The Population Dynamics of *Parlatoria Oleae* (Cloveé) (Hemiptera: Diaspididae) and Factors Affecting its Seasonal Abundance on Pear Trees under Irrigation in Burg El-Arab Area, Alexandria, Egypt.

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ADDITIONAL INDEX WORDS: hemiptera, diaspididae, Parlatoria oleae, seasonal abundance, pear trees.

ABSTRACT

The estimated infestation rate of *Parlatoria oleae* (Cloveé) on pear trees at Burg el-Arab area indicated three peaks during October, February and June. The mean of total counts was also found to be parallel with the same periods of infestation.

The numbers of the individuals of the immature stage reached the maximum during autumn and summer months. The adult females reached the maximum during September, November, winter months and early summer. The adult males were observed in high ratio during September. October, January. February and August. The parasitized scale insects with the parasitoid *Aphytis diaspidis* (Howard) reached the maximum rate during February and August. The olive scale insect was found to have three generations per annum on pear trees under irrigation at Burg el-Arab area, Alexandria Governorate.

INTRODUCTION

The olive scale insect, *Parlatoria oleae* (Cloveé) distributes in all regions of the world such as Australasion ; Afrotropica ; Nearctic . Oriental ; Palaearctic and Neotropica . It was identified in Egypt by Newstead (1906), Hall(1922) and Ezzat (1958) .

The olive scale insect has been reported to be an occasional economic pest of nut trees and direct financial loss is occurred by this pest

due to the marketing and discoloration of smooth - skinned fruits such as plums, apricots and olives. Losses in quantity and quality or marketable production might be attributed to infestation by the olive scale, which is considered to be the major agricultural pest in the U.S.A. (Westcott , 1973).

Therefore, this investigation could be considered as an attempt to study some ecological aspects of *P. oleae* infesting pear trees under irrigation system at Burg el-Arab area in Alexandria Govemorate , Egypt

MATERIALS AND METHODS

The study was carried out at Burg el-Arab area (50km west of Alexandria) from 1st of September 2004 till 31th of August 2006 to estimate the population density of the olive scale insect infesting pear trees (*Pyrus communis*) at a special private farm . No chemicals were applied to the experimental plants throughout the course of this study. Ten trees were chosen to follow-up the population density of the olive scale insect. Trees chosen were in the same age and similar in size, shape, height, vigour and homogeneous in infestatior rate. Fortnightly, from each tree ten leaves and five small branches (15cm long) were picked out at random from all directions of each tree. Leaves and branches were put in clothes bags and transported to the laboratory for counting and classifying the existing individuals of detected species using a stereoscopic binocular microscope. The upper and lower surfaces of leaves and all the branches were examined and the pre-adults, adults (males and females) and parasitized stages of the inspected insects were counted and recorded.

The rate of increase in population densities were calculated half-monthly by dividing the mean number found in sampling date over that found in the preceding one according to Bodenheimer (1951).

The selected weather factors that have been considerd to determine their effects on the population of olive scale insect were mean day temperature, mean relative humidity, wind speed and dew point. Daily records of these weather factors in Alexandria Governorate were obtained from the General Authority for Meteorology at Kobri El Koba, Cairo, Egypt. The obtained data were statistically analyzed according to Snedecor (1970).

RESULTS AND DISCUSSION

The infestation rates of the olive scale insect, *P. oleae* infesting pear trees at Burg el-Arab area in both growing seasons (2004-2005 & 2005-2006) are given in Table (1) show that the rate of infestation indicated three distinct peaks, during October-November, February and June. In both growing seasons 2004-2006 the highest infestation rate reached 50% and 56% of total examined leaves and branches during June, versus the insect complete disappearance during April.

This finding is agreement with those obtained by Moursi and Mesbah (1985) who reported that the highest fraction of infestation rate with *P. oleae* on olive trees at Burg el-Arab was observed during June, while the lowest one was during April.

Considering the mean of total counted number of *P. oleae* per sample, a merely similar trend of results was observed. Whereas, the higher mean values of counted insects/sample were detected also during October-November, February and June months (Table 1).
Herein, the lowest counted insects number/sample was recorded during December in both growing seasons (1.0 ± 0.2 & 6.2 ± 0.9 in 1st and 2nd ones, respectively), it disappeared completely from branches and leaves during April (Table, 1). Then more gradually increased to a mean number of inspected scale insects/sample reached the maximum during June and July, amounted to 75.8 ± 3.1 & 79.0 ± 2.1 in 1st season, while it was 78.4 ± 1.7 and 59.8 ± 2.8 individuals per tree in the second one, respectively.

As to the determined 3 peaks of occurring rates of infestation, the fluctuating population density of *P. oleae* on pear trees also showed three distinct peaks of abundance in merely similar months, during both growing seasons. The incidence of the first peak of 38.6 ± 4.5 & 55.4 ± 2.9 individuals/sample was recorded in October, 2004 and 2005, respectively. The second one (38.2 ± 2.6 & 33.2 ± 5.5 individuals) in February, 2005 and 2006, respectively. The third peak occurred in July, 2005 (79.0 ± 2.1) and during June, 2006 (78.4 ± 1.7). (Table 1).

The estimated value of quotient of increase indicated that the favorable periods of annual increase occurred in the months of October, January and June, and amounted to 3.45 & 5.5; 16.4 & 3.22 and 4.51 & 3.81, in the first and second growing seasons, respectively (Table 1).

Noticeably, from Table (2), the higher densities of the inspected population of nymphal stage were recorded during October, November and summer months of June, July and August and comprised 54.7 ± 3.2, 41.2 ± 6.8, 37.2 ± 4.7, 35.6 ± 7.5 and 48.1 ± 4.4%; respectively; in the 1st growing season and 51.2 ± 4.7, 53.1 ± 6.1, 46.8 ± 1.7, 29.1 ± 2.3 and 34.3 ± 6.6 in the 2nd growing season, respectively (Table, 2 and Fig, 1).

The minimal densities of these immatures occurred during January and May in both seasons (28.3 ± 5.1 & 7.1 ± 0.4 and 17.2 ± 3.6 & 9.1 ± 0.4 respectively), while completely coincided of disappear was happened during September, December, February, March and April, in the first growing season and/or during September, February, March and April in the 2nd growing season (Table 2 and Fig.1).

The incidence of adult females was more or less higher during September, November, winter months, March, May and June, versus their more or less lowered (%) values of occurrence recorded in October, July and August, while the disappeared completely in April in both the growing seasons. During the period of September, 2005 to August 2006, the maximal values (%)of adult female population densities showed the same trend of pattern as that of the first growing season (2004-2005), but the calculated percentages were to a more or a less extent lower than those calculated values of the first one, whereas the value percent of the revealed adult females recorded during the first year reached 100.0% of the total count during December in the 1st growing season, while it was 80.6 ± 8.0% of total count during the 2nd growing one (Table 2 and Fig. 1).

Data in Table (2) also clearly shows that the adult males were observed in high ratio during September, October (38.8 ± 5.7 & 30.6 ± 5.8%) of the total count, respectively, then they decreased to 1.80 ± 0.3 during November and disappeared in December, reincreased in adult males gradually in January and February to reach 16.7 ± 1.7% of the total count in March. The adult males disappeared again in April, followed by a gradual reincrease that reached the maximum of 37.3 ± 7.6 in August in the first growing seasons. (Fig. 1).

In the second growing season (2005-2006), the population of adult males was high in September (47.2 ± 7.8 of total count), gradually decreased to the minimum of 3.2 ± 1.0% in November, reincreased to 30.0 ± 7.9% in December; followed by a more or less gradually redecrease till

March; completely disappeared during April, then reincreased again in the subsequent months of May 37.7 ± 0.4% followed by less high values (%) reached 30.8 ± 4.3 & 30.2 5.7% of the total during July and August (Table 2).

It is worth to mention here that the rate of occurring male stage mainly concentrated on the leaves than on branches, thus it was found during the vegetative period of pear tree versus its minimum occurrence during late autumn and winter months which are characterized with the absence of vanished leaves of this deciduous plant species.

This finding is agree with the results obtained by Huffaker *et al.* (1962), who found that males of *P. oleae* represented abut 80% of the population on leaves with the reverse was true for scales on the limbs during the early autumn in Califomia.

The olive scale insect was found to be parasitized with the parasitoid *Aphytis diaspidis*, the percentage of parasitism reached the maximum (7.2 ± 2.8% of total count) during February of 1st growing season 2004-2005, while that maximal percentage reached 15.8 ± 1.8% of total count during August, in the 2nd growing seasons of 2005-2006. In general, the rate of the parasitoid efficiency was merely similar during the subsequent months of both growing seasons as shown in Table 2 and fig. 1).

From the above cited results, it could be confirm that *P. oleae* appeared to have three generations per annum on pear trees under irrigation at Burg el-Arab area. The first lately autumn-early winter generation with a peak in October; the second wintry-spring scarce number generation with a comparatively lower peak in January; and the third summer one with a prominent peak, merely during July in both growing seasons. (Fig, 1).

The obtained data agrees with the results of Asfoor (1997) who determined three generations on pear trees in Qualubiya Governorate and only two generations on plum trees. Ezz (1997) reported also that there are three generations per year, in May, August and October on plum, apricot and peach in Wadi el-Natron, Beheira and Qualyobia (Egypt).

On the other hand, Kasim (1995) mentioned that there were two generations on plum and peach in Beheira, Egypt. Also, Kosztarab (1996) and Gill (1997) stated that there were two generations per year in California

and southern USA for *P. oleae*, but up to four generations per year in the Mediterranean region (Habib *et al.*, 1969; El-Hakim and Helmy, 1985).

The seasonal variations in infestation rate mean total count/sample and population age structure of *P. oleae* on pear trees are shown in Tables 3 & 4 and Fig. 2. Data revealed that the highest infestation rate occurred during summer months in the two successive growing seasons and represented 32.7 & 39.3% of total infestation in first and second growing seasons, respectively. The infestation rate can be arranged descendingly as follows: Summer, Autumn, Winter and Spring in the first year; vice versa: Summer, Winter, Autumn and Spring in the second year. (Tables 3 and 4).

The population density, as mean total count/sample of collected individuals was the highest during summer months; more or less lowered in autumn and winter months, while it was at the minimum during spring months. Sequently, analysis of the population age structure of the insect indicated that the highest rate of immatures was also observed during summer months (40.3 ± 5.3 & 36.8 ± 3.4% of total in the 1st and 2nd growing seasons, respectively) followed by autumn then winter months (32.0 ± 3.3 & 34.8 ± 3.3%); and (9.4 ± 1.7 & 11.0 ± 1.7% of total respectively). The lowest rate of this stage was revealed in spring months (2.4 ± 0.4 & 3.0 ± 0.4%) of total in first and second growing seasons, respectively (Tables 3 & 4).

Vice versa, the higher calculated percentages of the inspected adult females were observed during winter (78.9 ± 4.2%, 62.2 ± 4.2%) followed by spring (48.1 ± 2.3 & 42.1 ± 3.1%), Autumn (39.3 ± 4.5 & 37.2 ± 3.6%) and summer (31.9 ± 4.5 & 31.7 ± 3.4%) in the first and second growing seasons, respectively (Tables 3 & 4).

The adult males were observed in merely similar less high percentages all around both the growing seasons in except, they were in low percentages in winter months in the first growing one (Tables 3 & 4).

The calculated percentages of the parasitized individuals were relatively low; not exceeded 7.7 ± 1.2% throughout the period of both growing seasons, but it was more lowered in the 1st growing season up to 1.2 ± 0.1%. Moreover, the remarkedly lower incidence of the parasitized individuals of that scale insect species was recorded in winter months of both growing seasons (Tables 3 & 4).

The deduced relationship between the calculated values of certain weather factors, i.e., daily mean temperature, daily relative humidity, dew point and wind speed with either the infestation rate (%) or total count of *P. oleae* on pear sample during the period of September, 2004 till August, 2005 and September, 2005 to August, 2006 is exhibited in Tables (5 & 6). The results show the more or less weak significant or nonsignificant positive or negative relationships between the studied physical factors and infestation rate in the first and second growing seasons except, the calculated strong significant negative (r) value between R.H. (%) and rate of infestation. That may be attributed to the followed missleading measure for determining this relationship by calculating the number of infested twigs or branches of pear tree by the insect, which may oftenly occurred on fewer numbers and/or on larger number of infested branches in 1st and 2nd growing seasons, in respect. Sometimes with an equal rate of counted number of inspected individuals in both cases, that sequently reflects on the performed calculation of estimated relationship of R.H% & rate of infested branches by the insect. This point of view, was confirmed from the included results in Tables 5&6 which indicated the more or less general weak (r) values between the values of total count/tree and the studied physical factors.

Whereas, all the excluded (r) values proved the significant and/or the insignificant positive or negative weak relationships between the correlated values of physical factors and counted number/tree during both growing seasons, respectively and assured the view point of the necessity of following the correct parameters for determining the effect and degrees of relationship of weather factors with the correlated values of developing insect individuals under field conditions.

Table (1): Monthly variations in infestation rate (%), total count per tree and quotient of increase of *Parlatoria oleae* infesting pear trees at Burg el-Arab area (September, 2004– August, 2006).

Date of inspection	2004-2005			2005-2006		
	Infestation (%)	Total count / sample	Quotient of increase (Q.I)	Infestation (%)	Total count / sample	Quotient of increase (Q.I)
September	14.0	11.2 ±3.1*	-	18.0	10.0 ±2.9	-
October	20.0	38.6 ±4.5	3.45	22.0	55.4 ±2.9	5.54
November	22.0	28.4 ±5.4	0.74	24.0	46.8 ±4.8	0.84
December	4.0	1.0 ±0.2	0.04	18.0	6.2 ±0.9	0.38
January	12.0	16.4 ±2.1	16.4	16.0	20.0 ±4.6	3.22
February	36.0	38.2 ±2.6	2.33	32.0	33.2 ±5.5	1.66
March	10.0	4.8 ±0.6	0.13	18.0	7.6 ±1.0	0.23
April	0.0	0.0 ±0.0	0.0	0.0	0.0 ±0.0	0.0
May	22.0	16.8 ±1.9	0.0	26.0	20.6 ±2.6	0.0
June	50.0	75.8 ±3.1	4.51	56.0	78.4 ±1.7	3.81
July	40.0	79.0 ±2.1	1.04	40.0	59.8 ±2.8	0.76
August	8.0	17.6 ±1.6	0.22	22.0	23.6 ±0.4	0.38

* Mean number ± standard error (S.E)

Table (2). Monthly variations, in population age structure (%) of *P. oleae* infesting pear trees at Burg el-Arab area (September, 2004 – August, 2006).

Date of inspection	2004-2005				2005-2006			
	Population age structure (%)				Population age structure (%)			
	Immature	Adults		Parasitized	Immature	Adults		Parasitized
		female	male			female	male	
September	0.0 ±0.0	57.7 ±6.1	38.8 ±5.7	3.5 ±0.2	0.0 ±0.0	51.4 ±2.4	47.2 ±7.8	1.4 ±0.2
October	54.7 ±3.2	13.3 ±4.6	30.6 ±5.8	1.4 ±0.7	51.2 ±4.7	19.9 ±1.7	21.8 ±3.5	7.1 ±0.8
November	41.2 ±6.8	57.0 ±4.2	1.8 ±0.3	0.0 ±0.0	53.1 ±6.1	40.2 ±6.9	3.2 ±1.0	3.1 ±0.1
December	0.0 ±0.0	100 ±0.0	0.0 ±0.0	0.0 ±0.0	16.0 ±1.6	54.0 ±4.3	30.0 ±7.4	0.0 ±0.0
January	28.3 ±5.1	61.7 ±3.3	6.2 ±0.5	3.8 ±1.0	17.2 ±3.6	56.7 ±5.1	18.4 ±1.8	7.4 ±2.0
February	0.0 ±0.0	75.0 ±9.2	7.8 ±4.1	17.2 ±2.8	0.0 ±0.0	75.4 ±4.4	12.9 ±2.2	11.7 ±2.0
March	0.0 ±0.0	83.3 ±1.1	16.7 ±1.7	0.0 ±0.0	0.0 ±0.0	80.6 ±8.0	19.4 ±2.3	0.0 ±0.0
April	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0	0.0 ±0.0
May	7.1 ±0.4	61.0 ±5.8	28.2 ±5.8	3.7 ±0.4	9.1 ±0.4	45.7 ±1.1	37.7 ±0.9	7.5 ±0.1
June	37.2 ±4.7	54.7 ±6.0	7.5 ±2.0	0.6 ±0.1	46.8 ±1.7	40.5 ±1.7	10.5 ±2.0	2.2 ±0.3
July	35.5 ±7.5	35.4 ±3.8	25.1 ±1.2	4.0 ±1.6	29.1 ±2.3	35.0 ±2.1	30.8 ±4.3	5.1 ±1.9
August	48.1 ±4.4	14.6 ±5.6	37.3 ±7.6	0.0 ±0.0	34.3 ±6.5	19.7 ±6.6	30.2 ±5.7	15.8 ±1.8

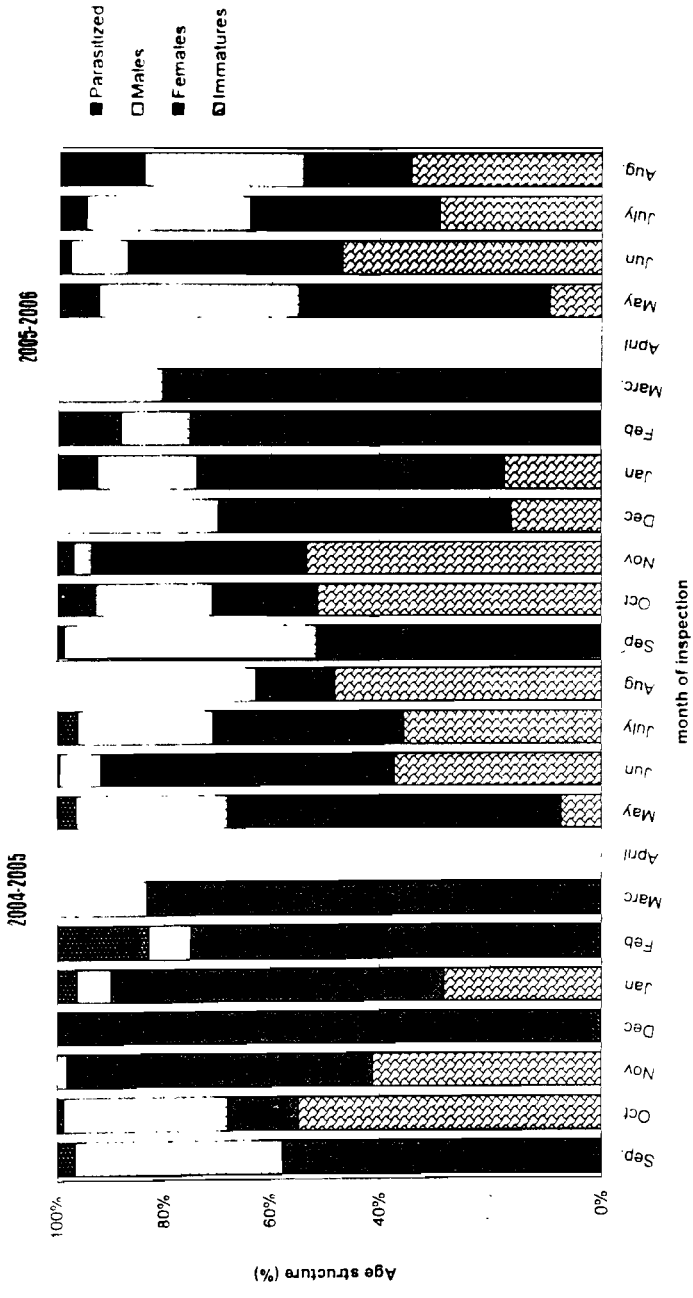

Fig. (1): Monthly calculated variations in population age structure (%) of *P.oleae* infesting pear trees at Burg el-Arab area in two growing seasons (2004-2005 & 2005-2006).

Table (3). Variations in seasonal occurrence of *P. oleae* on pear trees at Burg el-Arab area (September, 2004 – August, 2005).

Season	Mean of Infestation (%)	Total count/sample		Population age structure (%)			
		No./ sample	% of total/ year	Immatures	Adults		Parasitized
					Females	Males	
Autumn	18.7	78.2±4.3	23.9	32.0	42.7	23 7	1 6
Winter	17.3	55.6±1 3	17	9.4	78.9	4.7	7.0
Spring	10 7	21.6±0 8	6.6	2.4	48 1	15.0	1.2
Summer	32.7	172..4±2.3	52.6	40.3	34.9	23.3	1 5

Table (4). Variations in seasonal occurrence of *P. oleae* on pear trees at Burg el-Arab area (September, 2005 – August, 2006).

Season	Mean of Infestation (%)	Total count/sample		Population age structure (%)			
		No./ sample	% of total /year	Immatures	Adults		Parasitized
					Females	Males	
Autumn	21.3	112.2±3.7	31.0	34.8	37.2	24 1	3.9
Winter	22 0	59 4±4 0	16.4	11 0	62 2	20 4	6 4
Spring	14.7	28.2±1 0	7.8	3.0	42 1	19 0	2 5
Summer	39 3	16 1±1.6	44 7	36.8	31 7	23 8	7 7

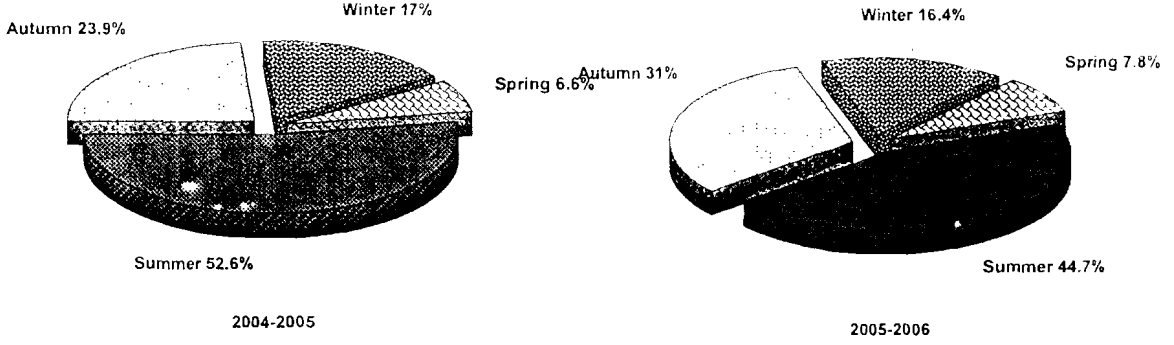

Fig. (2): Variation in seasonal occurrence of *P. oleae* infesting pear trees at Burg el-Arab area in two growing seasons (2004-2005 & 2005-2006).

Table (5). Simple correlation (r) values of four abiotic factors with their significance levels on infestation rate (%) of *P. oleae* on pear trees at Burg el-Arab area in two growing seasons (2004-2005 & 2005-2006).

Factors	2004 - 2005			2005 - 2006		
	r	d.f	t	r	d.f	t
Dialy mean temperature (°C)	0.17	10	1.75	0.38	10	4.40*
R.H (%)	-0.13	10	1.33	-0.93	10	68.81**
Dew point (°C)	0.28	10	3.04	0.38	10	4.44*
Wind spead (m/sec.)	0.31	10	3.37*	0.14	10	1.43

r = Simple correlation d.f = Degree of freedom
t = t. value
* Significant * highly significant

Table (6). Simple correlation (r) values of four abiotic factors with their significance levels on total count of *P.oleae* on pear trees at Burg el-Arab area in two growing seasons (2004-2005 & 2005-2006).

Factors	2004 - 2005			2005 - 2006		
	r	d.f	t	r	d.f	t
Dialy mean temperature (°C)	0.33	10	3.71*	0.42	10	5.02*
R.H. (%)	-0.10	10	1.02	-0.34	10	3.86*
Dew point (°C)	0.46	10	5.83*	0.39	10	4.60*
Wind spead (m/sec.)	0.30	10	3.31*	0.34	10	3.82*

r = Simple correlation d.f = Degree of freedom
t = t. value
* Significant

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الملخص العربي

التغير المعدى بحشرة الزيتون القشريه *PARLATORIA OLEAE* (CLOVER) والعوامل المؤثرة على التغير فى تعدادها الفصلى على اشجار الكمثرى فى المزارع المرويه بمنطقه برج العرب- الاسكندريه- مصر.

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سجل اعلى معدل الإصابة بالحشرة خلال فترة الدراسة أعلاه فى اشهر أكتوبر – نوفمبر ، فبراير – يونيو بينما لوحظ اعلى تعداد كلى خلال نفس الفترات السابقة . وقد بلغ معدل تعداد الحوريات أقصاه خلال أكتوبر – نوفمبر وخلال أشهر الصيف بينما الحشرات الكاملة الآناث تكون أعلى ما يمكن خلال سبتمبر و أشهر الشتاء ويونيو ولوحظ تواجد الذكور بنسبة عالية خلال سبتمبر وأكتوبر و فبراير وأغسطس.هذا وقد سجل ايضا أعلى معدل للتطفل بالطفيل *A. diaspidis* خلال شهرى فبراير وأغسطس . ووجد أن للحشرة ثلاثة أجيال في السنة على أشجار الكمثرى : الجيل الأول من نهاية الخريف لأول الشتاء مع أقصى ارتفاع خلال أكتوبر والثاني في يناير أما الثالث خلال يوليو.