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POPULATION DYNAMICS OF BLACK PARLATORIA SCALE, *Parlatoria ziziphi* (LUCAS) (HEMIPTERA : DIASPIDIDAE) ON SOUR ORANGE (*Citrus aurantum* L.) AT QALUBYIA GOVERNORATE, EGYPT.

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ABSTRACT

The population dynamics of black parlatoria scale, *Parlatoria ziziphi* (Lucas) (Hemiptera: Diaspididae**)** were studied on sour orange (*citrus aurantum*) for two successive years (2005-2006) at Qalubyia Governorate. The obtained results revealed that *P. ziziphi* had three generation a year. The highest generation occurred in summer followed by moderate generation in autumn and relatively smaller generation in winter. The summer generation peaked in early June and started from mid March or early April until mid July with duration of 3.5 - 4.5 months; the autumn generation peaked in early October and extended from mid July or early August to late December with duration of 5 – 5.5 months whereas the winter generation peaked in mid January and started from early January to early April and lasted for 3 months.

The main weather factors (daily mean max. and min. temperatures and % R.H.) affected greatly on the annual generations of *P. ziziphi* in both studied years. The summer generation affected with 51 - 52% , while autumn and winter generations affected with 47 - 63.4% and 93.5 - 94.8% respectively.

INTRODUCTION

The black parlatoria scale, *Parlatoria ziziphi* (Lucas) is a common insect pest on citrus trees. The insect infest the leaves, branches and fruits and causes dieback in twigs, premature drop of fruit and leaves and deformation of fruit.

In Egypt, the insect was observed for the first time in 1937 on mandarin trees in Alexandria and near Cairo (Hosny, 1943). In West Africa, Vilardebo (1976) studied its distribution and development in relation to climatic factors whereas Amin and Salem (1978) reported that several citrus orchards had been heavily infested with *P. ziziphi* especially in the southern region of Qalubyia Governorate.

The host plants of *P. ziziphi* in Egypt were varied and could be arranged according to the insect preference as follows: sour orange, grape fruit, shaddock, citron, orange, rough lemon, and lime (El-Bolok *et al.*, 1986). The changes in climatic factors affected greatly on the environmental ecosystem and the activity of insect pests would be changed. So, the present work was conducted to study the effect of some climatic weather factors on the seasonal abundance, number and duration of generations of *P. ziziphi* in sour orange orchard to design an integrated pest management program for its control.

MATERIALS AND METHODS

The population dynamics of the black parlatoria scale, *P. ziziphi* were carried out on sour orange orchard located at Qalubyia Governorate for two successide years (2005-2006). Five trees has the same size, shape, height, vegetation and homogenous in their infestation with insect pest were selected. The sour orange trees about 25 years old and 6 meters height. The sour orange orchard received the normal agricultural practices without application any chemical control measures before and during the period of investigation.

Samples of 100 leaves of *Citrus aurantam* were picked up at random from 5 trees, each sample contain 20 leaves/tree presented all parts of the tree. Samples were examined carefully by aid of stereomicroscope. The alive individuals of nymphs, pre-ovipositional females and oviparous females were counted and recorded. Number of annual generations was estimated from the obtained data throughout the two successive years (2005-2006) by using the changes in the half monthly counts of nymphal populations according the formula proposed by Jacob (1977). Effect of the main weather factors on the insect activity in both studied years were statistical analyzed with MSTATC Program to determine the preferable time for the insect activity and the proper time for its control.

RESULTS AND DISCUSSION

1- Population fluctuation of *P. ziziphi* on sour orange trees

a. Nymphal population

The obtained results in the both studied years (2005 &2006) were illustrated in Fig. (1). The nymphal population showed three annual peaks of activity per each year, the 1st peak occurred through January in both studied years (45.3 – 48.1 nymph/leaf) followed by highest peak in early June (42.9 – 46.5 nymph/leaf) and moderate peak in early October (20.5 – 39.3 nymph/leaf) in both years, respectively.

b-Adult population

1- Pre-ovipositional females population

As illustrated in Fig. (1), the pre-ovipositional females population showed three annual peaks per year. The 1st peak occurred in mid January (40.6 - 45.3 pre-ovipositional female/leaf) in the both studied years; the 2nd peak recorded in early June (55.9 - 60.5 pre-ovipositional female/leaf) in the two years whereas the last peak observed in early October in the two years (49.3 – 52.4 pre-ovipositional female/leaf) in the two years, respectively.

The obtained results revealed that, the pre-ovipositional females of *P ziziphi* had the same trend as the nymphal population and had three annual peaks per each year.

2- Oviparous females population

The population of the oviparous females was shown in Fig. (1). The obtained results revealed that, the oviparous females of *P ziziphi* population were more abundant than both nymphs and pre-ovipositional females populations in the both studied years, respectively.

The population fluctuation of the oviparous females population showed three peaks of activity a year. The 1st peak occurred in mid January (133.0 - 138.3 oviparous female /leaf) in the both years, respectively. The 2nd peak occurred in early June with population ranged from 146.2 to 167.2 oviparous female /leaf in the two years whereas the last peak recorded in early October (155.0-160.9 oviparous female) in the two years, respectively.

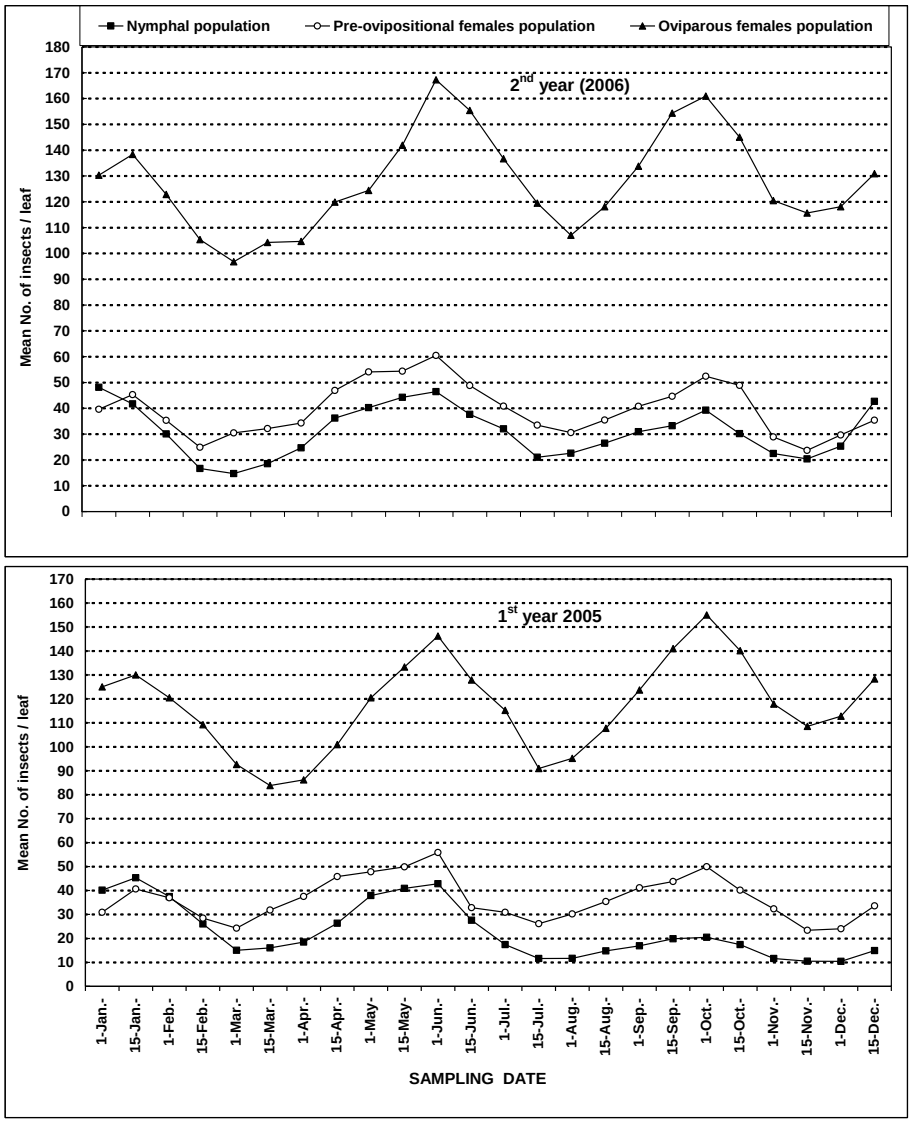

Fig. (1): Seasonal abundance of *Parlatoria ziziphi* (nymphal stage, pre-ovipostonal and ovipostion females) on sour orange trees at Qalubyia Governorate in both studied years (2005 & 2006).

Amin and Salem (1978) showed that, the maximum population of *P. ziziphi* occurred in September and the minimum population recorded in March. On the other hand, El-Bolok *et al.* (1984) reported two peaks of activity for *P. ziziphi* on sour orange leaves abundant in April and October in Giza region.

2- Seasonal variation of *P. ziziphi* population on sour orange trees

The obtained results showed that *P. ziziphi* populations had 3 peaks of abundance (Fig., 2) in both studied years (2005/ 2006), respectively.

The 1st peak occurred in mid January (215.6 – 225.3 insect/leaf) in both years under field conditions of 13.3 – 14.7°C and 62 – 64.9% R.H. The 2nd peak was recorded in early June (244.9 – 274.2 insect/leaf) under environmental conditions of 25.9 - 26.4 °C and 53.4 - 63.9 %R.H. whereas the last peak occurred in early October (225.4 – 252.6 insect/leaf) at 24.6 - 25.9°C and 45.8 56.5% R.H., respectively.

The afore-mentioned results revealed that *P. ziziphi* had three peaks of activity a year occurred in winter, summer and autumn. The highest peak occurred in summer followed by moderate peak in autumn and relatively smaller peak in mid January, respectively.

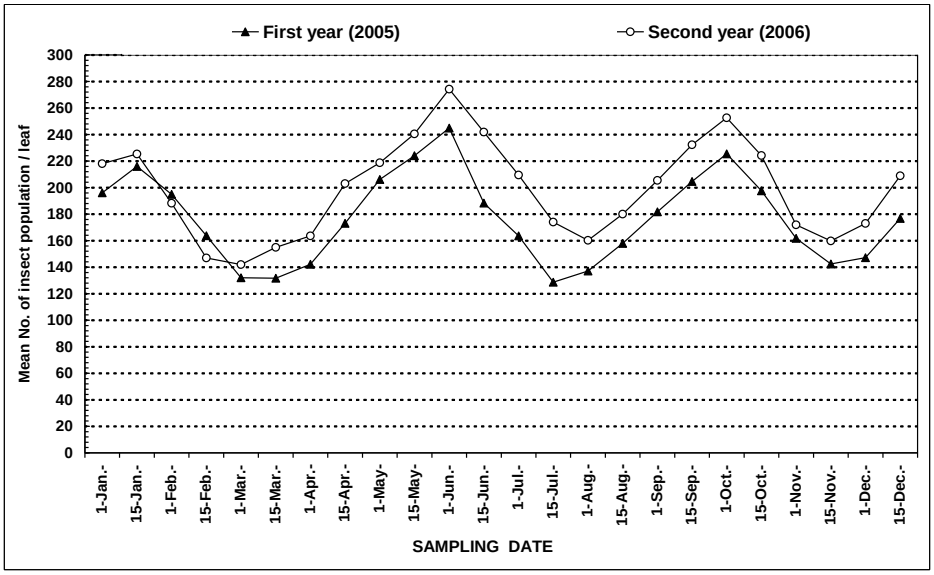

Fig. (2): Seasonal abundance of *Parlatoria zizyphi* population on sour orange trees at Qalubyia Governorate in both studied years (2005& 2006)

3- Number and duration of generations

The obtained results revealed that *P. zizyphi* had three annual generations a year (Fig., 3).

a- 1st year (2005)

- The first generation lasted about 3 months (From early January to early April).
- The 2nd generation was about 3.5 months (From early April to mid July).

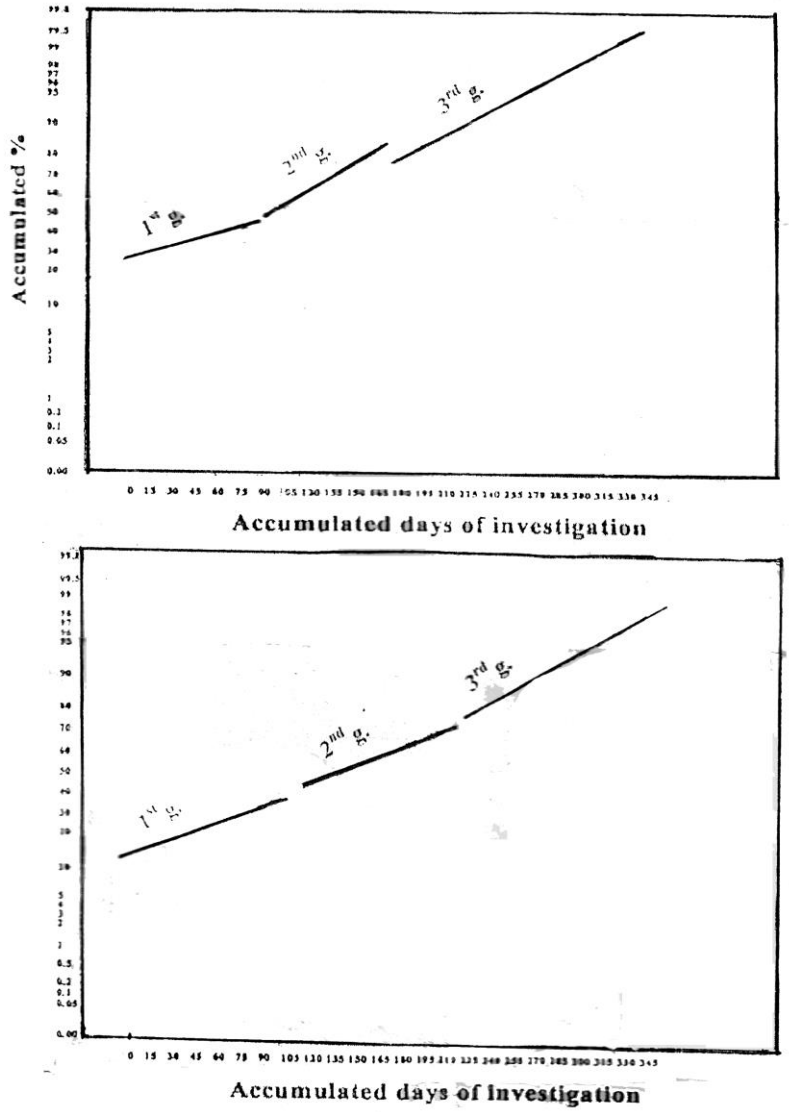

Fig.(3): Annual generations (g.) of *Parlatoria ziziphi* on Naranj trees during (2005-2006) according to Jacob's method.

Fig. (3): Annual generations of *P. ziziphi* on sour orange trees during both studied years (2005-2006) according to Jacob's method.

- The 3rd generation lasted about 5.5 months (From mid July to last December).

b- 2nd year (2006)

- The 1st generation occurred from early January to early April, with duration of 3 months.
- The 2nd generation recorded from mid March to mid July with about 4.5 months.
- The 3rd generation occurred from early August to last December with duration of 5 months.

The obtained results in agreement with Abdel-Aleem (1984); Salama *et al.* (1985) and Samah (2000), they founded three annual generations a year for *P. ziziphi* whereas Amin & Salem (1978); El-Bolok *et al.* (1984) and Sweilem *et al.* (1984) reported two annual generations per year for *P. ziziphi* on sour orange.

On the other hand, Huang *et al.* (1988) founded 3-4 overlapping generations a year for *P. ziziphi* and Serag (1997) recorded 2-3 annual generations for *P. ziziphi* per year.

2- Effect of daily mean minimum temperature

Data in Table (1&2) showed negative correlation highly significant effect for daily mean minimum temperature on the insect activity in the 1st generation during the 1st year whereas in the 2nd year, the relation was positive insignificant effect. The real effect of this factor was determined by partial regression coefficient which was highly significant (t value= 3.8 & 4.4) in the both years, negative effect in the 1st year and positive effect in the 2nd one. The obtained results showed that, daily mean minimum temperature was above the optimum range of insect activity in the 1st year and under the optimum range of insect activity in the 2nd one, respectively.

The effect of daily mean minimum temperature on the insect activity in the 2nd and 3rd generations showed insignificant relation for the both generations in the two years, respectively. The exact effect of daily mean night temperature was negative effect for the both generations in the both years and significant effect for the 3rd generation only in the 1st year (t value =2.04) The night minimum temperature was around the optimum zone of insect activity in both generations except the 3rd generation of the 1st year which was above the optimum range of insect activity.

3- Effect of daily mean relative humidity (%)

Effect relative humidity (%) on the insect generations (Table,1&2) showed positive relation insignificant effect on the 1st generation during the 1st year and positive relation significant effect in the 2nd year whereas in the 2nd generation it was insignificant, positive effect in the 1st year and negative effect in the 2nd one. Relative humidity (%) showed negative relation on the 3rd generation in the two years, significant effect in the 1st year and insignificant effect in the 2nd one. The real effect of % R.H. appeared in the 3rd generation of the 1st year which was above the optimum range of insect activity (t value =2.65) in the 1st year and around the optimum of activity in the 2nd year.

4- The combined effect of the main weather factors on the annual generations.

The combined effect of the main weather factors on the annual generations showed that, it was significant on the 1st generation in the both years and the changes in the half monthly counts of the insect population referred to effect of the tested weather factors ranged 93.5 - 94.8% whereas in the 2nd generation the combined effect of these factors was insignificant and the insect population affected by 51 - 52% in the both years, respectively. The combined effect of these factors on the 3rd generation in the 1st year was significant and insignificant in the 2nd year and the changes in the half monthly counts of the 3rd generation affected with 47 - 63.4% in the both years, respectively.

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دراسات بيئية على حشرة البارلاتوريا القشرية السوداء *Parlatoria ziziphi* على أشجار النارنج في محافظة القليوبية.

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أجريت الدراسة الحالية على أشجار النارنج في محافظة القليوبية لمدة عامين متتاليين ٢٠٠٥/٢٠٠٦ بغرض دراسة النشاط الموسمي للحشرة وعدد أجيالها في العام وتأثير عوامل الطقس السائدة (درجة الحرارة العظمى ، درجة الحرارة الصغرى والرطوبة النسبية) في محافظة القليوبية على نشاطها.

اتضح من نتائج الدراسة وجود ثلاثة أجيال للحشرة على مدار العام ظهرت في الصيف والخريف والشتاء وكان جيل الصيف أقوى الأجيال جميعا يليه جيل الخريف ثم جيل الشتاء. بدأ جيل الصيف من مارس أو ابريل واستمر حتى منتصف يوليو (من ٣,٥ إلى ٤,٥ شهرا) وكانت ذروة نشاطه في أوائل يونيو، أما جيل الخريف بدأ من منتصف يوليو / أغسطس (٥ -٥,٥ شهرا) وظهرت قمة نشاطه في أكتوبر، ووجد جيل الشتاء في الفترة من أوائل يناير وحتى أوائل ابريل (٣ أشهر) وكانت قمة نشاطه في منتصف يناير في كلا العامين على التوالي.

اتضح من نتائج التحليل الاحصائى أن نشاط الحشرة تأثر كثيرا في الأجيال الثلاثة بعوامل الطقس السائدة في محافظة القليوبية ، حيث تأثر جيل الصيف بـ ٥١ - ٥٢% في كلا العامين وتأثر جيل الخريف بـ ٤٧- ٦٣,٤% في كلا العامين بينما تأثر جيل الشتاء بـ ٩٣,٥ - ٩٤,٨ % على التوالي.

Table (1): Effect of main weather factors on *P. zizphi* population on sour orange trees at Qalubyia Governorate during the 1st year (2005).

Generation	Generation (G) Period		Duration of generation/ Month	Weather Factor	Simple correlation and regression values			Partial regression values		ANOVA Table	
	From	From			r	b. reg. ± s.e	t value	P. reg. ± s.e	t value	F Value	E.V. %
First	Early January	early April	3	Mean max. temp.	-0.753	-13.27 ±5.81	2.30	1.85 ±6.0	0.31	12.08	94.8
				Mean min. temp.	-0.952	-21.67 ±3.465	6.25	-20.1 ±5.3	-3.8		
				Mean R.H. (%)	0.645	6..24 ±3.70	1.69	2.8 ±2.7	1.04		
Second	early April	mid July	3.5	Mean max. temp.	0.691	6.62 ±3.47	1.91	7.32 ±6.6	1.11	0.69	51
				Mean min. temp.	0.324	4.80 ±6.10	0.69	-2.31 ±9.9	-0.23		
				Mean R.H. (%)	0.306	2.10 ±3.26	0.64	0.751 ±3.65	0.206		
Third	Mid July	Late December	5.5	Mean max. temp.	0.006	0.03 ±1.41	0.018	9.0 ±4.29	2.10	4.62	63.4
				Mean min. temp.	-0.120	-0.68 ±1.77	0.38	-11.13 ±5.45	-2.04		
				Mean R.H. (%)	-0.568	-3.15 ±1.14	2.76	-2.80 ±1.06	-2.65		

b.reg. = Simple regression coefficient
P.reg. = Partial regression coefficient
E.V. = Explained variance

Table (2): Effect of main weather factors on *P. zizphi* population on sour orange trees at Qalubyia Governorate during the 2nd year (2006).

Generation	Generation (G) Period		Duration of generation/ Month	Weather Factor	Simple correlation and regression values			Partial regression values		ANOVA Table	
					R	b. reg. ± s.e	T value	P. reg. ± s.e	t value	F Value	E.V. %
First	early Jan.	early April	3	Mean max. temp.	-0.716	-16.18 ±7.10	2.29	44.0 ±14.1	3.12	14.43	93.5
				Mean min. temp.	0.1940	6.25 ±14.16	0.44	18.7 ±4.23	4.4		
				Mean R.H. (%)	0.843	5.97 ±1.70	3.51	-2.80 ±1.06	-2.65		
Second	mid March	mid July	4.5	Mean max. temp.	0.056	0.575 ±4.56	0.126	1.11 ±8.3	0.134	1.10	52
				Mean min. temp.	-0.045	-0.30 ±2.98	0.100	-0.25 ±5.4	-0.046		
				Mean R.H. (%)	-0.719	-10.10 ±4.74	2.32	-10.9 ±6.3	-1.75		
Third	Early August	Late December	5	Mean max. temp.	0.113	0.98 ±3.85	0.254	17.5 ±12.4	1.42	0.89	47
				Mean min. temp.	-0.102	-1.51 ±6.60	0.229	-28.7 ±23.04	-1.25		
				Mean R.H. (%)	-0.321	-6.68 ±8.81	0.76	-2.90 ±11.6	-0.25		

b.reg. = Simple regression coefficient
P.reg. = Partial regression coefficient
E.V. = Explained variance

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