

**SEASONAL ABUNDANCE OF THE OLIVE SCALE,
PARALATORIA OLEAE COLVEE (HOMOPTERA:
DIASPIDIDAE) AND ITS PARASITOIDS IN MIDDLE EGYPT**

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(Received 10-12-2006)

INTRODUCTION

The olive scale insect, *Paralatoria oleae* Colvee a polyphagous pest of many trees and shrubs, causing great losses in apple, pear, plum and other kinds of fruits, but is frequently encountered also on subtropical plants, primarily on olive trees. It is widespread in the Mediterranean and subtropical areas of the world. All the aboveground parts of host plants may be heavily infested. Feeding on the olive fruits causes the appearance of purple discolorations and slight deformities. The entire crop may be lost, the oil contents of infested olives decreases considerably. (Apple Baum and Rosen, 1964 and Verma and Dinabandhoo, 2005).

Reviewed researches in the available literature on the fluctuation and seasonal abundance of the olive scale insect, *P. oleae* indicated that two or three generations were found per year depending on the area and the host plant world wide. In this respect, Huffaker *et al.*, (1962) in California demonstrated that two generations of *P. oleae* were recorded on olive trees. Similar results were reported by other authors at different parts of the world (Applebaum and Rosen, 1964 in Israel; Benassy, 1967 in Morocco; Goma, 1978 in Bulgaria; Argyriou and Kourmadas, 1979 in Greece; Laccone, 1981 in Italy; Soudah and Kabour, 1983 in Amman; Atzemis, 1985 in Belgium; Aleksidze *et al.*, 1995 and Verma and Dinabandhoo, 2005 in India). In Egypt, most authors reported 2-3 generations of *P. oleae* annually on olive trees (Hafez *et al.*, 1967; Habib *et al.*, 1969; El-Hakim and Helmy, 1982; Moursi and Mesbah, 1985; Kasim, 1995; Asfoor, 1997 and Zidan *et al.*, 2002)

Natural enemies of the olive scale insect and their role in regulating its population was reported by some authors (in California, Huffaker *et al.*, 1962; Finney, 1966 and Kennett, 1967; in Belgium, Argyriou and Kourmadas, 1979; in

Macedonia, Atzemis, 1985; in China, Liang *et al.*, 1999; in Egypt, Ezz, 1997 and Abd-Rabou, 1997 & 1999 and in France, Rochat and Gutierrez, 2001).

The present work declaring the following studies:

- 1- The seasonal changes in the population dynamics of the olive scale insect in Beni-suif Governorate.
- 2- Survey of the natural enemies of *P. oleae*.
- 3- The role of parasitoids in suppressing the population of the olive scale insect.

MATERIAL AND METHODS

Survey of *P. oleae* natural enemies

Olive, *Olea europea* L. infested leaves with the olive scale insect were randomly collected from different orchards throughout two years, extending from Jun. 2004 till May 2006. The samples were packed in paper pages and transferred to the laboratory for examination. The specimens were carefully examined and all insects except only the olive scale insect were removed to survey its natural enemies. The examined leaves were enclosed in plastic jars of 15 cm. diameter and 20 cm. height covered with muslin, held in position by a rubber band and kept under preferential conditions for securing any emergence parasitoids.

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

Seasonal abundance of *P. oleae*

Olive trees, infested with *P. oleae* located at Beni-suif district, were used for this purpose. An orchard about 3 feddans 12 years old cultivated with olive trees and heavily infested with the olive scale insect was chosen for this study. The orchard was not exposed to any chemical treatments before or during the investigations. At 15-day intervals, 100 leaves with different stages of *P. oleae* were collected at random from different directions of the orchard. The leaves represented different sides, peripheral, inner zones, lower and middle strata of the tree. These

leaves were kept in paper pages and transferred to the laboratory for careful examination and counting of the olive scale insect.

The stages of scale insect considered in counting process were:

a- Nymphs (1st and 2nd instars).

Half-monthly percentages of nymphs helped in estimating the number of generations. These were indicated by the peaks of nymphs throughout the two consecutive years. This method was followed according to Amin, (1970) and Morsi, (1999) who reported that, in scale insects the percentage method is preferred over the numbers method.

b- Males (pre pupal and pupal stages).

c- Adult females (gravid and non-gravid females).

The role of parasitoids as mortality factor of *P. oleae*

The rates of parasitism in different stages of *P. oleae* infesting olive trees were estimated throughout two successive years extending from the beginning of Jun. 2004 till May 2006. Heavily infested leaves from the olive 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 first and second nymphal instars, the newly developed adult females, the full grown adult females and the males' prepupal and pupal stages. This Sample was divided into 4 replicates with 25 scales. Each scale was removed, transferred by lifting the scales cover and mulched on a slide in a water film. Scales in each sample were dissected under a binocular microscope, and classified as follows, live unparasitized individuals, parasitized individuals having (larvae, pupae and emerging holes). Total percentage of parasitism of the olive scale insect was estimated.

RESULTS AND DISCUSSION

Survey of the natural enemies

The obtained results showed that the natural enemies of *P. oleae* are

Parasitoids:

Four primary parasitoid species belong to family Aphelinidae were recorded on *P. oleae*, names of the respective species are *Coccoghagoides utilis* Doutt (this species was recorded from Egypt for the first time), *Aphytis diaspidis*

How, *A. maculicornis* Masi, *A. chrysomaphali* Mercet and one hyperparasitoid, *Marietta leopardina* Motschulsky.

Our results are in full agreement with those obtained by Abd-Rabou, 1999 in Egypt who recorded the above mentioned species of Aphelinidae (except for the species, *Coccoghagoides utilis*) and the species, *Encarsia aurantii* Howard from samples of *P. oleae*. While abroad, the dominant parasitoid species were *C. utilis* and *A. maculicornis* (i.e., Benassy, 1967 in Morocco; Kennett, 1967 in California; Atzemis, 1985 in Belgium and Rochat & Gutierrez, 2001 in France).

Predators:

The larvae and adults of two species of Coccinellidae; *Pharoscyrmus varius* Kirsch and *Chilocorus bipustulatus* Linne, were found feeding on different stages of this pest. In this respect, the second genus (*Chilocorus*) was dominant and associated with *P. oleae* in many countries of the world, i.e., Belgium (Argyriou and Kourmadas, 1979); Georgia (Alesidze *et al.*, 1995) and China (Liang *et al.*, 1999).

Seasonal variations in the population of the *P. oleae*

Half-monthly counts of *P. oleae* on leaves of olive trees are given in tables 1 and 2. It is obvious that this insect species had six outbreaks in the population through the first year of study (2004/05), this increasing were recorded in first of Jun., mid-Aug., mid-Oct., mid-Dec., mid-March and mid-May, the total population reached 5639, 7967, 6240, 5400, 5833 and 13847 individuals /100 olive leaves, respectively. At the same dates, the nymphs reached the highest populations recording 3293, 4267, 3473, 3933, 2953 and 5140 individuals /100 olive leaves, respectively (table 1). In the second year of investigation 2005/06, the population of the olive scale insect took the same trend and recorded three peaks only at first of Jul., first of Nov., and first of March, the counts of total population were 6987, 5540 & 5971 and 2776, 1740 & 3107, respectively (table 2). Generally, the outbreaks in total populations of *P. oleae* were related with high counts in population of pre-pupae & pupae of males and adult females during the successive years of study.

The highest percentages of nymphs (i.e. percent of nymphal stage population over the total) during the first season were 81.9, 72.8 and 74.5% recorded at first of Aug., mid-Dec. and mid-Feb., respectively. Similar results were obtained for the second season (2005/06). These three periods (i.e., dates of increasing) can be recommended for control of this insect by their natural enemies. The lowest percentages of nymphs were 15.9% and 8.6% recorded at Nov., 2004 and Dec., 2005, respectively during the successive years of study.

TABLE (I)

Half-monthly counts of the olive scale insect, *P. oleae* per 100 olive leaves in Beni-suef Governorate during the first season (2004/2005).

Sampling date	Nymphs			Pre-pupae & pupae males	Adult females	Total population	% Nymphs
	1 st	2 nd	Total				
1/6/2004	1293	2000	3293	1133	1213	5639	58.4
15/6	500	300	800	427	213	1430	55.9
1/7	146	120	266	127	393	786	33.8
15/7	217	130	347	117	300	764	45.4
1/8	520	400	920	86	116	1122	81.9
15/8	2067	2200	4267	1700	2000	7967	53.6
1/9	1113	1200	2313	267	315	4895	47.3
15/9	233	700	933	887	516	2336	39.9
1/10	120	200	320	172	314	806	39.9
15/10	1573	1900	3473	1667	1100	6240	55.7
1/11	1120	1200	2320	1320	1500	5140	45.1
15/11	35	62	97	197	315	609	15.9
1/12	123	87	210	507	120	837	25.1
15/12	1833	2100	3933	600	867	5400	72.8
1/1/2005	186	213	399	174	133	706	56.5
15/1	287	413	700	687	376	1763	39.7
1/2	317	516	833	157	280	1270	65.6
15/2	215	423	638	96	123	857	74.5
1/3	900	1017	1917	667	700	3284	58.4
15/3	1000	1953	2953	1180	1700	5833	50.6
1/4	120	247	367	227	186	780	47.1
15/4	140	120	260	113	200	573	45.4
1/5	453	540	993	500	501	1994	49.8
15/5	2140	3000	5140	3707	5000	13847	37.1

Concerning the population dynamics of *P. oleae*, our results are in full agreement with those obtained by Habib *et al.* (1969) who observed that this pest recorded three generations annually on olive trees, Haffez *et al.* (1967) in Alexandria, mentioned that *P.oleae* had three generations annually on pear, El-Hakim and Helmy (1982) reported that *P.oleae* had three generations annually at Tora and in Fayoum and two peaks in Alexandria, Moursi and Mesbah (1985) reported two peaks in March and August-September on olive trees in northern delta. Kasim (1995), mentioned two generations of *P.oleae* on plum and peach in Beheira. Zidan *et al.*, (2002), recorded three

generations on olive trees in Ismailia, as spring, summer and fall-winter, the spring generation extended from Feb.12 to Jun.4, summer generation extended from Jun.4 to Aug.13, and fall-winter continued to Feb. Similar results were recorded in Macedonia (Atzemis, 1985) and Georgia (Aleksidze *et al.*, 1995).

TABLE (II)

Half-monthly counts of the olive scale insect, *P. oleae* per 100 olive leaves in Beni-suef Governorate during the second season (2005/2006).

Sampling date	Nymphs			Pre-pupae & pupae males	Adult females	Total population	% Nymphs
	1 st	2 nd	Total				
1/6/2005	287	400	786	320	400	1407	48.9
15/6	280	100	380	508	94	982	38.7
1/7	1753	1023	2776	1200	3011	6987	39.7
15/7	1006	889	1895	805	987	3687	51.4
1/8	47	86	133	307	60	500	26.6
15/8	353	194	547	198	380	1125	48.6
1/9	173	204	377	207	420	1004	37.5
15/9	260	247	507	247	507	1261	40.1
1/10	253	160	413	160	413	986	41.1
15/10	740	600	1340	816	1220	3376	39.7
1/11	1000	740	1740	1787	2013	5540	31.4
15/11	173	633	806	820	1693	3319	24.3
1/12	85	197	282	992	863	2137	13.9
15/12	67	13	80	785	60	925	8.6
1/1/2006	96	75	171	93	185	449	38.9
15/1	240	127	367	216	543	1126	32.6
1/2	293	319	612	315	615	1542	39.7
15/2	876	145	1021	74	296	1391	73.4
1/3	2107	1000	3107	1840	1024	5971	52.1
15/3	299	1600	1899	1371	1615	4885	38.9
1/4	1760	2000	3760	567	815	5142	73.1
15/4	267	400	667	320	613	1600	41.7
1/5	1113	1300	2413	1120	819	4352	55.5
15/5	300	800	1100	667	800	2567	42.9

The role of parasitoids as mortality factor of *P. oleae*

Percentages of parasitism, (table3) showed three peaks during the first season 2004/05, the peaks were 52, 30 and 67 individuals /100 scale insect in mid-

Jul., first of Jan. and mid-May, respectively. Meanwhile, during the second year 2005/06, the percentages of parasitism were 37, 39 and 38 % on mid-Oct, mid-Dec., and mid-May respectively. The lowest percentages of parasitism (6 and 7%) were recorded in Feb. during the two respective years of study.

TABLE (III)

Total percentages of parasitism among the olive scale insect, *P.oleae* infesting olive trees in Beni-suif Governorate during 2004/05 and 2005/06 season. (Based on 100 dissected scale insects)

2004/2005					2005/2006				
Sampling date	Larvae	pupae	Emergence holes	Total (%Parasitism)	Sampling date	Larvae	pupae	Emergence holes	Total (%Parasitism)
1/6/2004	36	15	22	73	1/6/2005	23	23	18	64
15/6	16	8	17	41	15/6	6	8	22	36
1/7	19	10	16	45	1/7	11	4	10	25
15/7	25	13	14	52	15/7	13	7	6	26
1/8	8	12	8	28	1/8	6	2	7	13
15/8	18	9	7	34	15/8	7	8	3	18
1/9	20	13	5	38	1/9	5	2	4	11
15/9	5	6	17	28	15/9	12	1	2	15
1/10	3	4	11	18	1/10	15	9	6	30
15/10	10	3	1	14	15/10	12	12	13	37
1/11	3	2	3	8	1/11	4	5	9	18
15/11	5	3	4	12	15/11	4	6	7	17
1/12	2	6	6	14	1/12	8	6	9	23
15/12	16	2	1	19	15/12	14	19	6	39
1/1/2005	11	14	5	30	1/1/2006	2	11	6	19
15/1	2	11	5	16	15/1	10	2	1	13
1/2	3	1	5	9	1/2	1	2	4	7
15/2	0	2	4	6	15/2	10	13	2	25
1/3	13	5	4	22	1/3	0	3	4	7
15/3	2	15	11	28	15/3	11	6	2	19
1/4	4	12	17	33	1/4	3	6	4	13
15/4	13	7	1	21	15/4	18	4	5	27
1/5	9	15	12	36	1/5	2	5	5	12
15/5	12	20	35	67	15/5	16	11	11	38

These results are also in agreement with those obtained by Benassy, (1967) in Morocco, who mentioned that, the Aphelinid parasitoid, *A. maculicornis* had three generations which were observed between late Feb. and early June.

SUMMARY

Studies on the seasonal abundance of the olive scale, *Paralatoria oleae* Colvee (Homoptera: Diaspididae) and its parasitoids were conducted in Beni-suif Governorate during the period extending from Jun. 2004 until May 2006. The olive scale, *P. oleae* have three peaks of abundance on olive trees per annum. The highest percentages of nymphs during the first season were 81.9, 72.8 and 74.5% recorded at first of Aug., mid-Dec. and mid-Feb., respectively. Similar results were obtained for the second season (2005/06). These above-mentioned times could be recommended for control of this insect by their natural enemies. The parasitoid species, *Coccoghagoides utilis* Doult (first record in Egypt), *Aphytis diaspidis* How, *A. maculicornis* Masi, *A. chrysomaphali* Mercet and the hyperparasitoid *Marietta leopardina* Motschulsky were found associated with *P. oleae*. The role of Parasitoids in regulating the abundance of populations of this scale insect was evaluated.

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