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Ecological studies of two scale insects (Hemiptera, Coccoidea) on *Morus alba* in Egypt

Abstract - Population fluctuations and seasonal abundance of *Hemiberlesia lataniae* (Signoret), also of its parasite *Habrolepis aspidioti* Compere & Annecke, and of *Icerya seychellarum* (Westwood) on *Morus alba* were studied in Egypt (Giza governorate) during 1997-1998. Both *Hemiberlesia lataniae* and *Habrolepis aspidioti* had four population peaks during the year, while *I. seychellarum* had two peaks. *Hemiberlesia lataniae* was more abundant than *I. seychellarum.* The effects of climatic factors such as temperature, relative humidity, photoperiod, dew point and wind velocity are discussed.

Key words: *Hemiberlesia lataniae, Icerya seychellarum, Habrolepis aspidioti, Morus alba,* ecology.

INTRODUCTION

Mulberry leaves are the main food for the silkworm . The quantity and quality of the mulberry leave production directly affects production of silkworm cocoon (Zheng *et al.,* 1988). Scale insects and mealybugs recorded attacking *Morus alba* (mulberry) in Egypt were *Aonidiella aurantii* (Maskell), *Aspidiotus nerii* Bouché, *Asterolecanium pustulans* (Cockerell), *Chrysomphalus aonidum* (Linnaeus), *Hemiberlesia lataniae* (Signoret), *Ceroplastes floridensis* Comstock, *Icerya aegyptiaca* (Douglas), *Icerya seychellarum* (Westwood) and *Maconellicoccus hirsutus* (Green) (Hall, 1922;1923).

Hemiberlesia lataniae is one of the most important scale insects attacking fruit and ornamental trees in Egypt. It infests mulberry, fig, guava, pear, apple, grape, and olive (El Minshawy *et al.,* 1972). *Habrolepis aspidioti* Compere & Annecke appears to be the most common and effective parasite of *H. lataniae* (Blank *et al.,* 1999).

Damage caused by *Icerya* sp. was described by several authors. Siddpapji *et al.* (1984) described the damage caused by *Icerya aegyptiaca* (Douglas) on mulberry in India. Newberry (1980) described the interaction between *I. seychellarum* and its host *Euphorbia pyrifolia* on Aldabra Atoll. They mentioned that the scale formed thick encrustation on leaf midribs and around branches, extracted the sap from the leaves, phloem feeding removed water, carbohydrates and nitrogen. Excreted honeydew led to the development of sooty mould which can reduce light transmission by as much as 25 percent and thereby reduce photosynthesis (Teeder & Smith, 1976).
Our work was conducted with the aim of:

1) Contributing some of the needed information on the seasonal abundance of *H. lataniae* and its parasite and *I. seychellarum* on mulberry trees.
2) The establishment of precise information about the relation between the population density of two scale insects and the influence of the following factors: temperature, relative humidity, photoperiod, dew point, and wind velocity.

MATERIALS AND METHODS

Morus alba trees heavily infested with *H. lataniae* and *I. seychellarum.* located in Giza Governorate, were used for sampling; four trees of similar size, height and vigor were selected. The trees were not exposed to any chemical treatment before and during the investigation. Biweekly samples were taken from first of April 1997 to mid March 1998. Samples of five branches (15 cm. each) were picked up at random from each direction: a total of twenty branches per tree and 80 branches for each sample. The total number of live individuals in each sample was taken as the population index. Specimens were confined in glass jars kept in laboratory for securing emerging parasites. Records of meteorological factors, mainly temperature, relative humidity, photo-period, dew point, and wind velocity, were obtained from the nearest meteorological station. The daily records of these factors were grouped into half monthly averages to correspond with the insect samples. To investigate the effect of climatic factors, simple correlation test was applied to verify their influence.

RESULTS AND DISCUSSION

1 - Occurrence of Hemiberlesia lataniae *and its parasite* Habrolepis aspidioti

Abundance and fluctuation of *H. lataniae* during the time of inspection is illustrated in Fig.1. The total number of adult females, nymphs and parasites counted on the randomized samples during the study were 4592, 4660 and 1166 respectively. Four adult peaks were observed in the mid April (25.5°C, R.H. 64%), mid June (29.15° C, R.H.53%), mid August (31.8°C, R.H. 60%) and first of January(14.6° C, R.H.68%). Generations overlapped since all stages were encountered at any time of the year; this finding was supported by Hassanein & Hamed (1985) who recorded four distinct peaks for *H. lataniae* on *Ficus nitida* in Egypt.. First peak of nymphal stages occurred in the mid May (25.5° C, R.H. 64%) and then reached its maximum abundance in the second peak mid July (26° C, R.H. 68%). Third and fourth peak occurred in the mid October (27° C, R.H. 59%) and February (16° C, R.H. 77%). First peak for nymphal stages was observed in the mid April to form the peak for adults in mid June (2 months in between). The second peak for nymphal stages occurred in the mid July to give the second peak for adults in the mid August (one month in between). Third peak two months and half was observed between the peak of nymphs and adults (mid October

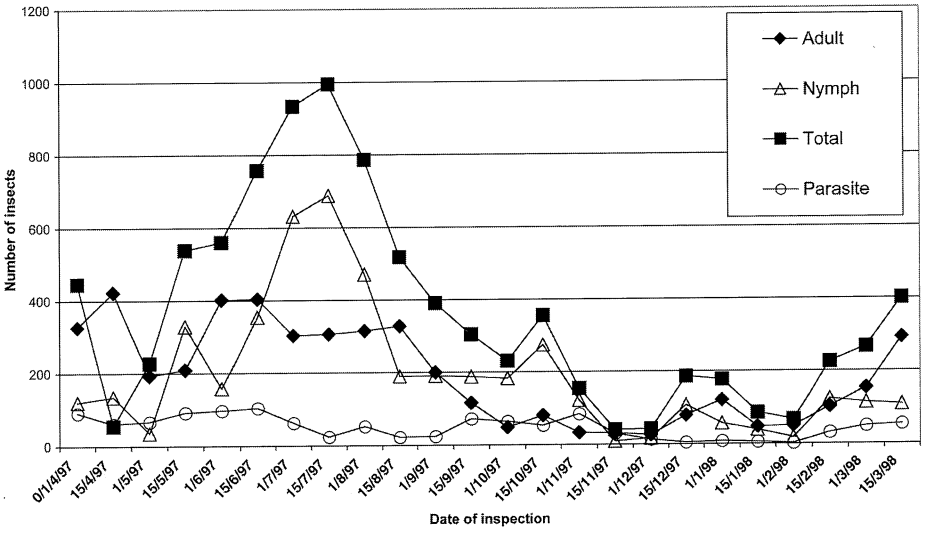

Fig. 1 - Population density of *H. latania* and *H. aspidioti* from April 1997 to March 1998.

and first of January). In case of fourth peak, it occurred in the mid February and mid April for nymphs and adults (2months in between). Our results agree with those obtained by Wang and Su (1989). They studied population fluctuations of the latania scale on grapevines in Taiwan. They indicated that crawlers increased in number with increasing temperature and day time, reaching a maximum number at 29°C.

2 - Rate of parasitism of Habrolepis aspidioti

Conserving the existing predators and parasitoids is valuable in preventing outbreaks of pests. Blank *et al.* (1999) recorded *H. aspidioti, Marietta picta* and *Aphytis sp.* as a parasitoid for *H. lataniae* in New Zealand, also they indicated that *H. aspidioti* was the most common and effective parasitoid. Accordingly, we studied the rate of parasitism for *H. aspidioti* (Fig. 2) which is the most important primary endoparasite of *H. lataniae* attacking mulberry trees in Egypt. The percentage of parasitism followed a curve with four peaks, first of May (29.39%), first of October (27.71%), mid November (75%) and first of March (18.35%) where temperature and relative humidity were respectively: 23.3° C, R.H. 54%, 23.3° C, R.H 59%, 20.7° C, R.H 65% and 16.6° C, R.H 67%. Our results agree with results obtained by Hassanein & Hamed (1985). Waite (1988) concluded that *H. lataniae* can be controlled by natural enemies in Queensland. He recorded the following parasitoids from *H. lataniae* attacking Avocado fruit: *Aphytis proclia* (Walker), *Encarsia citrina* (Craw) (Hymenoptera, Aphelinidae), *Signiphora flavella* Girault (Hymenoptera, Signiphoridae).

Concerning predators, during the time of investigation we found only *Scymnus*

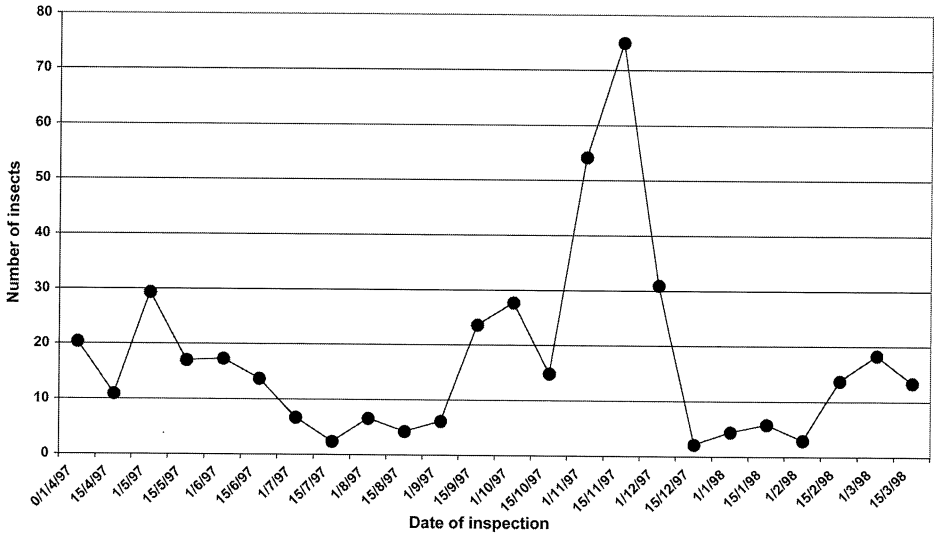

Fig. 2 - Rate of parasitism of *H. aspidioti* on *H. lataniae* from April 1997 to March 1998.

syriacus (Marseul) (Coleoptera, Coccinellidae) in the middle of May and a larva of *Cueta variegata* Klug (Neuroptera, Myrmeleonidae) in the first of June. On the other hand, Waite (1988) observed *Chrysopa spp.* (Neuroptera) and *Rhizobius satelles* (Blaisd.) (Coleoptera, Coccinellidae) feeding on *H. lataniae* in Queensland.

3 - Occurrence of Icerya seychellarum

The Seychelles fluted scale is a polyphagous species that attacks a wide variety of ornamentals, vegetable crops, fruit and forest trees. In Mauritius, this species is recorded from about 145 host plants (Mamet, 1948).

Abundance and fluctuation of *I. seychellarum* during the time of investigation (Fig.3) had two peaks in the first of June (23.85°C, R.H. 54%) and August (28.95° C, R.H. 68%) for immature stages. These were found mostly on the underside of the leaves along the main vein. The peaks for adults occurred in the mid June (29.15°C, R.H.53%), and first of October (23.25°C, R.H.59%). In Japan there was one generation per year (Clausen,1931). According to Bedford (1965) one generation/year occurs in South Africa and most stages are present throughout the year. Also he mentioned that the immature stages were most abundant during mid summer.

4 - Occurrence in relation to weather factors

Insects and parasites showed positive correlation to all climatic factors under test except with the relative humidity which showed negative correlation. Insects and parasites react in the same manner to these factors with different degree of significance. Significant correlation (0.487*) was observed between adults and the nymphal stages

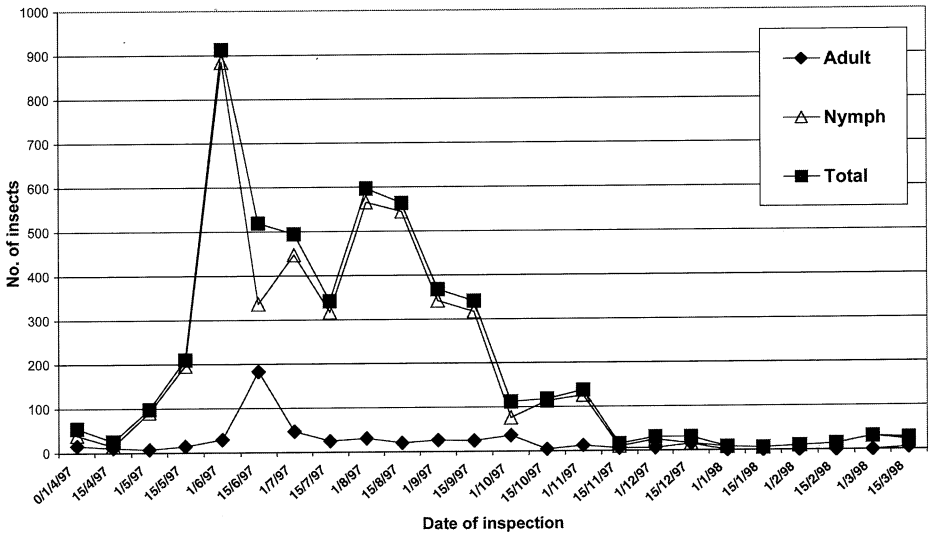

Fig. 3: Popuation density of I. seychellarum from April 1997 to March 1998.

of *H. lataniae.* With regard to correlation between adults *H. lataniae* and its parasites, a significant value was obtained (0.490*) while only slight positive correlation was noted for the nymphal stages (0.252). Concerning the correlation between *H. lataniae* and *I. seychellarum*, the r value was highly significant between adults (0.525 **) and significant (0.462*) for the nymphal stages.

Table 1 represents the population density of *H. lataniae,* its parasite *H. aspidioti* and *I. seychellarum* in correlation with certain climatic factors during the time of experiment.

Table 1 - Simple correlation between the population density of two scale species and one parasitoid and certain climatic factors.

Climatic Factors	Simple Correlation				
	H. lataniae		*H. aspidioti*	*I. seychellarum*	
	nymphs	adults		nymphs	adults
Max._Temp.	0.535**	0.668**	0.634**	0.626**	0.531**
Min._Temp.	0.577**	0.402*	0.285	0.764**	0.362
Relative humidity	-0.124	-0.357	-0.465*	-0.488*	-0.342
Dew point0.726**	0.367	0.311	0.665**	0.519**	
Photoperiod	0.751**	0.761**	0.507**	0621**	0.316
Wind velocity	0.19	0.647**	0.664**	0.528**	0.722**

* Significant at 0.05

** Significant at 0.01

Adults of *H. lataniae* showed highly significant positive correlation to maximum temperature and wind velocity, but negative correlation to relative humidity. The highest population occurred in the mid April where maximum and minimum temperature were 35°C and 16°C, while the relative humidity was 53 % and wind velocity 1.7m/Sec. The lowest population occurred in the first of December when maximum and minimum temperature and wind velocity were as follows: 22.9°C, 10.8°C, 58% and 1m/Sec respectively. Concerning nymphal stages, highly significant positive correlation was obtained between population and maximum temperature and slight positive correlation to wind velocity, while a negative correlation was noted to relative humidity. The highest population was observed in the mid July where maximum and minimum temperature, relative humidity and wind velocity were 31.4°C, 20,5°C, 60% and 1.8m/Sec. respectively. The lowest population occurred during the first of February when maximum and minimum temperature, relative humidity and wind velocity were 23.5°C, 10.2°C, 66.00% and 1.4m/Sec. These finding agree with those obtained by Wang & Su (1989) in Taiwan. They studied the effect of temperature on population parameters of Latania scale and found that the fecundity reached a maximum (138.9/female) at 27°C. The maximum rate of intrinsic increase (r), was at 27°C.

Adults of *I. seychellarum* showed highly significant positive correlation to maximum temperature and wind velocity, but a negative correlation to relative humidity. The highest population number occurred in the mid June where maximum and minimum temperature, relative humidity and wind velocity were 39.3°C, 19.0°C, 53% and 4.7m/Sec. No population was observed from the beginning of January to March, when the range of maximum and minimum temperature, relative humidity and wind velocity were 20.4°C-23.5°C, 8,8°C -11°C, 66%-77% and 1.1-1.7m/Sec. With regard to nymphal stages of *I. seychellarum,* data showed highly significant positive correlation to maximum and minimum temperature and wind velocity, while significant negative correlation was obtained between population and relative humidity. The highest population occurred in the first half of June, when maximum and minimum temperature, relative humidity and wind velocity were 34.0°C, 20.0°C, 54% and 4.1m/Sec. The lowest population number was observed in the mid January where maximum and minimum temperature, relative humidity and wind velocity were 20.4°C, 9.0°C, 68% and 1.3 m/Sec respectively.

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