Seasonal Abundance of *Icerya aegyptiaca* (Douglas) on Mandarin Trees and its Associated Predators at Giza Governorate

Samah M. Y. Helmy*

Plant Protection Research Institute, Agricultural Research Center, Giza, Egypt

INTRODUCTION

Citrus fruit is the leading exportable agricultural product of Egypt and is an important source of national income. Citrus cultivation area represents about 29% of the total fruit area, Egypt ranking as the sixth biggest producer of orange throughout the world. There are different citrus varieties cultivated in Egypt like orange, mandarin, lime, lemon, grapefruit and sour orange. Mandarins *Citrus reticulata* Blanco (Rutaceae) is the second largest cultivated after sweet orange. The total cultivated area reaches to 47646 ha produced 982790 t. (Waleed, 2019). The Egyptian mealybug *Icerya aegyptiaca* (Douglas) (Coccoidea : Monophlebidae) is a highly polyphagous and widespread scale insect. It is known to feed on 123 species of plants belonging to 49 plant families, it was causing immense injury to fruit trees. *I. aegyptiaca* can cause cosmetic damage when its abundant white wax covers leaf surfaces. When population densities are high, *I. aegyptiaca* may induce leaf drop symptoms and in some cases, dieback of the branches and the entire plant. Little to no honeydew is produced by the insect; thus, *I. aegyptiaca* is rarely associated with sooty mould. *I. aegyptiaca* has the tendency to cause outbreaks in areas with little wind flow, such as the inner areas of bushes (Usato, et al. 2010). Predators are a major component of natural control and integrated pest management programs of scale insects. Scales are often controlled by predators as beetles, lacewings and mites. The ladybird beetle, *Rodolia cardinalis* (Mulsant) (Coleoptera: Coccinellidae) is a specialist predator that has a very restricted prey range, one that is probably limited to the family Monophlebidae and possibly the tribe Iceryini (Hoddle,2010). Hamed and Saad (1989) observed the coccinellid *R. Cardinalis*, adapting its known feeding habit from *I. aegyptiaca*, on the Citrus.

The green lacewing, *Chrysoperla carnea* (Steph.) (Neuroptera: Chrysopidae), is a generalist predator in its larval stage of most species of soft bodied insect pests, especially aphids, whiteflies, coccids and mealy bugs (Alghamdi, et. al, 2018). Considering the climatic changes that we are witnessing at the present time; it is necessary to know their impact on the seasonal abundance of insect and the associated natural enemies to determine control programs.

Therefore, the objective of the present work has aimed to study the Seasonal abundance of *I. aegyptiaca* attacking mandarin orchards and its associated predatory insects, also investigate the effect of some weather factors on Seasonal abundance of the different instar stages of *I. aegyptiaca* and its associated predatory. Also, study evaluate the biotic and abiotic factors on the seasonal abundance of the different instar stages *I. aegyptiaca*.

MATERIALS AND METHODS

The present studies were carried out in Giza Governorate to evaluate the seasonal abundance of *I. aegyptiaca* attacking mandarin trees *Citrus reticulata* Blanco and its associated predators during the two successive years 2016-2017. Five trees of the same age and size from mandarin orchards were chosen and use as replications (No insecticides were applied during two years of investigation).

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* Corresponding author.
E-mail address: samah.yassien407@gmail.com
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Samples were collected every 14 days during the two successive years from the beginning of January 2016 till December 2017. Each sample consisted of 100 leaves were randomly collected (20 leaves from each tree for the four directions and middle of each tree). The collected leaves were taken to the laboratory in polyethylene bags for investigation the Egyptian mealybug specie and its associated predators. The population of I. aegyptiaca per each sample was sorted into their developmental stages (nymphs, adult females and ovipositing females) and its predators were counted. The predators which observed on each sample in spot close to colonies of I. aegyptiaca were collected by an aspirator and counted.

Also, the seasonal abundance of the two associated predators during two years of investigation were studied.

To study the role of the main weather factors, i.e. temperature and relative humidity on the seasonal abundance of the insect pest and its predators, the temperature and relative humidity were obtained for Giza Governorate from the Egypt-Weather Underground https://www.wunderground.com/global/EG.html.

The biweekly maximum and minimum temperatures as well as relative humidity and total number of predators were calculated.

Multiple regressions were conducted for weather factors combined as well as abiotic factors and population of the different instars stage I. aegyptiaca described. The obtained determination factor (R²) of E.V. % was used to explain the effect of testing factors. Process Correlation and Regression were used in SAS to analysis the obtained data (SAS Instue.1998).

RESULTS AND DISCUSSION

Seasonal abundance of the different instars stage Icerya aegyptiaca on mandarin trees:

Data presented in Fig. (1), showed that nymphs, adult females, ovipositing females and the total population of I. aegyptiaca recorded three peaks on mandarin trees during the first year 2016. The peaks of nymphs recorded on the 15th of May (153 indiv.), the 1st of August (198 indiv.) and the 15th of November (121 indiv./100 leaves). The peaks of adult females recorded on the 1st of June (118 indiv.), the 15th of August (116 indiv.) and the 1st of December (112 indiv.). The peaks of ovipositing females recorded on the 15th of June (48 indiv.), the 1st of September (54 indiv.) and the 1st of December (58 indiv.). The peaks of total population recorded on the 1st of June (292 indiv.), the 15th of August (352 indiv.) and the 1st of December (282 indiv./100 leaves).

The obtained results in Fig. (2), cleared that, nymphs, adult females, ovipositing females and the total population of I. aegyptiaca recorded three peaks on mandarin trees during the second year 2017. The peaks of nymphs recorded on the 15th of May (149 indiv.), the 1st of August (194 indiv.) and the 15th of November (117 indiv./ 100 leaves). The peaks of adult females assured on the 1st of June (114 indiv.), 15th of August (112 indiv.) and 1st of December (108 indiv./ 100 leaves). The peaks of ovipositing females recorded on the 15th of June (44 indiv.), the 1st of September (50 indiv.) and the 15th of December (42 indiv./ 100 leaves). The peaks of total population recorded on 1st of June (280 indiv.), the 1st of December (260 indiv./ 100 leaves).

As a conclusion, nymphs, adult females, ovipositing females and the total population of I. aegyptiaca occurred on June, August and December. Also, the highest peak for I. aegyptiaca occurred in 15th August 2016 and 2017.
during the two successive years of study. The present findings are in accordance with those obtained by Ghanim, et al. (2013) showed I. aegyptiaca attacking mandarin trees in Mansoura recorded three peaks in October, June and September during 2011-2012.

Also, the highest peak recorded in the 15th of September during the two successive years of study. Awadalla and Ghanim (2016) mentioned that I. aegyptiaca had 2 peaks November and June in the first year on mango trees in Mansoura district, while, recorded three peaks in November, June and September in the second year. The highest average number of I. aegyptiaca were recorded in Autumn. Nébié, et al. (2016) mentioned that I. aegyptiaca on Mango trees recorded three abundance peaks in July, September and May. Moursi, et.al. (2013) recorded three peaks of Icerya purchasi on Mandarin was from February and April and June in the first year. in June, July and September in the second year. Icerya seychellarum observed with Mandarin in May. These results differ with those for Awadalla, (2017) mentioned that I. aegyptiaca (Douglus) recorded only one peak of abundance on pomegranate trees in Mansoura. Mostafa, (2012) recorded seychellarum mealybug, Icerya seychellarum (Westwood) infested citurs trees in Demmyat and has two annual peaks one in June and November.

**Seasonal abundance of Rodolia cardinalis & C. carnea associated with I. aegyptiaca on mandarin trees**

Data arranged in Fig. (3), showed that the population abundance of the common insect predators R. cardinalis and C. carnea associated with I. aegyptiaca on mandarin trees during the first year 2016. Three peaks were recorded for R. cardinalis in 15th of February (7 indiv.), 15th of August (31 indiv.) and 15th of November (31 indiv.). C. carnea had three peaks, in 15th of June (16 indiv.), 1st of September (7 indiv.) and 15th of November (7 indiv./100 leaves).

Data illustrated in Fig. (4) revealed that, the population abundance of the main predatory insects R. cardinalis and C. carnea associated with I. aegyptiaca on mandarin trees during the second year of study. R. cardinalis had three peaks in 1st of March, 15th of August and 1st of December and represented by (5, 30 and 31 indiv./100 leaves), respectively. C. carnea recorded three peaks in 15th of June (10 indiv.), in the beginning of September (5 indiv.) and in the beginning of December (9 indiv./100 leaves), respectively (Fig. 4).

As a conclusion, R. cardinalis and C. carnea had three peaks during the two successive years of study. The maximum activity of R. cardinalis recorded in 15th of August and 15th of November 2016 while C. carnea recorded in the 15th of June and in 15th of November 2016. R. cardinalis recorded in 15th of August and the beginning of December 2017 while C. carnea recorded the maximum activity in 15th of June and in the beginning of December 2017.

**Fig. 3.** Seasonal abundance of Rodolia cardinalis and Chrysoperla carnea with I. aegyptiaca on mandarin trees during the first year 2016 at Giza Governorate.

**Fig. 4.** Seasonal abundance of Rodolia cardinalis and Chrysoperla carnea with I. aegyptiaca on mandarin trees during the second year 2017 at Giza Governorate.

These results agree with those of Ghanim, et al. (2013) recorded that three peaks for R. cardinalis on I. aegyptiaca attacked mandarin trees at Mansoura district in October, in June and in September the two successive seasons. Also, C. carnea on I. aegyptiaca recorded four peaks, in October, June, August and September in the first season and three peaks in October, June and September in the second season. Awadalla and Ghanim (2016) recorded that R. cardinalis had three peaks of abundance, while C. carnea had 2-3 peaks of I. aegyptiaca on Mango trees at Mansoura district in Egypt. R. cardinalis and C. carnea were recorded in autumn with the highest average number of I. aegyptiaca.

These results differ with those for Awadalla, (2017) recorded that had two peaks of abundance in July and November for R. cardinalis (Mulsant) on I.
**Table 1. The simple correlation and regression coefficients and multiple regressions between population of the different instars stages of *Icerya aegyptiaca* (Douglas) and *Rodolia cardinalis* (Mulsant) & *Chrysoperla carnea* (Steph.) with the temperature & Relative humidity on mandarin trees in Giza Governorate, 2016.**

<table>
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<tr>
<th>Factor</th>
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<th>Multiple regression</th>
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<tr>
<td></td>
<td>$r$</td>
<td>$b$</td>
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<tr>
<td>Nymph</td>
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<td></td>
<td>T min.</td>
<td>0.86</td>
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<td></td>
<td>R.H.%</td>
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</tr>
<tr>
<td></td>
<td>R. <em>Cardinalis</em></td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>C. <em>carnea</em></td>
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<td></td>
<td>All above</td>
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<tr>
<td>adult females</td>
<td>T max.</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td>T min.</td>
<td>0.66</td>
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<tr>
<td></td>
<td>R.H.%</td>
<td>-0.66</td>
</tr>
<tr>
<td></td>
<td>R. <em>Cardinalis</em></td>
<td>0.85</td>
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<tr>
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<td>C. <em>carnea</em></td>
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<td></td>
<td>All above</td>
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<td>ovipositing females</td>
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<tr>
<td></td>
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<td>R. <em>Cardinalis</em></td>
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<td>C. <em>carnea</em></td>
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<tr>
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<td></td>
<td>C. <em>carnea</em></td>
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<td>58.05</td>
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With the respect to biotic factors *R. cardinalis* & *C. carnea* and the nymph, adult females, ovipositing females and total populations correlation value were (0.80 - 0.50, 0.85 - 0.61, 0.89 - 0.53 and 0.88 - 0.57) respectively, in first year 2016. While in the second year correlation value were (0.78-0.51, 0.85 -0.60, 0.89 - 0.56 and 0.86 - 0.54) respectively, between *R. cardinalis* & *C. carnea* and the nymph, adult females, ovipositing females and total populations (Tables, 1 and 2).

With the respect to abiotic factors as maximum and minimum temperature had significant effect on the population of the nymph stages of *I. aegyptiaca* in two years of study, while maximum temperature had significant effect on the population of adults in two years of study 2016 and 2017 (Tables, 1 and 2). Relative humidity showed high non-significant effects on the population abundance for *I. aegyptiaca* and its predators during two years of study.

The combined effect of temperature and relative humidity was 84.54% and 78.52% of the nymph stages, adult females was (66.74% & 68.79%), ovipositing females was (90.56% & 55.42%) and total populations was (52.02% & 76.56%) during the first and second seasons, respectively (Tables, 1 and 2).

To evaluate the common effect of biotic and abiotic factors was 90.56% and 92.92% of the nymph stages, adult females was (87.11% & 88.36%), ovipositing females was (94.16% & 90.09%) and total populations was (94.16% &
84.35%) during the first and second seasons, respectively (Tables 1 and 2).

These results are supported by those obtained by Ghanim, et. al. (2013) showed that the temperature a highly positive significant and relative humidity a highly negative significant of the seasonal abundance for I. aegyptiaca. Also, showed a highly positive significant effect for R. cardinalis and C. carnea during the two years of study. Nébié, et. al. (2016) mentioned that the temperature and relative humidity significantly affected (0.037 ≤ P < 0.0001) the populations of I. aegyptiaca. A positive and significant correlation was observed between I. aegyptiaca and the temperature.

REFERENCES


الأفرع الموسمية للبق الدقيقى المصرى Icerya aegyptiaca

على أشجار اليوسفى والمفترسات الحشرية المصاحبة

الدقي - حلمي محمد سماح

ишAttempting to conclude the results of the study. The study also showed that there was a positive significant correlation between the temperature and relative humidity significantly affected (0.037 ≤ P < 0.0001) the populations of I. aegyptiaca. A positive and significant correlation was observed between I. aegyptiaca and the temperature.

REFERENCES


