Seasonal activity of the white date palm scale insect, *Parlatoria blanchardii* (Targioni-Tozzetti) infesting date palm trees at Esna district, Luxor Governorate, Egypt.

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Abstract: The present work was carried out throughout two successive years (2010/2011 and 2011/2012) at Esna district, Luxor Governorate. As a basic study for developing future management of the white date palm scale insect, *Parlatoria blanchardii* (Targioni-Tozzetti), to determine the seasonal activity of this insect. The obtained results showed that half monthly observations of this insect had four peaks of seasonal activity per year, which was recorded in the mid-October, mid-November, mid-April and mid-June in the first year (2010/2011) and during the mid-October, mid- December, mid-April and mid-June during the 2nd year (2011/2012). Also, the least total population density of *P. blanchardii* was recorded in February during the two years of investigation. As well as, the first year of study cleared that the total population of this insect was higher in comparison to the second year of investigation. Concerning, the monthly variation rate in the population (R.M.V.P), the obtained results showed that the favourable times for this insect were from October to June of the first year and October to July of the second year. Climatic conditions of autumn and spring months during the first year and autumn and summer months during the second year were the optimal for the insect multiplication and build up, since the highest R.M.V.P value was achieved during both years. The obtained results showed that, effect of minimum temperature and dew point through the first year and maximum temperature and mean relative humidity during the second year were the most important weather factors affecting on the population changes of *P. blanchardii* in the field. The results showed that the combined effect of these climatic factors such as maximum temperature, minimum temperature, relative humidity and dew point and mean percentage of parasitism during the 1st and 2nd years was highly significant and significant effect of total population for the two years of study, respectively. The percentages of explained variance (E.V.) indicate that all tested variables were responsible for 59.4 and 52.1% of the population changes during the 1st and 2nd years of (2010/2011 and 2011/2012), respectively.

[Salman, A.M.A., S.F.M. Moussa and M.M.S. Bakry. **Seasonal activity of the white date palm scale insect, *Parlatoria blanchardii* (Targioni-Tozzetti) infesting date palm trees at Esna district, Luxor Governorate, Egypt.** *Nat Sci* 2013;11(2):32-40]. (ISSN: 1545-0740). http://www.sciencepub.net. 6

Keywords: *Parlatoria blanchardii*, Seasonal activity, environmental conditions and date palm trees.

1.Introduction

Date palm tree, *Phoenix dactylifera* L. is one of the oldest domesticated fruit crops **(El-Shibli and Korelainen, 2009)**. Among several pests, infesting date palm trees, white date palm scale, *Parlatoria blanchardi* (Targioni-Tozzetti) is considered as pest. Adults and nymphs of this insect feed on leaves sap, sucking great amount of sap which contain macro- and micro-elements. At high level of infestation with this scale insect, remarkable damage occurs, resulting in early leaves drop and yield reduction **(El-Said, 2000)**. Great damages can be done by this scale insect by sucking the plant sap that give low rates of photosynthesis and respiration which leads to curling, yellowing, dropping to leaves. A characteristic symptom of infestation by *P. blanchardi* is the appearance and accumulation of its scales on attacked palm parts **(El-Said, 2000, El-Sherif *et al*., 2001 and Blumberg, 2008).**

The objective of this study is to estimate the seasonal activity, rate of monthly variation and effect of environmental resistance factors on the population of this insect was carried out for two successive years (2010/2011 and 2011/2012) at Esna district, Luxor Governorate.

2. Material and Methods

The population fluctuations of this scale found infesting date palm trees were carried out at half-monthly intervals at Esna district, Luxor Governorate during two successive years (2010/2011 and 2011/2012). An orchard about one feddan was selected for sampling during the above-mentioned period. Four palms of White variety of almost similar and as uniform as possible in size, age (5 years), shape, height, vegetative growth and received the normal agricultural practices without pruning the fronds and application any chemical control measures before and during the period of investigation, were randomly chosen for sampling

which was practiced at half-monthly intervals were selected for carrying out this study. The sample size (12 leaflets) was taken from every palm at a rate of (3 leaflets) from each of the north, east, south and west directions. Regular half-monthly samples were collected and immediately transferred to laboratory in polyethylene bags for inspection by the aid of stereo-microscope. Number of alive insects on upper and lower surfaces of leaflets on date palm trees was individually sorted into immature stages (first nymphal instar and second nymphal instar) and mature stages (adult females and gravid females) and then were counted and recorded together opposite to each inspected date.

Also, the rate monthly variation in the population (R.M.V.P) was calculated according to the formula reported by **Serag-El-Din (1998):**

$$\text{(R.M.V.P)} = \frac{\text{Av. count of insect at a month}}{\text{Av. count given at the preceding month}}$$

Concerning, the effect of the environmental resistance factors (physical and biotic) on the total population of *P. blanchardii*. Necessary meteorological data at Luxor governorate were obtained from the Central Laboratory for Agricultural climate, Agriculture Research Center, Ministry of Agriculture in Giza. The half monthly of tested main weather factors (Max. temp., Min. temp., mean of % relative humidity and mean of dew point °C) and the percentage of parasitism were worked out.

According to the results of the simple correlation, regression coefficient and the partial regression formula which was adopted to find out the simultaneous effects of tested main weather factors and % of parasitism of *Aphytis phoenicis* on *P. blanchardii*. The partial regression method termed the C-multipliers was adopted according to **Fisher (1950)**. Statistical analysis in the present work was carried out with Computer using (**MSTATC Program software, 1980**) to determine the preferable time for the insect activity and the proper time for its control.

3.Results and Discussion

1-Seasonal fluctuations in population:

The half-monthly counts of *P. blanchardii* different stages infested date palm trees at Esna district, Luxor Governorate were recorded through the two successive years (2010/2011 and 2011/2012). Also, means of the half-monthly records of temperature, relative humidity and dew point throughout the two years of investigations are graphically illustrated in Figs. (1 and 2).

1.1- The first year (2010/2011):

Concerning, the data in the first year of (2010/2011), as recorded in Fig. (1), it was observed that the total number of insect increased gradually to reach the first peak. The first peak was recorded in the 1st week of October with the means of 139.4 individuals/leaflet, weather factors were 39.7°C, 23.8°C, 25.5% and 14.3°C for Max., Min. temp., relative humidity and dew point, respectively. Then, the insect population decreased in mid-October. Again, the population increased gradually to reach the second peak of this insect was recorded in mid-November when the population reached 163.7 individuals/leaflet with means of 33.0°C, 17.0°C, 33.6% and 11.7°C for Max., Min. temp., relative humidity and dew point, respectively. Followed by a dramatic decline and sharply to reach in the beginning of March. Thereafter, the population increased gradually to reach the third peak in mid-April, when 87 individuals/ leaflet were recorded under the means field conditions of 30.3°C, 16.4°C, 25.1% and 6.6°C for Max., Min. temp., relative humidity and dew point, respectively. Moreover, the population decreased unit mid-May. Again, the population increased gradually to reach the fourth peak in mid-June, where 113.2 individuals/ leaflet were recorded under the mean field conditions of 41.1°C, 25.6°C, 17.2% and10.9°C for Max., Min. temp., relative humidity and dew point, respectively. Then after, population decreased continuously to reach in the beginning of August and then increased in mid- August (Fig., 1).

A similar trend in the seasonal fluctuation of 1st nymphal instar was observed. The peaks of 1st nymphal instar were recorded in the beginning of October, mid-November, mid-April and mid-June when the population density was 55.7, 65.8, 30.4 and 44.6 individuals/leaflet, respectively. According to data of 2nd nymphal instar, four peaks were recorded in mid- October, beginning of December, beginning of May and beginning of July, when the population density was 37.3, 33.8, 20.5 and 28.1 individuals per leaflet, respectively.

Differently, adult females had four peaks that were recorded in mid-September, beginning of November, beginning of April and beginning of June, when the population density was 24.4, 37.5, 19.8 and 22.7 individuals per leaflet, respectively. Similarly, however with different values the gravid females had four peaks that were recorded in the beginning of October, mid-November, mid-April and mid-June when the population density was 43.0, 46.7, 27.6 and 30.6 individuals/leaflet, respectively. The least total population density of *P.*

blanchardii was recorded in the mid of February, which may be attributed to the sharp diminution of the minimum temperature (under 10ºC) and high relative humidity which affected greatly on the population.

The obtained results are illustrated in Fig. (2) also, showed that in the first year (2010/2011) the highest population density of *P. blanchardii* (1st nymphal instar was 41.0 individuals/leaflet), 2nd nymphal instar (26.0 individuals/leaflet), adult females (22.9 individuals/leaflet), gravid females (27.7 individuals/leaflet) and total population was 117.6 individuals/leaflet were recorded in autumn, thus due to the environmental conditions which were more suitable for the insect activity. But, the least population density of this insect was recorded in spring.

1.2- The second year (2011/2012):

Concerning, the data during the second year of (2011/2012) as recorded in Fig. (3) it was cleared that the total population of this insect was smaller in comparison to the first year of investigation, which may due to the influence of favourable factors (such as environmental conditions,…etc.) and the abundance of the natural enemies. Also, the least population density of *P. blanchardii* (1st nymphal instar was 10.2 individuals/leaflet), 2nd nymphal instar (11.5 individuals/leaflet), adult females (8.3 individuals/leaflet), gravid females (7.5 individuals/leaflet) and total population was 37.6 individuals/leaflet were recorded in the beginning of March, 2012. **Dent (1991)** stated that the seasonal phenology of insect numbers, the number of generations, and the level of insect abundance at any location are influenced by the environmental factors at that location.

The population of insect peaked in November and December during the two years, respectively. When crawlers emerged after the egg laying period, their population decreased during several months due to mortality of first instars in the winter. Careful view to the annual fluctuations in insect activity in relation to the physical factors. It appeared that, the annual fluctuations in the population density during the two years were affected by the variability in these physical factors in the both years of investigation.

The obtained results in Fig. (4), clearly showed that in the second year (2011/2012), the highest population density of *P. blanchardii* (1st nymphal instar was 30.62 individuals/leaflet) were recorded in winter. While, the 2nd nymphal instar (23.0 individuals/leaflet), adult females (23.9 individuals/leaflet), gravid females (20.8 individuals/leaflet) and total population was 98.2 individuals/leaflet were recorded in autumn. But, the least population density of *P. blanchardii* (1st nymphal instar, 2nd nymphal instar, adult females, adult females, gravid females and total population) were recorded in spring.

They reported that the environmental factors and bio-enemies working as controlling agents. The time and sharp of seasonal fluctuation is depending on the geographical studied country. From the previously mentioned results, it could concluded that the insect population was higher in autumn season and thus due to the environmental conditions which were more suitable for the insect activity. Based on the data obtained during the two successive years, it could be concluded that the total population of this insect have four peaks, which was recorded in the beginning of October, mid-November, mid-April and mid-June in the first year. While, in the mid-October, mid- December, mid-April and mid-June during the 2nd year of study. These results were coincided with those obtained by **Salama (1972)** in Wadi El-Natroun, Egypt, found that *P. blanchardii* on date palm were the most abundance in October. **Kehat *et al.* (1974)** in Israel, stated that the populations of *P. blanchardii* on date palms were found to increase substantially in autumn. **Saad (1980)** in Egypt, found that a significant difference in the insect activity during autumn and winter. **Hussain (1996)** at Bahria oases showed that, the population density of *P. blanchardii* on date palms had three peaks in October, March and July. **Eraki (1998)** in Egypt, reported that that *P. blanchardii* had four peaks, which was recorded in the beginning of March, beginning of June, beginning of September and beginning of December per year. Also, stated that the environmental conditions during in December were suitable period for population growth, as well as these conditions were to be optimum in December for *P. blanchardii*. **Youssef (2002)** at Baltim region, Kafr El- Sheikh Governorate, Egypt, reported that insect had three distinct peaks during the year of study, the highest peak was found in October, the second in March and the smallest third one in June.

Rate of monthly variation (R.M.V.P.) in the population of the white date palm scale insect, *P. blanchardii*:

The monthly variation rates in the population of total population of *P. blanchardii* were calculated (Table, 1). The rate of monthly variation in the population is considered an indicator to the favourable month for insect activity expressed as monthly the increase of this insect

population through the year. When R.M.V.P. is > 1 it means more activity, < 1 means less activity and = 1 means no change in the population density during the two successive months.

It was shown as recorded in Table (1) that the favourable times of annual increase for total population, it could be concluded that the favourable times for annual increase appeared to be in October, November, March, April and June during the first year (2010/2011), when the rates of monthly variation were 1.45, 1.18, 1.09, 1.45 and 1.75, respectively. While, it took place in October, December, January, April, June and July during the second year (2011/2012), when the rates of monthly variation were 1.21, 1.52, 1.05, 2.12, 1.14 and 1.01, respectively (Table, 1). This result was agreeable with **Laudeho and Benassy (1969)** in Mauritania, stated that the density and severity of infestation with *P. blanchardii* is affected by microclimate conditions. High temperature combined with wind and low humidity was very effective for the survival of the crawlers. Generally, it seems that autumn and spring months during the 1st year and autumn and summer during the 2nd year, were the most favourable period for *P. blanchardii* activity under the field conditions at Esna district, Luxor Governorate. These results were coincided with those obtained by **Kehat *et al.* (1974), Saad (1980) and Eraki (1998)**, they reported that that found that a significant difference in the insect activity during autumn and winter. **Swaminathan and Verma (1991)** found the infestation with *P. blanchardii* on date palm trees sets in December on wards on leaflet from basal tissues, upwards reached its peak in net October.

3 - Effect of the Environmental factors (physical and biotic) on the total *P. blanchardii* population:

3.1- Effect of physical factors (abiotic):

A- Mean maximum temperature:

In the first season as reported in Table (2), the correlation coefficient (r) between the mean maximum temperature and total population was positive significant (+0.43), while was insignificant positive in the second year was (+0.24). The unit effect regression coefficient (b), indicates that an increase of 1°C in the mean maximum temperature increased the population by 1.88 and 0.82 individuals per leaflet for the two year, respectively. As well as, the partial regression values (P.reg) (Table, 21) emphasized insignificant positive relation that was (+1.91) and "t value" was (+1.28) for the 1st year of (2010/2011). While, was significant positive (+12.6) and "t value" was (+2.37) for 2nd year of (2011/2012) were recorded in Table (2). The obtained results revealed that, mean max. temp., within the optimum range of total population activity in the 1st year and under the optimum range in the 2nd year.

B- Mean minimum temperature:

Data in Table (2) showed the correlation coefficient (r) between mean minimum temperature and the total population for the 1st and 2nd rears was insignificant positive (+0.13 and +0.23), respectively. The calculated regression coefficient (b) for the effect of this factor indicated that for every 1˚C increase, the population increased by 0.62 and 0.78 individuals per leaflet for two years, respectively. The real effect of this factor on total population revealed that, it was highly significant negative from the partial regression was (-11.27) and t value was (-3.15) during 1st year, while was insignificant negative, P.reg. value was (-3.22) and "t value" was (-0.51) in the 2nd year, respectively (Table, 2). From the previous data, it could summarized that the mean minimum temperature entirely above the optimum range of total population in the 1st year and around the optimum range in the 2nd year.

C- Effect of mean relative humidity:

Results in Table (2) revealed that, the effect of this weather factor on total population. The correlation coefficient (r) between mean relative humidity and total population was insignificant negative correlation for 1st year was (-0.05) and insignificant positive correlation for the 2nd year (+0.12). The unit effect (regression coefficient) indicates that an increase of 1% R.H. decreased the population density by 0.15 individuals per leaflet for 1st year and increased the population by 0.27 individuals per leaflet for 2nd year, respectively.

The partial regression analysis for the true effect of mean relative humidity on the total population revealed that it was insignificant negative for 1st year (P.reg) value was (-2.90) and "t value" was (-1.81), while it was significant positive for 2nd year (P.reg) value was (+5.09) and "t value" was (+2.62). The obtained results revealed that, mean relative humidity around the optimum range of total population the 1st year and under the optimum range in the 2nd year, Table (2).

D- Effect of mean dew point:

Regarding the data in Table (2) showed that, the effect of mean dew point on total activity was significant and insignificant positive correlation for 1st and 2nd years of study was (+0.42 and +0.38), respectively. As well as, the calculated regression coefficient (b) for effect of this factor indicates that for every 1˚C increase in the mean dew point, the population density of this insect

increased by 3.62 and 1.83 individuals per leaflet for two years of study, respectively.

Partial regression coefficient for the exact effect of mean dew point on the total population revealed that it was highly significant positive for 1st year (P.reg) value was (+13.78) and "t value" was (+2.88), while it was insignificant negative for 2nd year (P.reg) value was (-6.70) and "t value" was (-1.71).The obtained results revealed that, mean dew point entirely under the optimum range of total population in the 1st year and around the optimum range in the 2nd year.

3.2- Effect of biotic factor (mean percentage of parasitism of *A. phoenicis*):

The results of parasitoids survey of this insect indicated that only one parasitoid species, *A. phoenicis* (Hymenoptera: Aphelinidae). Data of this parasitoid was based on half-monthly counts and depended on the counts of parasitized scale insects with larvae and pupa of *A. phoenicis* (not on the emergency wasps). Also, this parasitoid is dominant and attacks the second instar nymphs and adults of *P. blanchardii* except the first instar nymphs.

The percentage parasitism of *A. phoenicis* during the two years of investigation it could be noticed that five peaks of activity were recorded. In the first year (2010/2011), were took place in mid - October (15.72%), beginning of December (11.91%), mid-May (9.7%), mid-June (8.5%) and mid-August (11.7%). While, the second year (2011/2012), it was found that the highest percentage of parasitism were recorded in beginning of October (12.6%), beginning of December (16.7%), beginning of April (9.1%), mid-June (9.22%), Mid-August (10.1%). The highest rate of parasitism (16.7 %) occurred when scale population was smallest (79.5 individuals per leaflets) in mid-October. These results were coincided with those obtained by **Saad (1980)** in Giza, Egypt, observed that *Aphytis sp.* and *Aspidiotiphagus lounsburyi* (Hymenoptera: Aphelinidae) were parasited on *P. blanchardii*. Parasitism was mostly occurred during March, April, June, August and October. **Eraki (1998)** in Egypt, mentioned that this insect is controlled by natural enemies, such as *A. phoenicis*. The parasitoid, *A. phoenicis* on this scale and showed with extensive numbers through each of June, November, January and March.

Results obtained during the two years of (2010/2011 and 2011/2012), in Table (2), proved that the correlation coefficient (r) between mean percentage of parasitism and the total population was significant positive for 1st and 2nd years (+0.47 and +0.44), respectively.

As well as, the precise effect of the mean percentage of parasitism on the total population was insignificant positive (P.reg) value was (+0.43 and +2.55) and "t value" was (+0.16 and +1.63) for the 1st and 2nd years, respectively. The obtained results revealed that, mean percentage of parasitism around the optimum range of total population within the optimum range in the two years, Table (2). It was cleared that the bio-factor of parasitism appeared of most and serious importance affected on the population of *P. blanchardii* in the field.

3.3- The combined effects of the biotic and abiotic factors on the total population:

The estimated partial regression values indicated the presence of a simultaneous effect of the factors on the population of insect in both years. The results showed that the combined effect of these climatic factors and mean percentage of parasitism on the total population during the 1st and 2nd years of study was highly significant and significant where the "F" value, (5.27 and 3.91), respectively for the two years, (Table, 2). In the same table, the influence of these combined all factors was expressed as percentages of explained variance (% E.V.) that was 59.4 and 52.1 %for 1st and 2nd years, respectively. The remaining unexplained variances are assumed to be due to the influences of other undetermined and unconsidered factors that were not included in this study in addition to the experimental error. The previous results indicated that the activity of this insect was mostly related to the simultaneous effect of these selected factors rather than the single effect of each factor separately.

Based on the obtained results (Table, 2), it could be concluded that the tested factors on total population during the two years affected the white date palm scale, *P. blanchardii*. Many investigators studied the effect of weather factors on the population of *P. blanchardii*. **Eraki (1998)** in Egypt, stated that the responsibility of four factors combined (Maxi. temp., Min. temp. mean of % relative humidity and % parasitism), expressed as mount of percentage of explained variance were 72.5, 74.9, 81.5 and 65.2% during 1st, 2nd, 3rd and 4th generations, respectively. In the second year of study, the explained variance was 76.6, 99.6, and 97.3% during 1st, 2nd and 3rd generations, respectively. **El-Said (2000)** in North Sinai**,** Egypt, stated that the effect of night minimum temperature on activity was negative and highly significant in the first season and significant positive in the second year. The effect of day maximum temperature was highly significant positive in 1st

year and insignificant negative in 2nd year. The effect of daily mean relative humidity was insignificant positive for both years of investigation. The simultaneous effect the three considered weather factors on activity was highly significant during both years of investigation. The percentage of variance explained by these factors was 56.5 and 53.6% for the two years.

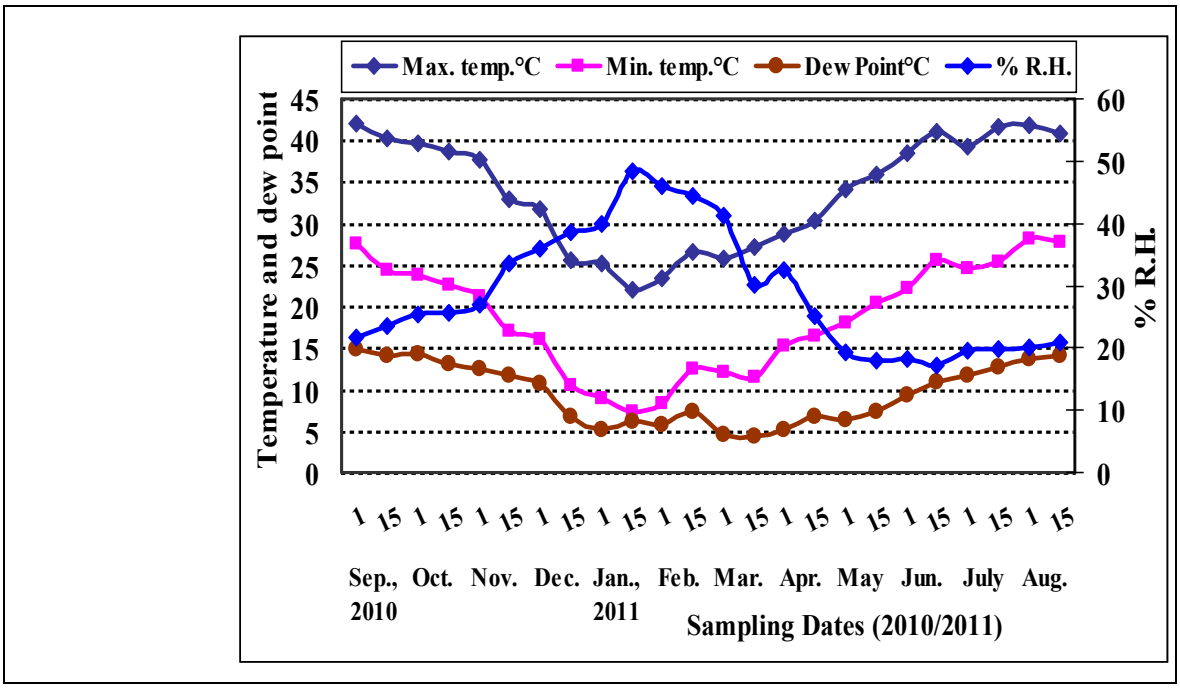
Table (1): Rate of monthly variation (R.M.V.P) in the mean number of *P. blanchardii* recorded on the date palm trees at Esna district, Luxor Governorate through the two successive years of (2010/2011 and 2011/2012).

Year	Month of inspection	Rate of monthly variation				
		1st nymphal	2nd nymphal	Adult females	Gravid females	Total
2010/2011	September	—	—	—	—	—
	October	1.74	1.60	0.80	1.57	1.45
	November	1.06	0.89	1.94	1.28	1.18
	December	0.82	1.12	0.74	0.73	0.84
	January	0.65	0.67	0.93	0.74	0.73
	February	0.52	0.63	0.74	0.44	0.58
	March	1.22	0.82	1.01	1.43	1.09
	April	1.69	1.44	0.93	1.84	1.45
	May	0.69	1.09	0.61	0.48	0.69
	June	1.78	1.35	1.85	2.22	1.75
	July	0.93	1.17	0.60	0.64	0.86
	August	0.66	0.74	1.57	0.79	0.82
2011/2012	September	—	—	—	—	—
	October	1.30	0.91	1.17	1.48	1.21
	November	0.51	1.15	0.48	0.37	0.58
	December	1.87	0.72	1.77	2.24	1.52
	January	0.95	1.64	0.84	1.01	1.05
	February	0.46	0.51	0.61	0.49	0.51
	March	0.70	0.70	0.64	0.71	0.69
	April	2.43	1.54	1.71	2.77	2.12
	May	0.98	1.54	0.94	0.65	0.98
	June	1.09	0.80	1.49	1.44	1.14
	July	1.04	1.34	0.63	1.05	1.01
	August	0.83	0.80	1.34	0.80	0.88

Table (2): Multifactor regression analysis between total population of *P. blanchardii* and five variables of physical and biotic factors on date palm trees at Esna district, Luxor Governorate during the two years (2010/2011 and 2011/2012).

Year	Tested factors	Simple correlation and regression values				Partial regression values			Analysis variance			
		r	b	S.E	t	P.reg	S.E	t	F values	MR	R^2	E.V%
2010/2011	Max. temp	0.43	1.88	0.85	2.20 *	1.91	1.49	1.28	5.27 **	0.77	0.59	59.40
	Min. temp	0.13	0.62	0.99	0.63	-11.27	3.58	-3.15**				
	R.H.%	-0.05	-0.15	0.67	-0.22	-2.90	1.60	-1.81				
	Dew Point (°C)	0.42	3.62	1.66	2.18 *	13.78	4.78	2.88 **				
	% of Parasitism	0.47	6.16	2.50	2.47 *	0.43	2.63	0.16				
2011/2012	Max. temp	0.24	0.82	0.72	1.15	12.60	5.32	2.37 *	3.91 *	0.72	0.52	52.10
	Min. temp	0.23	0.78	0.71	1.10	-3.22	6.33	-0.51				
	R.H.%	0.12	0.27	0.48	0.56	5.09	1.95	2.62 *				
	Dew Point (°C)	0.38	1.83	0.95	1.93	-6.70	3.91	-1.71				
	% of Parasitism	0.44	3.65	1.60	2.28 *	2.55	1.56	1.63				

r = Simple correlation S.E = Standard error MR = Multiple correlation E.V% = Explained variance
b = Simple regression b.reg = Partial regression R^2 = Coefficient of determination



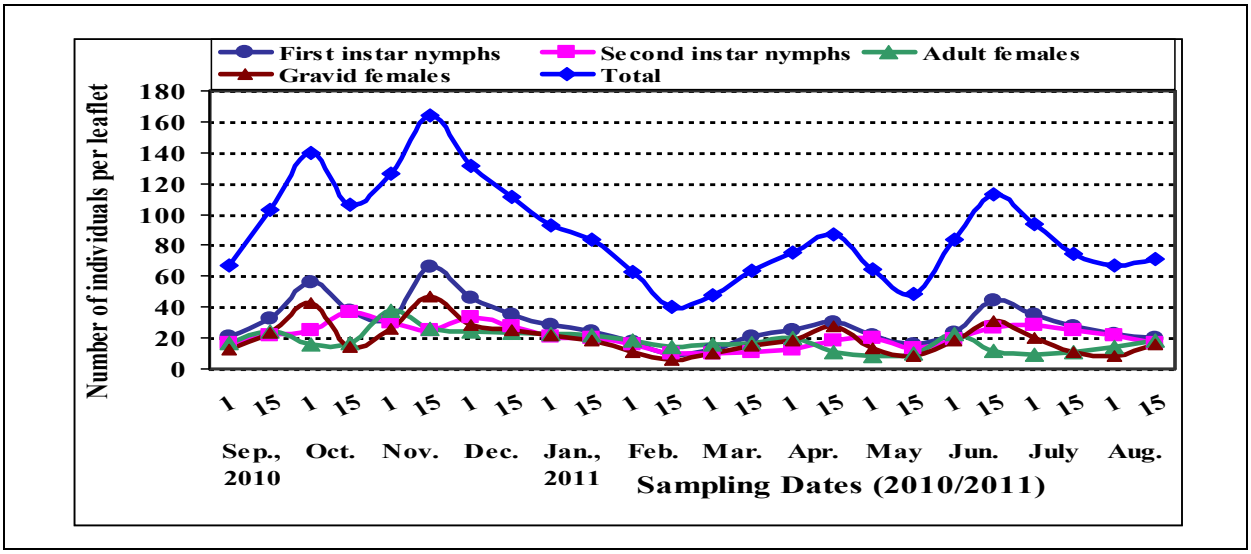


Fig. (1): Seasonal abundance of different stages of the white date palm scale, *P. blanchardii* on the date palm leaflets and weather records at Esna district, Luxor Governorate during the 2010/2011 year.

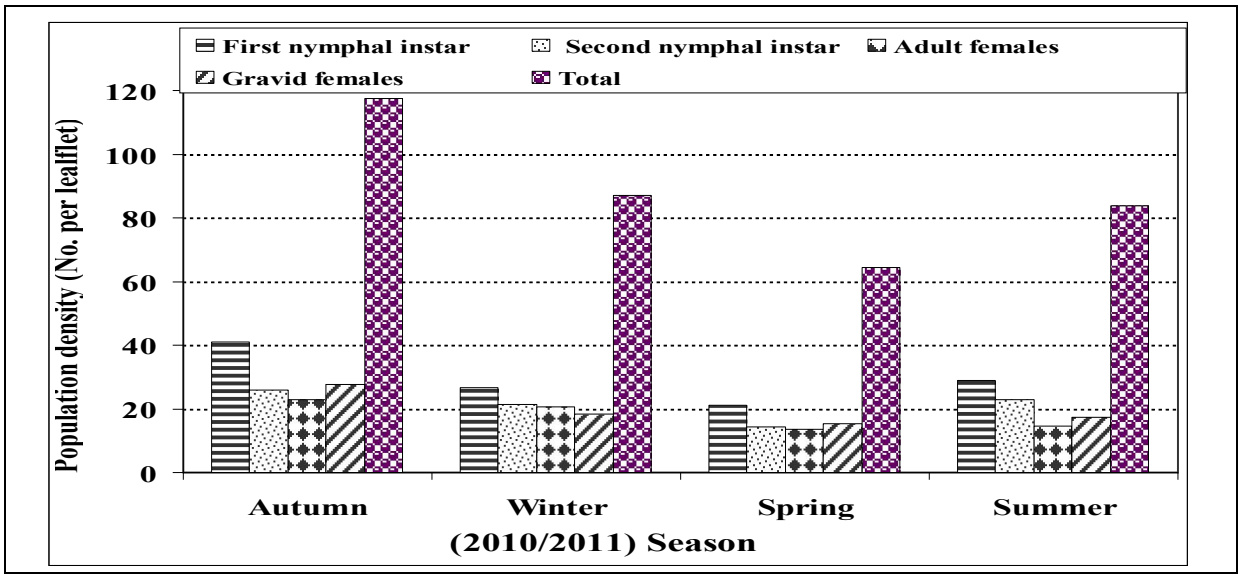


Fig. (2): Population density of *P. blanchardii* different stages recorded on the date palm leaflets at Esna district, Luxor Governorate during 2010/2011 year.

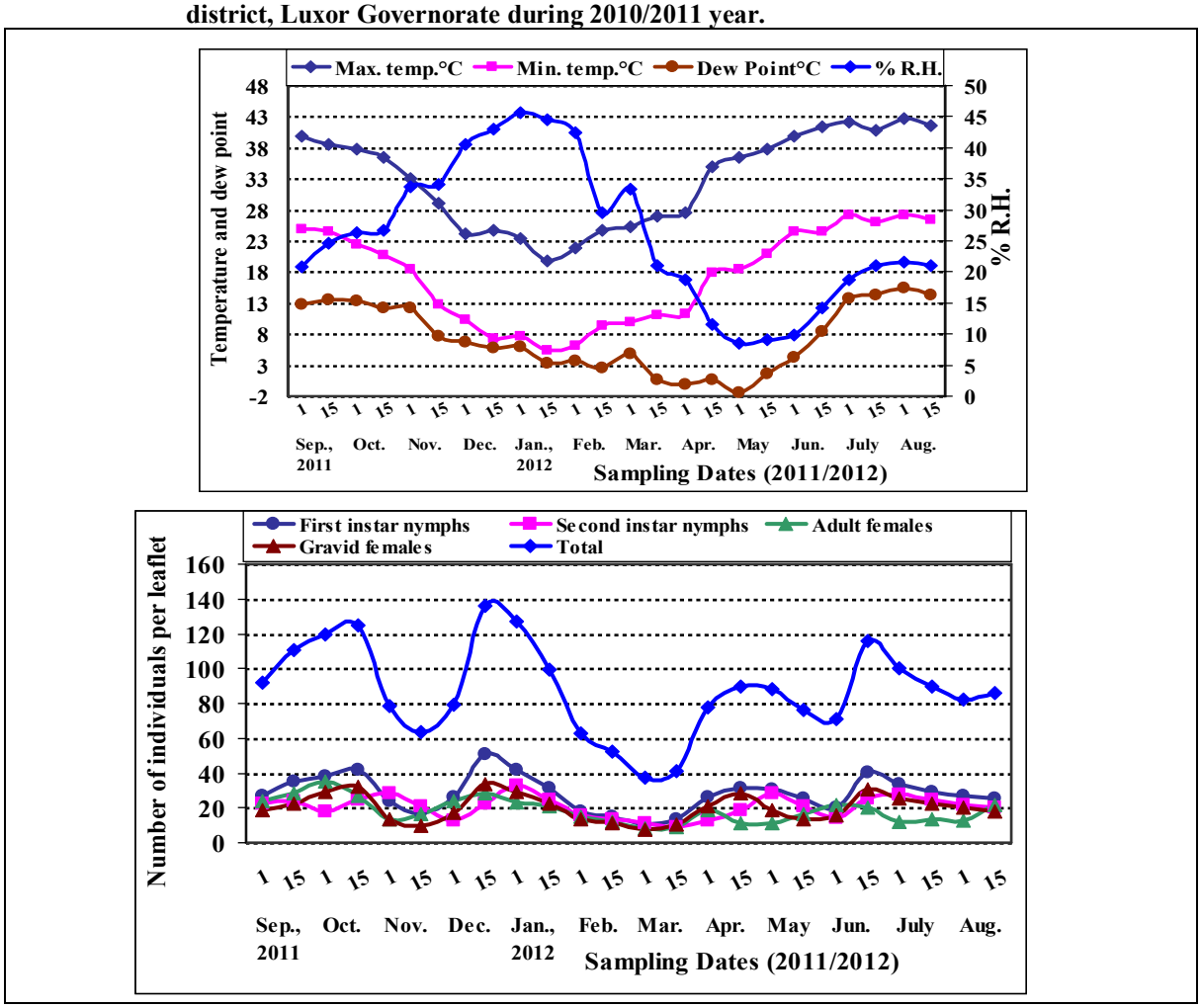


Fig. (3): Seasonal abundance of different stages of the white date palm scale, *P. blanchardii* on the date palm leaflets and weather records at Esna district, Luxor Governorate during the 2011/2012 year.

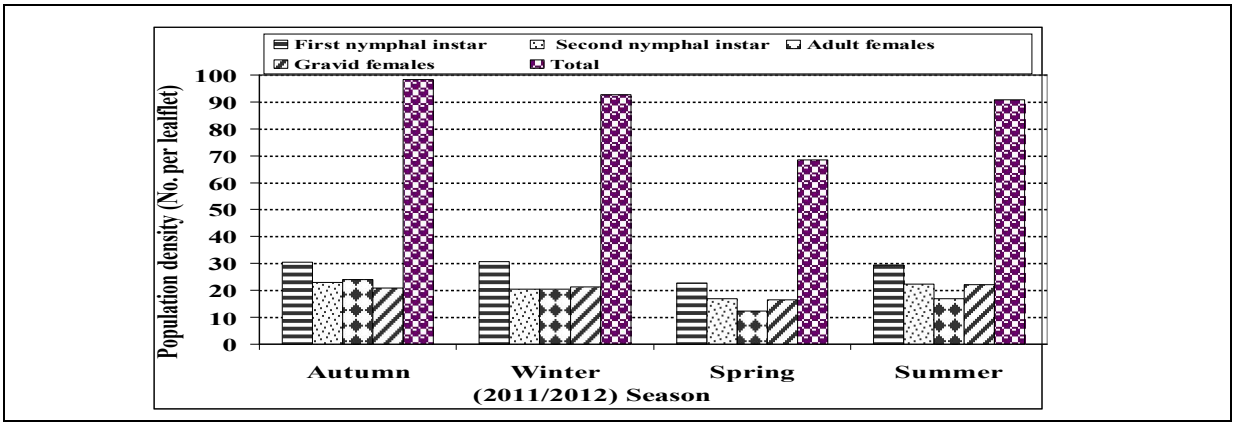


Fig. (4): Population density of *P. blanchardii* different stages recorded on the date palm leaflets at Esna district, Luxor Governorate during 2011/2012 year.

References

1. **Blumberg, D. (2008):** Date Palm Arthropod Pests and Their Management in Israel. *Phytoparasitica* 36(5): 411-448 pp.
2. **Dent, D. (1991):** Insect Pest Management. C.A.B. International.
3. **El-Said, M.I. (2000):** Survey of date palm insects in North Sinai with special reference to the ecology and biology of the species, *Parlatoria blanchardii* (Targ.-Tozz), supper family Coccoidea. M.Sc. Thesis, Fac. of Agric., Cairo Univ., 97 pp.
4. **El-Sherif, S.I.; Elwan, E.A. and Abd-El-Razik, M.I.E. (2001):** Ecological observations on the date palm parlatoria scale, *Parlatoria blanchardii* (Targioni- Tozzettii) (Homoptera diaspididae) in north Sinai, Egypt. Second International Conference on Date Palms (Al-Ain, UAE, March 25-27).
5. **El-Shibli, S and H. Korelainen (2009):** Biodiversity of date palm *Phoenix dactylifera* L. in Sudan: Chemical, morphological and DNA polymorphism of selected cultivars. Plant Genet. Resour. (7), 194-203 pp.
6. **Eraki, M. M. (1998):** Ecological studies on some scale insects infesting date palm trees. Ph.D. Thesis, Fac. of Agric., Al-Azhar Univ., Egypt 127 pp.
7. **Fisher, R. A. (1950):** Statistical methods for research workers. Oliver and Boyd Ltd., Edinburgh, London. 12th ed., 518 pp.
8. **Hussain, A. E. (1996):** Comparative study on distribution and seasonal abundance of date scale, *Parlatoria blanchardii* (Targ.). Populations in Giza and Bahria Oases regions. Bull. Ent. Soc. Egypt., 74:54-60 pp.
9. **Kehat, M.; E. Swirski.; D. Blumberg and S. Greenberg (1974):** Integrated control of date-palm pests in Israel. Phytoparasitica, 2 (2): 141-149 pp. (*c.f.* R.A.E., 64 (4): 1988, 1976).
10. **Laudeho, Y. and Benassy, C. (1969):** Contribution a letude del ecologie de *Parlatoria blanchardii* (Targioni -Tozzettii) on Adrar Mauritania. Fruits, 24: 273-287 pp.
11. **MSTATC (1980):** A Microcomputer Program of the Design Management and Analysis of Agronomic Research Experiments. Michigan State Univ., USA.
12. **Saad, A.G.A. (1980):** Studies on palm trees insects belonging to Coccoidea in Egypt. Ph. D. Thesis, Fac. Agric., Al-Azhar Univ., Cairo, Egypt.
13. **Salama H. S. (1972):** On the Population Density and Bionomics of *Parlatoria blanchardii* (Targioni -Tozzetti) and Mycetaspis personatus (Comstock) (Homoptera: Coccoidea). Zeitschrift für Angewandte Entomologie, 70(4): 403-407 pp.
14. **Serag El-Dien, A. M. (1998):** Ecological and biological studies on the *Chrysomphalus dictyospermi* and *Coccus hesperidium*. M.Sc. Thesis, Fac. Sci., Cairo Univ., 212 pp.
15. **Swaminathan, R. and S. K. Verma (1991):** Studies on the incidence of date palm scale, *Parlatoria blanchardii* (Targ.) in western Rajasthan. Journal article Entomon 16(3): 217-221 pp.
16. **Youssef, A. E. (2002):** Ecological studies on date palm scale insect, *Parlatoria blanchardii* (Targ.) on two date palm varieties at Kafr El-Sheikh Governorate. J. of Agri. Sci., Mansoura (27): 1291-1299 pp.

12/29/2012