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Survey of *Aphytis*, parasitoid Species of the Olive Parlatoria Scale Insect, *Parlatoria oleae* (Clovee) (Homoptera: Diaspididae) in Southern Syria

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ABSTRACT

The aim of this study was to determine the parasitoid species which belong to genus *Aphytis* (Hymenoptera: Aphelinidae) associated with the olive parlatoria scale, *Parlatoria oleae* (Clovee) (Homoptera: Diaspididae). Samples were collected from olive orchards at Al-Qunaitra and Daraa districts (Southern of Syria) throughout a year 2009/10. Two parasitoid species belong to genus *Aphytis*; *A. maculicornis* (Masi) and *A. hispanicus* (Merect) were found in this study. *A. maculicornis* was the most dominant parasitoid, with a mean parasitism rate of 39.25 % at Al-Qunaitra and 10.25 % at Daraa, whereas *A. hispanicus* was less abundant, with mean parasitism rates of 6.5 and 2.5% at Al-Qunaitra and Daraa districts, respectively. Total parasitism rate on *P. oleae* was higher at Al-Qunaitra (45.75%) than at Daraa (12.75%).

Key words: Survey, *Aphytis* spp. , *Parlatoria oleae*, Al-Qunaitra, Daraa, Syria.

INTRODUCTION

The armored scale insects (Homoptera: Diaspididae) are serious pest species on agricultural and ornamental plants. The olive parlatoria scale, *Parlatoria oleae* (Clovee) is a potential pest on olive and apple trees in several Mediterranean countries including Syria (Basheer and Mohmalji, 2006). Nymphs and adults suck the plant sap through the fruits, leaves, twigs and branches. Plant tissues are damaged as a result of plant fluid removal and injection of toxic substances (Basheer and Mohmalji, 2006). Heavy infestation causes yellowing of leaves, leaf abscission and overall decrease in tree growth. Infested fruits, sometimes, show depigmentation marks which may develop to darkly pigmented spots and deformation. Effective chemical control of the diaspidid species is difficult to be achieved and total reliance on chemical control has been demonstrated to be ineffective (Basheer, 1997). In addition to development of resistance of *P.oleae* against most of applied pesticides, traditional control measures, especially, chemical control failed to stop losses caused by it. The only way to bring back the natural balance is to minimize the use of chemical insecticides and increase the population of natural enemies to play their role in minimizing the pest population (Rodrigo and Mari, 1992 and Kasim, 1995). Indigenous biological control agents (parasitoids and predators) provide an opportunity for successful control of *P. oleae* (Rosen, 1986). Species of the genus *Aphytis* Howard (Hymenoptera: Aphelinidae) are external parasitoids of diaspidid scale insects including *P. oleae.* These species are very effective biological control agents of this serious pest. Several species of *Aphytis* have been successfully employed in biological control projects directed against economically important pest species in various parts of the world (Rosen and DeBach, 1979; Basheer, 1990; El-Dash *et al,* 1997 and Moustafa, 1999). In Bulgaria, according to Basheer (1990), *Aphytis proclia* is an active parasitoid of San Jose scale *Quadraspidiotus pernisiosus.* Furthermore, *A. maculicornis* and *A. hispanicus* were recorded as the most abundant parasitoids on olive scale and chaff scale *Parlatoria pergandii.* respectively (Erler and Tunc, 2001). In Australia, according to Broadley and Thomas (1995), *A. lingnanensis* and *A. melinus* are the main parasitoids of oleander scale *Aspidiotus nerii.* Some studies have been recorded that *A. chilensis* as one of parasitoids of armored scales in several Mediterranean countries (Karaca *et al.*, 1999 and Lo Pinto *et al*; 2002). Studies in Egypt have been recorded *A. lepidosaphes* as one of the most important parasitoid species of purple scale *Lepidosaphes beckii* (Abbas, 1992; El-Kholy *et al.*, 1994 and Moustafa, 1999). In Lebanon *A. chrysomphali* is the main parasitoid of Florida red scale *Chrysomphalus aonidum* (Traboulsi, 1969). In Syria, *A. chrysomphali* and *A. maculicornis* are parasitoids of California red scale *Aonidiella aurantii* and olive scale *Parlatoria oleae,.* respectively (Basheer, 1999 and Basheer and Mohmalji, 2006).

Because of the little knowledge concerning the species of genus *Aphytis* associated with *P. oleae* in Syria. The main objective of this study was to survey the parasitoids of genus *Aphytis* associated with *P. oleae.*

MATERIALS AND METHODS

The study was carried out between April 2009 and March 2010 in Southern Syria (Al-Qunaitra and Daraa districts) in olive orchards that have not received any insecticidal treatment. Ten olive trees were selected randomly in each orchard. Attempts were made to ensure that same trees were not used every week. Forty sampling branches, 25 cm long and of the same age and thickness, were collected randomly from each tree at 7 day intervals. Each sample was placed in a plastic bag, taken to the laboratory in Center of Research and Study of Biological Control at Damascus University and examined directly under a binocular stereomicroscope. All scale insects that showed old holes made by parasitoids and all types of other scale insects were removed. Samples were placed in wooden boxes, each having three cylinders to attract parasitoids towards light. Each sample was monitored for a month and parasitoid species in cylinders were collected then kept in specimen tubes containing warm 75% ethyl alcohol and droplets of glycerin using a soft brush, then all parasitoids were taken for identification. Identification of specimens to genus and species levels was based on keys of Rosen and DeBach (1979) and Hayat (1994).

Percentages of parasitism (par.%) were calculated according to the following formula:

$$\text{Par. \%} = [A / (A+N+D)].100$$

Where:

A: Number of parasitized scales.
N: Number of living scales.
D: Number of dead scales.

Frequency for every species (of *Aphytis* was calculated as follows:

$$A\% = [Na / Na + Nb] .100$$

Where:

Na & Nb: Numbers of individuals of each *Aphytis* species.

Abundance of *P. oleae* parasitoid species was also compared between Al-Qunaitra and Daraa, using the Jaccard formula where the coefficient of similarity equals: c. $(a + b\text{-}c)^{-1}$ (Magurran, 1988) where; (a) is the number of parasitoids at Al-Qunaitra, (b) is the number of parasitoids at Daraa and (c) is the total number of parasitoids, recorded at both sites.

RESULTS AND DISCUSSION

Two parasitoid species of genus *Aphytis*; *A. maculicornis* and *A. hispanicus* were recovered from living scale insect, *P. oleae* at the two sites of experiment. *A. maculicornis* was the most abundant parasitoid species, accounting 82.62% of the emerged parasitoids and with a mean parasitism rate of 39.25% at Al-Qunaitra and 10.25% at Daraa districts. The other parasitoid species, *A. hispanicus* emerged also from the samples collected from the two sites, accounting 15.38% of the emerged parasitoids and with mean parasitism rates of 6.5% at Al-Qunaitra and 2.5% at Daraa (Fig. 1).

The olive scale parasitoids' fauna of Al-Qunaitra was similar to that of Daraa. The coefficient of similarity =1 according to Jaccard formula.

El-Dash *et al* (1997) found that *A. maculicornis*, *A. paramaculicornis* (Debach and Rosen) and *Prospaltela inquirenda* (Silv.) were the most abundant parasitoid species on the olive scale in Egypt.

Regional and seasonal dynamics of the parasitoids on olive scale:

Parasitoids recovery from olive scale began in March 2009 at Al-Qunaitra and Daraa districts with a peak of 67 % occurred in May (Fig. 2).

A. maculicornis was the dominant parasitoid species with a mean parasitism rate of 39.25% at Al-Qunaitra and 10.25% at Daraa, whereas *A. hispanicus* was less abundant with a mean parasitism rate of 6.5% at Al-Qunaitra and 2.5% at Daraa districts, Southern Syria (Fig. 3).

The study showed that there was a difference in the parasitoid active period at the two districts. *A. maculicornis* was present throughout the period when the parasitoids were active. In contrast, *A. hispanicus* was recovered mostly during early spring and late summer (Fig. 3). *A. maculicornis* was the most abundant olive scale parasitoid species in this study; it attacked mostly the young females and second nymphal instar of olive scale.

Aphytis species dominated the solitary parasitoids exploiting olive scale in southern Syria. These species are all ectoparasitoids on the armored scales. *A. maculicornis* appeared as the most active parasitoid. *A. hispanicus* attacks also, the armored scales of genera *Parlatoria* and *Lepidosaphes*. *A. hispanicus* is a solitary parasitoid; it was mostly recovered during the cooler months of the year. It occurred frequently in this survey but suggesting that its impact on *P. oleae* is limited.

Obtained results related to *Aphytis* species on olive scale agree with those found by Basheer and Mohmalji (2006) in Syria, Erler and Tunc (2001) in Turkey, Daane *et al* (2005) in USA, and disagreed

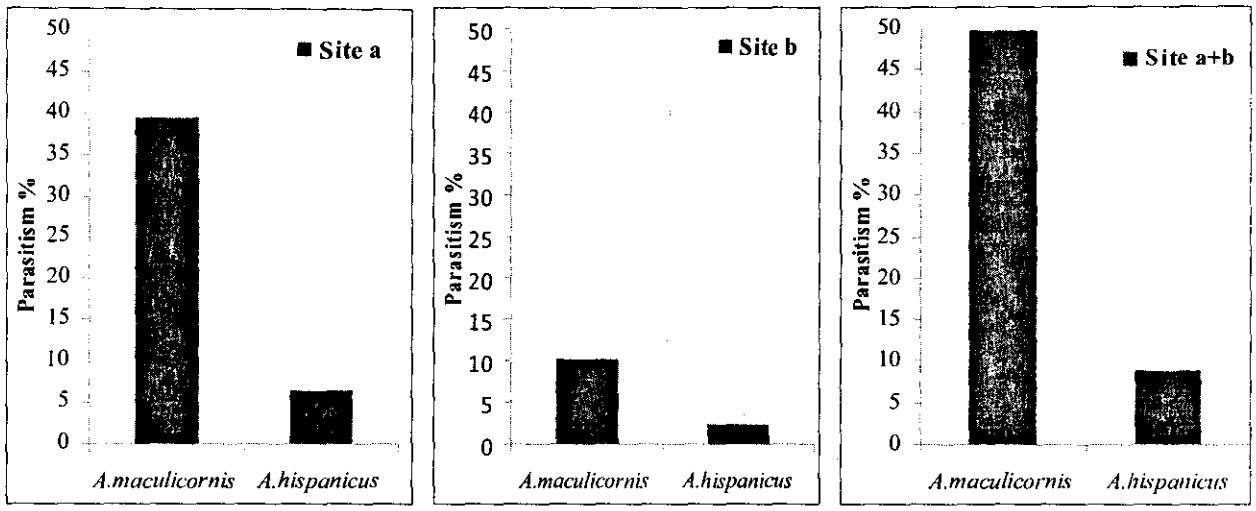

Fig. (1): Percentages of parasitism on olive scale. *P. oleae* by two parasitoid species at two olive orchards; Al-Qunaitra (site a) and Daraa districts (site b), in southern Syria during the year 2009/10.

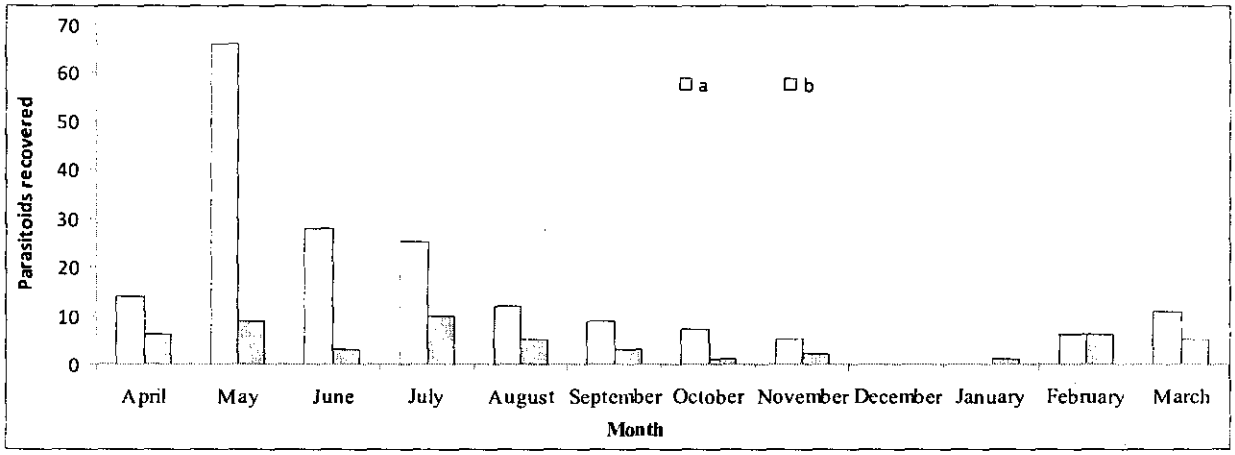

Fig. (2): Monthly abundance of parasitoids species associated with the olive scale at two olive orchards Al-Qunaitra (site a) and Daraa (site b) districts, Southern Syria, during the year 2009/10.

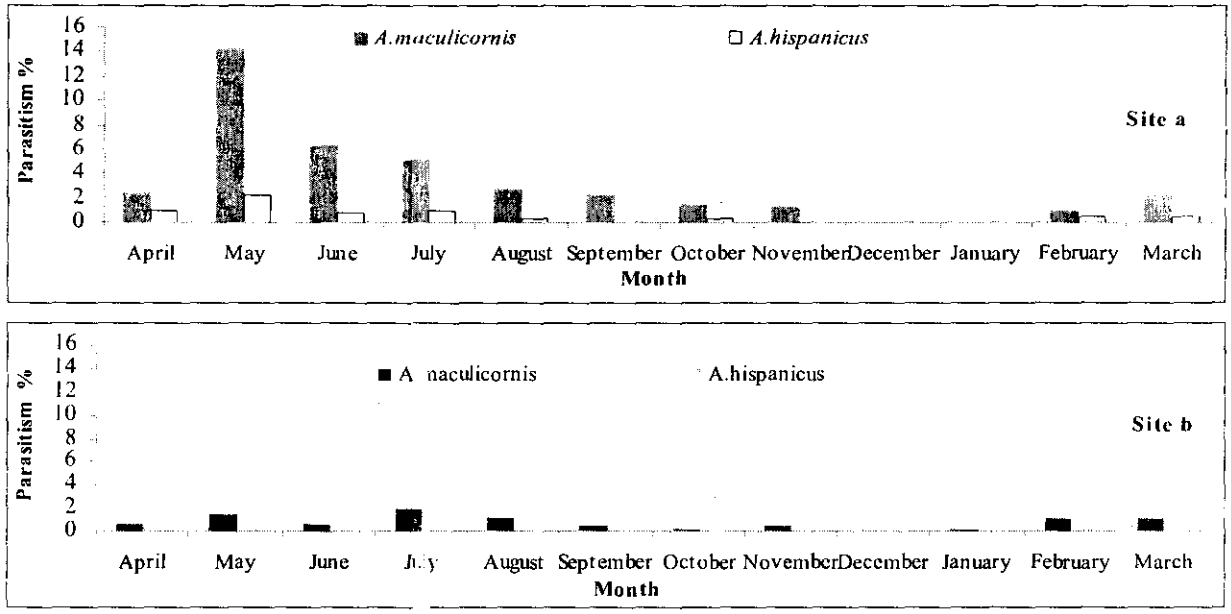

Fig. (3): Spatio-temporal dynamics of the parasitoids of olive scale infested olive in southern Syria. Bars represent data from individually isolated parasitized scales during a year 2009/10 at Al-Qunaitra and Daraa districts.

with Abou-Elhagage (2004) in Egypt.

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