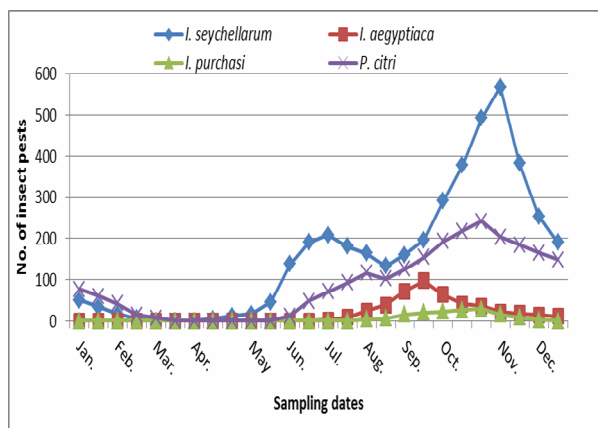
#### **The population abundance of the mealybug species and their associated predators**

The obtained results in Fig. (1) showed that the Seychelles fluted scale, *Icerya seychellarum* (Westwood) recorded two peaks of abundance in May 29th 2014 and 30th of October 2014, and represented by 161 and 367 individuals/ sample, respectively. Also, the citrus mealybug *Planococcus citri* Risso had two peaks, the first one in the second week of July (143 individuals/ sample) and the second peak was recorded in the end of November (192 individuals). Meanwhile, the Egyptian fluted mealybug *Icerya aegyptiaca* (Douglas) and the cottony-cushion scale *Icerya purchasi* Maskell each recorded only one peak of abundance on pomegranate during the first year 2014 in the beginning of September and the 3rd week of October 2014, and represented by 58 and 46 individuals, respectively.



**Fig. 1. The population abundance of the mealybug species attacking pomegranate trees during 2014 in Mansoura region.**

Data represented in Fig. (2) revealed that, during the second year 2015, *I. seychellarum* recorded two peaks of abundance, represented by 209 and 568 individuals in 23th of July and 26th of November 2015, respectively. Moreover, *P. citri* recorded two peaks by early August (117 individuals/ sample) and 29th of October (242 individuals). While, *I. aegyptiaca* and *I. purchasi* recorded one peak for each species during the second year on pomegranate trees.

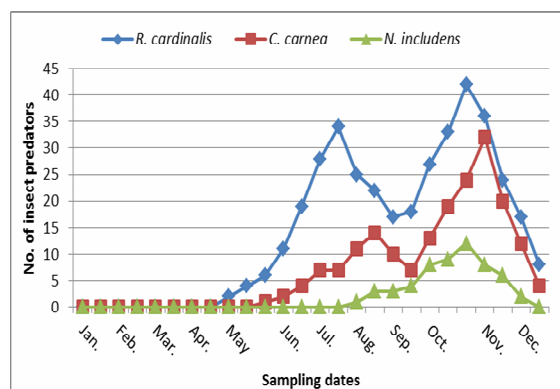


**Fig. 2. The population abundance of the mealybug species attacking pomegranate trees during 2015 in Mansoura region.**

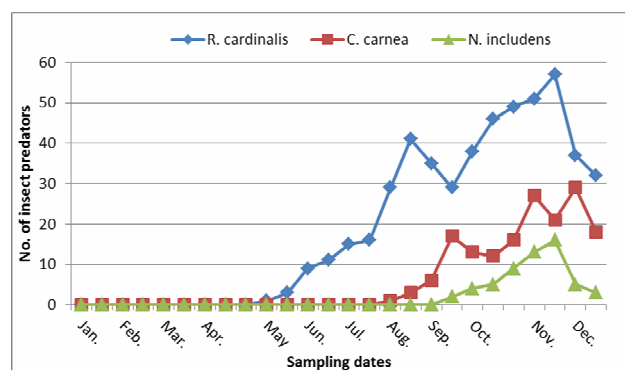
Data illustrated in Fig. (3) revealed that, *Rodolia cardinalis* (Mulsant) had two peaks of abundance during the first year 2014, the first one was recorded in the end of July (34 individuals) and the second peak in the second week of November (42 individuals). Also, the green lacewing *Chrysoperla carnea* (Steph.) had two peaks of abundance, the first peak in 21st of August (14 individuals) and the second one in 13th of November (32 individuals). Meanwhile, the coccinellid predator *Nephus includens* (Kirsck) had only one peak in the end of October (12 individuals).

As shown in Fig. (4) the obtained data, indicated that during the second year of study, *R. cardinalis* had two peaks in 20th of August and 26th of November, and represented by 41 & 57 individuals, respectively. Moreover, *C. carnea* recorded two peaks, the first one on 17th of September (17 individuals) and the second

peak on 10th of December (29 individuals). Meanwhile, *N. includens* had only one peak (16 individuals) in the end of November 2015



**Fig. 3. The population abundance of the main predators associated with the mealybug species on pomegranate trees during 2014 in Mansoura region.**



**Fig. 4. The population abundance of the main predators associated with the mealybug species on pomegranate trees during 2015 in Mansoura region.**

The obtained results agree with those findings of Daoxun *et al.* (2002) in China, who revealed that *I. purchasi* attacking pomegranate. Ozturk and ulusoy (2009) in Turkey revealed that *P. citri* one of the main insect pest attacking pomegranate orchards and the predator *C. carnea* was found to be one of the common species in pomegranate orchards. Mesbah (2008) in Egypt recorded *P. citri* and *I. aegyptiaca* infesting pomegranate and occurred with high numbers of pomegranate trees during the two seasons 2005 and 2006. Khalifa (2010) in Egypt, recorded three and two peaks of *I. seychellarum* during seasons 2006 and 2007 on pomegranate trees in Kafr El-sheikh region, respectively. Balikai *et al.* (2011) in India, stated that, *P. lilacinus* infesting pomegranate trees during the flowering and fruiting stages of the crop and excretion the honeydew on the leaves.

**The seasonal occurrence of the mealybug species on pomegranate trees**

As shown in Table (1), in the first year 2014, the highest average number for *P. citri* occurred in autumn season (153.4±9.9 individuals), followed by summer (90.4±14.6 individuals). Also, *I. seychellarum* was the

highest in autumn (238.6±40.1= 58.2%), followed by in summer (94.4±21.5). While, *I. aegyptiaca* was the highest in summer followed by in autumn and represented by 30.1±6.7 and 14.7±4.0 individuals,

respectively. Meanwhile, *I. purchasi* had the highest average number in autumn followed by in summer and represented by 21.1±6.1 and 13.9±3.6 individuals, respectively.

**Table 1. Seasonal average number and percentage of the mealybug species attacking pomegranate trees in the four seasons during 2014 in Mansoura region.**

seasons	<i>P. citri</i>		<i>I. purchasi</i>		<i>I. aegyptiaca</i>		<i>I. seychellarum</i>	
	No.	%	No.	%	No.	%	No.	%
Winter	12.7±6.7 c*	3.9	0.0±0.0	0.0	0.0±0.0	0.0	8.2±4.4 c	1.7
Spring	24.2±13.8 bc	7.5	0.0±0.0	0.0	0.3±0.3	0.6	81.5±26.6 b	17.1
Summer	90.4±14.6 b	32.8	13.9±3.6 b	39.6	30.1±6.7 a	66.8	94.4±21.5 b	23.0
Autumn	153.4±9.9 a	55.7	21.1±6.1 a	60.4	14.7±4.0 b	32.6	238.6±40.1 a	58.2
Total	1928	100	245	100	316	100	2869	100
Annual Av.±SE	74.2±12.5 B**		9.4±2.5 C		12.2±3.2 C		110.3±21.1 A	

\* Means followed by the small same letters in column among the four seasons insignificantly differences at 0.05%.

\*\* In the annual average, values followed by the capital same letters insignificantly difference at 0.05%.

Data arranged in Table (2) indicted that, the highest average number *P. citri*, *I. purchasi* and *I. sechellarum* were recorded in autumn and represented by 193.9±12.2, 15.3±4.5 and 365.6±51.1, respectively. Only *I. aegyptiaca* recorded the highest average number in summer with an average of 35.1±14.4 individuals.

differences during the two years. *I. seychellarum* recorded the highest average number 110.3 and 158.6 individuals/sample, followed by *P. citri* 74.2 and 87.9 individuals while *I. purchasi* came in the last category with an average of 9.4 and 6.0 individuals, during the two successive years, respectively.

Statistical analysis between the four seasons for the mealybug species revealed that a highly significant

**Table 2. Average number and percentage of the mealybug species attacking pomegranate trees in the four seasons during 2015 at Mansoura region.**

seasons	<i>P. citri</i>		<i>I. purchasi</i>		<i>I. aegyptiaca</i>		<i>I. seychellarum</i>	
	No.	%	No.	%	No.	%	No.	%
Winter	33.8±13.0 c	8.9	0.0±0.0	0.0	0.0±0.0	0.0	18.0±8.6 c	2.6
Spring	2.2±2.0d	0.6	0.0±0.0	0.0	0.0±0.0	0.0	36.5±21.8 c	5.3
Summer	101.7±13.7 b	31.1	6.9±3.3	31.0	35.1±14.4 a	54.2	176.9±9.9 b	30.0
Autumn	193.9±12.1 a	59.4	15.3±4.5 a	69.0	29.7±7.2 a	45.8	365.6±51.1 a	62.1
Total	2285	100	155	100	454	100	4124	100
Annual Av.±SE	87.9±15.7 B		6.0±1.9 C		17.5±5.2 C		158.6±31.3 A	

\* Means followed by the small same letters in column among the four seasons insignificantly differences at 0.05%.

\*\* In the annual average, values followed by the capital same letters insignificantly difference at 0.05%.

These finding results agree with Yangmin *et al.* (1998) in China, revealed that, *Eriococcus lagerstroemiae* on pomegranate trees and the nymphs overwintering in the bark gaps of trees. They added that, low winter temperatures resulted in high mortality of the pest. Mani and Krishnamoorthy (2000) in India, recorded that, the population of *P. citri* and *P. lilacinus* affected insignificantly by different weather factors. Kotikal *et al.* (2011) in India, suggested that, the mealybug *P. lilacinus* infesting pomegranate trees where nymphs and adults of the insect pest made early

appearance during February and caused maximum damage during March and April.

3.3. The annually occurrence of the mealybug species and their predators

Data arranged in Table (3) revealed that, *I. seychellarum* came in the first category during the two years and represented by 53.5 and 58.7%, followed by *P. citri* with a percentage of 36.0 and 32.6%, respectively. Meanwhile, *I. purchasi* ranked the last category and represented by 4.6 and 2.2% during years 2014 and 2015, respectively.

**Table 3. annual total number and percentage of the main mealybug species attacking pomegranate trees during 2014 and 2015 in Mansoura region.**

Mealybug species	2014		2015	
	No.	%	No.	%
<i>P. citri</i>	1928	36.0	2285	32.6
<i>I. purchase</i>	245	4.6	155	2.2
<i>I. aegyptiaca</i>	316	5.9	454	6.5
<i>I. seychellarum</i>	2869	53.5	4124	58.7
Total	5358	100	7018	100

Regarding to the associated predators, data illustrated in Table (4) showed that, *R. cardinalis* ranked first category and represented by (60.6 and 69.4%) followed by *C. carnea* (30.4 and 22.7%), while, *N. includens* came the last category with percentage of (9.0 and 7.9%) during the two successive years 2014 and 2015, respectively.

**Table 4. Annual total number and percentage of the associated predators with mealybug insects attacking pomegranate trees in 2014 and 2015 in Mansoura region.**

Insect predators	2014		2015	
	No.	%	No.	%
R. cardinalis	373	60.6	499	69.4
C. carnea	187	30.4	163	22.7
N. includens	56	9.0	57	7.9
Total	616	100	719	100

The obtained results agree with those findings of Ozturk and Ulusoy (2009) in Turkey who indicated that, pomegranate orchards attacking with P. citri and the predator C. carnea was found the most abundant species in pomegranate orchards.

**The relationship between mealybug species and their associated insect predators**

The data presented in Table (5) showed that the monthly average number of the mealybug species, associated predators and predator-prey ratio (P. P. ratio) during the two years. It can be noticed that, the highest monthly average number of the mealybug species

(519.3 individuals) coincided with the highest average number of predators (62.3 individuals) in October during the first year. Moreover, during the second year, the highest average number of mealybugs (702.0 individuals) coincided with the highest average number of predators (92.5 individuals) in November 2015. Predator-prey ratio was the best during the period from July till November and ranged between 1: 4.7 and 1: 10.1 during the first year. While, during the second year, it was the best during the period from August till December and ranged between 1: 6.4 and 1:10.6.

**Table 5. The monthly average number of the mealybug species, associated predators and predator-prey ratio during the two successive year 2014 and 2015 at Mansoura region.**

Months	2014			2015		
	Mealybug species	Predators	P.P. ratio	Mealybug species	Predators	P.P. ratio
Jan.	51.5	0.0	-	111.5	0.0	-
Feb.	11.0	0.0	-	40.0	0.0	-
Mar.	0.0	0.0	-	4.0	0.0	-
Apr.	8.5	0.0	-	6.0	0.0	-
May	136.3	4.3	1: 31.7	31.5	2.0	1: 15.8
Jun.	216.5	18.0	1: 12.0	195.0	10.0	1: 19.5
Jul.	215.0	38.0	1: 5.7	283.5	15.5	1: 18.3
Aug.	178.0	38.0	1: 4.7	296.0	37.0	1: 8.0
Sep.	296.5	29.5	1: 10.1	423.0	44.5	1: 9.5
Oct.	519.3	62.3	1: 8.3	679.0	64.0	1: 10.6
Nov.	458.5	63.0	1: 7.3	702.0	92.5	1: 7.6
Dec.	260.0	21.5	1: 12.1	395.0	62.0	1: 6.4

The obtained results are in agreement with the finding of Mesbah (2008) in Egypt, suggested that, the relationship between the predator R. cardinalis and I. aegyptiaca showed a significant differences during the two season 2005 and 2006. Also Mani and Krishnamoorthy (2000) in India, recorded that, the natural enemies parasitoids and predators effectively reduced the population density of P. citri.

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## الوفرة العددية لأنواع البق الدقيقي التي تصيب أشجار الرمان والمفترسات الحشرية المرتبطة بها في منطقة المنصورة، مصر

هاجر سمير صالح عوض الله  
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أجريت هذه التجارب بالمزرعة البحثية التابعة لكلية الزراعة - جامعة المنصورة خلال سنتي ٢٠١٤، ٢٠١٥ وذلك لدراسة أنواع البق الدقيقي التي تهاجم أشجار الرمان والمفترسات الحشرية المرتبطة بها وأوضحت النتائج أن حشرة البق الدقيقي السيشلارم سجلت أعلى ذروة تعداد لها حيث كانت ٣٦٧ و ٥٦٨ فرد يليها حشرة بق الموالح الدقيقي حيث كانت ١٩٢ و ٢٤٢ فرد خلال سنتي الدراسة ٢٠١٤، ٢٠١٥ على التوالي. بينما حشرة البق الدقيقي الأسترالي سجلت أقل ذروة تعداد حيث كانت ٤٦ و ٢٩ فرد يليها حشرة البق الدقيقي المصري حيث كانت ٥٨ و ٩٨ فرد خلال سنتي الدراسة على التوالي. وأظهرت النتائج أن المفترس أبو العيد فيداليا سجل أعلى ذروة تعداد له حيث كانت ٤٢ و ٥٧ فرداً يليها المفترس أسد المن الأخضر حيث كان ٣٢ و ٢٩ فرداً بينما المفترس أبو العيد نيفس انكلودينس جاء في المرتبة الأخيرة وسجل ١٢ و ١٦ فرداً خلال سنتي الدراسة على التوالي. أظهر التحليل الإحصائي خلال المواسم الأربعة في سنتي الدراسة وجود اختلافات عالية المعنوية بين أنواع البق الدقيقي المختلفة حيث سجل البق الدقيقي سيشلارم أعلى متوسط تعداد (١١٠.٣ ± ٢١.١، ٣١.٣ ± ١٥٨.٦ فرد) يليها بق الموالح الدقيقي (١٢.٥ ± ٧٤.٢، ١٥.٧ ± ٨٧.٩ فرد) بينما البق الدقيقي الأسترالي جاء في المرتبة الأخيرة بمتوسط تعداد ٩.٤ ± ٢.٥ و ٦ ± ١.٩ فرد خلال سنتي الدراسة ٢٠١٤ و ٢٠١٥ على التوالي. بالنسبة للمفترسات الحشرية احتل المفترس أبو العيد فيداليا المرتبة الأولى بنسبة ٦٠.٦ و ٦٩.٤% يليه المفترس أسد المن الأخضر بنسبة ٣٠.٤ و ٢٢.٧% بينما المفترس أبو العيد نيفس انكلودينس جاء في المرتبة الأخيرة بنسبة ٩ و ٧.٩% خلال سنتي الدراسة ٢٠١٤ و ٢٠١٥ على التوالي. وقد وجد أن نسبة المفترس للفريسة خلال الأشهر من يوليو حتى ديسمبر تراوحت بين ٤.٧ : ١ و ١٠.٦ : ١ (مفترس: فريسة) خلال سنتي الدراسة.