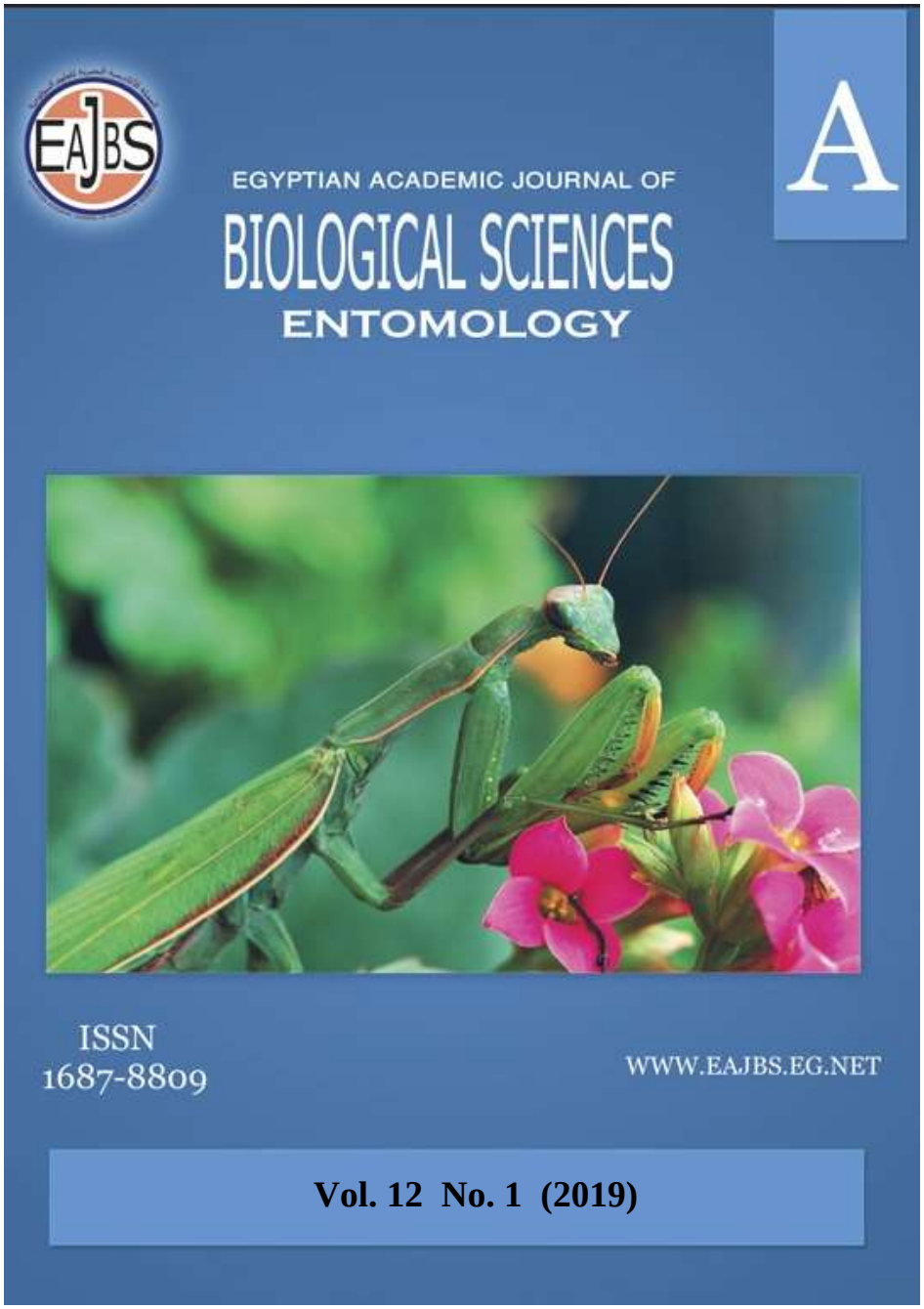

Egyptian Academic Journal of Biological Sciences is the official English language journal of the Egyptian Society for Biological Sciences, Department of Entomology, Faculty of Sciences Ain Shams University.
Entomology Journal publishes original research papers and reviews from any entomological discipline or from directly allied fields in ecology, behavioral biology, physiology, biochemistry, development, genetics, systematics, morphology, evolution, control of insects, arachnids, and general entomology.
www.eajbs.eg.net

Citation: *Egypt. Acad. J. Biolog. Sci. (A. Entomology) Vol. 12(1) pp: 145- 152 (2019)*

Egypt. Acad. J. Biolog. Sci., 12(1):145– 152 (2019)

Egyptian Academic Journal of Biological Sciences
A. Entomology

ISSN 1687- 8809
www.eajbs.eg.net

Some Ecological Aspects on the Mango Shield Scale, *Milviscutulus mangiferae* (GREEN), (Hemiptera: Coccidae) ON *Laurus nobilis* L. Trees at Giza, Egypt

Abbas, A. A. E. [1]; Mohamed, G. H. [2]; Helmi, A. [3]; Abd- Elhamed, N. A[1]. and Tharwat, A. A. [2]

1-Entomology Zoology Dep., Fac. of Science (Girls), Al-Azhar University.
2-Plant Protection Res. Institute, Agricultural Research Center, Dokki, Giza, Egypt.
3-Plant Protection Dep. Fac. of Agriculture, Ain Shams University

ARTICLE INFO
Article History
Received:13/1/2019
Accepted:7/2/2019

Keywords:
Ecology, *Milviscutulus mangiferae*, parasitoid, *Laurus nobilis,* Egypt.

ABSTRACT

Studies on some ecological aspects of *Milviscutulus mangiferae* (Green) and its associated parasitoid on *Laurus nobilis* L. (Lauraceae) trees were carried out at Orman botanical garden, Giza Governorate, during two successive years 2016-2017 and 2017-2018. Results revealed that total alive stages had four main peaks of high activity on *Laurus nobilis* and it passed throughout three generations per year. The first generation with duration 3.5 months during two years. The second generation with duration of 5& 4.5 months for the two years, respectively. The third generation with duration of 3.5&4months for two successive years, respectively. *Coccophagus scutellaris* (Dalman)(Hymenoptera : Aphelinidae) was recorded as a parasitoid associated with *M. mangiferae* . The high activity of the two years of study recorded on (mid-October, 1st December, 1st June and the highest one was in 1st August) and (mid-October, mid- December, mid-April and mid-July).The total effects of seven abiotic factors; Max., Mean, Min., Temp. °C, RH%, Wind, Dew point**(°C)**, solar radiation, and (biotic factor) parasitism % on the mean numbers of alive stages during the two years were74.18% and 80.55%, respectively.

INTRODUCTION

Laurus nobilis L. known as bay laurel belonging to the Family Lauraceae is one of the most useful essential oil and is an industrial plant used in foods, drugs and cosmetics. It is native to southern Mediterranean region and widely cultivated in Europe and USA as an ornamental plant in North

African countries. Laurel essential oil can be extracted from various parts of the plant and chiefly consisted of 1, 8 Cineole, sabinene, α-pieneand p-Cymene. (Chahal *et al*. 2017 and Jemaa *et al.* 2012). *Milviscutulus mangiferae* (Green) (Hemiptera: Coccidae) recorded in Egypt for the first time as a new pest attacking mango orchard in different Governorates (Abd-Rabou and Evans, 2017).

M. mangiferae is a highly polyphagous pest. Recorded from Scale Net (2017) on different host plants from 82 genera belong 42 families in 62 countries of the world. Natural dispersal is likely to be slow. Parthenogenesis is the dominant form of reproduction for this scale pest and males are seldom recorded. Adults die just after producing the first-instar stage. Only these early stage crawlers can migrate to any

extent and it is their movement that disperses a population (Kasuya, 2000).

These species causes crop losses by severely depleting plant cell nutrients resulting in a reduction of photosynthetic capacity. Damages caused to plants include loss of sap, clogging of leaf or fruit surfaces with honeydew, on which sooty mould subsequently grows (Ben-Dov and Hodgson1997).

Coccophagus scutellaris (Dalman) (Hymenoptera: Aphelinidae) is one of the best-known parasitoids of soft scale insects and used in their biological control program, (Abd-Rabou, 2011).

The present work aims to detect activity periods of this pest and its associated parasitoid as well as determine the different effects of some physical factors on its activity.

MATERIALS AND METHODS

The population fluctuations of *M. Mangiferae* on Bay Laurel, *Laurus nobilis* trees at Orman botanical garden, Giza governorate throughout two successive years 2016&2018 were determined. Five trees are almost similar in size, heights, age, growth vegetation and also received the same horticultural practices and without any chemical control were selected in each district for sampling purposes. Each sample has consisted about 25 leaves (5 leaves/tree) were collected randomly for biweekly examination. These samples were kept in polyethylene bags and transferred to the laboratory for counting procedures. Each sample was examined carefully by using a stereoscopic microscope. Identification of specimens was carried out at the Plant Protection Research Institute, Dokki, Giza, Egypt.

The insect individuals on these leaves were sorted into different developmental stages (immature, adult females and gravid females) as well as alive and dead individuals then counted and recorded. Also, the natural enemies (parasitoids) found associated with the population of this soft scale insects were also recorded and counted. The parasitism percentage was calculated according to the formula of Orphanides (1982)

$$\text{Parasitism \%} = \frac{\text{No. parasitized scale insects}}{\text{Total No. parasitized and non-parasitized scale insects}}$$

The associated parasitoid of the studied pest was identified at Entomology lab. At Biological Control Department, Rice Research & Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt. Data of the half-monthly counts of the alive total population were used to estimate the numbers and durations of annual field generations. These data were worked out according to the methods suggested by Audemard and Milaire (1975) and amended by Jacob (1977). The graphical representation of these data was carried out by using the computer software program (Sigma plot, ver.11).

Weather factors data assumed to affect studied insect (i.e. maximum and minimum daily temperatures and mean percentage of daily relative humidity Solar radiation, Wind and Dew point) were obtained for the Giza area from The Egypt-Weather Underground https: // www. wunderground. com/ global /EG. html. Obtained data were summarized for every fourteen days previous to the sampling date. Considered weather factors mean over each determined generation were calculated and presented.

RESULTS AND DISCUSSION

Seasonal Abundance of *M. Mangiferae* on *Laurus nobilis* at Giza Governorate: The Total Number of A Lives Stage:

Data illustrated in Figs. (1 & 2) showed that population density of this soft scale insect species was more abundant during the 2017-2018 year than the 2016-2017 year. Thus the annual means for total population were 213.4 and 237.6 alive individuals /leaf during both years, respectively. Half-monthly mean numbers of the alive total population were recorded four peaks of seasonal abundance. During the first year, these peaks occurred in mid-October, mid-December, mid-April and the highest one was in mid-June, These peaks were represented by means of population density 279.5, 329, 238.3 and 380.9 individuals/leaf, respectively. During the second year, these peaks occurred in mid-October, mid-December, mid-April and the highest one was in mid-July, 2018.The means of the total alive population were 285.9, 351.9, 267.7 and 428.5 individuals/leaf for these peaks; respectively.

The nymphal stage had three peaks during two years recorded on (mid-October, mid-December and1stJune, 2017 and represented by 133, 151.4 and 151.1 nymphs/leaf). Also in the 2018 year, these three peaks occurred on (mid-October, mid-December and the highest peak was on1st June 2018 with 130.7, 166.9 and 171.9 nymphs/leaf, respectively.

The adult female had four peaks during the two years per a year recorded on (mid-October, mid-December, mid-April and mid-June, 2017 with mean numbers of population 61.5, 119.7, 154.2 and 153 females/leaf) .While in 2018 the four population peaks recorded on (mid-October, mid-December, mid-April and mid-July with mean numbers of population 71.4, 130.6, 168.6 and 190.5 females/leaf) for the four peaks; respectively. While gravid females had three peaks throughout two years were recorded on (mid-October, 1st May and mid-July, 2017 whereas these mean numbers of population density were 85, 73 and 160.3 gravid females/leaf).Also in the 2018 year, these three peaks occurred on (mid-October, 1st May and mid-July, 2018 with mean numbers of population density; 83.8, 79.4 and 163.8 gravid females/leaf) for the three peaks; respectively.

The activity of *M. mangiferae* on mango trees in Qalubyia Governorate took place from early April until January with three periods of high activity synchronized with the three growth flushes of mango trees, these peaks were recorded in spring, summer and autumn (Attia *et al*. 2018).

Coccus mangiferae (Green) population reached its peak in October, but there were also considered in June and the maximum number of scales per leaf was 600(Avidov and Zaitzov, 1960). (El-Dash, 1997) revealed that the total average of the total monthly count of *Kilifia acuminata* indicated three peaks of abundance in May, July and October- November.

Estimated Number and Duration of Annual Field Generations:

As shown from the obtained data in Figs. (3 and 4), *M. Mangiferae* had three generations annually during the two successive years. The first generation with duration 3.5 months during two years of study extended from 1st September to 1st December. The second generation with duration of (5 & 4.5 months) and started from mid-December to 1st May in the first year and from mid-December to mid-April in the second year. The third generation with duration of (3.5 & 4months) for two successive years, respectively and started from mid-May to mid-August, 2017 in the first year and 1st May to mid-August, 2018 in the second year.

The population density of *M. mangiferae* on mango trees indicated the

occurrence of three generations per year. The first generation recorded in spring for two years. The second generation recorded on summer while, The third generation recorded on (autumn/winter) for two years (Attia *et al*. 2018). *C. mangiferae* had three generations per year on mango and recorded on spring, summer and autumn (Avidov and Zaitzov, 1960).

K. acuminata had three overlapping generations /year on mango trees, each generation lasted about four months at Sharkia Governorate, Egypt.(Hassan, *et al*.2012)

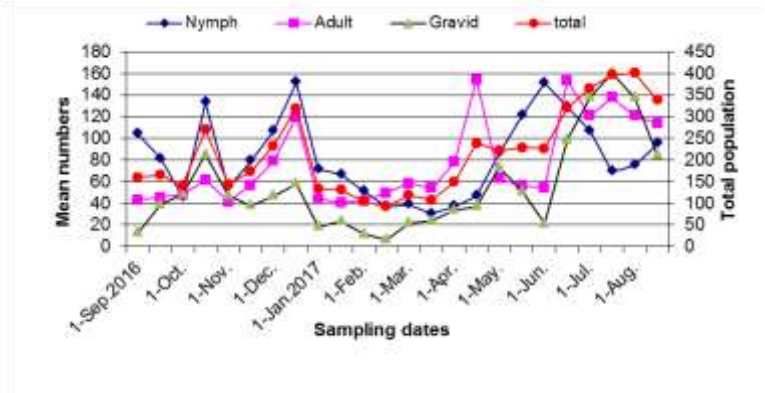

Fig. (1): Seasonal fluctuations of different developmental stages as alive population of the soft scale insect, *Milviscutulus Mangiferae* on *Laurus nobilis* at Orman garden, Giza governorate during 2016/2017.

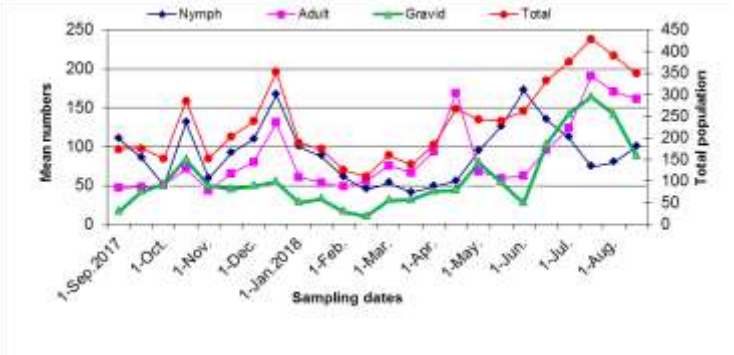

Fig. (2): Seasonal fluctuations of different developmental stages as alive population of the soft scale insect, *Milviscutulus Mangiferae* on *Laurus nobilis* at Orman garden , Giza governorate during 2017/2018.

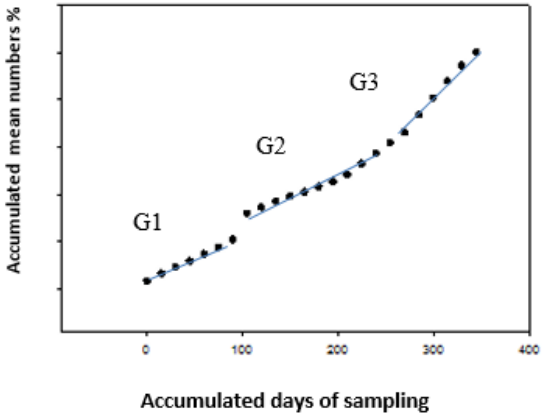

Fig. (3): The sequence of annual generations of *Milviscutulus Mangiferae* on *Laurus nobilis* trees at Orman botanical garden, Giza governorate during 2016/17 year.

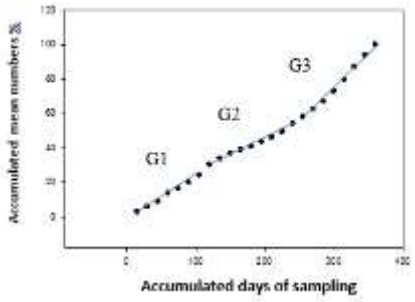

Fig. (4): The sequence of annual generations of *Milviscutulus Mangiferae* on *Laurus nobilis* trees at Orman botanical garden, Giza governorate during 2017/18 year.

Parasitoid Associated with *M. mangiferae:*

One parasitoid only, ***Coccophagus scutellaris*** found to be associated with this pest during this work. Data illustrated in Figs. (5 and 6), revealed the total count of this parasitoid during the second year 2017/2018 was higher than the first year 2016/2017, with mean numbers of 16.4 & 28.9 individuals/leaf for the two successive years, respectively. The total population of *C. scutellaris* curve had four peaks per year. These peaks were recorded on in 2016/2017 mid-October, 1st December, 1st June and the highest one was on 1st August with mean numbers of 19.5, 42.3, 35.3 and 87.5 individuals While in the second year, these peaks recorded in mid-October, mid- December, the highest one was in mid-April and mid-July with mean numbers of 25.2, 22.3, 57 and 58.7 individuals for the four peaks, respectively.

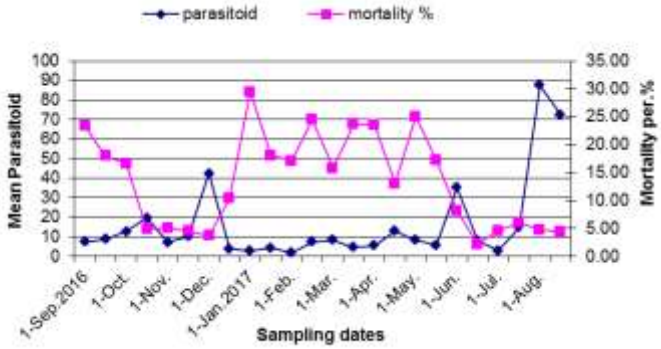

Fig.(5): Seasonal fluctuation of parasitoid species, *Coccophagus scutellaris* associated with *Milviscutulus Mangiferae* and mortality percentage on *Laurus nobilis* at Orman garden , Giza governorate during 2016/2017.

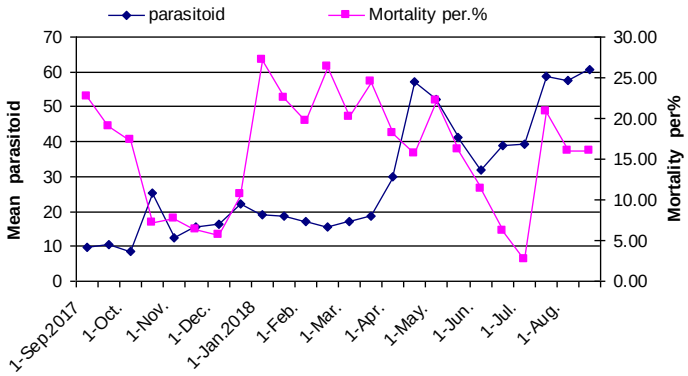

Fig. (6): Seasonal fluctuation of parasitoid species, *Coccophagus scutellaris* associated with *Milviscutulus Mangiferae* and mortality percentage on *Laurus nobilis* at Orman garden , Giza governorate during 2017/2018

Percentages of Total Mortality:

As shown from obtained data in Figs. (5&6) the percentages of total mortality indicated that three peaks per year. These peaks were recorded on 1st January -1st May- mid-July for two years with mortality percentages, 29.45%, 25.02% and6.03% and 27.11%, 22.24% and 20.76% for the two years,

Effect of Some Ecological Factors on the Change of Population Density of *M. Mangiferae* :

Data presented in Table (1) showed that the single effect of the three (maximum, minimum and means temperature) had positive highly effect on the changes in the population density of *M. Mangiferae* on *Laurus nobilis* trees at Giza Governorate. While the mean percentage of relative humidity showed a negative highly significant effect on the changes of population density of this soft scale species during the first year (2016-2017) .While during (2017/18) the same factor showed positive insignificant effects on the change in population density. The correlation coefficient values (r) were -0.73 and 0.04 for both years, respectively. The regression coefficient values (b) were 5.63 and 0.77 individuals for both years, respectively. Wind showed positive highly significant effects in the first year (r) was 0.73 and the unit effect (b) was 4.52 individuals. While during 2017/2018 showed negative insignificant. The correlation coefficient value (r) was -0. 09 and the unit effect (b) were 0.67 individuals. Dew point (°C) showed positive insignificant effect during 2016/17.While during 2017/18 showed positive significant effects on the population of this soft scale insects. (r) Value was 0.56 and the unit effect (b) was 10.62 individuals. Mean solar radiation showed a positive significant effect during the two years (r) were 0.48 and 0.54 for both years, respectively. The unit effects (b) were 9.11 and 9.12 individuals for both years, respectively. Also, the parasitoid, *C. scutellaris* showed positive significant effects in both years.

These results also revealed that the changes in the population density of *M. Mangiferae* on *Laurus nobilis* were mostly related to the combined effects of the selected weather factors and the parasitoid, *C. scutellaris*. The explained variance values were 74.18 % & 80.55% at Giza Governorate for the two successive years, respectively. In general, conditions of relatively high temperature and humidity are beneficial to soft scale population growth (Kosztarab1996).

Table (1): Results of statistical analysis of simple correlation and partial regression to investigate the relationship between eight ecological factors and changes in mean numbers of total population *M. Mangiferae* on *Laurus nobilis* at Giza Governorate during 2016/17 and 2017/18 season.

2016/17						% E.V	2017/18					% E.V.
Tested Factors	Simple correlation		Partial regression				Simple correlation		Partial regression			
	r	p	b	S.E	P		r	p	b	S.E.	P	
Max. Temp.	0.65***	.001	9.31	2.31	0.00***	74.18 %	0.54**	0.01	8.80	2.81	0.006**	80.55 %
Min. Temp.	0.61**	.002	10.61	2.921	0.002**		0.54**	0.01	10.39	3.42	0.006**	
Mean Temp.	0.63***	.001	10.06	10.06	0.00***		0.55**	0.01	9.70	3.109	0.005**	
RH%	-0.73***	.000	5.63	1.10	0.00***		0.04	0.85	0.77	4.064	0.851	
Wind	0.73***	.001	4.52	0.91	0.00***		-0.09	0.67	0.67	10.137	0.671	
Dew point	0.38	.069	6.29	3.31	0.069		0.56**	0.01	10.62	3.380	0.005**	
Solar radiation	0.48*	.017	9.11	3.06	0.29		0.54**	0.01	9.12	3.064	0.01**	
Parasitoid	0.53**	.008	0.12	0.04	0.01**		0.76***	0.00	4.04	0.730	0.00***	

REFERENCES

Abd-Rabou, S. (2011). *Coccophagus scutellaris* (Hymenoptera: Aphelinidae): A highly effective biological control of soft scale insects (Hemiptera: Coccidae in Egypt. Psyche: A Journal of Entomology 1-6.

Abd-Rabou, S. and Evans, G. A. (2017) . The Mango Shield scale, *Milviscutulus mangiferae*((Green) (Hemiptera :Coccidae)- A new invasive soft scale in Egypt. Acta phytopathologica et Entomologica. Vol. 53, Issue 1, pp. 91-96.

Attia, S. A. ; El-Sayid, M. I. and Abd-ELAziz, S. Y. (2018). Abundance and Generation Determination of the Mango Shield Scale *Milviscutulus Mangiferae* (Green) (Coccidae: Homoptera) an Invasive Coccid Infesting Mango Orchards at Qaliobiya Governorate. J. Plant Prot. and Path., Mansoura Univ., Vol.9 (3): 209 - 213

Audemard, H. and H. G. Milaire (1975). Le pieeage carpocapse (*Laspeyresia pomonella* L.) avec une pheromone sexuelle de synthese: prmiers resultats utilisables pour I estimation des populations st lacconduite de la lutte. Ann. Zoll. Ecol. Anim.; 7-61.

Avidov, Z. and Zaitzov, A. (1960). On the biology of the mango shied scale *Coccus mangiferae* (Green) Israel katvium Vol. 10 No,3-4,125-137.

Ben-Dov, Y. and Hodgson, C. J.(1997). Scale Insects: Their Biology, Natural Enemies and Control. Volume2. Elsevier Science.251–442pp.

Chahal, K. K.; Mandeep, K. ; Urvashi, B.; Nancy, S. and Amandeep, K. (2017). A review on chemistry and biological activities of *Laurus nobilis* L. essential oil. J. of Pharmacognosy and phytochemistry, 6(4): 1153-1161.

El-Dash, A. A. (1997). Abundance and bionomics of Lecanium acuminatum Signoret (Homoptera : Coccidae). Menufiya J. Agric. Res., 22 (1):155-166.

Hassan, A. S.; Nabil, H. A.; Shahein , A. A. and Hammad, K. A. A. (2012). Some ecological aspects of *Kilifia acuminata* (Hemiptera : Coccidae) and its parasitoids on mango trees at Sharkia Governorate, Egypt. Acad. J. Bio. Sci., 5(3): 33-41.

Jacob, N. (1997). Un model mathematic pentru stabilirea. Limitelor economicee de tolo- ranta a atacului molilor. Fructelor in Iupte intergrate. Analele I. C. P. P., Romania, 15: 179.

Jemaa, M. B.; Tersim, N.; Toudert, K.T. and Khouja, M. L. (2012). Insecticidal activities of essential oils from leaves of *Laurus nobilis* L. from Tunisia, Algeria and Morocco and comparative chemical composition. J. of Stored Products Research, 48:97-104.

Kosztarab, M. (1996).Scale insects of northeastern America;identification, biology and distribution. Virginia Museum of Natural History special publication Number 3, Martinsville, VA.

Kasuya, E. (2000). Kin-biased dispersal behaviour in the mango shield scale, *Milviscutulus mangiferae*. Animal Behaviour, 59, pp629-632.

Orphanides, G. M. (1982). Biology of the California red scale, *Aonidiella aurantii* (Maskell) (Homoptera, Diaspididae), and its seasonal availability for parasitization by *Aphytis* spp in Cyprus. (Biological citation): Boll. Entomol. Agraria Filippo Silvestri, 39: 203-212 pp.

Scale Net (2017). Online database on scale insects. Available at: http://www.sel.barc.usda.gov/scalenet/query.htm. (Accessed January 2017).

ARABIC SUMMERY

بعض النواحى البيئية على حشرة المانجو الغازية على أشجار اللورا فى حديقة الأورمان بالجيزة مصر

عفاف عبد الوهاب عباس* جمال الدين حسين محمد أشرف حلمى*** نعمة أحمد عبد الحميد***
أسماء أحمد ثروت***
*كلية العلوم بنات (قسم علم الحيوان) جامعة الأزهر
**معهد بحوث وقاية النباتات- مركز البحوث الزراعية – الدقى –الجيزة –مصر
*** قسم وقاية النبات-كلية الزراعة جامعة عين شمس**

تم دراسة بعض الدراسات البيئية على حشرة المانجو الرخوة على أشجار اللورا (الغار) فى حديقة الأورمان بمحافظة الجيزة خلال عامين متتاليين (٢٠١٦-٢٠١٧) و (٢٠١٧- ٢٠١٨) وذلك لدراسة التقلبات الموسمية لتعداد الحشرة والطفيليات المصاحبة لها وكذلك حساب النسبة المئوية للتطفل ونسبة الموت كما تم دراسة تأثير بعض العوامل الجوية على تعداد الحشرة.

وقد أوضحت النتائج المتحصل عليها أن التعداد الكلى للحشرة لها ثلاث فترات نشاط وسجلت ثلاث أجيال لكل عام من عامى الدراسة، وكانت مدة الجيل الأول ٣,٥ شهر خلال العامين وسجل الجيل الثانى أطول الاجيال وكانت مدتة ٥شهور و ٤,٥ شهر فى العامين على التوالى أما الجيل الثالث وكانت مدتة من ٣,٥شهور الى ٤ شهور على التوالى. وقد تم تسجل طفيل *Coccophagus scutellaris* مصاحب للحشرة وسجل أربع قمم للنشاط فى منتصف أكتوبر- أول ديسمبر- أول يونيو وأعلى قمة فـى أول أغسطس فى العام الأول أما فى العام الثانى سجلت هذة القمم فى (منتصف أكتوبر- أول ديسمبر- أعلى قمة فى منتصف أبريل – منتصف يوليو . أما تأثير العوامل الغير حيوية (الحرارة والرطوبة النسبية والرياح ونقطةالندى والأشعة الكونية) والحيوية (نسبة التطفل) على التعداد الكلى للحشرة فقد تبين أن التأثير المشترك لهذة العوامل كان لة دور فعال فى خفض تعداد الحشرة حيث وصل النسبة المئوية للتباين المشترك (E.V.%) ٧٤.١٨ % و ٨٠,٥٥% خلال عامى الدراسة.