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

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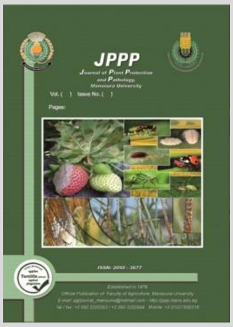

ABSTRACT

The present work was carried out in Giza Governorate to study the seasonal abundance of the Egyptian mealybug *Icerya aegyptiaca* (Douglas) (Coccoidea : Monophlebidae) during (2016-2017) which attacking mandarin trees *Citrus reticulata* Blanco (Rutaceae) and its main associated predatory insects. Also, study effect of biotic and abiotic factors on the seasonal abundance of its stages. The obtained data showed that, nymphs, adult females, ovipositing females and the total population of *I. aegyptiaca* recorded three peaks on mandarin trees during (2016 -2017). These peaks of total population of *I. aegyptiaca,* occurred on June, August and December. The highest peak recorded in 15th August (2016 -2017).The results revealed that, three peaks were recorded for *Rodolia cardinalis* (Mulsant) (Coleoptera: Coccinellidae) and *Chrysoperla carnea* (Steph.) (Neuroptera: Chrysopidae), during the two successive years of study. Simple correlation coefficient indicated that, the relationship between *I. aegyptiaca* and its associated predators assured that, a highly positive significant effect during (2016-2017). The temperature showed a positive significant effect on the population of *I. aegyptiaca*. 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 (2016-2017).

Keywords: seasonal abundance, Egyptian mealybug, *Icerya aegyptiaca*, *Rodolia cardinalis***,** *Chrysoperla carnea***.** Mandarin trees.

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 (Uesato, *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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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.w underground.com/global/EG.ht ml.

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*as described. The obtained determination factor (R^2) 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.), the15th of August (116 indiv.) and the 1st of December (112 indiv.). The peaks of ovipositing females recorded on the15th 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 1stof 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 the15th of December (42 indiv. / 100 leaves). The peaks of total population recorded on 1st of June (280 indiv.), the 1stof September (330 indiv.) and the 1st of December (270 indiv. / 100 leaves).

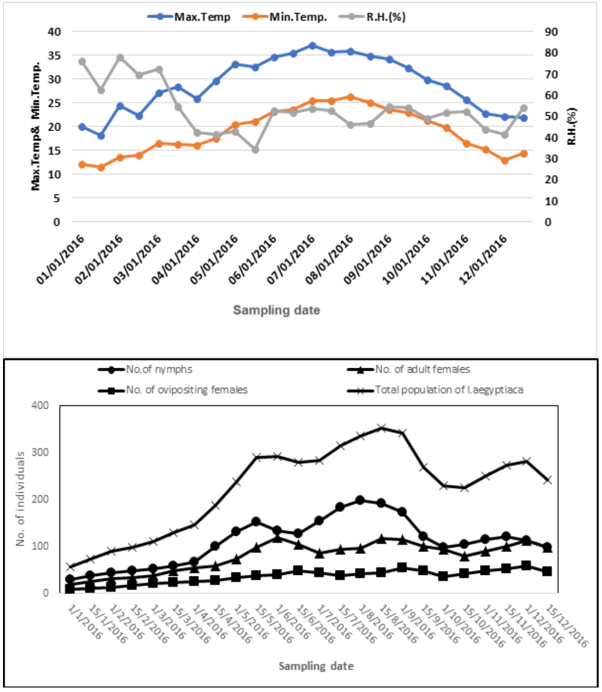

Fig. 1. Seasonal abundance of the different instars stage *Icerya aegyptiaca* (Douglas) attacking mandarin trees during the first year 2016 at Giza Governorate.

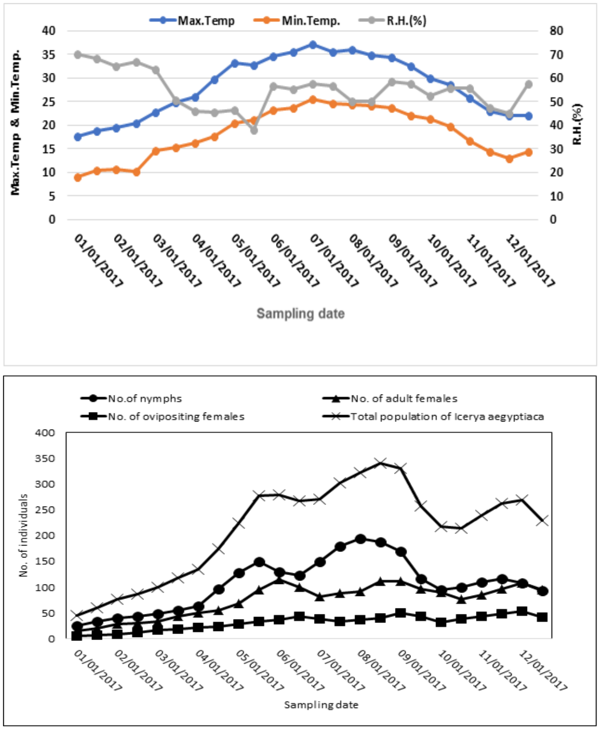

Fig. 2. Seasonal abundance of the different instars stage *Icerya aegyptiaca* (Douglas) attacking mandarin trees during the second year 2017 at Giza Governorate.

As a conclusion, nymphs, adult females, ovipositing females and the total population of *I. aegyptiaca* recorded three peaks on mandarin trees during the two years of study 2016 and 2017. These peaks total population of *I. aegyptiaca* occurred on June, August and December. Also, the highest peak for *I. aegyptiaca* recorded in15thAugust 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 the15thof 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 *R. 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 15thof February (7 indiv.), 15thof August (31 indiv.) and 15thof November (31 indiv.). *C. carnea* had three peaks, in 15thof June (16 indiv.), 1stSeptember (7 indiv.) and 15thof November (7 indiv. /100 leaves).

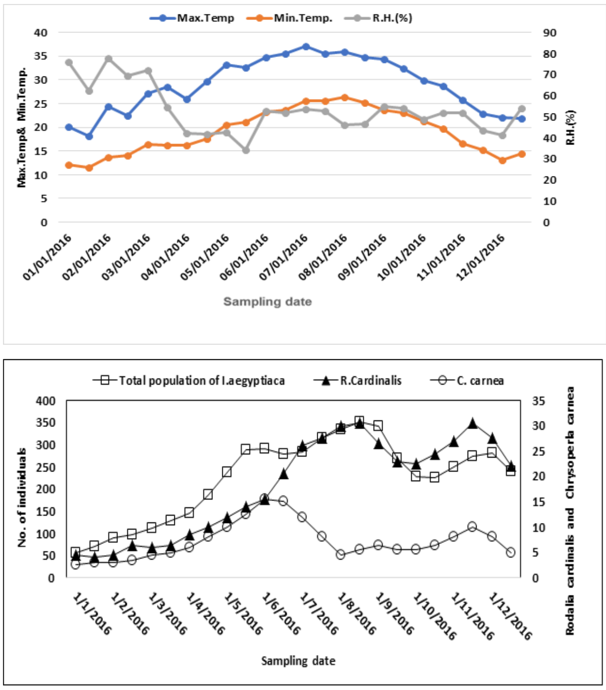

Fig. 3. Seasonal abundance of *Rodolia cardinalis* and *Chrysoperla carnea* with *I. aegyptiaca* on mandarin trees during the first year 2016 at Giza Governorate.

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 1stMarch, 15thof August and 1stDecember and represented by (5, 30 and 31 indiv. /100 leaves), respectively. *C. carnea* recorded three peaks in 15thof June (10indiv.), 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 15thof August and 15thof November 2016 while *C. carnea* recorded in the 15thof June and in 15thof November 2016.*R. cardinalis* recorded in15thof August and the beginning of December 2017 while *C. carnea* recorded the maximum activity in 15thof June and in the beginning of December 2017.

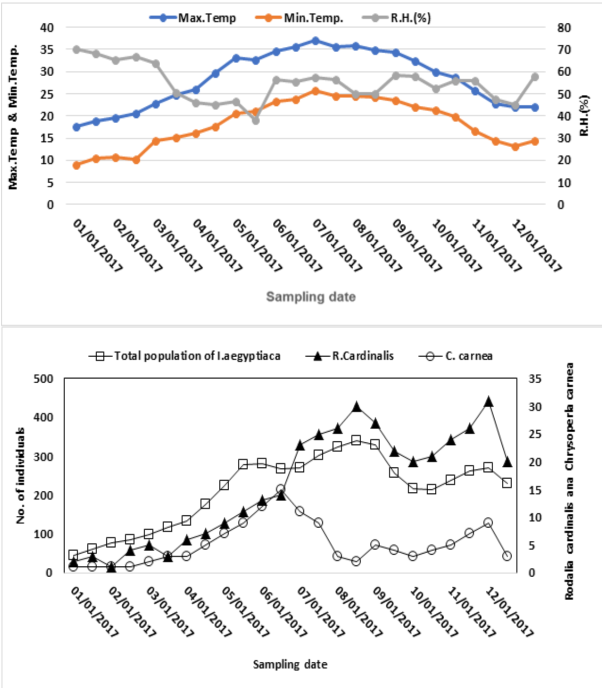

Fig. 4. Seasonal abundance of *Rodolia cardinalis* and *Chrysoperla carnea* with *I. aegyptiaca* on mandarin trees during the second year 2017 at Giza Governorate.

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.*

aegyptiaca infested pomegranate trees in Mansoura. Also, *C. carnea* recorded two peaks, the first one on September and the second peak on December. El-Sobky, (2020) recorded that had one peak of abundance in the second week of September in the first year while in the second week of October in the second year of investigation, respectively on navel orange in Qalubiya Governorate, on the oter hand *R. cardinalis* had two peaks of abundance during the first year 2018, the first one was recorded in the 2[nd]June and the second peak in the 1[st]October during the second year of study.During two studied years determined positive correlation between max., min. temperatures and the total population in the two years of study. On the other hand,there were weak negative correlation of relative humidity in Qalubiya Governorate.

Effect of biotic and abiotic factors on the population abundance of the different instars stage *I. aegyptiaca*

The effect of biotic factor as predators *R. cardinalis* & *C. carnea* and abiotic factors maximum, minimum temperature & relative humidity on seasonal abundance of the different instars stage of *I. aegyptiaca* were studied. Correlation, regression analysis and multi regression between biotic and abiotic factors and population of the different instars stage of *I. aegyptiaca* was in liner degree, in two years of study 2016 and 2017 were estimated. Statistically, the results represented in Tables (1 and 2).

Table 1. The simple correlation and regression coefficients and multiple regressions between population of the different instar stages of *Icerya aegyptiaca* (Douglas) and *Rodolia cardinalis* (Mulsant) & *Chrysoperla carnea* (Steph.) with the temperature & Relative humidity on mandarin trees in Giza Governorate, 2016.

Factor		Simple correlation and regression			Multiple regression		
		r	b	P	F	P	E.V.%
Nymph	T max.	0.80	6.95	0.0001			
	T min.	0.86	8.99	0.0001	36.45	00001	84.54
	R.H.%	-0.61	-2.73	0.0014			
	R. Cardinalis	0.80	4.14	0.0001	25.73	0.0001	71.02
	C. carnea	0.50	6.97	0.0123			
	All above				34.54	0.0001	90.56
adult females	T max.	0.59	3.25	0.0025			66.74
	T min.	0.66	4.37	0.0005	13.38	0.0001	
	R.H.%	-0.66	-1.84	0.0005			
	R. Cardinalis	0.85	2.79	0.0001	61.59	0.0001	85.43
	C. carnea	0.61	5.33	0.0016			
	All above				24.32	0.0001	87.11
ovipositing females	T max.	0.43	1.07	0.0354			
	T min.	0.50	1.50	0.0127	34.54	0.0001	90.56
	R.H.%	-0.62	-0.80	0.0011			
	R. Cardinalis	0.89	1.32	0.0001	65.22	0.0001	86.13
	C. carnea	0.53	2.08	0.0083			
	All above				34.52	0.0001	94.16
Total	T max.	0.71	11.27	0.0001			
	T min.	0.78	14.86	0.0001	7.23	0.0018	52.02
	R.H.%	-0.67	-5.37	0.0004			
	R. Cardinalis	0.88	8.25	0.0001	69.72	0.0001	86.91
	C. carnea	0.57	14.38	0.0035			
	All above				58.05	0.0001	94.16

Table 2. The simple correlation and regression coefficients and multiple regressions between population of the different instar stages of *Icerya aegyptiaca* (Douglas) and *Rodolia cardinalis* (Mulsant) &*Chrysoperla carnea*(Steph.) with the temperature & relative humidity on mandarin trees in Giza Governorate, 2017.

Factor		Simple correlation and regression			Multiple regression		
		r	b	P	F	P	E.V.%
Nymph	T max.	0.86	6.78	0.0001			
	T min.	0.87	8.22	0.0001	24.37	0.0001	78.52
	R.H.%	-0.50	-3.11	0.0119			
	R. Cardinalis	0.78	3.87	0.0001	21.75	0.0001	92.92
	C. carnea	0.51	56.53	0.0116			
	All above				47.28	0.0001	92.92
adult females	T max.	0.69	3.41	0.0002			
	T min.	0.73	4.38	0.0001	14.70	0.0001	68.79
	R.H.%	-0.53	-2.08	0.0073			
	R. Cardinalis	0.85	2.67	0.0001	52.73	0.0001	83.39
	C. carnea	0.60	4.92	0.0019			
	All above				27.32	0.0001	88.36
ovipositing females	T max.	0.54	1.21	0.0067			
	T min.	0.59	1.60	0.0022	8.29	0.0009	55.42
	R.H.%	-0.50	-0.88	0.0123			
	R. Cardinalis	0.89	1.27	0.0001	75.33	0.0001	87.77
	C. carnea	0.56	2.08	0.0040			
	All above				32.72	0.0001	90.09
Total	T max.	0. 80	11.39533	0.0001			
	T min.	0.83	14.20	0.0001	21.78	0.0001	76.56
	R.H.%	-0.54	-6.07	0.0060			
	R. Cardinalis	0.86	7.81	0.0001	56.59	0.0001	84.35
	C. carnea	0.54	13.38	0.0035			
	All above				73.08	0.0001	95.31

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 ($0.037 \leq P < 0.0001$) the populations of *I. aegyptiaca*. A positive and significant correlation was observed between *I. aegyptiaca* and the temperature.

REFERENCES

Alghamdi, A.; Al-Otaibi, S. and Sayed, S.M. (2018). Field evaluation of indigenous predacious insect, *Chrysoperla carnea* (Steph.) (Neuroptera: Chrysopidae), fitness in controlling aphids and whiteflies in two vegetable crops. Egyptian J. of Bio. Pest Cont., 28 (20): 1-8.

Awadalla, H. S. S. (2013). Ecological studies on some mealybug species attacking Mandarin trees and their predatory insects at Mansoura district. J. Plant.Prot. and Path., Mansoura Univ., Vol. 4(3):303-315.

Awadalla, H. S. S. (2017). The Population Abundance of the Mealybug Species Infesting Pomegranate Trees and their Associated Insect Predators in Mansoura Region, Egypt.J. Plant Prot. and Path., Mansoura Univ., 8 (1), 15– 19.

Awadalla, H.S.S. and Ghanim, A. A. (2016). Population density of the main mealybug species attacking Mango trees and their associated predatory insects at Mansoura region. J. Plant Prot. and Path., Masoura Univ.,7(1): 31-40.

Ghanim, A.A.; Abdel-Salam, A. H.;Elkady, H.A.; El-Nagar, M.E. and Mohamed, N. E., (2013): Ecological studies on some mealybug species infesting grapevine trees and their associated predatory insects at Mansoura district. J.Plant Prot. and Path., Mansoura Univ., 4 (10): 821-836.

Hamed, A. R. and Saad, B. (1989) Adaptation of *Rodolia cardinalis* Mulsant (Coleoptera: Coccinellidae) to *Icerya aegytiaca* and *Icerya seychellarum* Westw. Proc. 1st Int. confer. Econ. Ent, Cairo, Egypt, II, 33–38.

El-Sobky, (2020) Ecological studies on two mealybug species (Hemiptera) and their predator on navel orange trees at Qalubiya Governorate. Egypt. J. Plant Protection Res. Inst. 3(4): 1067-1074.

Hoddle, M. (2010). Biological Control of *Icerya purchasi* with *Rodolia cardinalis* in the Galapagos. App. Bio. Cont. Res., 1-10.

Medina, P.; Budia, F.; Estal, P. andViñuela, E. (2003). Effects of Three Modern Insecticides, Pyriproxyfen, Spinosad and Tebufenozide, on Survival and Reproduction of *Chrysoperla carnea* Adults. Ann. Appl. Biol., 142, 55–61.

Moursi, K. S.; Mesbah, H.A.; El-Sayed, N. A. and Abdel Wanees, O. M. (2013). Scale Insects and Mealy Bugs Associated with Citrus Trees in El Beheira Governorate, Egypt. Alex. Sci. ex. j., 34 (3): 299-305.

Moustafa, M. (2012). Scale insects (Coccoidae: Hemiptera) infested citrus trees and their natural enemies, with a key of these pests in Egypt. Egypt. Acad. J. bio. Sci., 5(1): 1- 23.

Nébié, K., Nacro; S.,Ouédraogo, I.; Dakouo, D. andOtoidobiga, L. C. (2016). Inventory and Distribution of Mango Mealybugs Species in Western Burkina Faso: Relative Abundance and Population Fluctuation. Adv. in Ent., 4, 191-199.

SAS Institute (1998). SAS user's guide. Statistics SAS Institute, cary, N.C.

Uesato, T.; Kondo, T.; Unruh, C. and Williams D. J. (2011). Establishment and host records of *Icerya aegyptiaca* (Douglas) (Hemiptera: Coccoidea: Monophlebidae) in the Sakishima Islands of the Ryukyu Archipelago, Japan, with notes on its worldwide distributions. Ent. Sci., 14, 49–55.

Waleed, F. A. (2019). Citrus Varieties in Egypt: An Impression. Int. Res. J. App. Sci., 1: 1-4.

الوفرة الموسمية للبق الدقيقى المصرى *Icerya aegyptiaca* على أشجار اليوسفى والمفترسات الحشرية المصاحبة له فى محافظة الجيزة

سماح محمد ياسين حلمي

معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقي - جيزة

تهدف الدراسة الحالية التى تمت فى محافظة الجيزة لدراسة التغيرات الموسمية للبق الدقيقى المصرى خلال موسمين متتابين ٢٠١٦-٢٠١٧ على أشجار اليوسفى وأعدائه الحشرية المصاحبة له . أيضا تم دراسة تأثير العوامل الحيوية والبيئية على التغيرات الموسمية لأطواره . قد أظهرت الدراسة أن لهذه الآفة ثلاث ذروات نشطة خلال عامى الدراسة.فى كلا العامين كانت ذروة النشاط فى منتصف أغسطس . من ناحية أخرى سجل كلا المفترسين الحشريين المصاحبين للآفة ثلاث ذروات للنشاط خلال موسمى الدراسة . يوجد ارتباط موجب قوى بين البق الدقيقى المصرى والمفترسين الحشريين المصاحبين له خلال سنتى الدراسة . كما أظهرت الحرارة تأثيرا موجبا عل تعداد البق الدقيقى المصرى .