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POPULATION DYNAMICS OF *AONIDIELLA ORIENTALIS* (NEWSTEAD) (COCCOIDEA: DIASPIDIDAE) AND ITS PARASITOID *HABROLEPIS ASPIDIOTI* COMPERE & ANNECKE (HYMENOPTERA: ENCYRTIDAE).

ABSTRACT

POPULATION DYNAMICS OF *AONIDIELLA ORIENTALIS* (NEWSTEAD) (COCCOIDEA: DIASPIDIDAE) AND ITS PARASITOID *HABROLEPIS ASPIDIOTI* COMPERE & ANNECKE (HYMENOPTERA: ENCYRTIDAE).

An experiment was carried out at Giza governorate, Egypt, between Aug. 1995 and Aug. 1997 to study the fluctuation and seasonal abundance of *Aonidiella orientalis* and its parasitoid *Habrolepis aspidioti* on *Ficus nitida* trees. A brief description of the parasitoid is given. The populations of *A. orientalis* in both years showed three distinct peaks during the summer, whilst the parasitoid probably had four. The effect of such climatic factors as temperature, relative humidity, photoperiod, dew point and wind velocity were also studied and the size of the populations of both the scale and the parasitoid appeared to be correlated with many of them.

Key words: biocontrol, citrus, meteorological conditions, ecology, oriental scale, host range, *Chrysomphalus aonidum, Aonidiella aurantii, Habrolepis rouxi.*

INTRODUCTION

The Diaspididae are an important component of the homopterous fauna on many plants. The oriental scale, *Aonidiella orientalis* (Newstead) was first recorded in Israel in 1980 (Ofek *et al.*, 1997) and its ecology and biology has been studied by several researchers: Badawi & Al-Ahmed (1990 - in Saudi Arabia), Dutta & Baghel (1991 - in India), Khalaf & Sokhansanj (1993 - in Iran) and Elder & Smith (1995 - in Australia). *A. orientalis* was first recorded in Egypt by Ghabbour (1988) and, as it is potentially an important pest, a study was undertaken.

A. orientalis has a wide host range and has been found on olive, guava, feijoa, litchi, acacia and avocado in Israel (Ofek *et al.*, 1997), sporadically on mangoes in South Africa (Daneal *et al.*, 1994) and on sapota in India (Mani & Krishnamoorthy, 1996). The parasitoid identified as attacking *A. orientalis* in Israel was the encyrtid *Habrolepis aspidioti* Annecke (Ofek *et al.*, 1997) and this species was also found in Egypt.

The present work was designed to: i. identify the diagnostic characters for *H. aspidioti* for rapid identification; ii. study the occurrence of *A. orientalis* in

relation to this parasitoid and iii. study the relationship between the population densities of *A. orientalis* and *H. aspidioti* and the following meteorological factors: temperature, relative humidity, photoperiod, dew point and wind velocity.

MATERIALS AND METHODS

Ecological studies on *A. orientalis* and its parasitoid *H. aspidioti* were carried out at Dokki, Giza governorate, on *Ficus nitida* in the absence of chemical control. Four trees of *F. nitida* of similar size, height and leaf density were selected. The trees were about 10 years old and 7m high. Studies were carried out during two successive seasons, from the second half of August 1995 to the beginning of August 1997. Samples of 15 leaves were picked at random from the four sides of each tree (total 60 leaves from each of the four trees) at 15 day intervals. Each sample was kept separately in a polythene bag and examined in the laboratory. The total number of live scales in each sample was taken as the population index. The parasitoid was recorded as the number of parasite pupae present.

Records of the following meteorological factors were obtained from the nearest meteorological station about 1km distant: temperature, relative humidity, photoperiod, dew point and wind velocity. The daily records of these factors were then grouped into half-monthly averages to correspond with those for the insect samples. To investigate the effect of these climatic factors, simple correlation tests were applied.

RESULTS AND DISCUSSION

Habrolepis aspidioti Compere & Annecke is an African species originally described from Ethiopia and North Africa under the name *Habrolepis famari*, but today known to be widely distributed (Annecke & Mynhardt, 1970).

Adult female: about 1mm long, body somewhat flattened. Retaining its natural shape in dry specimens; largely black. Dorsum of thorax with a strong metallic blue-green lustre. Antennae largely blackish, except for distal two funicle segments. Legs blackish, except for distal half of tibia and tarsus, base of femur of foreleg, tibia and tarsus of middle leg and tarsus of hind leg, which are yellowish. Wing distinctly marked as illustrated (Compere, 1961).

Biology: an internal, solitary, primary parasitoid of a number of armoured scale insects, including circular purple scale (*Chrysomphalus aonidum* (L.)) and red scale (*Aonidiella aurantii*).

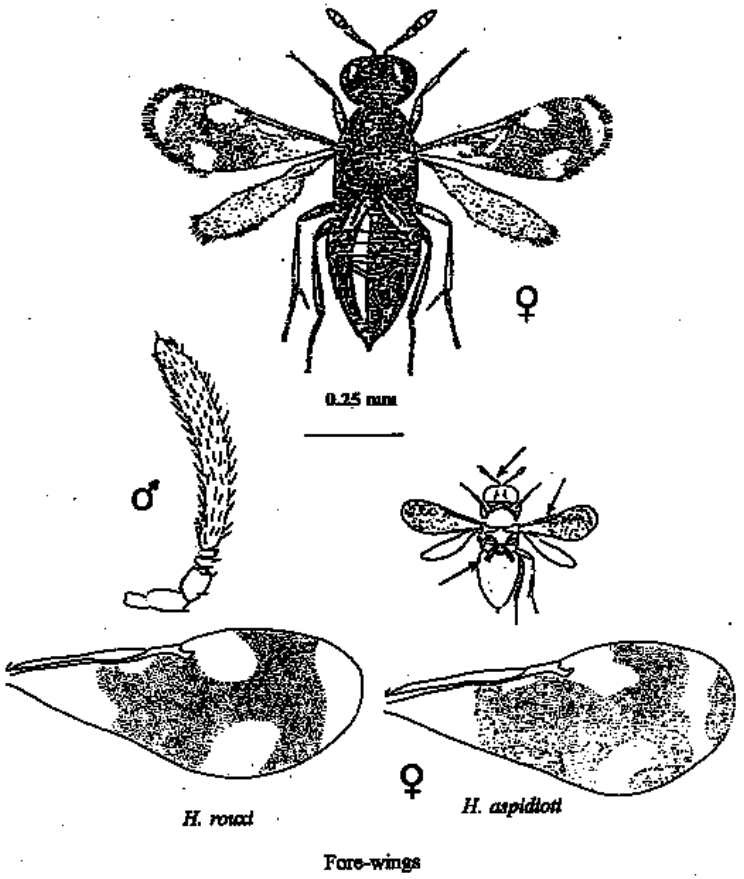

Fig. 1. Characters of adult males and females of *Habrolepis rouxi* and *H. aspidioti*.

Distribution: widespread in Africa and Israel; introduced into North America.

Habrolepis rouxi Compere is a closely related species which coexists with *H. aspidioti* on circular purple scale in South Africa. The adult females of these two species can be separated by the pattern of the fore-wings as indicated in Fig. 1 and the key (Compere, 1961).

KEY FOR IDENTIFICATION OF ADULT FEMALE *HABROLEPIS ASPIDIOTI* AND *H. ROUXI*:

-Apex of fore-wing distinctly marked with a black area *Habrolepis aspidioti*
-Apex of fore-wing without a black area and hyaline.....*Habrolepis rouxi*

OCCURRENCE OF *A. ORIENTALIS* AND *H. ASPIDIOTI* IN EGYPT:

The abundance of *A. orientalis* between the 2nd half of Aug. 1995 to the beginning of Aug. 1997 is shown in Fig. 2. In both years, there was a distinct trough during the winter, with the populations dropping to around 5000/240 leaves between Oct. and March, followed by three distinct peaks of 30,000 or more during the summer, one in April/May, another in July/Aug. and the last in Sept. These data suggest that *A. orientalis* has three distinct generations during the summer in Egypt, going into some sort of diapause during the winter. This does not agree with the observations of Badawi & Al-Ahmed (1990), who recorded four distinct peaks for *A. orientalis* on *Ficus nitida* in Saudi Arabia.

With regard to the frequency of *H. aspidioti*, the population fluctuations are less clear, although the patterns are more or less similar in the two years. In both years, the greatest populations (of more than 500/240 leaves) were in April/May, July/Aug. and in Sept., coinciding with the three *A. orientalis* peaks. However, there is also a strong suggestion in both years of a smaller, fourth peak in November, rising to about 400-500/240 leaves from a low of about 150/240 leaves; this peak was rather less distinct in 1995 than in 1996. In 1996, there is also a suggestion of a further peak in late March, but this was not evident in the following year.

SCALE AND PARASITOID FREQUENCY IN RELATION TO METEOROLOGICAL CONDITIONS:

The correlations found between the populations of *A. orientalis* and *H. aspidioti* and certain meteorological conditions are shown in Table 1. Both insects had positive correlations with all the measured weather parameters except relative humidity, where they were negative. The degree of significance of the correlations was also relatively similar for both the scale and the parasitoids. In addition, there were highly significant positive correlation between size of *A. orientalis* populations and those of *H. aspidioti* ($r = 0.740^{**}$ in the first year; $r = 0.767^{**}$ in the second year).

The slightly lower "r" values for the parasitoid compared with the scale insects suggests that these correlations may be affected by its endoparasitic behaviour and that it is less affected by weather whilst a larva within the scale.

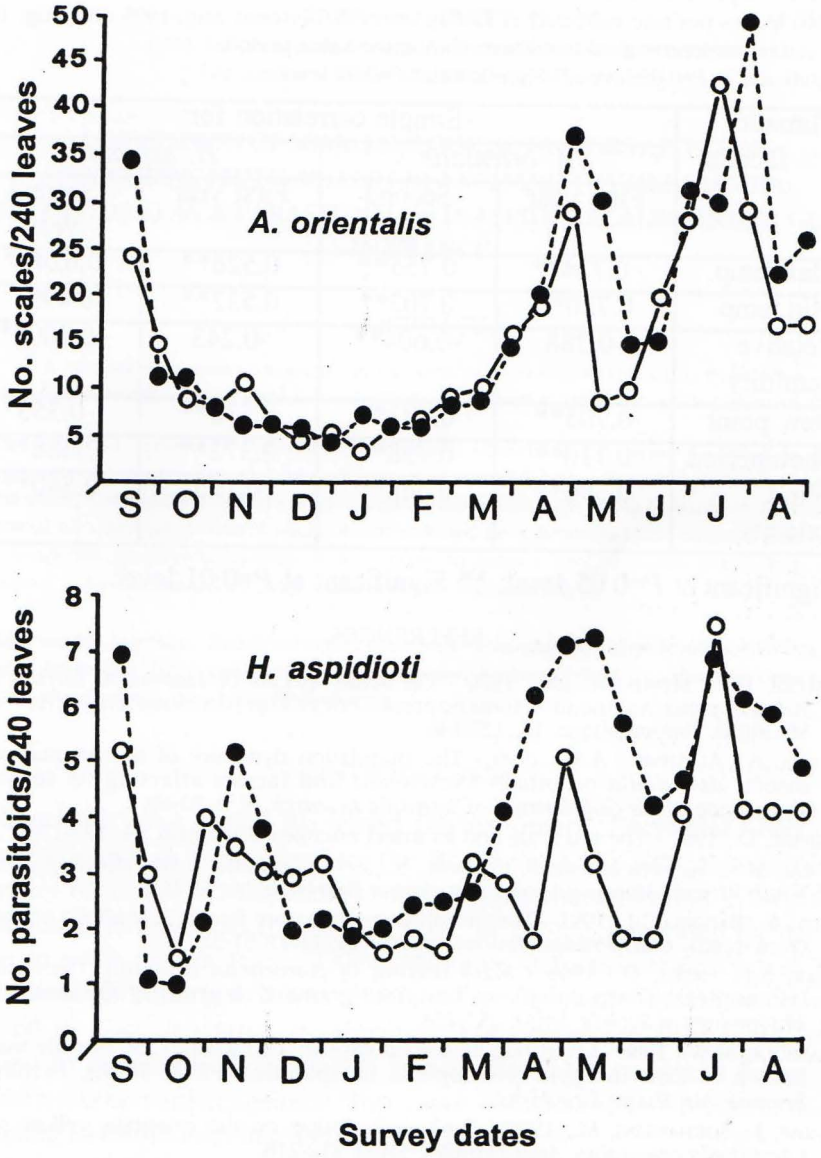

Fig. 2. Population densities of *A. orientalis* (in '000) and *H. aspidioti* (in '00) at fortnightly intervals between Aug. 1965 and Aug. 1997. Where -o- = data points for first 12 months and -•- = data points for second 12 months.

Table 1: simple correlations between the total number of *A. orientalis* and *H. aspidioti* on 240 leaves per tree collected at 15 day intervals between Aug. 1995 and Aug. 1997 and certain meteorological conditions during the same period.
* Significant at P=0.05 level; ** Significant at P=0.01 level.

Climatic factors	Simple correlation for:			
	A. orientalis		*H. aspidioti*	
	First year	Second year	First year	Second year
Max.temp.	0.724**	0.755**	0.526**	0.624**
Min.temp.	0.720**	0.703**	0.537**	0.499*
Relative humidity	-0.388	-0.604**	-0.243	-0.700**
Dew point	0.705**	0.573**	0.536**	0.353
Photoperiod	0.710**	0.738**	0.372**	0.688**
Wind velocity	0.590**	0.668**	0.195	0.540**

Significant at P=0.05 level; ** Significant at P=0.01 level.

REFERENCES

ANNECKE, D.P., MYNHARDT, J.M., 1970 - On some species of *Habrolepis foerster* and *Adelencyrtus* Ashmead (Hymenoptera: Encyrtidae) in Southern Africa and Mauritius. *Entomophaga*, 15: 127-148.

BADAWI, A., AL-AHMED, A.M., 1990 - The population dynamics of the oriental scale insect, *Aonidiella orientalis* (Newstead) and factors affecting its seasonal abundance. *Arab Gulf Journal of Scientific Research*, 8(3): 81-89.

COMPERE, D., 1961 - The red scale and its insect enemies. *Hilgardia*, 31: 173-178.

DANEAL, M.S., VAN DER MERWE, S., DE JAPER, K., 1994 - Sporadic scales affecting mango. *South African Mango-grower's Association Yearbook*, 14: 72-74.

DUTTA, S., BAGHEL, G.I., 1991 - The morphology of mature female *Aonidiella orientalis* (Newstead). *Uttar-Pradesh Journal of Zoology*, 11(1): 31-35.

ELDER, R.J., SMITH, D., 1995 - Mass rearing of *Aonidiella orientalis* (Newstead) (Homoptera: Diaspididae) on butternut-gramma. *Journal of the Australian Entomological Society*, 34(3): 253-254.

GHABBOUR, M.W., 1988 - Overbridging certain gaps in the classification of scale insects known to exist in Egypt (Homoptera: Diaspididae). Ph.D. Thesis, Faculty of Science, Ain Shams University.

KHALAF, J., SOKHANSANJ, M., 1993 - Biological studies on the orientalis yellow scale (*Aonidiella orientalis*). *Alon-Hanotes*, 51(5): 212-218.

MANI, M., KRISHNAMOORTHY, A., 1996 - *Aonidiella orientalis* (Newstead) (Diaspididae: Homoptera) and its natural enemies found on Sapota, ber, custard apple and banana. *Entomon*, 21(3-4): 273-274.

OFEK, G., HUBERMAN, G., YZHAR, Y., WYSOKI, M., KUZTIZKY, W., INBAL, Z., 1997 - The control of the oriental red scale, *Aonidiella orientalis* (Newstead) and the California red scale, *A. aurantii* (Maskell). *Applied Entomology and Phytopathology*, 60(1 & 2): 53-59.