

STUDIES ON THE BIONOMICS OF THE BLACK PARLATORIA SCALE, *Parlatoria ziziphus* (Lucas) (DIASPIDIDAE – HOMOPTERA) ON APPLE TREES IN EL-GHARBIYA GOVERNORATE.

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ABSTRACT

The seasonal life history of the black Parlatoria scale, *Parlatoria ziziphus* (Lucas) was studied in El-Santa region, El-Gharbiya Governorate, during 1999-2000 years on a heavy infested apple trees. In general, *P. ziziphus* was found to have two generations a year. During which, the egg stage was recorded throughout march-May and July-September and lasted about 10-12 weeks in both years.

The nymphal stages were present during about 12-14 weeks, in the first generation April – June in first year and March – July in second one, and throughout 13-14 weeks during July – October in the second generation.

The adult female stages took place, in the first generation, lasted about 15 weeks during June –September in 1999 and May – September in 2000. In the second generation, lasted about 35-37 weeks, during September- May and September – first June in the first and second years, respectively.

The generation period lasted about 16 weeks in the first generation March – September in the first and second years, and lasted about 33-35 weeks, July – next May and July – next June in the first and second years, throughout the second generation.

The total number of eggs was 49.0 ± 4.06 and 33.8 ± 6.46 eggs / female for the first generation and second generation, successively.

The occurrence period of immature male stage of first generation lasted about 14-16 weeks during April – July and March-July in the first and second years. While, in the second generation, lasted about 16-17 weeks during July – November in both years. The adult male, lasted about 7-9 weeks in the first generation, during June – July and may- July in the first and second Years. The second generation lasted about 13-15 weeks during August- first December in the first year and August – November in the second year.

INTRODUCTION

Parlatoria ziziphus (Lucas) was recorded as a secondary pest in Egypt up to 1972, but the wide spread of citrus cultivation's in Egypt, helped in the spread of the black Parlatoria scale, especially with that prevailing favorable climate for the insect progress.

It attacks leaves, branches and fruit causing chlorotic appearance, dryness of the infested areas giving a final damage of poor quality fruit. According to Ferris (1937) *P. ziziphus* was first recorded in Europe and later in every tropical and subtropical parts of the world on numerous hosts mainly citrus. Hosny (1943) observed the insect for the first time on mandarin trees

in Alexandria and near Cairo. Abdel fattah et al. (1978) gave a brief description of the morphology and biology of the different stages of the insect. Amin and salem (1978) gave some population studies of this species. Vilardebo (1980) in west Africa, stated that rough weather precluded the development of *P.ziziphus*. Sweilem et al. (1985) carried out morphometric studies on *P.ziziphus*. El-Bolok et al. (1987) found that sour orange was the most preferable host for egg production. It is of interesting to study the biological aspects in life history of this pest under field conditions for better planning of effective control measures. Therefore the present work was carried out to determine the seasonal life history of this insect on the apple trees in El-Gharbiya Governorate, Egypt.

MATERIAL AND METHODS

Five adjacent apple trees homogenous in size, age and ratio of infestation by *Parlatoria ziziphus* were selected for the life history of *P.ziziphus* study in a heavy infested apple orchard in El-Gharbiya Governorate (El-Santa region).

Thirty twigs (each 20 cm long) were collected weekly from different sides of the trees (one from north south, west and east; and two from the core from January 1999 to May 2001). The twigs were examined in the laboratory by using a binocular microscope the designate periods of occurrence of the different stages. To determine the fecundity of *P.ziziphus* 10 gravid females on apple twigs in there replicates from each generation were collected at random from the field. Each was kept in a Petri-dish with a piece of the twigs to estimate the number of eggs laid by each female, the incubation period and percentage of hatchability.

Daily mean temperature and relative humidity were obtained from the meteorological station in El-Gharbiya Governorate

RESULTS AND DISCUSSION

1. Egg production

Fecundity of *P. ziziphus* females: The number of eggs laid by each female (including the egg shells left beneath its scale, as well as the eggs remaining within the body), was counted. On apple twigs, Table [1] indicates that the production of eggs varies in the different month of the year. The highest number of eggs 49.0 ± 4.06 /female) was obtained in May in the first generation at 24.36°C and 59.34 R.H. %. In the second generation, the production of eggs was lower than the first one, being 33.8 ± 6.46 /female at 26.62°C and 64.67 R.H.%. Sweilem et al. (1985) found that, the number of eggs per female of *P.ziziphus* on sour orange leaves, averaged 34.3 eggs per female, while females feeding on the fruits laid more eggs than those feeding on the branches or leaves. The highest number of eggs 48.5 ± 2.7 egg / female was obtained in May 23.5°C and 56.4% R.H., and the lowest records were obtained in hot season, ranged between 20.2 ± 1.3 and 25.9 ± 1.5 eggs / female in June and August, respectively.

Table (1): Average number of eggs *P.ziziphus* female, incubation period and hatchability % of eggs during 1st and 2nd generations, under field conditions.

	First generation	Second generation
Av. no. of eggs / female	49.5 + 4.06	33.8 + 6.46
Incupation period	11.2 + 1.87	9.3 + 2.94
Hatchability %	91.7 + 2.0	78.0 + 3.29

Hatching percentage of eggs was about $91.7 \pm 2.00\%$ after incubation period of 11.2 ± 1.87 days in the first generation and about $78.0 \pm 3.29\%$ after incubation period of 9.3 ± 2.90 days in the second generation.

Sweilem et al (1985) mentioned that, the incubation period of *P.ziziphus* ranged between 5.4 to 12.1 days under field conditions. Hung et al. (1990) stated that, eggs took a mean 7.8 – 11.6 days to hatch, and egg hatchability was 85.7 – 99.7% .

2. occurrence of the different stages of *P.ziziphus* on apple trees:

2.1. The eggs:

Data in Table (2 and 3) indicate that the overwintering adult females of *P.ziziphus* had begun oviposition in mid March and March 7th in the first and second years, respectively. In this respect, the eggs were, last recorded in May 21th and first June in the first and second years, respectively.

The eggs of the second generation were first observed by July 7th and first July in first and second years, respectively, and to be last recorded in September 21th and mid September in the first and second years, respectively.

In all cases, the egg stage and the first generation lasted about 10-12 weeks under field conditions ($19.67\text{ }^{\circ}\text{C}$ - 63.38% R.H. and $19.30\text{ }^{\circ}\text{C}$ - 64.33% R.H. in the first and second seasons) and lasted 11-12 week in the second generation at $27.85\text{ }^{\circ}\text{C}$ - % 66.15 R.H. and $27.70\text{ }^{\circ}\text{C}$ - % 66.31 R.H. in the first and second seasons, respectively.

2.2. The first instar:

Data in (Table 2 and 3 and 4 and 5) demonstrate that, the first instar showed two periods of seasonal activity. The first period started in first April in the first year and ending on June 7th and from March 21th and ending on mid June in the second year. It lasted about 10-12 weeks at $22-15\text{ }^{\circ}\text{C}$ - %60.28 R.H and $21.02\text{ }^{\circ}\text{C}$ - % 6342 R.H, in the first and second years.

The second period infestation started from mid July in the first year until first October and from July 7th until September 21th in the second year. The second period in second generation lasting for 11 weeks in both years at $27.85\text{ }^{\circ}\text{C}$ - % 66.18 R.H. and $27.61\text{ }^{\circ}\text{C}$ - % 66.22R.H. in the first and second years, respectively.

Table (2): Periods of occurrence of the different *P. ziziphus* female stages, on apple twigs during 1999 – 2000 years and average temperature (T.C°) and relative humidity (A.H.%)

Stage	First generation			Second generation				
	Date	Periods (in weeks)	Average of		Date	Periods (in week)	Average of	
			T. C°	R. H. %			T. C°	R. H. %
Egg	Mar. 15- May 21	10	19.67	63.38	Jul. 7-Sep. 21	11	27.85	66.15
Nymphal stages								
1 st	Apr. 1 – Jun. 7	10	22.15	60.28	Jul. 15 – Oct. 1	11	26.59	66.0
2 nd	Apr. 21 – Jun. 21	9	23.74	61.68	Aug. 7- Oct. 15	10	26.23	65.56
Adult stage								
Preoviposition	Jun. 1 – Jul. 21	8	27.56	65.71	Sep. 15 – Mar. 15	25	18.67	66.53
Oviposition	Jul. 7 – Sep. 15	10	27.85	66.15	Mar. 7- May 21	11	19.23	64.19
Postoviposition	Aug. 7 – Oct. 21	11	26.33	65.56	April 21-Jul. 1	10	24.59	63.73
Generation period	Mar. 15 – Sep. 15	16			Jul. 7 – May 21	33		

Table (3): Periods of occurrence of the different *P. ziziphus* female stages, on apple twigs during 2000 – 2001 years and average temperature (T. C°) and relative humidity (R.H.%).

Stage	First generation			Second generation				
	Date	Periods (in weeks)	Average of		Date	Periods (in week)	Average of	
			T. C°	R. H. %			T. C°	R. H. %
Egg	Mar 7- Jun. 1	12	19.30	64.33	Jul. 1-Sep. 15	12	27.70	66.31
Nymphal stages								
1 st	Mar. 21 – Jun. 15	11	21.17	63.49	Jul. 7 – Sep. 21	11	27.18	65.83
2 nd	Apr. 15 – Jul. 1	11	23.32	62.80	Jul. 21- Oct. 15	12	26.55	65.78
Adult stage								
Preoviposition	May 21 – Jul. 15	8	26.42	64.64	Sep. 7 – Mar. 21	27	19.73	64.59
Oviposition	Jul. 1- Sep. 7	11	27.56	66.20	Mar. 15 – Jun. 1	11	20.46	64.77
Postoviposition	Aug. 1 – Oct. 15	11	25.94	65.33	May 1 – Jul. 7	10	25.66	63.22
Generation period	Mar. 7 – Sep. 7	16			Jul. 1 – May 21	35		

Table (4): Periods of occurrence of the different *P.ziziphus* male stages, on apple twigs during 1999 year and average temperature (T. C°) and relative humidity (R.H.%).

Stage	First generation				Second generation			
	Date	Periods (in weeks)	Average of		Date	Periods (in week)	Average of	
			T. C°	R. H. %			T. C°	R. H. %
Nymphal stage 1 st	Apr. 1 – Jun. 7	10	22.15	60.28	July 15-Oct. 1	11	27.85	66.18
2 nd	Apr. 21 – Jun. 15	8	23.74	61.68	Aug. 1 – Oct. 15	11	26.23	65.56
Prepupal	May 7 – Jul. 1	8	26.49	63.58	Aug. 7 – Nov. 1	12	25.72	64.82
Pupal	May 15 – Jul. 7	8	26.66	63.88	Aug. 15 – Nov. 15	13	24.63	65.17
Adult stage	Jun. 1 – Jul 15	7	27.56	65.71	Aug. 21 – Dec. 7	15	23.06	66.25

Table (5): Periods of occurrence of the different *P.ziziphus* male stages, on apple twigs during 2000 year and average temperature (T. C°) and relative humidity (R.H.%).

Stage	First generation				Second generation			
	Date	Periods (in weeks)	Average of		Date	Periods (in week)	Average of	
			T. C°	R. H. %			T. C°	R. H. %
Nymphal stage 1 st	Mar. 21 – Jun. 15	12	21.02	63.42	Jul. 7- Sep. 21	11	27.61	66.22
2 nd	Apr. 21 – Jun. 21	9	23.20	62.66	Jul. 21 – Oct. 7	11	25.45	65.77
Prepupal	May 7 – Jul. 1	8	25.43	63.70	Aug. 1 – Oct. 21	12	25.94	65.52
Pupal	May 15-Jul. 15	9	26.33	64.41	Aug. 7 – Nov. 1	12	24.42	64.66
Adult stage	May 21-Jul 21	9	26.42	64.64	Aug. 15- Nov. 15	13	24.26	63.21

2.3. The Second instar:

The second instar female nymphs of the 1st generation were first observed on April 21th and 15th during 1999 and 2000 years, at 23.74 °C - % 61.68 R.H. and 23.32 °C - % 62.80 R.H., successviely. While in the second generation were recorded on August 7th. And July 21th., and was present until mid October in both years, at 26.23°C - % 65.56 R.H and 26.55 °C - % 65.78 R.H. in 1999 and 2000 years. The second instar lasted about 9-11 weeks in first generation, and about 10-12 weeks in second one. The obtained results are supported by the statement of Huffaker et al. (1962) that, all seasonal phases of *P.oleae* life history may vary as much as two – four weeks from year to year or from place to place even on the same host plant.

The second instar male was present for about 8-9 weeks in the first generation in 1999 and 2000 years. The period starting on April 21th in both years; and ending in mid June and June 21th at 23.74 °C - % 61-68 R.H and 23.20 °C- % 62-66 R.H. in first and second years, respectively. In the second generation, the second instar lasted 11 weeks in both years, this period started at the beginning of August to mid October in first year, and from July 21th to October 7th. In second year. At 26.23 °C - % 65.56 R.H and 25.45 °C - % 65.77 R.H in 1999 and 2000 years.

2.4. The prepupal and pupal male stages :

The obtained results show that, the prepupal and pupal periods varied in the different month according to the surrounding enviromental conditions of the year. The prepupal of the first generation , was first observed on May 1st., 1999 and May 7th, 2000 and on August, 7th and 21th during the second generation in both years. In the first generation prepupal was present until July, 7th , 1999 and first July, 2000 during a period of 8-9 weeks at about 26-.66 °C - % 63-58 R.H and 25.43 °C- % 63.70 R.H in the first and second years, successively.

That of the second generation was observed during a period from August 7th, and first August until first November and October 21th. in the first and second years. And lasted about 12 weeks in both years at 25.72 °C - % 64.82 R.H and 25.94 °C - % 65.52 R.H throughout the two seasons, respectively.

The pupal stage was recorded in the first generation during about (8-9) weeks elapsed between mid may and July 7th. (in the first year) and between mid May to mid July (in the second one). In the second generation, it was present during about 12-13 weeks in the first and second years, respectively. The periods extended from mid August to mid November at 24.63 °C - % 65.17 R.H in first year and from August 7th to first November at 24.42 °C - % 64.66 R.H in the second year.

2.5. The adult male:

Data in Tables 4 and 5 indicate that, the adult males of the first generation were first collected from the beginning of June to mid July at 27.56 °C- % 65.71R.H. (in the first year) and from May 21th to July 21th. at (26.42 °C- % 64.46R.H. (in the second year) and during a period from 7-9 weeks in 1999 and 2000 years, respectively. Those of the second generation

were recorded throughout 13-15 weeks time at 23.06 °c - % 66.25R.H and 24.26 °c - % 63.21 R.H. in the first and second years, and extended from August 21th to December 7th in 1999 year and from mid August to mid November in 2000 year.

2.6. The adult female:

From the results obtained (Table 2 and 3), it appears that the pre-oviposition period greatly varies in the different months of the year in correlation with the surrounding environmental conditions. The shortest period in the first generation occurred in these individuals hatching in March and attaining adult stage at the beginning of June and May 21th in the first and second years, respectively, and lasted about 8 week in both years. The average temperature and humidity during this period were 27.56 °c - % 65.71R.H and 26.42 °c - % 64.67% R.H in 1999 and 2000 years, respectively.

On the other hand, this period was much prolonged in those crawlers attaining the adult stage in mid September and September 7th, being 25-27 weeks in the first and second years, respectively, since hibernation of females occurred between October and the beginning of March. Overwintering females began to deposit eggs at March 7th, the and mid March and hatching started after 12-15 days. Sweilem et al. (1985) mentioned that, the preoviposition period of *P.ziziphus* ranged between 24.5 and 45.3 day and the longest duration occurred in those attaining the adult stage in October (138.1 ± 0.54 days).

The oviposition period varied in the different months of the year. The duration was about 10-11 weeks occurred in those females oviposit in July 7th and first July in the first generation at 27.85 °c-% 66.15 R.H. and 27.65 °c-% 66.20 R.H in both years of study. The duration of the second generation was about 11 weeks in both years, when the ovipositing between March and May or beginning June. Sweilem et al. (1985) stated that, the oviposition period was comparatively long in *P.ziziphus* averaging $24.5 + 0.3$ days for those females ovipositing in August and September. The longest period (45.3 ± 0.5 days) occurred in females ovipositing between March and May.

Oviposition period recorded for *P.oleae* in Egypt ranged between 34.6 and 72.6 days in August 31.9 °c and September 28°c (Amin and salem, 1978).

Huang et al. (1990) found that, the duration of the oviposition period was 79.3 – 134 days.

Postoviposition period:

Postoviposition period, lasted about 11 weeks in the first generation, its observed on August 7th and first august in first and second years, at 26.33 °c- % 65.56 R.H. and 25.94°c - % 65.53R.H., and lasted about 10 week in the second generation, observed on April 21th and first May in both years of study.

3. Generation period:

The data obtained in Table (2 and 3) revealed that, the black *Parlatoria* scale, *P. zizyphus* (Lucas) has two overlapping generations a year. Individuals of the first generation were noticed to infest apple twigs during 16 weeks beginning on mid March and March 7th and ending September in the first and second years, respectively.

The second generation took place during a period elapsed between July 7th and May 21th in first year and first July and the beginning of June in next year. This period lasted about 33-35 weeks.

This agrees with findings of Amin and Salem (1978), El - Bolok et al. (1987) and Sweilem et al. (1985). They mentioned that, *P. zizyphus* had two generations a year, one in April - May and the other in September - October. While in China, it had 3-4 overlapping generations a year, Hung et al. (1990).

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دراسات على الطبائع البيولوجية لحشرة النبق القشرية السوداء *Parlatoria ziziphus* (Lucas) على أشجار التفاح في محافظة الغربية (دياسبيددي - متشابه الأجنحة).

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أقيمت التجربة بمحافظة الغربية بمنطقة السنطة لمدة عامين متتاليين خلال ١٩٩٩-٢٠٠٠ واستهدفت البحث دراسة دورة حياة حشرة النبق القشرية السوداء تحت الظروف الحقلية وكذلك دراسة خصوبة الإناث البالغة معمليا (عدد البيض وفترة الحضانه وكذلك نسبة الفقس). وكذلك تطرقت هذه الدراسة إلى الوصف العام للأطوار المختلفة لتلك الحشرة وأطوارها المختلفة. ثبت من خلال هذه الدراسة أن للحشرة النبق القشرية السوداء جيلين في العام وذلك من خلال شهرى مايو وسبتمبر في كلا العامين وسجل طور البيض خلال مارس - أبريل - مايو ويوليو - أغسطس - سبتمبر وذلك لمدة ١٠-١٢ أسبوعا في كلا العامين. وسجل طور الحورية لمدة ١٢-١٤ أسبوعا في الجيل الأول من (أبريل حتى يونيو) ومن مارس حتى يوليو في العام الأولى والثاني على التوالي ولمدة ١٣-١٤ أسبوعا من يوليو حتى أكتوبر في الجيل الثاني في كلا العامين. سجل الطور اليافع من الإناث على امتداد ١٥ أسبوعا من يونيو حتى سبتمبر فى عام ١٩٩٩ ومن مايو حتى سبتمبر في عام ٢٠٠٠ وكما سجل الجيل الثانى على امتداد ٣٥-٣٧ أسبوعا من سبتمبر حتى مايو التالى ومن سبتمبر حتى أوائل يونيو التالى وذلك فى عامى ١٩٩٩ و ٢٠٠٠.

استغرق الجيل الأول مدة ١٦ أسبوعا من مارس حتى سبتمبر فى العام الأول والثانى ، كما استغرق الجيل الثانى ٣٣-٣٥ أسبوعا من يوليو حتى مايو التالى ومن شهر يوليو حتى يونيو التالى وذلك فى العام الأول والثانى للتجربة.

كما وجد أن متوسط إعداده البيض للإناث البالغة $٤٩ + ١,٠٦$ و $٣٣ + ٦,٤٦$ بيض لكل أنثى وذلك خلال شهر مايو فى الجيل الأول وشهر سبتمبر فى الجيل الثانى كما سجلت أطوار الحورية للذكور للجيل الأول ١٤-١٦ (أسبوعا من ابريل حتى يوليو ومن مارس حتى يوليو فى العام الأول والثانى للتجربة وسجل الجيل الثانى لمدة ١٦-١٧ أسبوعا من يوليو حتى نوفمبر فى كلا العامين.

سجلت الذكور البالغة لمدة ٧-٩ أسبوعا فى الجيل الأول وذلك من يونيو حتى يوليو ومن مايو حتى يوليو فى العامى الأول والثانى كما استغرق الجيل الثانى مدة ١٣-١٥ أسبوعا من أغسطس حتى أوائل ديسمبر فى العام الأول ومن أغسطس حتى نوفمبر فى العام الثانى.