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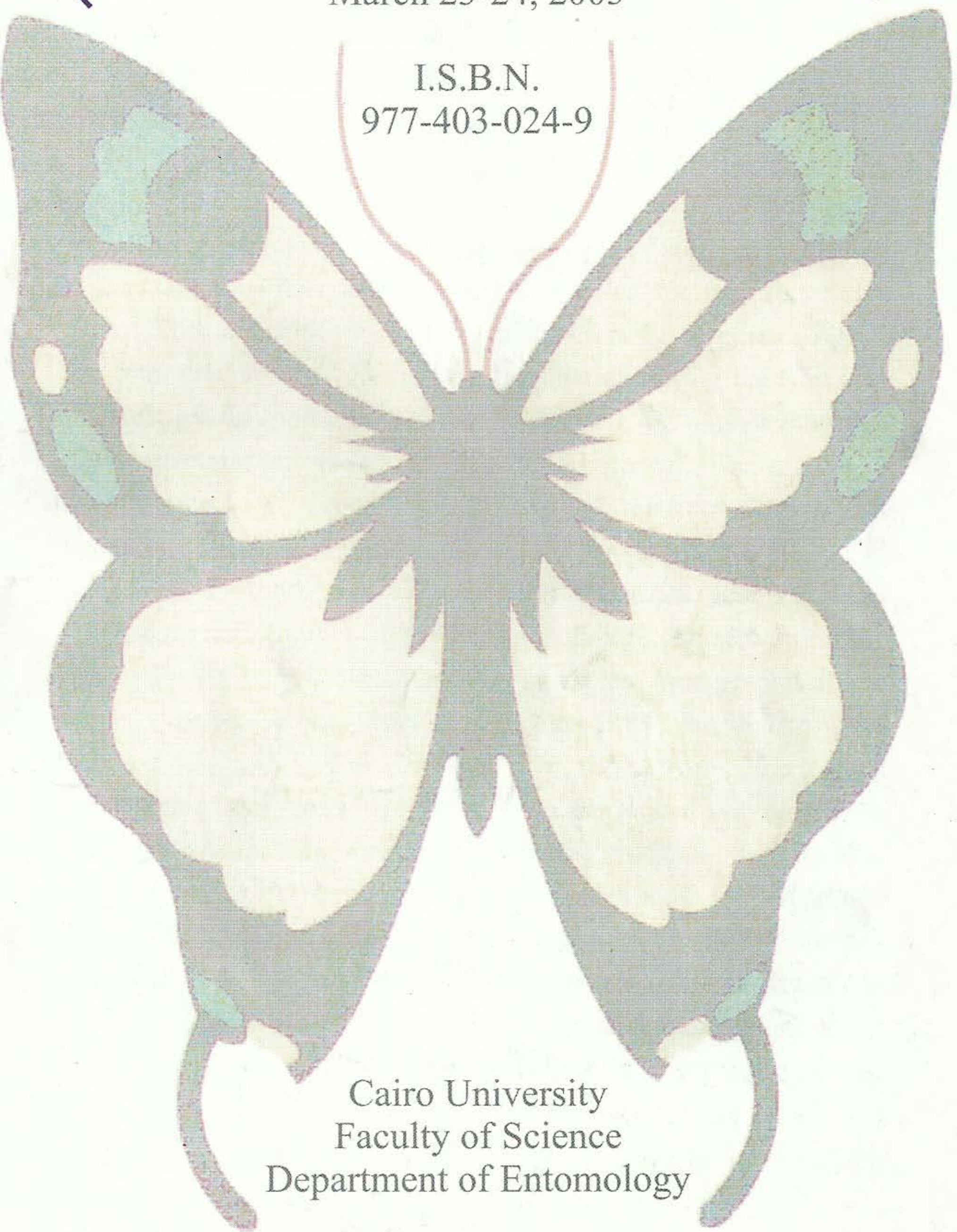

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POPULATION DYNAMICS OF THE BROWN SOFT SCALE, *COCCUS HESPERIDUM* ON *FICUS NITIDA* TREES IN GIZA GOVERNORATE, EGYPT

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ABSTRACT

The population dynamics of the brown soft scale *Coccus hesperidum* on *Ficus nitida* trees was studied for two successive years (1995 and 1996) at Dokki region, Giza Governorate, Egypt. The total density of *C. hesperidum* population during the first year of investigation (5832 individuals /30 leaves) was higher than that of the second year (3964 individuals /30 leaves). The composite age-structure of *C. hesperidum* on *Ficus nitida* trees showed that preadults, females and gravid females represented 76.28, 10.74 and 12.98% of the total population, respectively in the year 1995 and 81.07, 8.88 and 10.05% of the total population, respectively in the year 1996. Results declared that this insect has four generations in the year. Three and two peaks of abundance for C. *hesperidum* were recorded during the years 1995 and 1996, respectively. The highest abundance of the insect was recorded at the end of winter in both years of investigation, whereas the lowest abundance was recorded during the 1^{st} of February 1995 and the 1^{st} of August 1996. The rate of monthly variation in the population of *C. hesperidum* showed that the favorable time for the annual increase of most stages and the total population of this insect occurred in mid-August, the beginning of September and in mid-February. The regression and relationships between selected climatic factors and the total population of *C. hesperidum* on *Ficus nitida* trees were studied during the investigation period.

INTRODUCTION

Ornamental plants play an important role in the national economy of Egypt. They are locally used in ornamentation, extraction of perfume oils and medical ingredients, besides their great values in exportation to foreign markets in winter and spring seasons (Moussa, 1999). Ornamental plants are exposed during the growing season to various diseases, animals and insect pests which cause, in certain cases, a serious damage to such delicate and precious plants (Nour El Din, 1997).

Scale insects are important pests for ornamental plants in Egypt (Moussa, 1999 and Mesbah *et al.* 2001). Scales suck plant juices and inject toxic secretions into plant tissues. Soft scales secrete honeydew, which attracts ants and encourages the growth of sooty mold, a fungus that feeds on the honeydew (Gausman and Hart, 1974). The brown soft scale, *Coccus hesperidum* L. was considered as one of the most common and important scale insect attacking citrus trees and ornamental plants in Egypt since 1922 (Hall, 1922). This insect is involved in the transmission of the sooty mould *Capnodium citri* to orange orchards (Nath, 1973).

As far as we know from the available literature, detailed information on the population dynamics of *C. hesperidum* on ornamental plants of Egypt is lacking. So, the present work was carried out to clarify some ecological aspects of this insect in relation to *Ficus nitida* trees. The scope included determination of the seasonal abundance, number of generations, peaks and depressions as well as the age structure of this important pest in relation to different climatic conditions. Results obtained from this study may help in a better understanding of the problems caused by this insect and the implementation of control programs.

MATERIALS AND METHODS

A public garden at Dokki region, Giza Governorate south of Cairo, Egypt was selected for the present investigation. Four trees of the host plant (*Ficus nitida* Thunb & Hort) of similar size, shape, heights and homogenous in their infestation with *C. hesperidum* were selected. These trees were about twenty years old and with a height of 3 to 4 meters. The selected trees received the normal agricultural practice and didn't receive any chemical control treatments for several years ago and throughout the period of investigation.

Weather factors; mainly maximum, minimum and mean temperatures (^{o}C) and average percent relative humidity (% R.H.), were obtained from the nearest meteorological station at Giza and were considered as the field experimental conditions (fig. 1).

A regular half monthly sampling, starting from the first of January 1995 till the end of December 1996 was undertaken. Thirty infested leaves with C. *hesperidum* L. were picked randomly from all directions of each tree. Collected leaves were packed immediately after their collection in polyethylene bags (20x30 cm) with minute holes and transferred to the laboratory on the same day and examined by using a stereoscopic binocular microscope. Different stages of C. *hesperidum* were examined, and recorded. To determine the number of annual generations for *C. hesperidum* the percentage of preadults (nymphs) in the total insect recorded was estimated. The monthly sampling date at which the highest percentage of nymphs occurred represents the beginning of a new generation. The rate of monthly variation in the population (R.M.V.P.) was considered as an indicator for the favorable time for the increase or decrease of the insect population throughout the year. The rate of monthly variation in population was calculated as follows:

$$\text{R.M.V.P.} = \frac{\text{Average count given at a month}}{\text{Average count in the preceding month}}$$

Data was statistically analyzed according to Snedecor (1970).

RESULTS AND DISCUSSION

The fluctuation of the total population of the brown soft scale, *Coccus hesperidum* on 30 heavily infested leaves of *Ficus nitida* during the years 1995 & 1996 is illustrated in (fig. 2).

In general, the total density of *C. hesperidum* population on *F. nitida* trees during the first year of investigation (5832 individuals /30 leaves) was higher than that of the second year (3964 individuals /30 leaves). The highest abundance of the insect was recorded at the end of winter in both years of the investigation (the 1st of March 1995 and 1996 where 366 and 412 insects were recorded, respectively). The lowest abundance of the insect was recorded during the 1st of February 1995 (74 insects/30 leaves) and the 1st of August 1996 (15 insects/30 leaves). Three beaks and three depressions of abundance for C. *hesperidum* were recorded during the year 1995. The three beaks of abundance were observed in the 1st of March, the 1st of June and the 1st of December, whereas the three beaks of depressions were recorded during the 1st of February, 1st of May and 1st of August (fig. 2). In the 2nd year of study only two beaks of abundance were recorded during the 1st of March and 1st of November 1996. Low abundance of the insect was generally observed during summer and winter seasons of the year 1996. Two beaks of depressions were recorded in the 1st of February and 1st of August 1996. The data showed that this insect has [redacted] during 1995. These generations began in the 1st of April, the 1st of August, the 1st of October, and in the 1st of December. In the 2nd year of investigation 1996, the 1st annual generations began in the 1st

of March; the small population recorded in the 1st of June, mid-July and 1st of September were considered as the second generation. The third generation began in the 1st of November and the last (fourth) began in mid-December. These results disagree with what have been found by other researches. Smaragdova (1979) recorded, up to seven generations of *C. hesperidum* in USSR; Quayle (1941) recorded five generations in California. Hassan (1992) in Sharkia Governorate, Egypt reported three to five generations. Rubtsoy (1953) recorded three annual generations in Russia. While Evans (1942) in Australia; Öncuer and Tuncyureck (1975) in Turkey recorded only one generation. These variations in the number of annual generations of *C. hesperidum* may be due to the difference in habitats, host plants and/or the prevailing climatic conditions.

The rate of monthly variation (R.M.V.P.) in the total population showed that the favorable time for annual increase of *C. hesperidum* occurred in mid-February, mid-May and mid-August, 1995 (the R.M.V.P. values were 2.99, 1.38 and 1.26, respectively). In the 2nd year of investigation the favorable time for annual increase occurred in mid-February, mid-August and 1st of September (the R.M.V.P. values were 2.28, 2.27 and 2.15, respectively). In case of gravid females the favorable time for annual increase occurred in mid-August and mid-May, 1995 (the R.M.V.P. values were 6.67 and 3.80, respectively) and in mid-August, mid-September and 1st of January, 1996 (the R.M.V.P. values were 2.0, 2.0 and 1.53, respectively). The rate of monthly variation in adult females population showed that the favorable time for annual increase occurred in mid-September and mid-October, 1995 (the R.M.V.P. values were 2.5 and 1.57, respectively) and in the 1st of September, mid-November and mid- January, 1996 (the R.M.V.P. values were 3.5, 2.33 and 2.3, respectively). The rate of monthly variation of preadult population showed that the favorable time for annual increase occurred in mid-February and mid-May, 1995 (the R.M.V.P. values were 5.33 and 1.22, respectively) and in mid-February, mid-August and

1st of September (the R.M.V.P. values were 3.51, 2.42 and 2.21, respectively). We can conclude that the favorable time for annual increase of the total population as well as most stages of *C. hesperidum* occurred in mid-August, the beginning of September and in mid-February.

The composite age-structure of *C. hesperidum* on *F. nitida* trees (fig. 3) shows that preadults were the predominant stage. They represented 76.28 and 81.07% of the total population in 1995 and 1996, respectively. The highest percentages of preadults were recorded in August 1995 (95.08%) and December 1996 (97.41%), whereas the lowest percentages (41.18 and 45.83%) were recorded in January in the two years of investigation, respectively. Adult females were represented by 10.74% and 8.88% in both years of investigation, respectively. The highest percentage of adult females was recorded in the 1st of February during both years of investigation (35.14 and 29.31%, respectively), whereas the lowest percentages were recorded in the 1st of September 1995 (2.26%) and mid-December 1996 (0.86%). Gravid females were represented by 12.98% and 10.05% during the two years of study, respectively. The highest percentage of gravid females was recorded in the 1st of January during both years of investigation (47.71 and 45.83%, respectively), whereas the lowest percentages were recorded in the 1st of April 1995 (0.8%) and mid-December 1996 (1.72%).

The simple correlation and regression coefficient between the bimonthly counts of *C. hesperidum* and selected climatic factors are presented in table (1). In the 1st year of investigation, a significant positive relationship was found between the estimated population density of *C. hesperidum* and each of the day maximum temperature and the percentage daily relative humidity ($r = 0.206$ and 0.016, respectively). A insignificant negative correlation and regression was found between the total population of *C. hesperidum* and the night minimum temperature in both years of investigation ($r = -0.123$ and -0.596, respectively). In the second year of investigation, the simple correlation indicated a positive non significant relation between the total population of C. *hesperidum* and the day maximum temperature and. the daily mean relative humidity. The combined effect of the three climatic factors on the total population of the insect was insignificant during both years of investigation. It seems that the effect of weather factors on the populations of scale insects varies according to the insect species, the host plant and or other environmental conditions. In our study a positive correlation was found between the %R.H and *C. hesperidum* population. A positive correlation between the green shield scale *Chloropulvinaria psidii* and %R.H. was also reported by Moursi *et al.* (2003), whereas Moussa (1999) found a negative correlation between % R.H. and the dictyospermum scale, *Chrysomphalus dictyospermi* on *F. nitida* . In another study El-Imery (1999) found negative and positive correlation between the %R.H. and the populations of the fig scale *Russellaspis pustulans* on fig and apple trees in two successive years. As far as we know from the available literature, the population dynamic of C. *hesperidum* has not been thoroughly studied before in Egypt. This study could be a starting point in this direction and hopefully would serve in future studies.

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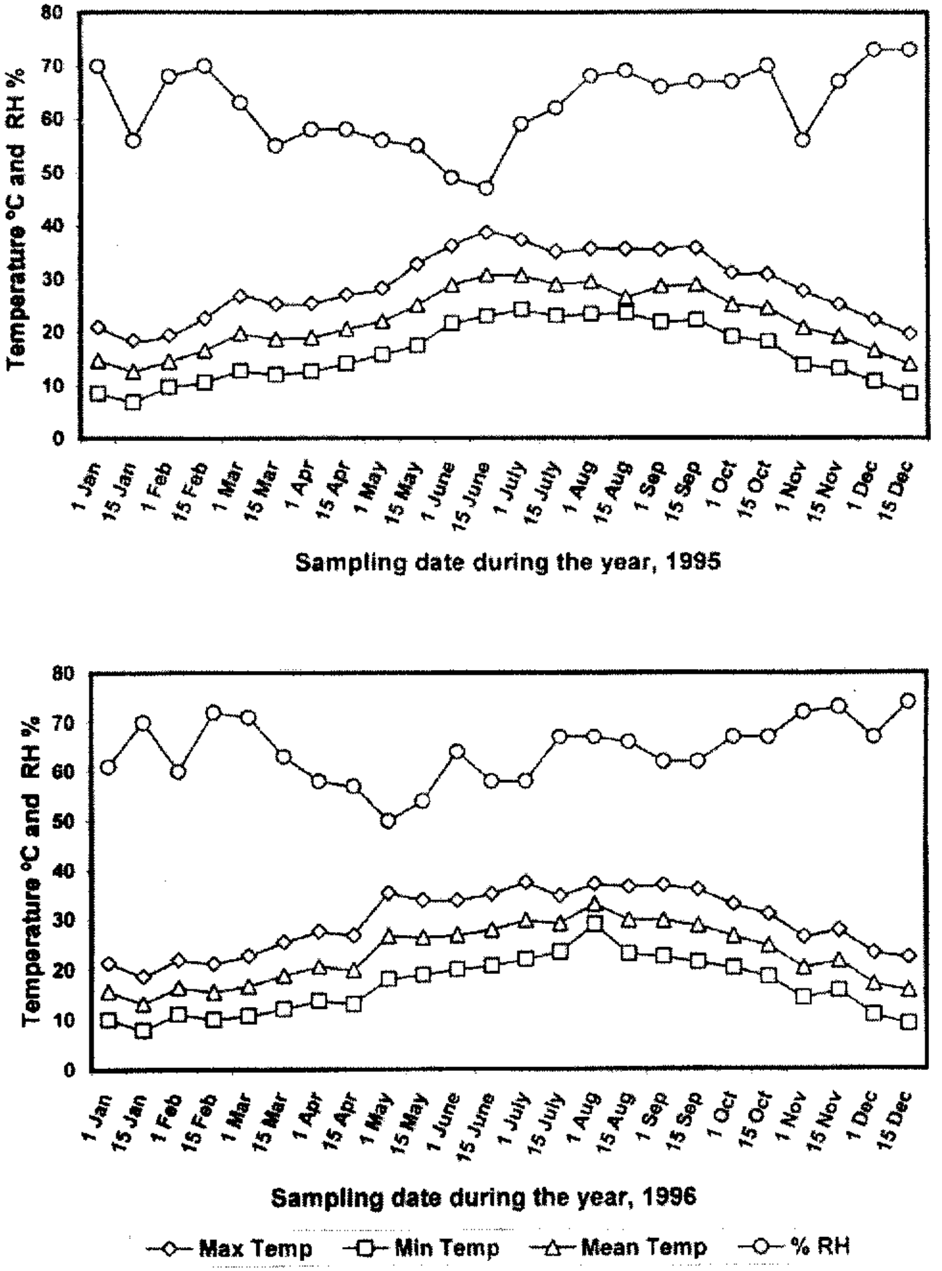

Fig. 1: Temperature °C and RH % of Giza governorate, Egypt during the study period

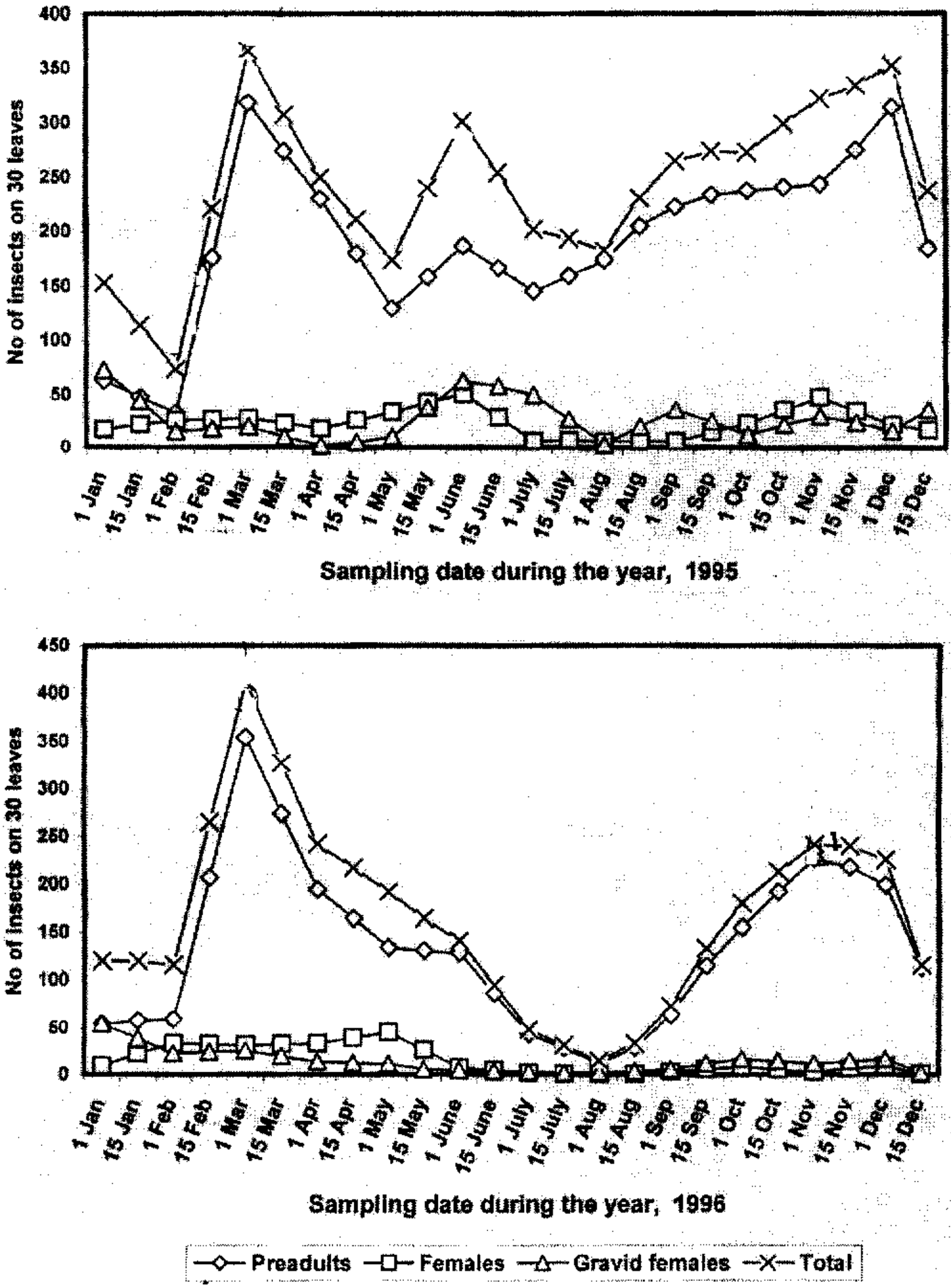

Fig. 2: Bimonthly counts of *Coccus hesperidum* on *Ficus nitida* trees at Giza Governorate, Egypt

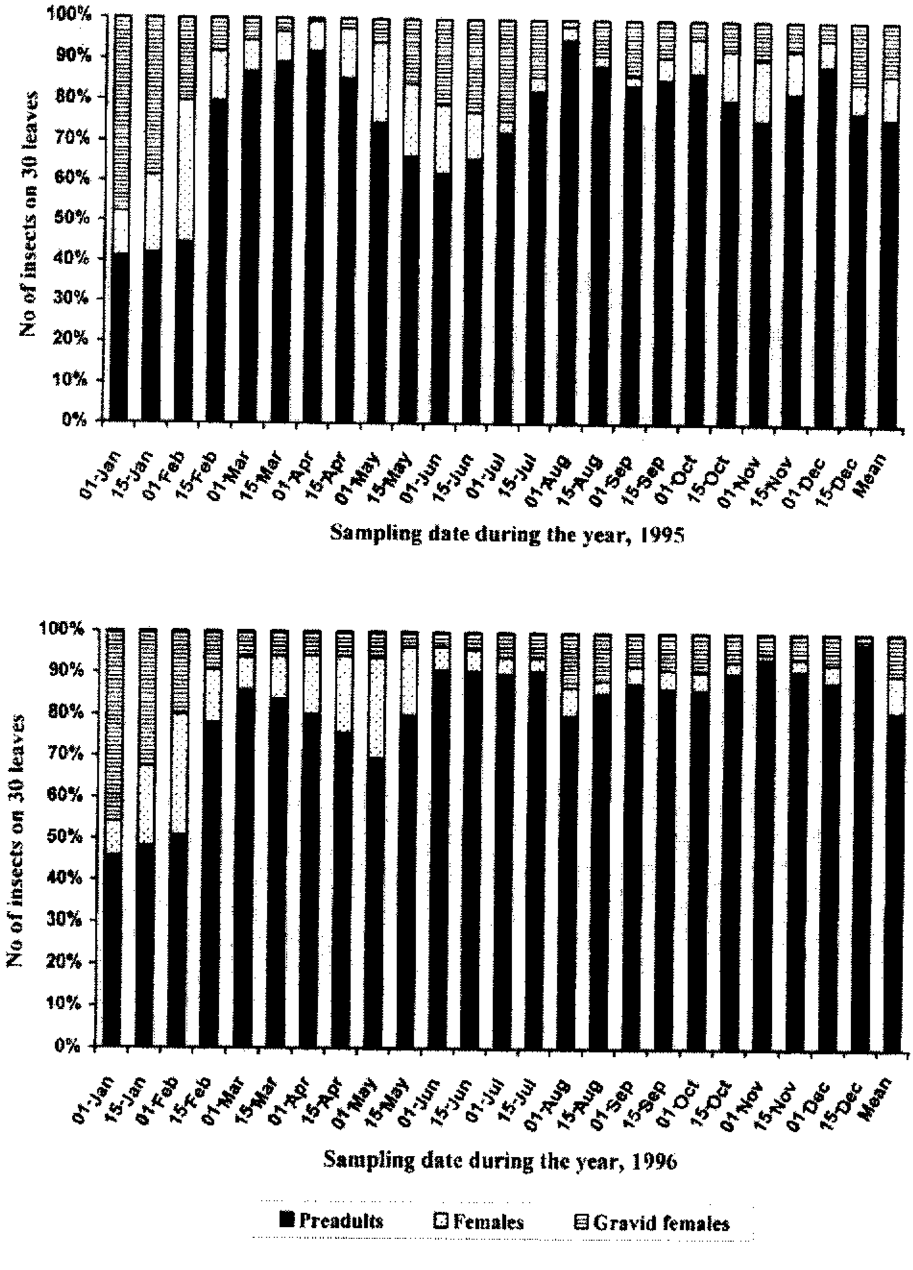

Fig. 3: Age structure of *Coccus hesperidum* on *Ficus nitida* trees at Giza Governorate, Egypt.