Pak. J. Biotechnol. VOL 15 (2) 535-540 (2018) ISSN Print: 1812-1837
www.pjbt.org ISSN Online: 2312-7791

CORRELATION BETWEEN PREDATOR GREEN LACEWING *CHRYSOPERLA CARNEA* (STEPHENS,1836) AND SEASONAL PRESENCE OF JASMINE WHITEFLY *ALEUROCLAVA JASMINI*TAKAHASHI IN SOME CITRUS SPEACIES.

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Article received 21.4.2018, Revised 13.6.2018, Accepted 20.6.2018

ABSTRACT

Seasonal presence of jasmine whitefly *Aleuroclava jasmini* Takahashi correlated to the predator *Chrysoperla carnea* **(**Stephens**)** were studied in 25000m² citrus of orchard (citrus, orange and clementine) During March 2014 to September 2015 at An Numaniyah city south of Iraq. The population density of jasmine whitefly showed a significant deference between the upper and lower height rate of trees125.1 and 90.8 nymph/1 cm^2 leaf area, respectively. Statistical analyses showed highest population density rate on orange trees was 139.3 nymph/1 cm^2 leaf area followed by citrus and clementine with 104.5 and 80.0 nymph/1 cm^2, respectively. For the interaction, the highest population density rate was registered on orange with 164.4 nymph/1 cm^2 at the lower height level. Effect of host correlated to season, orange registered the highest population density rates comparison citrus species with 214.4, 164.0 and 125.9 nymph/1 cm^2. Compared to other seasons, population density rates were the highest in summer season with 281.9, 128.3 and 101.5 nymph/1 cm^2. In addition, orange registered the highest population density rate comparison to other citrus species at summer season. The distribution of jasmine whitefly through the year, registered Population density 55, 25 and 20% respectively on summer autumn and spring seasons. The two insects were correlated in positive relationship. The lacewing population density reflected during the study period. The predator showed an obvious increase when scored 50.8 egg/ 160 leaves in March. Then the highest lacewing rate was registered in July with 250.6 egg per 160 citrus leaves. When jasmine whitefly population density decreased, the rate started to decrease and scoring 30.9 egg/160 leaves in November.

INTRODUCTION

Citrus are grown naturally in tropical zone due to their economic and nutritional importance. to contain its fruits low carbohydrates, proteins, lipids, high percentages of vitamins especially C, B1, B2, A and organic acids including citric acid. Citrus include high inorganic nutrients contents such as K, Ca, Fe, Mn, Na, S and P. (Al-Jumaili and Al-Dujaili,1989). Citrus trees are attacked by many pests including different insects like scale insects, coccids, aphids, Mediterranean fruit fly, whitefly and *Agrotes spp.* (Katsoyannos,1996). Damages caused by whitefly adults and nymphs occur through feeding and honeydew excreting on leaf surfaces which enables microorganism growth and dust buildup and inhibits photosynthesis. Moreover, the toxic effect of whitefly saliva results in leaf yellowing and drop. Further damage occurred through virus transmission by whitefly (Al-Azawi et al., 1990, Vanlentere and Noldus, 1990, Abboud, 2006, yrne and Bellows, 1991, loannou, Oliveira et al., 1994, Papayiannis et al., 2008). Many whitefly species have been reported o citrus in Iraq, including *Bemisia `afer* (Priesner and Hosny), *B. jasmine* (Gennadius), *Siphoninus phillyreae* (Haliday), *Trialeurodes rara* Singh, *T. ricini* (Misro) and *T. vaporariorum* (Westwood) (Al-Malo,1988). The whitefly *Aleuroclava jasmine* was reported on Pikake plant in Florida but without remarks at its economic important (Leonhardt and Taves,2002). In Iraq, many studies indicated that the highest population density rate of whitefly nymph instars on orange and clementine trees was from July to October. As well, temperature differences between summer and winter in Iraq have a great effect on whitefly eggs and instars. Most studies focused on whitefly population density on orange and clementine because they were the most infested among other citrus species in Baghdad (Al-shammary, 2004). Khalaf et al., (2010) indicted *A.jasmini* the highest population density rate on clementine followed by orange compared to other trees in citrus orchards in south of Baghdad, In July 2001, many citrus orchards in different provinces; Baghdad, Diyala, Saladin, Karbala, Babel and Wasit, have suffered an outbreak of *A. jasmini* , resulted in severe losses of citrus production. Since 2001, *A. jasmini* control has been a great challenge due to the limited studies regarding behavioral nature and life cycle of this pestin Iraq and neighboring countries of the Middle East. This study, event to estimate the population density of jasmine whitefly on citrus trees, its correlation to population density and predation efficacy of the green lacewing *Chrysoperla carnea* (Stephens) and the possi-

bility to use this pest to control within IPM program of citrus mealybug in Iraq.

MATERIALS AND METHODS

A sampling program done according to Diehl et al., (1997). The survey of whitefly infestation was performed in 25000 Square meters citrus orchard located at Numaniyah city south of Iraq. Three citrus species, orange *Citrussinensis* L., *C. aurantium* L. and *C. reticulata* were included for the whitefly survey. Five trees for each species randomly selected were used as replicates for the period from March to December 2015. Data were registered 4 times in a month each 7days. Sampling procedure was collected by dividing each tree into two levels lower and upper (1.5 m from the ground) levels and four directions (east, west, south and north). Leaf samples (four leaves each) were collected randomly from each direction (The total number of leaves collected was 32 and 160 for single tree and species, respectively) for the period from 1st of March 2014 to 28th of February 2015. Leaf samples collected were kept in paper bags and labeled based on tree number, level and direction, transferred to laboratory and examined under light microscope. Nymph number was calculated in 1 cm^2 leaf area. The Presence of green lacewing accompanied with the pest was calculated through number of eggs, larva and adults. The whitefly and green lacewing species were identified by Iraqi Natural History Museum at University of Baghdad. Temperature and relative humidity measured by the weather forecasting station during the study were recorded.

RESULT AND DISCUSSION

1- Population density of jasmine white fly *A. jasmini* on citrus species: Table 1 results showed significant difference in population density of this insect and it was the most influential in the Lower height compared with the up height with average of 125.1 and 90.8 nymph/ 1 cm^2 respectively. The orange species was greater compared with the clementine and citrus species with average reached 104.5, 139.3 and 80.0 nymph/1cm^2 respectively. Interaction results showed significant differrence and the orange with Lower height treatment was greater compared with the other treatments and reached 164.4 nymph/1 cm^2. These results agree with (Al-shammary, 2004, Khalaf et al., 2010, Manjy, 2015). The freshness and low orange leaves thickness and their high content of Saccharides, Proteins and Carbohydrates, besides that the cuticle in orange tree leaves was less thickness than citrus and clementine leaves (Ko,2001). While Salinas (1994) mentioned that this insect has different population density on citrus trees and the relative humidity has negative effects on adult insect density and number of lay eggs. The Lower level is preferred in orange followed by clementine and citrus due to that the physiological egg development is delayed to long and it passes long dormancy time, and from field observations and weekly registered, the adult insects were seen in 17/3/2014 and the insect eggs on the new leaves in 7/4/2014 and the first nymphet stage in 5/5/ 2012. These results were agreed with results of (Uygun et al.,1990) through registration and cyclic test of nymphs presence in citrus groves in Turkey, and also they agreed in *A. jasmine* insect distribution on different citrus trees with their levels, variance of the ecological system from area to area , and of timing of insect appearance which were very important to control this insect during studies of insect by (Rodriguez, 2008, Mckenzie, 2008, Minaeimoghadam, 2008).There was no agreement between our results and (Waston,2007) results in survey on orange trees that were planted in San Diego District in USA, due to planting, care and using the chemical insecticide in control of this insect. Collecting huge numbers of cotton white fly (*Bemisia tabaci*) on 60 cm height with significant greater on 120 cm height beside high effects of distribution and density of white fly insect on new branches and new young leaves which are more convenient in adult nutrition and lay eggs (Atakan and Canhilal, 2004).

Table 1: Population density of jasmine white fly *Aleuroclava jasmini* in the up and Lower heights on citrus kinds (citrus, orange and clementine).

Height			Host
Average	lower	upper	
80.0	91.8	68.3	C. aurantium
104.5	119.1	89.9	C. reticulata
139.3	164.4	114.2	Citrus sinensis
	125.1	90.8	Average

LSD.05 Host= 19.70, LSD.05 Height = 16.09, LSD. 05 interactions = 27.86

2- population density of *A. jasmini* in different seasons on citrus species: Result in table -2 showed significant difference and the orange species was greater on the other species through effect on host and its correlation with season in averages 214.4, 164.0 and 125.9 nymph/ 1 cm^2 respectively. The results showed presence significant difference and orange was greater in summer season in average of 328.5 nymph/ 1 cm^2. it was shown that increase of Jasmine white fly (*A. jasmini*) population density in the Lower level was in its high densities in July due to generation

of adults in this period in which convenient temperature and moisture were present with presence of host which prefers orange firstly clementine and then Citrus in less extent. This may be due to presence of shade and high moisture at Lower level of citrus trees and this in turn stimulates adults to lay eggs in high densities. These results agreed with results of Al-shammary (2004) and Khalaf et al., (2010) and results of pal (1975) and Salinas and Sumalde (1994) who indicated that *Dialeurodes citri* begins the activity from middle of February untill middle of November in interacted generation and the most adult's presence was in February, April, July and August in India. These results did not agree with Mora (1987) who mentioned that adults appearance and eggs lay of citrus white fly *D. citri* on orange depend mainly on the length of convenient season time and presence of soft twigs at which insect reached its maximum numbers during May month and its dispersing to nymphs from (third and fourth age) and the adults appear in at end of February and start of March (Michalopolus, 1989). Walker and Aitken (1993) mentioned that the highest eggs lay average was during Decem-ber, January, April, July and September and eggs density is affected by sun rays which limit eggs incubation period.

Table 2- Population density of Jasmine white fly *Aleuroclava jasmini* in different seasons of the year on citrus kinds (Orange, Clementine and Citrus).

average	Season			Host
	Autumn	Summer	Spring	
125.9	88.3	224.0	65.5	C. aurantium
164.0	124.7	271.9	95.6	C. reticulata
214.4	171.9	328.5	142.8	Citrus sinensis
	128.3	271.8	101.3	Average

LSD.05 host= 20.93, LSD.05 seasons= 20.93, LSD.05 interactions = 36.25

Figure 1 shows distribution of Jasmine white fly nymphs in different seasons in which they preferred summer season and reached 55% ratio of insect population, while they were 20% and 25% in spring Autumn seasons respectively. These results agree with results of Fasulo and Weems (2002) in their study on field population density of this insect who reported that dispersing the insect is as nymphs and the pupa appear in start of spring and followed by adults which laing eggs on the new vegetative parts , and the distribution of *A. jasmini* insect and its wide spread on different citrus trees, environmental system , and timing of insect appearance in the suitable times which are very important in controlling the insect where the insect community is affected by the atmospheric condition and it declines gradually in Autumn (Minaeimoghadam et al., 2008). Did not agree with our results where the insect has different population levels on citrus and it caused high population expansion in citrus planting regions in Autumn season and its community is not affected by the atmospheric condition such as decline of temperature, relative humidity and sun rays that were not sharp in these months

(Macleod, 2001, Luo and Zhou,2002).

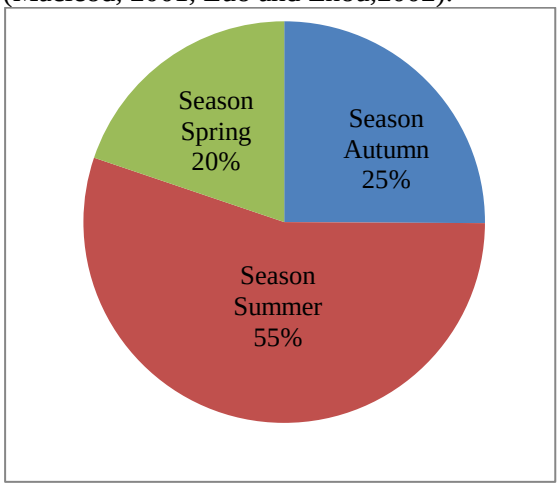

Figure 1: Distribution of jasmine white fly *A. jasmini* on citrus in the study period.

3- population density of *Chrysoperla carnea* (Stephens) on citrus species: Table 1 & 2 showed that jasmine white fly insect *A. jasmine* had highest population density in the up and Lower heights on orange trees , and it is shown in figure 3 that the predacious *Chrysoperla carnea* was present during this study period on orange trees in the up and Lower heights on the infected orange trees by insect *A. jasmine* and had connection with the trees with wavering population density, and its numbers start increase from March month due moderation temperature and relative humidity, this increase goes on and connected with increase of numbers of the jasmine white fly insect in Autumn and Summer months until end of autumn. It can be noticed that the predacious started to increase in spring months in average of (50.8 egg/160 citrus leaves) in March month to reach its maximum in summer month in average of (250.6 egg/160 citrus leaves) in July month while, in Autumn months the predacious numbers started to decline with decreasing number of insect in average of (195.25 egg/160 citrus leaves) in August month and egg of the predacious continue to

gradual decline and reached its lowest levels in Autumn months (30.9 egg /160 citrus leaf) and the insect stayed at very low levels , These results agree with results of (Khuram et al., 2008, Shi et al., 2010, Sultan and Khan, 2014) who reported that the predacious green lacewing (*Chrysoperla spp.*) has high population density in summer months due to connection With the insects of Whiteflies from the family Aleyrodidae and that its density decreased significantly in the Autumn months. The predator *Chrysoperla carnea* (Steph.) has a high population density during the Spring months in its different stages. Its population density reached 157.5 eggs / 100 citrus leaves and its population density remained vibrate during the Summer months, Autumn and Winter (Legaspi et al., 1996, Senior et al., 1998, Atlihan et al., 2004, Elekcioglu and Senal, 2007).

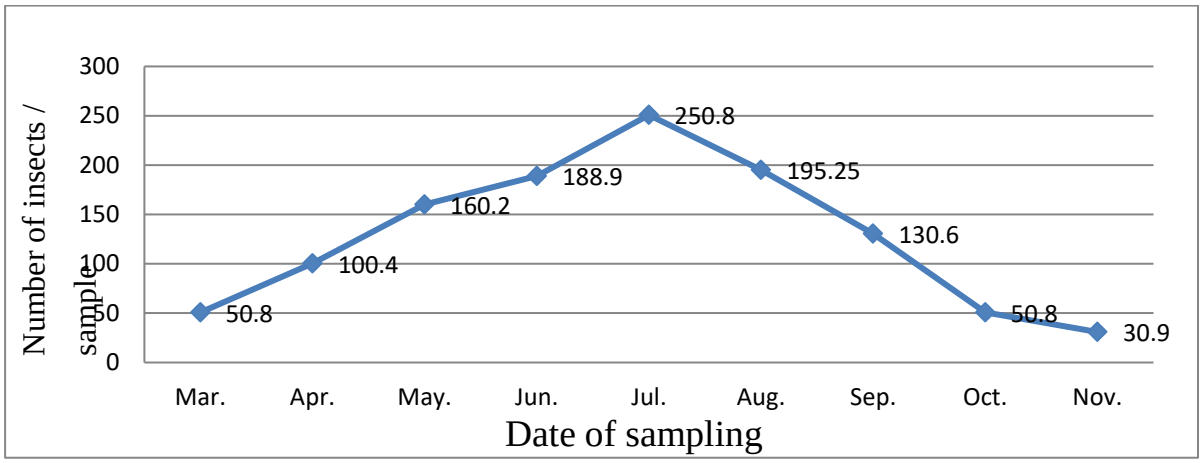

Figure 3: Population densities of predators *C. carnea* (Stephens) during the study period.

Result figure 4 showed there is appositive relation for this predacious efficiency with *A. jasmini* insect and other pests, adaptability to the most Agrosystem, easy breading on wide range. This quality enables us to put it in IPM program to the Millibuqs after preventing and preening it in Iraq environment, especially from the extreme and randomity using of insecticide in peak population.

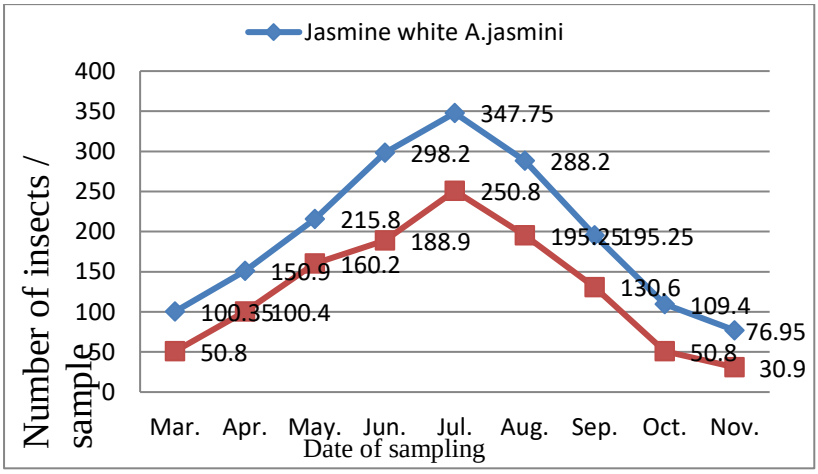

Figure 4: White jasmine insect *A. jasmini* associated with the predator *C. carnea*.

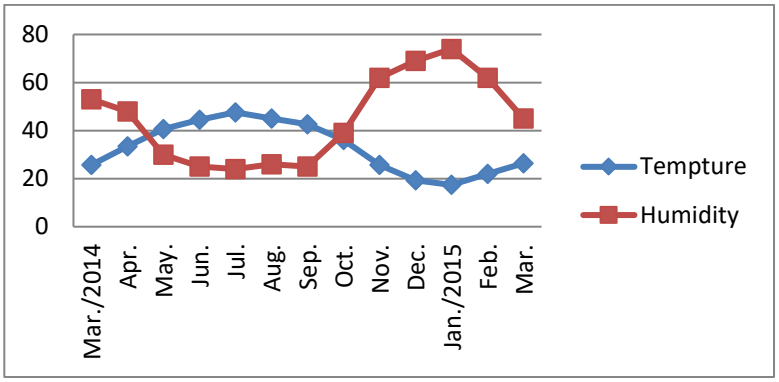

Figure 5: Temperature and relative humidity in an Numaniyah city in Wasit province during the period of study 2014-2015.

Acknowledgments

Especial thank to Haneen, S.H. and A.A.F. Hamodi and Muna A.Alrawi

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