

POPULATION DYNAMICS OF *Saissetia coffeae* Walker (HOMOPTERA : COCCIDAE) AND ITS PARASITOIDS ON GUAVA IN MIDDLE EGYPT

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ABSTRACT:

Studies on the seasonal fluctuations of the population of *Saissetia coffeae* Walker (Homoptera: Coccidae) and its parasitoids were conducted in Beni-suif Governorate during the period extending from May 2006 until April 2008. The parasitoid species, *Coccophagus lycimnia* Walker, *Marietta leopardina* Motsch. *Metaphycus helvolus* Comp. and *Scutellista cyanea* Motsch. were found associated with *S. coffeae*. The hemispherical scale insect, were appeared either three or two periods of activity (generation) during the first and second seasons, respectively. The highest peak counts was observed during winter (December and January). On the other hand, the parasitoids activity appeared in three periods in both season in combination with those of the insect pest. The climatic factors (max. & min. temp. and % R.H.) affected insignificantly on the population of each insect pest and the parasitoids, while the correlation between both populations was significant in both season of study.

Key words: *Saissetia coffeae* , Seasonal fluctuations, Parasitoids.

INTRODUCTION:

Hemispherical scale insect, *Saissetia coffeae* feed on plant juices and cause a deformation of infested plant parts, loss of leaves, retarded plant growth, and even death of the plant. They are found clustered on the shoots, leaves, and young fruit of plants (Hill, 1983). The hemispherical scale insect, distributed in the tropics, sub-tropical areas and habiting as polyphagous species on some host plants, *i.e.* coffee, tea, fig, guava, olive, mango, banana, citrus, wild plants and other ornamental trees. (Shafee *et al.*, 1998; Kondo and Kawai, 1995; Pena *et al.*, 1999 and Morsi, 1999).

Reviewed researches in the available literature on the fluctuation and seasonal abundance of the hemispherical scale insect are little (Chatterjee *et al.*, 2000 in India and Li and Su, 2002 in Taiwan).

Natural enemies of the hemispherical scale insect and their role in regulating its population was reported by some authors (Rosen *et al.*, 1971; Oncuer, 1977; Prinnsloo, 1984; Hamed and Hassanien, 1991; Osman, 1996; Morsi, 1999 and Abd-Rabou, 2004 and 2005).

The present work declaring the following studies:

- 1- Qualitative survey of *S. coffeae* natural enemies.
- 2- Seasonal fluctuation of the hemispherical scale insect and associated parasitoids in Beni-suif Governorate.
- 3- The relation between the scale insect pest, associated parasitoids and some of the predominant climatic factors (max. and min. temp. and R.H.%).

MATERIAL AND METHODS

1- Qualitative survey of *S. coffeae* natural enemies:

Leaves of guava infested with the hemispherical scale insect were randomly collected from different orchards at Beni-Suif Governorate throughout two years, extending from May 2006 till April 2008. The samples were packed in paper pages and transferred to the laboratory for examination. The specimens were carefully inspected and all insects except the hemispherical scale insect were removed to survey the associated natural enemies. The examined leaves were introduced in plastic jars of 15 cm. diameter and 20 cm. height covered with muslin, held in position by a rubber band and kept under the laboratory conditions for obtaining any emerged parasitoids.

The collected parasitoids were preserved in vials containing 70% ethanol and 5% glycerin, additional to prepared mounting slide specimens were used for identification. In addition, the associated predacious insects were separated from the collected leaves during the initial examination. Feeding tests were run to ensure that predators are natural enemies of this scale insect pest. The parasitoids and predators were identified to the species levels by the Biological Control Res. Dept., Plant Prot. Res. Institute, Agric. Res. Center, Giza, Egypt.

2- Seasonal fluctuations of *S. coffeae*:

Guava trees, infested with *S. coffeae* located at Beni-suif (Sids district) were used for this purpose. A field of about 2 feddans cultivated with guava trees and heavily infested with the hemispherical scale insect pest was chosen for this study. The orchard was not exposed to any chemical treatments before or during the two years of investigations.

At 15-day intervals, 100 leaves with different stages of *S. coffeae* were collected randomly from different directions of the orchards. These leaves were kept in paper bags and transferred to the laboratory for careful examination and counting of the hemispherical scale insect and associated parasitoids. The stages of scale insect considered in counting process were:

- a- Nymphs (2nd and 3rd instars).
- b- Adult females (virgin and ovipositing).
- c- Half-monthly counts of nymphs helped in estimating the number of generations. Which indicated by the peaks of nymphs throughout the two consecutive years. This method was followed according to **Amin, 1970 and Morsi, 1999.**

3- Seasonal fluctuation of the associated parasitoids:

The rates of parasitism in different stages of *S. coffeae* infesting guava trees were estimated throughout two successive years extending from the beginning of May 2006 to April 2008. Heavily infested leaves from guava trees were selected at random from cardinal directions and central cores of the trees.

Half-monthly samples (each consisted of 100 randomly selected scales) were chosen. These samples represented nymphal instars, the newly developed adult females and the full grown adult females. Each scale was removed, transferred by lifting the scales cover and mulched on a slide in water film. Scales in each sample were dissected under a binocular microscope, and classified as follows, alive un parasitized individuals,

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parasitized individuals having (larvae, pupae and emerging holes). Total percentages of parasitism of the hemispherical scale insect were estimated.

The relation between the population of pest, the parasitoids populations and some of the predominant climatic factors (min. temp., max. temp. and R.H.%) were evaluated by using correlation co-efficient at the levels of 0.05 and 0.01.

RESULTS AND DISCUSSION

1- Qualitative survey of *S. coffeae* natural enemies:

The obtained results showed that, the natural enemies of *S. coffeae* are:

a : Parasitoids :

Four primary parasitoid species were recorded on *S. coffeae*, two species belong to family Aphelinidae, one of Encyrtidae and one of Pteromalidae. The respective species are *Coccophagus lycimnia* Walker, *Marietta leopardina* Motsch., *Metaphycus helvolus* Comp. and *Scutellista cyanea* Motsch, respectively.

Our results are in agreement with those obtained by **Priesner and Hosny, 1940; Hamid and Hassanien, 1991 and Morsi, 1999** (in Egypt); **Rosen et al., 1971** (in Israel); **Oncuer, 1977 and Kaydan et al., 2006** (in Turkey); **Hayat, 1971** (in India) and **Al-Ahmed and Badawi, 1992** (in Saudi Arabia).

b. Predators :

Larvae and adults of two species of Coccinellidae : *Pharoscyrnus ovoids* Sicard and *Cybocephalus tumidus* Endrody-Younga, additional to larvae of *Eublemma scitula* Ramb. (Lepidoptera : Noctuidae) were found feeding on different stages of this insect pest.

In this respect, **Ponsonby and Copland (2007)** recorded *Chilocorus nigritus* (Coleoptera: Coccinellidae) as a biological control agent of hemispherical scale insects in temperate glasshouses in UK. **Samuel et al (1993)** in India recorded *Eublemma* sp., *Chrysopa* sp., *Cryptolaemus montrouzieri* as a predators on this insect pest. **El-Minshawy and Saad, 1977** mentioned that, all larval stages of *E. scitula* were predatory on *S. coffeae* and consumed 18.04 mature females.

2- Seasonal fluctuations of *S. coffeae* and associated percentages of parasitism:

Half- monthly counts of the different stages of *S. coffeae* on leaves of guava trees are given in tables (1 and 2), while associated percentages of parasitism are summarized in table (3) and illustrated by figs (1 and 2).

2.1. In the first season (2006 / 2007):

Tabulated and illustrated data (table 1 & 3 and fig.1) indicated that all individuals of hemispherical scale insects (nymphs and adults) were observed in high counts during all dates of inspection.

At the first date of inspection, the lowest counts of nymphs /100 guava leaves (495) and all individuals (790) were recorded. Such counts fluctuated either slightly or drastically during the successive dates of inspection to record three periods of activity, with obvious three peaks. The first period extended from the beginning of May 2006 until mid of August, with medium peak of 1370 nymphs and 2620 all individuals / 100 leaves which recorded at mid June (in association with 38.3°C max., 20.4°C min. temp. and 53.1% R.H.). The highest rates of parasitism (58%) was also recorded in the same dates.

The second period of activity extended from the beginning of August until end of December, with the lowest peaks of 1299 nymphs and 2484 total individuals at mid October, in association with 29.7°C max., 16.8°C min. and 54.3% R.H., with a medium percentage of parasitism (28%).

Table (1): Population of hemispherical scale insect, *S. coffeae* per 100 guava leaves in Beni-suif Governorate during the first season (2006/2007).

Sampling date	Nymphs			Virgin females	Ovipositing females	Total population	% Nymphs	Max temp.	Min temp.	R.H. %
	2 nd	3 rd	Total							
1/5/2006	295	200	495	150	145	790	62.7	32.2	16.3	51.4
15/5	311	235	546	400	450	1396	39.1	35.1	17.2	50.9
1/6	185	164	349	462	405	1216	34.9	36.4	19.9	52.3
15/6	610	760	1370	650	600	2620	52.2	38.3	20.4	53.1
1/7	580	670	1250	514	671	2435	50.9	40.1	21.2	50.1
15/7	490	509	999	732	702	2433	41.1	39.6	21.7	51.1
1/8	311	326	637	309	350	1296	49.2	38.2	21.3	55.2
15/8	391	375	766	219	245	1230	62.3	39.8	22.7	56.3
1/9	318	429	747	306	486	1539	48.5	36.2	19.8	53.9
15/9	511	623	1134	389	306	1829	62.0	38.2	18.8	49.1
1/10	582	618	1200	513	592	2305	52.1	34.6	17.6	52.1
15/10	685	614	1299	505	680	2484	52.3	29.7	16.8	54.3
1/11	421	323	744	514	560	1818	40.9	24.5	10.4	65.9
15/11	322	398	720	300	272	1292	55.7	23.2	10.6	61.4
1/12	311	389	700	270	319	1289	54.3	20.2	9.8	62.3
15/12	423	218	641	280	271	1192	53.8	19.4	6.8	63.2
1/1/2007	399	409	808	410	493	1711	47.2	18.6	5.2	64.9
15/1	723	795	1518	600	658	2776	54.7	20.1	5.7	60.4
1/2	672	715	1387	513	400	2300	60.3	21.2	5.4	59.2
15/2	534	565	1099	407	506	2012	54.6	22.7	8.9	58.3
1/3	417	382	799	390	320	1509	52.9	27.5	8.9	55.3
15/3	286	314	600	228	295	1123	53.4	26.8	10.6	52.4
1/4	300	289	589	286	300	1175	50.1	32.8	12.8	53.3
15/4	280	207	487	233	220	940	51.8	31.7	13.8	52.1

The third period of activity extended from mid Dec. until end of study (mid April), with the highest peak (1518 nymphs and 2776 total individuals), correlated with the lowest temperatures (20.1°C max. and 5.7°C min.) and 60.4% R.H. at mid. January, coincided with 24% parasitism.

These results indicated that periods of the parasitoids activity were approximately coincided with the activity periods of the insect pest.

Statistical analysis by using correlation coefficient indicated that the climatic factors affected insignificantly on the population of each of the pest and the parasitoids. On the other hand, the relation between both populations was significant.

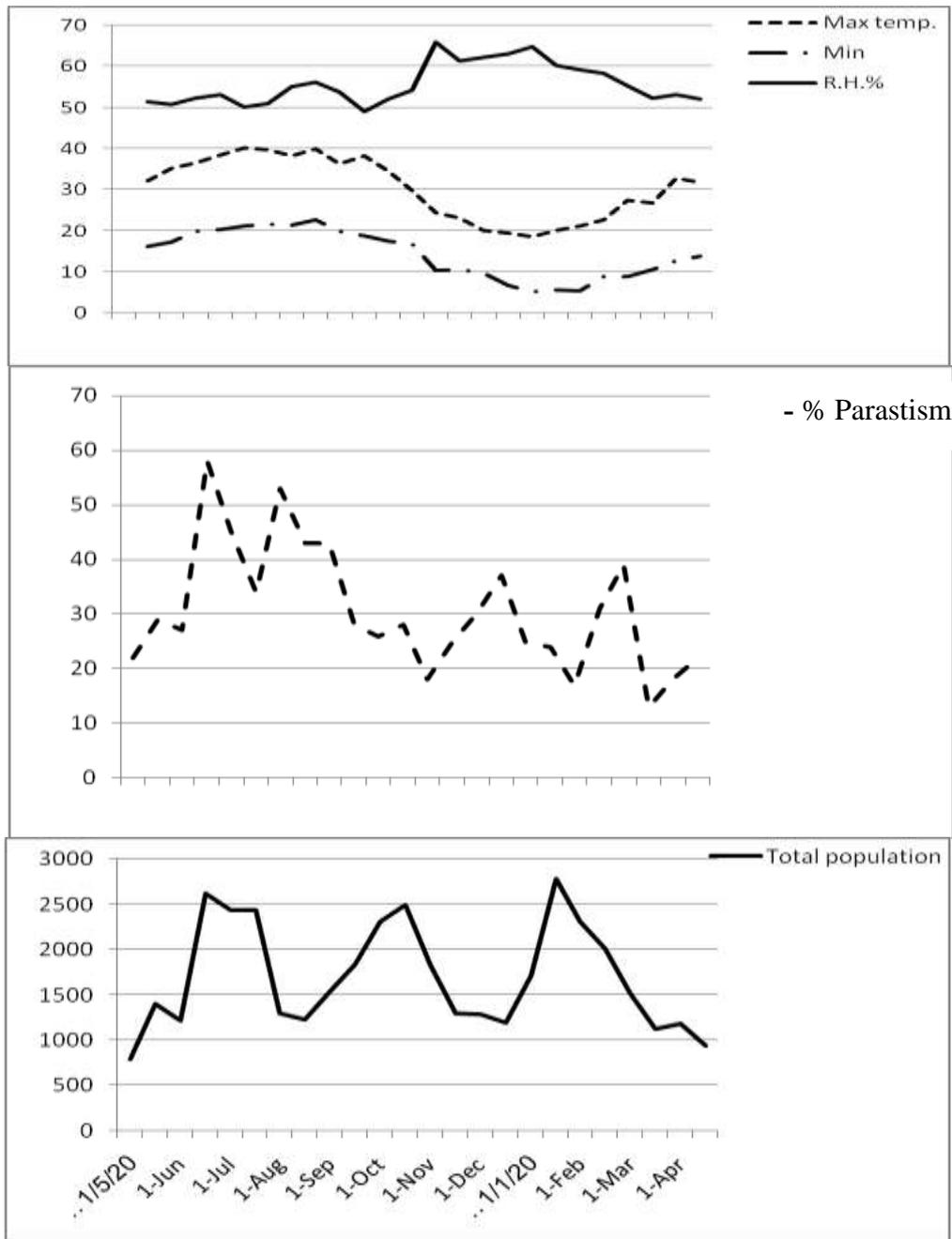


Fig. (1): Population of *S. coffeae* (per 100 leaves) and its parasitoids (per 100 scale insects) on guava trees in Beni-suif Governorate during the first season (2006/2007).

2.2. In the second season (2007 / 2008):

As seen from tables (2 & 3) and fig. (2), population of each of the pest *S. coffeae* and associated parasitoids during this season were lower than those recorded in the first season.

At the beginning of study (first of May), somewhat low counts of the insect pest (317 nymphs and total individuals), associated with the lowest

percentage of parasitism, in general (13%) were recorded. These records fluctuated slightly during the successive periods of study to arrive the lowest peaks of 724 nymphs, 1042 total individuals and 37% parasitism in association with 42.7°C max. 22.3°C min. and 53.6% R.H. i.e., the first period of activity extended from first May until early of September.

The second period of activity extended from mid August to end of the season with median peaks of 800 nymphs (at first October) and 1385 total individuals (at mid September), coincided with 20 – 30% parasitism at 32.4 – 34.6°C max.; 18.6- 21.0°C min. and 75.2-58.4% R.H.

Table (2): Population of hemispherical scale insect, *S. coffeae* per 100 guava leaves in Beni-suif Governorate during the second season (2007/2008).

Sampling date	Nymphs			Virgin females	Ovipositing females	Total population	% Nymphs	Max temp.	Min temp.	R.H. %
	2 nd	3 rd	Total							
1/5/2007	135	182	317	45	23	385	82.3	38.6	18.6	49.2
15/5	226	180	406	200	42	648	62.7	37.3	17.9	50.1
1/6	310	227	537	71	146	754	71.2	38.9	20.2	52.0
15/6	268	115	383	150	106	639	59.9	39.9	20.6	51.2
1/7	335	118	453	142	140	735	61.6	38.2	21.9	50.3
15/7	415	309	724	288	30	1042	69.5	42.7	22.3	53.6
1/8	118	123	241	86	99	426	56.6	38.8	20.1	50.4
15/8	127	76	203	40	67	310	65.9	39.4	21.2	58.1
1/9	214	268	482	98	120	700	68.9	36.4	22.4	54.6
15/9	415	384	799	306	280	1385	57.7	34.6	21.0	57.2
1/10	389	411	800	211	200	1211	66.1	32.4	18.6	58.4
15/10	400	312	712	225	230	1167	61.1	31.9	19.7	57.2
1/11	390	300	690	198	206	1094	63.1	29.4	15.2	58.4
15/11	248	308	556	410	500	1466	37.9	27.9	12.4	57.2
1/12	226	114	340	146	200	686	49.6	22.7	10.2	59.4
15/12	324	166	490	185	209	884	55.4	20.2	9.8	55.2
1/1/2008	126	134	260	80	35	375	69.3	19.4	6.2	60.4
15/1	89	147	245	85	75	405	60.5	18.6	5.3	61.2
1/2	48	96	144	79	71	294	48.9	21.8	6.7	62.4
15/2	92	47	139	81	85	305	45.6	20.5	7.3	60.1
1/3	61	37	98	60	87	245	39.5	27.2	11.7	59.4
15/3	92	98	190	75	50	315	60.3	29.9	12.5	55.1
1/4	81	58	139	42	97	278	50.0	31.4	13.4	53.6
15/4	122	95	217	95	99	411	52.8	40.2	15.6	50.6

The last peaks of population followed by slight reductions, in general, until mid November then the reductions were drastic toward end of the season.

On the other hand, as seen from table (3) and fig (2), although two periods of the parasitoids activity were correlated with the observed two periods of the pest activity, a third period for the parasitoids was observed during the period extending from mid October until end of the season, with a peak of 43% recorded at the beginning of Jan. 2008, correlated with 19.4°C max. ; 6.2°C min. temp. and 60.4 % R.H.

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Statistical analyses indicated that the climatic factors affected insignificantly on the populations of the pest and the parasitoids, except max. and min. temperatures affected significantly on the pest. On the other hand, the correlation between the population of the pest and parasitoids was significant.

Table (3): Total percentages of parasitism among the hemispherical scale insect, *S. coffeae* infesting guava trees during 2006/2007 & 2007/2008 seasons. (Based on 100 dissected scale insects).

2006/2007					2007/2008				
Sampling date	Larvae	pupae	Emergence holes	Total (%Parasitism)	Sampling date	Larvae	pupae	Emergence holes	Total (%Parasitism)
1/5/2006	5	7	10	22	1/5/2007	3	5	5	13
15/5	10	6	13	29	15/5	5	4	6	15
1/6	7	12	8	27	1/6	2	5	2	9
15/6	21	19	18	58	15/6	10	4	12	26
1/7	13	15	17	45	1/7	13	12	17	42
15/7	4	9	21	34	15/7	18	13	6	37
1/8	8	15	30	53	1/8	6	6	10	22
15/8	4	8	31	43	15/8	24	4	12	40
1/9	3	15	25	43	1/9	13	8	23	44
15/9	5	10	13	28	15/9	8	10	15	33
1/10	2	3	21	26	1/10	3	12	5	20
15/10	15	6	7	28	15/10	5	9	3	17
1/11	2	2	14	18	1/11	12	4	7	23
15/11	1	5	19	25	15/11	19	7	8	34
1/12	10	17	3	30	1/12	17	6	14	37
15/12	2	16	19	37	15/12	25	3	10	38
1/1/2007	3	5	17	25	1/1/2008	18	9	16	43
15/1	0	11	13	24	15/1	14	14	7	35
1/2	2	6	9	17	1/2	3	7	9	19
15/2	3	9	19	31	15/2	6	6	15	27
1/3	16	15	8	39	1/3	3	4	16	23
15/3	3	4	6	13	15/3	8	3	23	34
1/4	3	6	9	18	1/4	3	7	22	32
15/4	5	5	12	22	15/4	2	3	11	16

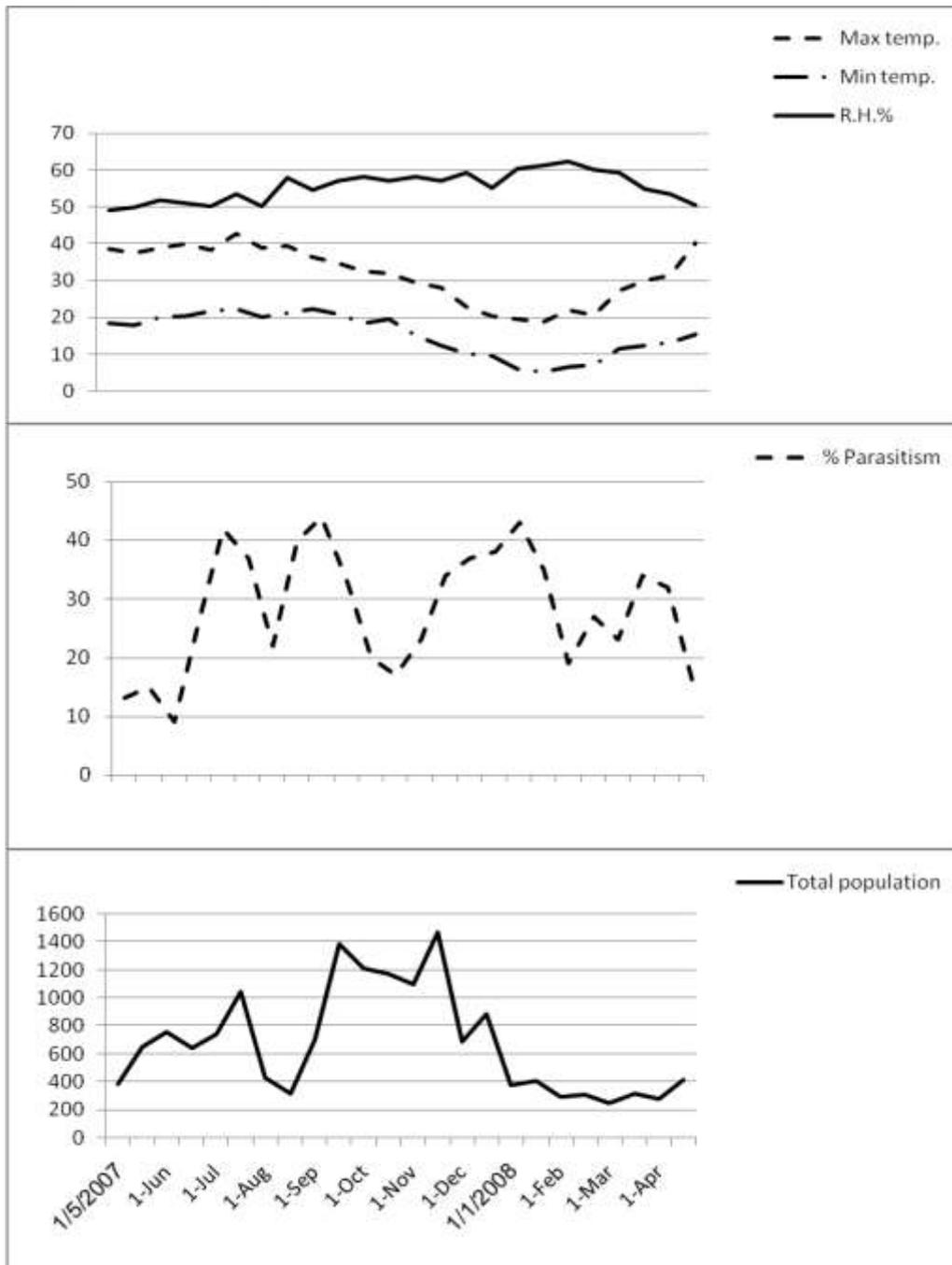


Fig. (2): Population of *S. coffeae* (per 100 leaves) and its parasitoids (per 100 scale insects) on guava trees in Beni-suif Governorate during the second season (2007/2008).

Concluding the abovementioned results, the hemispherical scale insect were appeared either three or two periods of activity (generation) during the first and second seasons, respectively. The highest peak counts was observed during winter (December and January). On the other hand, the parasitoids activity

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appeared in three periods in both season in combination with those of the insect pest.

Statistical analyses indicated that the climatic factors (max. & min. temp. and % R.H) affected, generally, insignificantly on the population of each insect pest and the parasitoids. On the other hand, correlation between both populations was significant in both season of study.

In this respect, **Chatterjee *et al.*, 2000 in India**, who mentioned that the population of this pest was related significantly with max. temp., R.H.% and rain fall but an inverse relation with min. temp. **Li and Su, 2002**, in Taiwan mentioned that the optimum development temperatures of, *S. coffeae* were 24-28°C and had 4-5 generations per year.

These results also in agreement with those obtained by **Morsi, (1999)**, in Egypt who mentioned that the Pteromalid parasitoid, *S. cyanea* was a high abundance emerged from *Ceroplastis rusci* which infested fig, mango, and guava trees from Jul. to Dec. On the other hand, in South Africa, **(Prinnsloo, 1984)** recorded the Encyrtid parasitoid, *M. helvolus* a solitary parasitoid on the genus, *Saissetia* and *Coccus* during the period extended from Jul. to Dec.

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تذبذب التعداد لحشرة الجوافة القشرية *Saissetia coffeae* Walker والطفيليات الحشرية المرتبطة بها على اشجار الجوافة في مصر الوسطى

عاطف احمد عبد الجيد محمد

جامعة الفيوم – كلية الزراعة - قسم وقاية النبات

أجريت هذه الدراسة في محافظة بني سويف (محطة البحوث الزراعية بسوس) لدراسة تذبذب التعداد لحشرة الجوافة القشرية والطفيليات الحشرية المرتبطة بها خلال الفترة من أول مايو ٢٠٠٦ إلى نهاية ابريل ٢٠٠٨. ومن أهم الطفيليات التي وجدت مرتبطة بهذا الآفة (*Coccophagus lycimnia* Walker, *Marietta leopardina* Motsch *Metaphycus*) الحشرة ٣ أو ٢ أجيال في السنة علي الجوافة خلال موسمي الدراسة على التوالي. ولوحظ أن أعلى تعداد لهذه الآفة سجل في فصل الشتاء (ديسمبر ويناير) وتأثر هذا التعداد تأثراً غير معنوي بالظروف المناخية (حرارة عظمى، صغرى ورطوبة نسبية). ومن ناحية أخرى، وجد أن للطفيليات الحشرية المرتبطة بهذه الآفة ثلاثة قمم نشاط مرتبطة معنويًا بتعداد هذه الحشرة.