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Seasonal Abundance of the Fig Wax Scale Insect, *Ceroplastes rusci* Linneus (Homoptera: Coccidae) and its Parasitoids in Middle Egypt

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ABSTRACT

The fig wax scale insect, *Ceroplastes rusci* (L.), is considered as the most serious scale insect attacking, *Psidum guajava* L., *Ficus carica* L., *Citrus sinensis* L.; mandarin, *Citrus* spp., *Mangifera indica* L., *Vitis venifera* L., *Malus sylvestris* Mill., *Aberia caffra, Dalbergia sissoo, Schinus terebinthifolius, Nerium oleander* and some ornamental plants. The seasonal abundance and percentage of parasitism of the fig soft scale insect was determined on the leaves of the guava in Beni-Suif Governorate. This work was carried out during May, 2001-April, 2003. The average bi-weekly number of insects/ leaf fluctuated throughout the two seasons of infestation with 2-3 annual peaks of abundance. In the first season 3 peaks occurred in June, October and January; however in the second season 2 peaks were recorded in July and November. The parasitoid speices, *Metaphycus helvolus* (Compere) ‹ *M.zebratus* Mercit‹ *Habrolepis* sp., *Scutellista cyanea* Motsch., *Microtyres flavus* How. ‹ *Microtyres* sp. ‹*Tetrastichus ceroplastae* Girault, *Marietta exitiosa* Compere and *Marietta* sp. were found parasitizing *C. rusci* in Beni-Suif Governorate. Rates of mortality caused by the above-mentioned parasitoids were estimated.

Key Words : *Ceroplastis rusc,* Parasitoids, Population dynamics, Egypt

INTRODUCTION

Although a great amount of studies have already been done on many scale insects, the fig wax scale insect ‹*Ceroplastes rusci* L. which is considered a serious pest on *Psidum guajava* L., *Ficus carica* L., *Citrus sinensis* L., *Citrus* spp., *Mangifera indica* L., *Vitis venifera* L., *Malus sylvestris* Mill., *Aberia caffra, Dalbergia sissoo, Schinus terebinthifolius, Nerium oleander* and some ornamental plants , has not taken the same attention .

The fig wax scale insect may cause direct injury by extracting a large amount of sap through leaves, branches and fruits. However, its main damage is due to the copious production of honey dew, which serves as substrates for various sooty mould fungi, severe infestations of fig, guava, citrus, mango, grape may result culling of the entire crop at the same time devitalize the plants .

Literature in hand show little work on the fluctuation and seasonal abundance of the fig soft scale insect (Monsatero, 1962; Benassy and Biliotti, 1963; Benassy and Franco, 1974; El-Nabawi *et al.,* 1986; Eraki, 1991 and Fazeli and Farzneh, 1993).

Many parasitoid species attacking *C. rusci*‹ were reported by several authors and the role of natural enemies in regulating its abundance was discussed by some authors (Priesner and Hosny, 1945; Monstero, 1962; Rosen, 1962 &1966; Panis, 1974; Oncuer, 1977; Kfir and Rosen, 1980; Argurioa and Santorini, 1981; Fazeli and Farzneh, 1993; Ragab, 1995; Morsi, 1999 and Abd-Rabou, 2001) .

Accordingly the present work deals with the following aspects:

1- The seasonal changes in the population dynamics of the fig soft scale insect in Beni-Suef Governorate
2- Survey of the parasitoids of the fig soft scale insect *C. rusci.*
3- The abundance of the parasitoids attacking the fig wax scale insect *C. rusci.*
4- Evaluation of the mortality rate caused by parasitoids of *C. rusci.*

MATERIALS AND METHODS

I: Seasonal variations in the population of the fig wax scale insect :

The population density and seasonal abundance of the fig wax scale insect *C. rusci* was carried out for 2 years (May, 2001 till April, 2003) at Beba District, Beni-Suif Governorate. An orchard about one feddan and 10 years old cultivated with guava trees, *P. guajava* and heavily infested with the fig wax scale scal *C. rusci* was chosen for this study. The orchard was not exposed to any chemical treatment during the three years prior to the present study and during the investigation period .

At 15 day-intervals, hundred leaves with different stages of the *C .rusci* were collected at random from different directions of orchard. The leaves represented different sides, peripheral, inner zones, lower and

middle strata of the tree. These leaves were kept in paper bags and transferred to the laboratory for careful examination and counting of the scale insect. The stages of scale insect considered in counting process were:

I- Nymphal instars .

II- Adult females (virgin and ovipositing)

II: Survey of natural enemies:

A survey of *C. rusci* parasitoids and predators was carried out in Beni-Suef and Minia Governorates, Middle Egypt, throughout two years, extending from May, 2001 till April, 2003. Samples of infested leaves and branches with the fig wax scale insect from mango ‹*Mangifera indica* L., guava ‹*Psidum guajava* L. and fig, *Ficus carica* L. trees were randomly collected from different orchards through the year round. The samples were packed in paper bags and transferred to the laboratory for examination. The specimens were carefully examined and all insects except only the fig wax scale insect were removed to survey its natural enemies. The examined leaves were enclosed in plastic jars of 15 cm. diameter and 20 cm. heights covered with muslin, held in position by a rubber band and kept under preferential conditions for securing any emergence of parasitoids .

The parasitoids were collected, sorted into species and preserved in vials containing 70% Ethyl Alcohol and Glycerin, in addition to slide mounting specimens for identification . The predacious insects were separated from the collected leaves during the initial examinations. Feeding tests were run to them to ensure that predators were natural enemies of this scale insect. The parasitoids and predators species were identified in Biological Control Res., Dept., Plant Prot. Res. Institute, Agric. Res. Center, Giza, Egypt.

***III*: Abundance of the parasitoids:**

Guava leaves infested with the second and third nymphs and adult females (virgin and ovipositing) of *C. rusci* were sampled bi-weekly (100 leaves per sample) from the afore-mentioned orchard during May, 2002 to April, 2003. Each leaf was stored in well-ventilated glass emergence tube after removing all the insects rather than the fig wax scale insect for its parasitoids emergence that their numbers were recorded daily and their percentages were calculated.

IV: Percentage of parasitism :

The rates of parasitism in different stages of *C. rusci* infesting guava trees were estimated throughout two successive years extending from the beginning of May, 2001 to mid-April, 2003. Heavily infested leaves from the guava trees were selected at random from cardinal directions and central cores of the trees. Half-monthly sample (100 randomly selected scales) was chosen. This sample represented the second and third nymphal instars, the newly developed adult females, the full-grown adult females. This sample was divided into 4 replicates with 25 scales each. Each scale was removed, transferred and mulched on a slide in a water film. Scales in each sample were dissected under a binocular microscope, and classified as follows: alive unparasitized, parasitized scale insects having (parasitic larvae, pupal parasitoids and emergence holes. The total percentage of parasitism of the fig scale insect was estimated .

RESULTS AND DISCUSSION

I: Seasonal variations in the population of the fig scale insect:

Half-monthly counts of *C. rusci* on leaves of guava trees are given in Table (1). It is obvious that this insect species had three annual peaks of abundance in the first year of study by mid-June, mid October and mid January where the population index reached 2893, 2685 and 2887 individuals per 100 leaves, respectively. The highest peak was that of June. A sharp decline in the population index occurred in April. The average annual fluctuation as calculated by dividing the maximum population by the minimum is 3.11.The quotient of increase as calculated by dividing the population of each month by that of preceding one showed that the favorable time for insect development is mid June and its value was 1.59.

In the second season of investigation 2002/03, the two peaks of 1315 and 1562 scales per 100 leaves were observed on mid-July and mid November. The highest peak was that of November. A sharp decline in the population index occurred in March and April. The average annual fluctuation was calculated by dividing the maximum population by the minimum is 7.26. The quotient of increase was calculated by dividing the population of each month by that of preceding one show that the favorable time for insect development is mid July and its value was 1.79, Table (2).

Table (1): Population of fig wax scale *Ceroplastes rusci* per 100 leaves in Beni-Suif Governorate during the first season (2001/2002).

Sampling Month	2nd Nymphs	3rd Nymphs	Total	%of Nymphs	Virgin females	Ovipositing females	Total population	Quotient of increase
May2001	402.5	164	671	50	300	303.5	1275	0.75
Jun.	498	577	1075	42.5	579	502	2356	1.4
Jul.	635	690.5	1325	50	623	686	2649	0.96
Aug.	401	354	755	54	309	301	1415	0.725
Sept.	514.5	626	1614	60.5	351	390.5	1882	1.25
Oct.	734	716	1450	57	508.5	639.5	2548	1.15
Nov.	428	330.5	758.5	49	407	416	1581.5	0.71
Dec.	367	303.5	675.5	54	285	295	1250	0.95
Jan,2002	561	647.5	1208.5	51.5	510	583	2301.5	1.55
Feb.	603	642	1245	57.5	461.5	450.5	2157	0.84
Mar.	351.5	298.5	650	51.5	305	312	1267	0.75
Apr.	295.5	253	548.5	57	252	261.5	958	0.91

Table (2): Population of fig wax scale *Ceroplastes rusci* per 100 leaves in Beni-Suif Governorate during the second season (2002/2003).

Sampling Month	2nd Nymphs	3rd Nymphs	Total	%of Nymphs	Virgin females	Ovipositing females	Total population	Quotient of increase
May2001	179	154	333	75.5	120	47	450	0.9
Jun.	298.5	171.5	470	59	110	120	640	1.06
Jul.	375	213.5	588.5	58	215	220	1023.5	1.46
Aug.	122	99.5	221.5	61	63	83	367.5	0.37
Sept.	264	276	550	60.5	199	201	950	1.99
Oct.	402.5	397.5	800	64.5	219	216.5	1235.5	1.03
Nov.	397.5	306.5	704	51	349	387	1340	1.14
Dec.	237	207	462	55.5	155.5	202.5	820	0.82
Jan,2002	180	150	330	70	82.5	54.5	467	0.77
Feb.	73	71.5	139.5	40.5	75.5	78	348	0.86
Mar.	76.5	42	118.5	47.5	68.5	68.5	250.5	0.84
Apr.	107	76.5	183.5	50	83.5	98	363.5	1.39

The results coincide with El-Nabawi *et al.* (1984) who stated that there were 2 peaks of abundance of nymphs of *C. rusci* on grape-vine in June and a higher one (between September and November) and adult females on the twigs peaked between July and September and again between December and February, when they reached maximum numbers. They concluded that there were 2 generations of the coccid per year. Fazeli and Farzneh (1993) stated that there were 2 generations per year; the 1st, active during spring, laid eggs in May and the 2nd active in summer laid eggs in August. Ragab (1995) recorded two annual generations of *C. rusci*, a summer generation from April to September and a winter one from September to the next April.

II. Survey of the natural enemies :

The obtained results showed that the natural enemies of *C. rusci* are:

a- Parasitoids:

Five primary parasitoid species of Encyrtidae : *Habrolepis* sp., *Metaphycus helvolus* (Compere), *M. zebratus* Mercit, *Microtyres flavus* (How.), *Microtyres* sp. ; one species of Pteromalidae namely: *Scutellista cyanea* (Motsch.) and one species of Eulophidae namely ‹ *Tetrastichus ceroplastae* (Girault) were secured from. *C. rusc.* Two species of Aphelinidae namely: *Marietta exitiosa* Compere and *Marietta* sp were recorded as hyperparasitoids.

b- Predators:

One species of Coccinellidae: *Scymnus syriacus* Marsuel, its larvae and adults were found feeding on different stages of *C. rusci.*

III: Abundance of the parasitoids attacking the fig wax scale insect *C. rusci* :

C. rusci was parasitized by *M. helvolus* , *M.zebratus, Habrolepis* sp., *Scutellista cyanea* ، *M. flavus, Microtyres* sp., *Tetrastichus ceroplastae, Marietta exitiosa* and *Marietta* sp., However, the species, *Habrolepis* sp., *Microtyres* sp. and *Marietta* sp. were very scarce in the samples collected so they excluded . The parasitoids namely : *M. helvolus* , *M. flavus*, *M.zebratus* ، *S. cyanea; T.ceroplastae* and *M. exitiosa* parasitized populations of the fig wax scale insect with an average rates of 9.17, 4.53, 2.84, 5.01,8.45 and 2.24 % , respectively, with total percentages of 32.18 % (Table, 3).

There were five peaks of 52.2, 49.7, 48.1, 48.7 and 40.6 % parasitism on July, 1st , September, 1st ، November 15th، 2002, January 15th ، and April, 1st ، 2003 ، respectively.

The most abundant parasitoids were :*M. helvolus* ، *M. flavus, M.zebratus* ،*S. cyanea* ، *T.ceroplastae* and *M. exitiosa* .The peaks of each parasitoid are clarified as follows:

1- *M. helvolus* : had 5 peaks appearing on July, 1st ، September, 15th ، December, 1st , 2002, January 15th ، and April, 1st ، 2003 .The respective percentages of these peaks were, 16.3, 16.5, 16.3, 22.3 and 29.8 %, respectively .
2- *M. flavus* : had 4 peaks with 9.2, 9.8, 11.2 and 7.2 % parasitism on June,15th ; December, 1st, 2002; January, 1st and February, 15th 2003 ،respectively.
3- *M.zebratu*: had 3 peaks with 11.7, 6.4 and 7.2 % parasitism on June, 15th December, 1st and February, 1st ، respectively.
4- *S. cyanea* : had 4 peaks with 8.2, 18.1, 9.4 and 9.5 % parasitism on June, 15th ; September, 1st; November, 1st and December, 15th٢٠٠٢ ,respectively.
5- *T. ceroplastae :* had 3 peaks of 17.8, 17.1 and 25.2 % parasitism on August,15th 2002; January, 15th and March, 15th , 2003, respectively.
6- *M. exitiosa* had 2 peaks with 11.4 and 4.0 % hyper-parasitism on July, 1st and November, 15th, respectively .

In this respect, Flanders (1942) reported that *M. helvolus* is capable of four to five generations of *S. oleae* under the "even hatch" black scale conditions prevailing in the interior areas of southern California. He also mentioned that where the scale is double-brooded, two or three additional generations of the parasitoid may be produced. Ben-Dov (1972) mentioned that *T . ceroplastae* had 2 peaks in April- May and in July- August.

Hafez *et al.* (1987) stated that *T. ceroplastae* had 2 recognizable peaks occurred in winter and summer.

IV: Role of parasitoids on the fig wax scale insect:

Percentages of parasitism, Table (4) showed four peaks appearing by mid-June, the beginning of August, mid- December and the beginning of March. The respective percentages at these peaks were; 62, 54, 37and 40%, respectively. Parasitized scale insects, harboring living stages of the parasitoids represented an important part of the peaks of the total percentage of parasitism. The lowest percentage of parasitism (11%) was recorded by mid-March.

Table (3): Total percentages of parasitism among the fig wax scale, *Ceroplastes rusci* infesting guava during the 2001/2002 & 2002/2003 seasons (Based on 100 dissected scale insects).

Sampling date	2001/2002 season					Sampling date	2002/2003 season				
	Larvae	Pupae	Emergence Hole	Total	% parasitism		Larvae	Pupae	Emerg-ence Hole	Total	% parasi-tism
May2001	8.5	6	13	27.5	27.5	May2002	4	4.5	3.5	12	12
Jun.	14.5	20.5	9.5	44.5	44.5	Jun.	6	4.5	6.5	17	17
Jul.	8	12	21.5	41.5	41.5	Jul.	15.5	12.5	12	40	40
Aug.	6	11	31.5	48.5	48.5	Aug.	15	5	11.5	31.5	31.5
Sept.	4.5	11.5	18.5	34.5	34.5	Sept.	11	9.5	18.5	40	40
Oct.	3	2	24	29	29	Oct.	4	10.5	4	18.5	18.5
Nov.	1.5	3.5	14.5	19.5	19.5	Nov.	15.5	5.5	8	29	29
Dec.	2.5	13	18	33.5	33.5	Dec.	13.5	5	17.5	36	36
Jan,2002	1.5	8.5	15	25	25	Jan,2003	22	5	14.5	41.5	41.5
Feb.	2.5	7.5	14	19	19	Feb.	10	10	8	28	28
Mar.	8	10.5	7	25.5	25.5	Mar.	5.5	3.5	15.5	24.5	24.5
Apr.	3	5.5	10.5	19	19	Apr.	3.5	4.5	17	25	25

Table (4): Percentages of parasitism of the fig wax scale, *Ceroplastes rusci* by different parasitoids during the 2002/2003 seasons in Beni-Suif Governorate.

Sampling date	No. of *C. rusci*/100 leaves	Percent parasitism						
		M. helvolus	*M. flavus*	*M. zebratus*	*S. cyanea*	*T. ceroplastae*	*M. exitiosa*	Total
May2002	1212.5	2.9	3.2	1.8	3.3	4.2	1.1	16.5
Jun.	1917.5	5	3	2.5	5.7	5.1	2.8	24
Jul.	2144	12.6	8.9	7.4	5.2	4.7	6.9	45.6
Aug.	964.5	5	4.2	2	6.7	14.2	2.3	34.1
Sept.	1685	15.6	3.7	1.7	10.9	10.4	1.3	43.6
Oct.	1862.5	6.5	2.7	2.6	4.1	4.6	0.6	20.9
Nov.	1249	7.5	4.6	2.9	9	9.5	3.2	38.6
Dec.	821	9.8	9.2	4.4	8.4	9.9	3	37.6
Jan,2003	1985	17.9	7.4	3.9	2	10.4	3.3	44.9
Feb.	1462.5	5.6	6.8	4.8	4.1	5.8	2.2	29.1
Mar.	768	4.2	2	0.3	0.85	14.2	0.4	21.9
Apr.	463.5	17	0.5	0	0	8.7	0.1	26.3
Mean	1377.9	9.1	4.7	2.9	5.02	8.5	2.3	31.9

REFERENCES

Abd-Rabou, S. 2001. Parasitoids attacking soft scales (Homoptera: Coccidae) in Egypt. Egypt. J. Agric. Res., 79 (3): 859-879.

Argurioa, L. C. and A. P. Santorini 1981. On the phonology of *Ceroplastes rusci* L. (Homoptera: Coccidae) on fig trees in Greece. Benaki Phytopathological Institute, Kifissia- Athens, Greece. 593- 601.

Benassy, C. and E. Biliotti 1963. *Ceroplastes rusci* L. (Homoptera: Lecaniidae) Exemple Intéressant Pour L'etude Dela Dynamique Des Populations. Entomophaga, 8 (3): 213- 217.

Benassy, C. and E. Franco 1974. On the ecology of *Ceroplastes rusci* L. (Homoptera: Lecaniidae) in the Alpes. Maritimes Annales de Zoologie Ecologie Animale , 6 (1): 11, 39.

Ben-Dov, Y. 1972. Life history of *Tetrastichus ceroplastae* Gir. (Hym.: Eulophidae) a parasite of the Florida wax scale *Ceroplastes floridences* Comst. (Homoptera: Coccidae), in Israel. J. Entomol. Soc. S. Afr., 35 (1): 17- 34.

El-Nabawi, A.; Hendi, A.; Kolaib, M. O.; and A. El-Dash 1986. Seasonal variations in the population of the fig wax scale *Ceroplastes rusci* L. on *Vitis vinifera* in Shebin El-Kom region (Egypt). Minufiya J. Agric . Res., 8: 463-473.

Eraki, M. M. 1991. Ecological studies on certain scale insects infesting fig trees. M. Sc. Thesis, Fac. of Agric. Al-Azhar Univ., pp. 123.

Fazeli, M.j. and A. Farzneh 1993. Biology of *Ceroplastis rusci* L.on figs in Fars province. Appl. Entomol. and Phytopathol., (1&2): 13-17.

Hafez, M. B.; El-Minshawy, A. M. and A. R. Donia 1987. Population fluctuation of the parasitoids of *Lepidosaphes beckii* New and *Ceroplastes floridences* Comst. Anz. Schadlingskde. Pflanz. Uniweltcschutz., 60 (1): 6-9.

Kfir, R. and D. Rosen 1980. Parasites of soft scales (Homoptera: Coccidae) in Israel: An annotated list. J. Entomol. Soc. S. Afr., 43: 113-128.

Monastero, S. 1962. Le cocciniglie degli agrumi in Siclia , *Mytilococcus beckii* New., *Parlatoria zizyphus* Lucas, *Coccus hesperidum* L., *Pseudococcus adonidum* L., *Coccus oleae* Bern.and *Ceroplastes rusci* L.. Boll. 1st Ent. Agr. Univ. Palermo, 28: 87 pp.

Morsi, G. A. 1999. Studies on the natural enemies of scale insects infesting fruit trees. Ph. D. Thesis, Fac. of Agric. Moshtohor , Banha Branch, Zagazig Univ. Pp. 184.

Oncuer, C. 1977. Investigations of the identification, distribution and effectiveness of the families of the natural enemies associated with the most important species of scale insects (Homoptera: Coccidae) causing damage to fruit trees in the province of Izmir. Ege. Univessitesti Ziraat Fakuleso Yayinlari No. 336: 129 pp.

Panis, A. 1974. Predatory activity of *Eublemma scitula* (Lepidoptera: Noctuidae: Erastriinae) in south of France. Entomophaga, 19 (4): 493-500.

Priesner, H. and M. Hosny 1940. Notes on parasites and predators Coccidae and Aleurodidae in Egypt. Bull. Soc. Fouad 1st. Entomol., 12: 58-70.

Ragab, M. E. 1995. Efficiency of *Scutellista cyanea* Motch. (Hym.: Pteromalidae) and *Tetrastichus ceroplastae*) Gir.) (Hym.: Eulophidae) in population suppression of *Ceroplastes rusci* L. (Hom.: Coccida). J. Appl. Entomol., 119: 627-630.

Rosen, D. 1962. An annotated list of hymenopterous parasites of citrus soft scales in Israel. Entomophaga, 4 (4): 351- 357.

Rosen, D. 1966 Keys for the identification of the hymenopterous parasites of scale insects, aphids and Aleyrodids on citrus in Israel. Scripta Hierosolym,. 18: 43- 79.

الاختلافات العددية لحشرة التين الشمعية *Ceroplastis rusci* Linnaeus وطفيلياتها فى منطقة مصر الوسطى

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تعتبر حشرة التين الشمعية *Ceroplastis rusci* L. من الآفات الضارة التى تصيب الجوافة، الموالح، المانجو، العنب، التين، التفاح وبعض نباتات الزينة. أجريت دراسة حقلية فى بستان جوافة صنف بلدى بمحافظة بنى سويف (مصر الوسطى)، وتم تقدير التذبذبات الموسمية ونسبة التطفل لحشرة التين الشمعية فى موسمى ٢٠٠١/٢٠٠٢ و ٢٠٠٢/٢٠٠٣. وكانت الحشرة متواجدة طوال العام وتم تحديد ٢-٣ قمم للتعداد فكان لها ٣ قمم فى العام الأول فى منتصف يونيو وأكتوبر ويناير أما فى العام الثانى فكان لها قمتان فى منتصف يوليو ونوفمبر. وقد تم حصر تسعة أنواع من الطفيليات خرجت من حشرة التين الشمعية وهى *Metaphycus helvolus* (Compere), *M. zebratus* (Mercit), *Habrolepes* sp., *Scutellista cyanea*, *Microtyres flavus* (How.), *Microtyres* sp., *Tetrastichus ceroplastae* (Girault) *Marietta exitiosa* Compare, *Marietta* sp., *C. rusci* (Motsch.) وقد تم تقويم دور هذه الطفيليات كعامل موت طبيعى للآفة.