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Monitoring of Certain Piercing- Sucking Insect Pests and their Controlling on Eggplant

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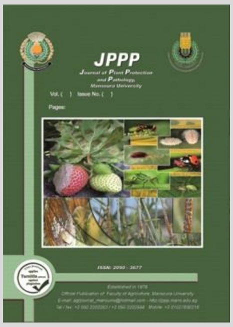

ABSTRACT

Two field experiments were conducted to study the population dynamics of whitefly, *Bemisia tabaci* (Genn.) and the cotton mealybug, *Phenacoccus solenopsis* Tinsley .The efficacy of some insecticides against these insect pests infesting eggplant plants were evaluated at Sharkia Governorate during the two successive seasons of 2016 and 2017. The obtained results revealed that *B. tabaci* recorded four peaks of abundance and the highest peak was the fourth one during 2016 and2017 seasons, respectively. Moreover, *P. solenopsis* recorded two peaks in the first season 2016 and the highest peak was the second one, while in the second season 2017, it had three peaks and the highest peak was the third one. The infestation of these insect pests was more abundant in the second season than in the first one, which may be due to the influence of the studied climatic factors. Moreover, results showed that Lambada-cyhalothrine+thiamehoxam and imidacloprid were the most efficient insecticides against *B. tabaci* followed by pyriproxyfen, abamectin+thiamethoxam, buprofezin and spiromesifen, which classified as moderately toxic against the tested insect during the two seasons, respectively. And also, results indicated that thiamethoxam and abamectin were the most toxic insecticides against *P. solenopsis* followed by imidacloprid, emamectin benzoate, pyrethrins and chlorpyrifos in both seasons, respectively. This study might leads to understand the ecology of these pests which will help in designing the integrated pest management programs for their control. On the other hand, it shows the role of systemic insecticides which are less harmful to natural enemies.

Keywords: *Bemisia tabaci*, *Phenacoccus solenopsis*, insecticides, seasonal abundance, efficacy, eggplant.

INTRODUCTION

Eggplant (*Solanum melongena* L.) is one of the most important vegetable crops grown in Egypt with large areas due to its economic importance and nutritional value. It infested by certain piercing-sucking insect pests such as the cotton mealy bug, *Phenacoccus solenopsis* Tinsley and the white fly, *Bemisia tabaci* (Gennadius).

They are important plant pests that fed on plant juices, causing yellowing of leaves and weakness of the plant. They secrete the honeydew during feeding , which encouraged the growth of sooty molds and reduced in the process of photosynthesis and death of susceptible plants and transmitted the phytopathogenic agents(Fereres and Moreno,2009; Abbas *et al.*, 2010; Vennila *et al.*, 2011 ; Moura *etal.*,2012; Nabil ,2017 and Nabil and Hegab,2019). The changes in climate factors played as an extrinsic integrative factor for determining the abundance and distribution of their insects. Agricultural practices for vegetable production currently require high inputs of chemical insecticides and fertilizers. There are many well-documented safety, health, and environmental concerns, as well as the development of resistant insect pests, in association with high chemical usages (Simmons and Abd-Rabou, 2009). Consequently, growers have become dependent on insecticides to prevent economic losses (Palumbo *et al.*, 2007). Farmers generally use pesticides for the successful control of insect pests (Hasanuzzaman *et al*., 2016). Insecticides such as Spiromesifen, pyriproxyfen, buprofezin, imidacloprid, lambada cyhalothrine+ thiamethoxam and Abamectin+ thiamethoxam were registered for whitefly *B. tabaci* control. Also, there were other insecticides, emamectin benzoate, chlorpyrifos, pyrethrins, thiamethoxam, imidacloprid and abamectin were recommended for controlling the mealy bug under field conditions in Egypt. These pesticides were the most common and repeatedly applied on numerous eggplant fields and other crops (Seal, 2008; Nadeem *et al*., 2011; Fida *et al*., 2017 and Jahel *et al*., 2017). This study could clarify some points to develop management strategies including the ecological parameters to specify the proper timing for pest control. Accordingly, The aim of the present work was conducted to follow up the population densities of *B. tabaci* and *P. solenopsis* on eggplant plants and evaluate the efficacy of some insecticides against these pests.

MATERIALS AND METHODS

Field experiments

An area about 2066 m^2 of eggplants (45 days old) was divided into two equal experimental areas at Hihhya district, Sharkia Governorate, Egypt during 2016 and 2017 seasons. The experimental design used was a completely randomized blocks for evaluation both insect pests with three replicates. Each plot (40m^2) was about 4 meters wide and 10 meters length with a one meter buffering area between the plots and the space between seedlings was 40 cm. The sowing date was in the second week of February during the two successive seasons. The first plant sample was started after one month of transplantation then continued weekly through the growing seasons until the fourth week of July for *P. solenopsis* and the second week of September for *B. tabaci* during 2016 and 2017 seasons.

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Plant Samples

Thirty leaves from each replicate were taken randomly from both diagonal directions of the control plots. These leaves were transferred to the laboratory and examined using a stereomicroscope in the same day. The immature stages of *B. tabaci* and the different stages of *P. solenopsis* on both surfaces of the leaves were counted and recorded according to Audemard and Milaire (1975).

Daily records of temperature and relative humidity were obtained from the Agrometeorological Station during the period of this investigation. Simple correlation values (r) and coefficient of determination percentage (C.D. %) were calculated using Computer Program (COSTAT, 2005).

Insecticide rates and applications

Two field experiments were conducted to investigate the efficiency of some insecticides of different groups against *B. tabaci* and *P. solenopsis* on eggplant during 2016 and 2017 seasons. All insecticides were applied at the label-recommended rates against *B. tabaci* on eggplant plants as follows: Spiromesifen (Oberon 24 % SC) at 240 cm^3/fed., pyriproxyfen (Admiral 10 % EW) at 240 cm^3/fed., buprofezin (Applaud 25 % SC) at 600 cm^3/fed., imidacloprid (Mallet 35 % SC) at 30 cm^3/100 L water, lambada cyhalothrine+thiamethoxam (Engeo 24.7 % SC) at 160 cm^3/ fed. and Abamectin+ thiamethoxam (Gate Fast 12 % SC) at 200 ml/ fed. . Also, there were other pestisides such as: emamectin benzoate (Pasha 1.9% EC) at 250 cm^3/fed., chlorpyrifos (Dursban 48% EC) at one L/fed., pyrethrins at 440 ml/Fed., thiamethoxam (Actara 25% WG) at 25 g / /100L, imidacloprid (Best 25% WP) at 75 ml /100 /L water and abamectin (Abamex 1.8 EC) at 40 ml/100 L water were evaluated against *P. solenopsis* on eggplants under field conditions. All insecticides were obtained from Plant Protection Research Institute, Agriculture Research Centre (ARC), Dokki, Giza. Regarding the foliar spray treatments with a single application were done in the first week of June and the first week of August for *P. solenopsis and B. tabaci* during 2016 and 2017seasons, respectively at a volume of 200 L of water per Feddan using a knapsack motor sprayer. The number of *B. tabaci* insects was recorded before spraying and after 1, 3, 7, 10 and 14 days of treatment, whereas, the number of *P. solenopsis* insects was recorded before spraying after 1, 3, 7, 10 and 14 days of treatment. Initial effect was recorded after one day of spray, while the residual effect was estimated during the period ranged from 3rd to 14th day after spray. Samples of thirty leaves were randomly collected from each replicate and placed in paper bags, for inspection in the laboratory. Alive stages of insects in plots treated with different compound were separately counted for estimating the percentage of reduction. Statistical analyses to compare the efficiency of the treatments and the daily number of alive stages were analyzed using ANOVA with Duncan's test at the 95% confidence level. The percentage of reduction in the populations of the tested pests was calculated according to the equation of Henderson and Tilton's (1955) as follows:

$$R = 100\times 1 - (Ta.\ Cb) / (Tb.\ Ca)$$

Where:

R = Percentage reduction in infestation
C = Insect number in the untreated control plot.
T = Insect number in the treated plot.
a = After insecticide application.
B= Before insecticide application.

RESULTS AND DISCUSSION

1. Population density of the whitefly and the cotton mealybug as a main insect pests infesting eggplant

The obtained results arranged in Figs. 1 and 2 showed the population density of the cotton whitefly, *B. tabaci* on eggplant plants during 2016 and 2017 seasons. The population density of *B. tabaci* started with a small number then increased gradually to reached the first peak of abundance with values of 889 and 1042 individuals at (26.1ºC with 66.9% R.H.) and(27.0ºC with 67.2 % R.H.) in the fourth week of April 2016 and 2017 seasons. The second peak occurred in the fourth week of May during 2016 season at 29.7ºC with 60.9% R.H. and represented by 677 individuals, while in the second season the second peak was noticed in the third week of May at (29.7 ºC and 61.1% R.H.) followed by the third one which recorded in the fourth week of June with a total numbers of 842 and 976 individuals at means of (29.0ºC with 64.3% RH.) and (29.4ºC with 65.4 % RH) during the both studying seasons, respectively. On the other hand, the population density of the insect pest increased sharply to reached the highest peak (the fourth peak) in the second week of August at (27.8ºC with 67.5% R.H.) and (28.0ºC with 69.2% R.H.) and represented by 1556 and 1677 individuals during 2016 and 2017 seasons, successively.

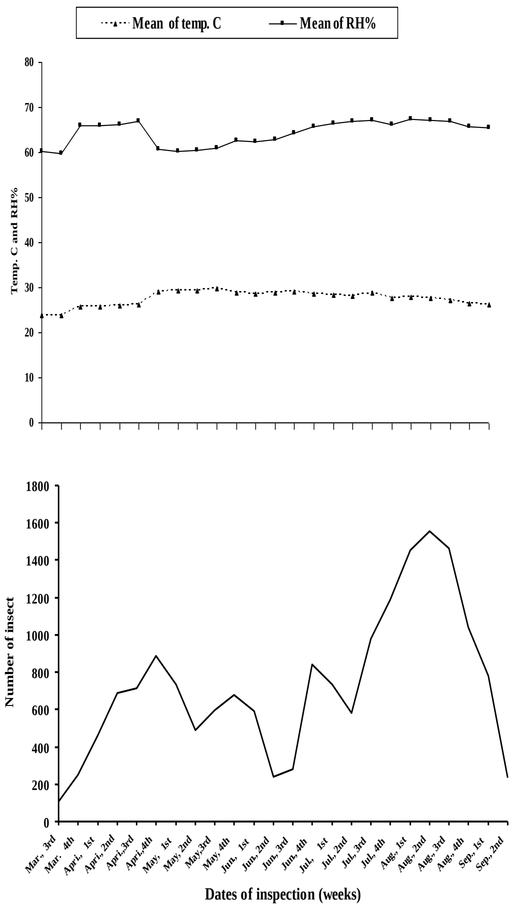

Fig. 1. Seasonal fluctuation of the whitefly, *Bemisia tabaci* , infesting eggplant at Sharkia Governorate during 2016 season

The obtained results arranged in Fig. (3) showed that the population density of the cotton mealybug , *P. solenopsis* in the first season 2016 on eggplants. It can be noticed that, the population begin with a few number and increased gradually to reached the first peak of May 2016 at (29.7ºC with 60.9% R.H.) and represented by 1389 individuals, Followed by the second peak (the highest peak) which recorded in the fourth week of June 2016 with values of 1757 individuals at means of 29.0ºC with 64.3% RH. .

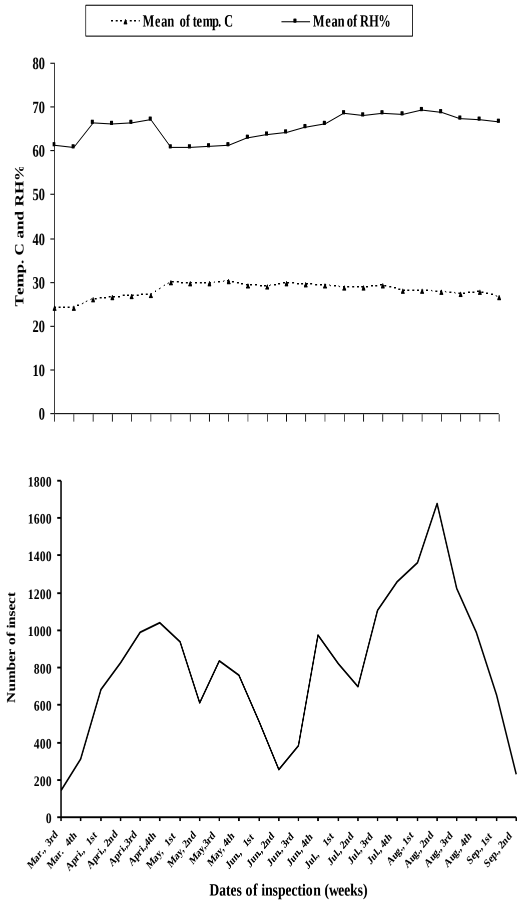

Fig. 2. Seasonal fluctuation of the whitefly, *Bemisia tabaci* , infesting eggplant at Sharkia Governorate during 2017 season

Data in Fig. (4) illustrated that the population density of this insect showed three peaks of abundance during 2017 season. The first peak recorded in the second week of April 2017 at (26.4 ºC with 66.1% R.H.) and represented by 429 individuals. The second one occurred in the third week of May and represented by 1656 individuals at means of 30.1ºC with 61.2% R.H..While, the population density of this insect reached to the highest peak (the third one) in the third week of June at (29.6ºC with 64.1% RH.) and represented by 1884 individuals.

As a conclusion , the obtained data in Figs. (1, 2, 3 and 4) indicated that , the cotton white fly, *B. tabaci* had four peaks of abundance annually and the highest peak was the fourth one and represented by 1556 and 1766 individuals /90 leaves in the second week of August during the two successive seasons 2016 and2017, respectively. Moreover ,the cotton mealybug , *P. solenopsis* had two peaks in the first season 2016 and the highest peak was the second one and represented by 1757 individuals /90 leaves ,while in the second season 2017 this insect had three peaks and the highest peak was the third one and recorded 1884 individuals /90 leaves.

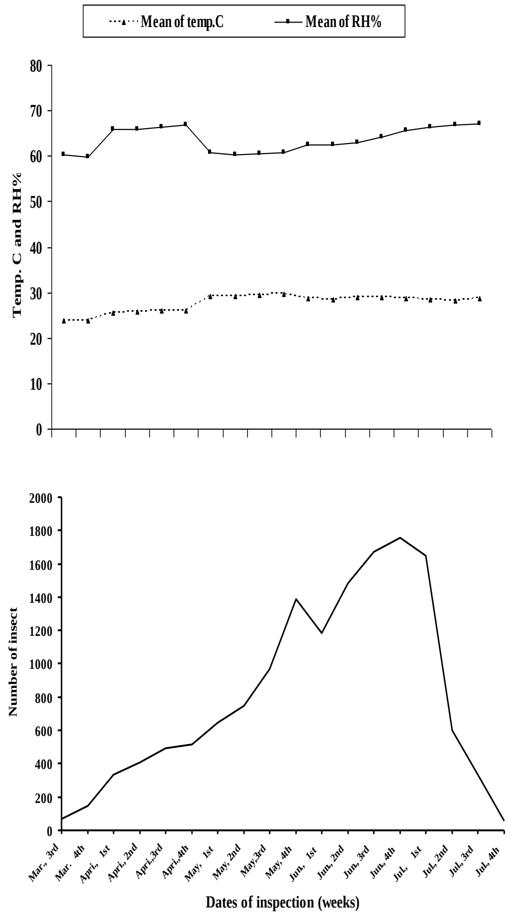

Fig. 3. Seasonal fluctuation of the cotton mealybug, *Phenacoccus solenopsis* Tinsley, infesting eggplant at Sharkia Governorate during 2016 season

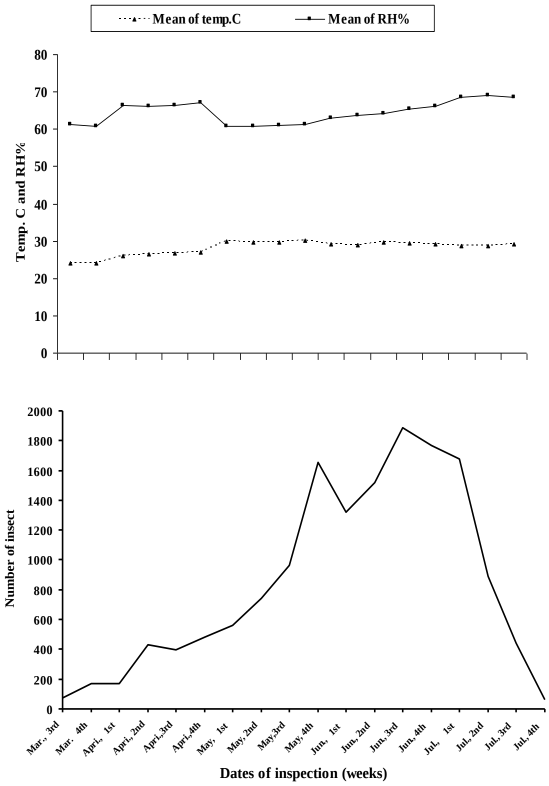

Fig. 4. Seasonal fluctuation of the cotton mealybug, *Phenacoccus solenopsis* Tinsley, infesting eggplant at Sharkia Governorate during 2017 season

The total numbers of aforementioned tested insects were higher in the second season than in the first one it may be due to the moderate values of temperature and highly values of relative humidity. These results agree with the findings of Abou-Zaid *et al.*(2012) and Hegab *et al.*(2014), who recoded that the population of *B..tabaci* reached its peak at the half of August. Nabil (2017) who showed that the females of *P. solenopsis* had two peaks of activity in June and August. Nabil and Hegab (2019), states that the occurrence of *P. solenopsis* had one peak in the first season and three peaks in the second season.

2. Effect of temperature and relative humidity on the population density of *B. tabaci and P. solenopsis* infesting eggplant

Effect of temperature

The obtained results in Table 1 revealed that the mean of temperature had a highly significant positive effect on the population density of *P. solenopsis* (r_1=0.638** and 0.659 **) in the two seasons, respectively. While it had a positive and non-significant effect on the population density of *B. tabaci* (r_1= 0.259 and 0.273) in the two seasons, consecutively.

Effect of relative humidity

The correlation coefficient between population density of *P. solenopsis* and relative humidity was negative and non-significant (r_2 = -0.144 and -0.146) in the two seasons, successively. Meanwhile, the correlation between relative humidity and population density of *B. tabaci* was positive and highly significant where r_2 =0.649** and 0.598** during 2016 and 2017 seasons, respectively.

Results in Table 1 showed the R^2, both correlation coefficient and coefficient of determination greatly influenced by the two aforementioned meteorological factors which played a conspicuous role in detecting the activity of these insect pests during the aforementioned investigated seasons. These results are in agreement with those obtained by Hegab (2015) who showed that the correlation between the number of whitefly and relative humidity was positively significant. Nabil (2017) found that the temperature had a positive significant effect on females population of *P. solenopsis*. Nabil and Hegab (2019) found that the temperature had a positive significant effect on the population of cotton mealy bug nymphs while it showed negative significant correlation between R.H. and the population of them.

Table 1. Coefficients of correlation and determination percentage between the means of temperature and relative humidity and the mean number of *B. tabaci* and *P. solenopsis* infesting eggplant plantations at Sharkia Governorate during 2016 and 2017 seasons

	Simple correlation coefficient		Coefficient of Determination (%)
1st season (2016)	**r_1**	**r_2**	**R^2**
B. tabaci	0.259	0.649**	46
P. solenopsis	0.638**	-0.144	54
2nd season (2017)	r_1	r_2	R^2
B. tabaci	0.274	0.598**	39
P. solenopsis	0.659**	-0.146	55

r_1 = Simple correlation coefficients between means of temperatures and the total numbers of insects.

r_2 = Simple correlation coefficients between means of relative humidity and the total numbers of insects.

****=significant at 0.1 level of probability.**

3. Efficacy of the tested insecticides against the cotton whitefly, *B. tabaci* infesting eggplant under field conditions

Data concerning the efficiency of three IGR, it is a selective insecticides (spiromesifen class of spirocyclic tetronic acids, generally known as keto-enols, pyriproxyfen class of juvenile hormone mimic, and buprofezin class of chitin synthesis inhibitor), imidacloprid, lambada-cyhalothrine + thiamethoxam and Abamectin + thiamethoxam against the whitefly attacking eggplant (var. Classic) plants under field conditions for two seasons (2016 and 2017) illustrated in Tables (2 and 3). In the first season, all tested insecticides showed high efficiency in mortality of the whitefly nymphs and adults. Also, there are significant differences between all tested compound. Application of Lambada cyhalothrine + thiamethoxam at 160 cm^3/fed. gave an excellent effect either as initial or residual effect recorded 83.62 and 93.88 %, respectively. Abamectin+thiamethoxam at 200 ml/fed caused 63.00 % as initial effect and 80.95 % as mean or residual effect, while, imidacloprid at 30 cm^3/100 L water indicated only 53.70 % as initial effect and 88.13 % as mean of residual effect. However, application of buprofezen at 600 cm^3/fed. Showed moderate effect between pyriproxyfen at 240 cm^3/ fed. and spiromesifen at 240 cm^3/ fed either as initial or residual effect which recorded 45.73 , 82.53 and 40.30, 78.70 and 35.25 and 74.965 %, respectively against the whitefly. After 3 days of treatments, the highest percentage of reduction was 88.00, 77.93, 77.52 and 72.65 for lambada cyhalothrine+ thiamethoxam, imidacloprid, pyriproxyfen and abamectin + thiamethoxam compared with to untreated control, respectively. At 7 days after application, it was clear that all the tested insecticides caused significant reduction of *B. tabaci* popoulation comparing with control. The percentage of reduction ranged between 77.14 % for spiromesifen to 96.29 % for lambada- cyhalothrine+ thiamethoxam after 10 days from application. Regarding the general mean, it is noticed that lambada-cyhalothrine+ thiamethoxam showed the most effective formulation and the highest reduction effect on whitefly during the first season with (96.73%), followed by imidacloprid (81.24 %), abamectin+thiamethoxam (77.36%) and pyriproxyfen (75.05 %), whereas, pyriproxyfen and buprofezin were classified as moderately toxic to *B. tabaci* (Table 2). During the second season of 2017, after one day application (initial effect), maximum reduction of whitefly, *B. tabaci* was recorded in lambada- cyhalothrine + thiamethoxam (76.95 %) and Abamectin + thiamethoxam (48.53 %) while pyriproxyfen and spiromesifen gave the minimum reduction with 37.63 % and 31.63%, whereas, buprofezen showed 28.84 %reduction, which classified as a slightly toxic formulation against *B. tabaci* as compare to untreated control. After 3 days, it was also observed that lambada-cyhalothrine+ thiamethoxam, pyriproxyfen and abamectin+ thiamethoxam were recorded 83.30, 75.17 and 72.31 %, respectively, followed by imidacloprid (71.47%), and those treatments were significantly different ($P \leq 0.05$), whereas, spiromesifen and buprofezen were 67.71 and 69.24 % classified as moderately toxic to *B. tabaci*, as compare to untreated control, respectively. Regarding to data recorded at 7, 10 and 14 days, it is obviously that, lambada-cyhalothrine+thiamethoxam was the most effective 88.48, 90.33 and 92.77 that are classified as highly toxic to *B. tabaci*, whereas, spiromesifen was indicated 75.73, 81.17 and 85.22 % as percentage reduction classified as moderately toxic to *B. tabaci*, as compare to untreated control, respectively. From these data it clear that the residual effect means ranged between 77.84 % for spiromesifen to 88.72 % for lambada-cyhalothrine+ thiamethoxam. In respect to the general effect, it seem that lambada-cyhalothrine+ thiamethoxam at 160 cm^3/ fed. was the most effective (86.36 %) and the effect was decreased gradually to reach 68.88 and 68.59 % mortality for spiromesifen and buprofezen , respectively (Table 3). Eggplant (*Solanum melongena*) is one of the most favored host plants, the whiteflies exhibit preferences for this plant among different varieties, as leaf trichrome density, trichrome length and leaf lamina thickness were positively correlated with numbers of whitefly adults and eggs (Seal, 2008 ; Hasanuzzaman *et al*., 2016 and Satar *et al*., 2018). Many chemical pesticides and integrated protection programs are used to control this pest and to decrease the widespread damage. Two selective foliar insecticides with different modes of action have been developed that are effective in reducing whitefly populations. Buprofezin is an insect growth regulator (IGR) that inhibits chitin synthesis (Ishaaya, 1988 and Palumbo *et al.,* 2001) and spiromesifen is registered IGR-like compound that inhibits lipid biosynthesis (Nauen *et al.,* 2003). Morin *et al.* (2008) found that high levels of resistance in *B. tabaci* to pyriproxyfen have been observed in several regions. In Florida, spiromesifen applied in different vegetable cropping systems at rates ranging from 100 to 150 g a.i/ha provided significantly greater control to *B. tabaci* nymphs than conventional insecticides (Toapanta *et al.,* 2008). Also, Sterk *et al.* (2008) stated that spiromesifen and some neonicotinoids are very effective against larvae and adults of different species of whiteflies, spider mites. In addition, spiromesifen was effective against all immature stages of whiteflies but exhibited geographical susceptibility differences. However, spiromesifen was significantly more active against early instars of whiteflies based on lowest LC_{50s} recorded (Prabhaker and Toscano, 2008). The efficac of different insecticides in controlling whitefly have been done by various workers viz (Jeschke, 2008; Palumbo, 2009; Nadeen *et al*., 2011and Fida *et al*., 2017). Also, Ghosal *et al.* (2018) found that the reduction of whitefly population over control after two sprays was 83.94% in spiromesifen+ imidacloprid followed by spiromesifen (80.39 %), buprofezin (73.67%), and imidacloprid (73.40%). Sulfoxaflor, abamectin+thiamethoxam and spirotetramat had the highest efficacy against *P. solenopsis* which recorded 80.3–96.05% reduction of the insect population after 21 days of application (Rezk *et al*., 2019).

Table 2. Average population and reduction percentages of the cotton whitefly, *Bemisia tabaci (Genn.)* infested eggplant after application of chemical insecticides during 2016 season

Compound		Pre-Count	Days post treatment					Mean of Residual effect	General mean
			1 day	3 days	7 days	10 days	14 days		
Spiromesifen 240 cm^3/fed	No. %Red.	5.68	4.41 (35.25)	2.28 (68.64)	2.06 (73.18)	1.80 (77.14)	1.57 (80.90)	1.92 74.965	2.42^C 67.02
Pyriproxyfen 240 cm^3/fed.	No. % Red	5.84	3.80 (45.73)	1.68 (77.52)	1.66 (78.98)	1.29 (84.06)	0.88 (89.59)	1.37 82.53	1.86^B 75.05
Buprofezin 600 cm^3/fed.	No. % Red	6.37	4.56 (40.30)	2.30 (70.79)	1.93 (77.59)	1.72 (80.52)	1.30 (85.90)	1.81 78.70	2.36^C 71.02
Imidacloprid 30 cm^3/100 L water	No. % Red	6.16	3.42 (53.70)	1.74 (77.93)	0.93 (88.84)	0.45 (94.73)	0.80 (91.03)	0.98 88.13	1.46^B 81.24
lambada cyhalothrine + thiamethoxam 160 cm^3/fed.	No. % Red	6.77	1.33 (83.62)	1.04 (88.00)	0.69 (92.46)	0.16 (96.29)	0.12 (98.78)	0.50 93.88	0.66^A 91.83
Abamectin + thiamethoxam 200 ml/fed	No. % Red	5.77	2.56 (63.00)	2.02 (72.65)	1.84 (76.42)	1.13 (85.87)	0.93 (88.87)	1.48 80.95	1.88^B 77.36
Control		8.29	9.94	10.61	11.21	11.49	12.00		

L.S.D. for Treatments= 7.5334 L.S.D. for Periods= 6.9745
Figures in parentheses refer to the percentages of reduction in mealybug's population comparing to control.
In the same column, means followed by the same letters are not significantly differed, p = 0.05 by Duncan (1955).
The concentrations used were based on the recommendations of the Egyptian Ministry of Agriculture for each insecticide to control cotton pests under field conditions.

4. Efficacy of the tested insecticides, against the cotton mealybug, *P. solenopsis* Tinsley on the eggplant under field conditions

Data in Tables (4and 5) clearly indicated that the order of efficiency of the tested insecticides was the same at both initial and residual effects in both seasons 2016 and 2017. No insecticide provided greater than 88.13% direct mortality of *P. solenopsis*. All treatments significantly reduced *P.solenopsis* on eggplant, compared with the nontreated control. The tested insecticides could be descendingly arranged as follows based on the initial effect: emamectin benzoate, chlorpyrifos, pyrethrins, thiamethoxam, imidacloprid and abamectin. Based on the initial effect values, the results indicated that emamectin benzoate insecticide was the most toxic insecticide (88.13 %) followed by chlorpyrifos (87.43 %), pyrethrins (79.71%), thiamethoxam (68.67 %), imidacloprid (65.03 %) and abamectin (40.87%) against *P. solenopsis* in 2016 season. At 3 days after treatment, emamectin benzoate at 250 cm^3/fed. Showed the highest effective insecticide followed by thiamethoxam at 25g/100L. At 7 and 10 days after treatment, application of imidacloprid at 75 ml/L00 L water resulted in a significant reduction in the number of the *P. solenopsis*, which recorded 95.46 and 100% mortality for all treatments. Regarding the mean of residual effect, data given in Table 4 indicated that thiamethoxam at 25g/100 L water had the steepest toxicity (91.67 %) ,whereas, chlorpyrifos had the flattest one (52.12 %). The other tested toxicants came between these two insecticides (thiamethoxam and chlorpyrifos).The percentages of reduction were recorded 85.92, 79.67, 77.80, 75.25, 69.91 and 60.94 % for thiamethoxam, imidacloprid, emamectin benzoate, abamectin, pyrethrins and chlorpyrifos as general mean, compared with control plot, respectively.

Table 3. Average population and reduction percentages of the whitefly, *Bemisia tabaci* after application of chemical insecticides infested eggplant during 2017season

Compound		Pre-Count	Days post treatment					Mean of residualeffect	General mean
			1 day	3 days	7 days	10 days	14 Days		
Spiromesifen	No.	6.44	4.90	2.54	2.24	1.84	1.53	2.03	2.61 D
240 cm³/fed	%Red.		(31.63)	(69.24)	(75.73)	(81.17)	(85.22)	77.84	68.59
Pyriproxyfen	No.	6.69	4.65	2.13	2.01	1.53	1.22	1.72	2.30DCB
240 cm³/fed.	% Red		(37.63)	(75.17)	(79.04)	(84.93)	(88.66)	81.95	73.08
Buprofezin	No.	6.33	5.02	2.62	1.96	1.61	1.40	1.89	2.52 DC
600 cm³/fed.	% Red		(28.84)	(67.71)	(78.40)	(83.24)	(86.24)	78.89	68.88
Imidacloprid	No.	6.70	3.98	2.13	1.49	1.30	1.58	1.62	2.09 CB
30 cm³/100 L water	% Red		(46.70)	(71.47)	(84.48)	(87.22)	(85.33)	82.12	75.04
lambada cyhalothrine +	No.	6.54	1.68	1.40	1.08	0.96	0.76	1.05	1.17 A
thiamethoxam 160 cm³/fed.	% Red		(76.95)	(83.30)	(88.48)	(90.33)	(92.77)	88.72	86.36
Abamectin + thiamethoxam	No.	6.45	3.70	2.29	1.84	1.49	1.13	1.68	2.09 B
200 ml/fed	% Red		(48.53)	(72.31)	(80.10)	(84.78)	(89.10)	81.57	74.96
Control		7.34	8.18	9.41	10.52	11.14	11.80		

L.S.D. for Treatments= 6.6933 L.S.D. for Periods= 6.1968
Figures in parentheses refer to the percentages of reduction in mealybug's population comparing to control.
In the same column, means followed by the same letters are not significantly differed, p = 0.05 by Duncan (1955).
The concentrations used were based on the recommendations of the Egyptian Ministry of Agriculture for each insecticide to control cotton pests under field conditions.

Table 4. Average population and reduction percentages of the cotton mealybug, *Phenacoccus solenopsis* infested eggplant after application of chemical insecticides during 2016 season

Compound		Pre-Count	Days post treatment				Mean of Residual effect	General mean
			1 day	3 days	7 days	10 days		
Chlorpyrifos	No.	6.36	1.05	2.01	4.50	5.54	4.016	3.27 B
1 L/fed.	%Red.		(87.43)	(76.57)	(46.12)	(33.67)	52.12	60.94
Emamectin benzoate	No.	6.80	1.06	1.76	3.85	4.69	3.433	2.84 B
250 cm³/fed.	% Red		(88.13)	(80.81)	(73.92)	(68.36)	74.36	77.80
Imidacloprid	No.	6.14	2.82	2.56	1.45	0.61	1.54	1.86 A
75 ml /L00 /L water	% Red		(65.03)	(69.09)	(89.12)	(95.44)	84.55	79.67
Abamectin	No.	6.13	4.76	1.85	1.88	0.45	1.39	2.23 AB
40 ml/100 L water	% Red		(40.87)	(77.63)	(85.87)	(96.63)	86.71	75.25
Pyrethrins	No.	6.08	1.62	2.46	4.18	5.09	3.91	3.33 B
440 ml/Fed.	% Red		(79.71)	(70.01)	(68.33)	(61.60)	66.64	69.91
Thiamethoxam 25 g /100L	No.	7.00	2.88	1.93	0.69	0.0	0.87	1.37 A
water	% Red		(68.67)	(79.56)	(95.46)	(100)	91.67	85.92
Control		8.94	11.74	12.06	19.41	19.49		

L.S.D. for Treatments= 21.834 L.S.D. for Periods=18.453
Figures in parentheses refer to the percentages of reduction in mealybug's population comparing to control.
In the same column, means followed by the same letters are not significantly differed, p = 0.05 by Duncan (1955).
The concentrations used were based on the recommendations of the Egyptian Ministry of Agriculture for each insecticide to control cotton pests under field conditions.

In 2017, the results presented in Table (5) indicated that emamectin benzoate at 250 cm³/fed. proved to be the most effective insecticide (90.78 % reduction) followed by chlorpyrifos at 1 L/fed. (87.86 %) followed by pyrethrins at 440 ml/Fed. (85.86 %) as initial effect against the of *P. solenopsis*. Imidacloprid came in second position between thiamethoxam and abamectin were 65.64, 58.57 and 51.15 % as initial effect, respectively. Pyrethrins was the most toxic treatment (83.84 %) after 3 days followed by emamectin benzoate (82.90 %) and thiamethoxam (82.12%) reduction of insect population. thiamethoxam, imidacloprid and abamectin had their effectiveness recorded 90.94, 86.79 and 85.59 % reduction of *p. solenopsis* within first seven days of application, respectively. After ten days following the insecticides application, thiamethoxam, imidacloprid and abamectin compounds showed the high effectiveness. All insecticides had obtained the mean percentage of reduction of *p. solenopsis* and were significantly higher than control treatments. Concerning the residual effect and general mean of the tested insecticides, thiamethoxam showed high effect (90.82 and 84.52 % as residual effect and general mean). Imidacloprid and abamectin were recorded 87.25, 82.82 and 80.08 and 74.90% for the residual effect and general mean, respectively. Pyrethrins showed moderate effect between emamectin benzoate and chlorpyrifos and recorded 74.07, 59.36 and 54.68 as residual effect, meanwhile, the corresponding percentages reduction 78.25, 65.98 and 63.00 as general mean, respectively. Neonicotinoids, thiamethoxam and imidacloprid provides effective control and good residual activity against *p.solenopsis*. However, emamectin benzoate and pyrethrins provided excellent *p.solenopsis* control for 3 days while thiamethoxam, imidacloprid and abamectin provided an additional 10 days of excellent and good control, respectively. In many cropping systems, control of *p. solenopsis* depends on insecticides including organophosphates (OPs), carbamates, pyrethroids, insect growth regulator (IGRs), and neonicotinoids. Imidacloprid and other neonicotinoids, e.g., thiamethoxam, have demonstrated efficacy against sucking insects including aphids, leafhoppers, mealybugs and whiteflies (Rauch and Nauen, 2003) acting on the nicotinic acetylcholine receptors (nAChRs) in the nervous system of pests (FAO, 2011 and Cutler *et al*., 2013). The field rates of thiamethoxam and imidacloprid applied in the laboratory resulted in 95.2 and 81.6% mortality, respectively in the 2nd instar nymphs of *P. solenopsis* (Rashid *et al*., 2011). Under laboratory conditions, Kumar *et al*. (2012) found that chlorpyrifos at 8 ml/ L caused 61.3% mortality in the five days-old nymphs of *P. solenopsis*. The *P solenopsis* infestations on different hosts could be effectively controlled using biological control agents, plant extracts, mineral oils and synthetic insecticides (Aheer *et al*., 2009; Suresh *et al*., 2010; Kumar *et al*., 2012; Rasheed *et al*., 2014; Ujjan *et al*., 2015; El-Zahi *et al*., 2016; El-Zahi and Fara, 2017 ; Abdel-Mageed *et al*., 2018; Waqas *et al*., 2019 and Zia and Haseeb, 2019).

Table 5. Average population and reduction percentages of the cotton mealybug, *Phenacoccus solenopsis* after application of chemical Insecticides infested eggplant during 2017 season

Compound		Pre-Count	Days post treatment				Mean of Residual effect	General mean
			1 Day initial(effect)	3 days	7 days	10 days		
Chlorpyrifos 1 L/fed.	No. %Red.	7.04	0.85 (87.95)	1.74 (79.79)	4.76 (45.45)	5.33 (38.81)	3.94 54.68	3.17^{C} 63.00
Emamectin benzoate 250 cm^3/fed.	No. % Red	6.60	0.61 (90.78)	1.38 (82.90)	2.08 (74.85)	2.86 (64.48)	1.10 74.07	1.73 ^{C} 78.25
Imidacloprid 75 g /L00 /L water	No. % Red	6.84	2.84 (58.57)	1.66 (80.16)	1.12 (86.79)	0.44 (94.80)	1.07 87.25	1.51^{AB} 80.08
Abamectin 40 ml/100 L water	No. % Red	6.72	3.29 (51.15)	2.25 (72.62)	1.20 (85.59)	0.81 (90.26)	1.42 82.82	1.887^{B} 74.90
Pyrethrins 440 ml/Fed.	No. % Red	7.62	1.08 (85.86)	1.54 (83.84)	4.62 (51.09)	5.36 (43.15)	3.84 59.36	3.15 ^{C} 65.98
Thiamethoxam 25 g /100L water	No. % Red	6.86	2.30 (65.64)	1.50 (82.12)	0.77 (90.94)	0.05 (99.41)	0.773 90.82	1.15 ^{A} 84.52
Control		9.10	9.12	11.13	11.28	11.26		

L.S.D. for Treatments= 9.5048 L.S.D. for Periods=8.0330
Figures in parentheses refer to the percentages of reduction in mealybug's population comparing to control.
In the same column, means followed by the same letters are not significantly differed, p = 0.05 by Duncan (1955).
The concentrations used were based on the recommendations of the Egyptian Ministry of Agriculture for each insecticide to control cotton pests under field conditions.

In the conclusions monitoring the dynamics of the tested insects will help in choosing the best time and strategy for management of the specified pests. The results of this study can be recommended for using lambada-cyhalothrine + thiamethoxam to control whitefly populations and prevent significant infestation comparing with IGR-like compounds such as spiromesifen, pyriproxyfen and buprofezin. Under normal field planting conditions in 2016 and 2017, spray treatments applied using the emamectin benzoate, chlorpyrifos, and pyrethrins provided good reduction against *P. solenopsis* and those treatments were significantly difference at ($P<0.05$), whereas, thiamethoxam, imidacloprid and abamectin classified as moderately toxic to *P. solenopsis*. This is particularly critical when growers consider IPM guidelines which restrict the use of these compounds to a single application per crop season.

REFERENCES

Abbas, G., M. J. Arif, M. Ashfaq, M. Aslam, and S. Saeed (2010). Host plants, distribution and over wintering of cotton mealybug (*Phenacoccus solenopsis*; Hemiptera: Pseudococcidae).International Journal of Agriculture and Biology, 12: 421- 425.

Abdel-Mageed, A. E. M., Naglaa , M. Youssef and M. E. Mostafa (2018). Efficacy of some Different Insecticides against Cotton Mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) and Its Associated Predators Journal of Plant Protection and Pathology, Mansoura Univ., 9 (6): 351– 355.

Abou-Zaid, A. M. M., E. M. Bakr, S. A. Yassin and N. A. A. Hameed (2012). Abundance of three sap sucking pests on three eggplant cultivars with utilization of *Phytoseiulus persimilis* Athias-Henriot against *Tetranychus urticae* Koch control. Acarines, 6: 49-53.

Aheer,G. M., R. Ahmad and A. Ali (2009). Efficacy of different insecticides against cotton mealybug, *Phenacoccus solani* Ferris. Journal of Agricultural Research, 47 (1): 47-52.

Audemard, H. and H. G. Milaire (1975). Le pieeage carpocapse (*Laspeyresia pomonella* L.) avec une pheromone sexuelle de synthese: premiers resultats utilisables pour 1 estimation des populations et laconduite de la lutte. Ann. Zoll. Ecol. Animal. 7-61.

COSTAT (2005). Version 6.311, Copyright(c), CoHort Software, 798 Lighthouse Ave. PMB 320, Monterey, CA, 93940, USA.

Cutler P. , R. Slater , A. J. F. Edmunds , P. Maienfisch , R.G. Hall , F. G. Earley , T. Pitterna , S. Pal , V. L. Paul , J. Goodchild , M. Blacker , L. Hagmann and A. J. Crossthwaite (2013). Investigating the mode of action of sulfoxaflor: a fourth-generation neonicotinoid. Pest Management Science, 69 (5): 607-619.

El-Zahi, E. S. , S. A. Aref and S. K. M. Korish (2016). The cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) as a new menace to cotton in Egypt and its chemical control. Journal of Plant Protection Research, 56 (2): 111-115.

El-Zahi, S. E. and A. I. Fara (2017). Population Dynamic of *Phenacoccus solenopsis* Tinsley on Cotton Plants and Its Susceptibility to Some Insecticides in Relation to the Exposure Method. Alexandria science exchange journal, 38(2): 231-237.

Fereres, A. and A. Moreno (2009). Behavioral aspects influencing plant virus transmission by homopterous insects. Bull. of plant virus epidemiology, 141(2):158-168.

Fida, M. H. , K. H. Lashari , M. A. Chandio , Z. A. Bhutto , N. A. Channa , A. A. Junejo , A. A. Soomro , S. H. Lashari and S. Mangi (2017). Effectiveness of different synthetic insecticides against *Bemisia tabaci* (genn) on tomato crop. International Journal of Fauna and Biological Studies, 4(3):06-09.

Food and agricultural organization/world health organization (2011). available from: http://apps. who. int/pesticide-residues-jmpr.

Ghosal, A. , M. L. Chatterjee and A. Bhattacharyya (2018). Field Bio-efficacy of Some New Insecticides and Tank Mixtures against Whitefly on Cotton in New Alluvial Zone of West Bengal. Pesticide Research Journal, 30(1): 31-36.

Hasanuzzaman, A. T. M. , M. N. Islam , Y. Zhang , C.Y. Zhang and T. X. Liu (2016). Leaf Morphological Characters Can Be aFactor for Intra-Varietal Preference of Whitefly, *Bemisia tabaci* (Hemiptera: Aleyrodidae) among EggplantVarieties. Plos One:1-15 April 15, 2016| DOI:10.1371/journal. pone.0153880.

Hegab, M. A., A. E. Ibrahim, A. A. Shahein and Jasmein, E. Abdel-Magid (2014). Susceptibility Of Certain Solanaceous Plant Varieties To Some Homopterous Insects Infestation. Journal of Entomology, 11(4):198-209.

Hegab, M.A. (2015). Studies On Certain Piercing Sucking Insects As Vectors Of Pytopathogenic Agents In Sharkia Governorate . Ph.D. Thesis Fac. Agric., Zagazig Univ. Egypt.

Henderson, C.F. and E.W. Tilton (1955). Test with acaricides against the brown wheat mite. Journal of Economic Entomology, 48:157-161.

Ishaaya, I. , Z. Mendelson and V. M. Madjar (1988). Effect of buprofezin on embryogenesis and progeny formation of sweetpotato whitefly (Homoptera: Aleyrodidae). Journal of Economic Entomology, 81:781-784.

Jahel , M. K. , S. M. Halawa , A. A. Hafez , T. R. Abd El-Zahar and K. K. Elgizawy (2017). Comparative efficacy of different insecticides against whitefly, *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) on Tomato Plants. Middle East Journal of Applied Sciences,7(4):786-793.

Jeschke, P. N. (2008). Neonicotinoids - from zero to hero in insecticide chemistry. Pest Management Science, 64:1084-1098.

Kumar, R. , M. Nitharwal , R. Chauhan , V. Pal and K.R.Kranthi (2012). Evaluation of ecofriendly control methods for management of mealybug, *henacoccus solenopsis* Tinsley in cotton. Journal of Entomology, 9 (1): 32-40.

Morin, S. , M. Wilson , P. Moshitzky , E. Laor and A. R. Horowitz (2008). Reversal of Resistance to Pyriproxyfen in the Q Biotype of *Bemisia tabaci* (Hemiptera: Aleyrodidae). Journal of Insect Science, in Fourth International *Bemisia* Workshop International Whitefly Genomics Workshop, Phillip A. Stansly and Cindy L. McKenzie, organizers (eds), December 3–8, 2006, Duck Key, Florida, USA, ISSN: 1536-2442.

Moura, M. F. , J. M. Marubayashi , T. Mituti , R. Gioria , R. F. Kobori , M. A. Pavan and R. K. Sakate (2012). Comparative analysis of coding region for the coat protein of PepYMV and PVY isolates collected in sweet pepper .Summa Phytopathologica, 38(1):93-96.

Nabil, H. A. and M. A. Hegab (2019). Impact of Some Weather Factors on the Population Density of *Phenacoccus solenopsis* Tinsley and its Natural Enemies. Egypt. Academic Journal of Biological Science, 12(2): 99– 108.

Nabil, H.A. (2017). Ecological Studies on Cotton Mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Sternorrhyncha: Coccoidea: Pseudococcidae) on Eggplant at Sharkia Governorate, Egypt . Egypt. Acad. J. Biolog. Science, 10(7): 195–206.

Nadeem, M.K. , S. Nadeem , M. Hasnain , S. Ahmed and M. Ashfaq (2011). Comparative efficacy of some insecticides against cotton Whitefly, *Bemisia tabaci* (Gennadius) (Homoptera:Aleyrodidae) Under natural field conditions.The Nucleus, 48(2): 159-162.

Nauen, R. , T. Bretschneider , A. Elbert , R. Fischer and R. Tiemann (2003). Spirodiclofen and spiromesifen. Pestic. Outlook, 14:243-246.

Palumbo, J. C. (2009). Spray timing of spiromesifen and buprofezin for managing *Bemisia* whiteflies in cantaloupes. Online. Plant Health Progress. 7 April 2009.

Palumbo, J. C. , A. R. Horowitz and N. Prabhaker (2001). Insecticidal control and resistance management for *Bemisia tabaci*. Crop Prot, 20:835-852.

Palumbo, J. C., K. Nolte, A. Fournier and P. C. Ellsworth (2007). Insect Crop Losses and Insecticide Usage for Spring Melons in Southwestern Arizona for 2007, Vegetable Report, College of Agriculture and Life Sciences, The University of Arizona, Tucson, AZ. Online.

Prabhaker, N. and N. C. Toscano (2008). Spiromesifen: A New Pest Management Tool for Whitefly Management Journal of Insect Science, in Fourth International Bemisia Workshop International Whitefly Genomics Workshop, Phillip A. Stansly and Cindy L. McKenzie, organizers (eds), December 3–8, 2006, Duck Key, Florida, USA, ISSN: 1536-2442.

Rasheed, M. , S. Bushra and M. Tariq (2014). Use And Impact Of Insecticides In Mealybug Control. International Journal of Advances in Biology (IJAB).Vol(1): No .2, November 2014.

Rashid, M. , M. K. Khattak , K. Abdullah and S. Hussain (2011). Toxic and residual activities of selected insecticides and neem oil against cotton mealybug, *Phenacoccus solenopsis* Tinsley (Sternorrhyncha: Pseudococcidae) under laboratory and field conditions. Pakistan Entomologist, 33 (2): 151-155.

Rauch, N. and R. Nauen (2003). Identification of biochemical markers linked to neonicotinoid cross resistance in *Bemisia tabaci* (Hemiptera: Aleyrodidae). Archives of Insect Biochemistry and Physiology, 54: 165-176.

Rezk, M., A. T. Hassan , M. F. El-Deeb , N. Shaarawy and Y. Dewer (2019). The impact of insecticides on the cotton mealybug, *Phenacoccus solenopsis* (Tinsley): Efficacy on potato, a new record of host plant in Egypt. Journal of Plant Protection Research, 59 (1):1427-4345.

Satar, G., M. R. Ulusoy, R. Nauen, and K. Dong (2018). Neonicotinoid insecticide resistance among populations of *Bemisia tabaci* in the Mediterranean region of Turkey. Bulletin of Insectology, 71(2): 171-177.

Seal, D. R. (2008). Development of a Management Program against Silverleaf Whitefly (SLW), *Bemisia argentifolii* Bellows & Perring (Hemiptera: Aleyrodidae), using Insecticides. Journal of Insect Science, in Fourth International Bemisia Workshop International Whitefly Genomics Workshop, Phillip A. Stansly and Cindy L. McKenzie, organizers (eds), December 3–8, 2006, Duck Key, Florida, USA, ISSN: 1536-2442.

Simmons , A. M. and S. Abd-Rabou (2009). Population of the Sweetpotato Whitefly in Response to Different Rates of Three Sulfur-Containing Fertilizers on Ten Vegetable Crops. International Journal of Vegetable Science, 15:57–70

Sterk, G., M. V. d. Veire and K. Put (2008). Implementation of Chemical and Biological Protection Compounds of Different Chemical and/or Biological Groups against Whiteflies in IPM Systems. Journal of Insect Science, in Fourth International Bemisia Workshop International Whitefly Genomics Workshop, Phillip A. Stansly and Cindy L. McKenzie, organizers (eds), December 3–8, 2006, Duck Key, Florida, USA, ISSN: 1536-2442.

Suresh, S. R. J. , P. Sivasubrmanian , P. Karuppuchamy , R. Samiyappan and E.I. Jonathan(2010). Invasive mealybugs of Tamil Nadu and their management. Karnataka. Journal of Agricultural Sciences, 23(1): 6-9.

Toapanta, M. , D. Schuster , R. Mann , R. Cordero , L. Buckelew , R. Steffens , S. Hand , R. Rudolph and R. Nauen (2008). Oberon® 2SC: A New Resistant Management Tool for Whitefly Control in Vegetables. Journal of Insect Science, in Fourth International Bemisia Workshop International Whitefly Genomics Workshop, Phillip A. Stansly and Cindy L. McKenzie, organizers (eds), December 3–8, 2006, Duck Key, Florida, USA, ISSN: 1536-2442.

Ujjan, A. A. , M. A. Khanzada , A. Q. Mahar and S. Shahzad (2015). Efficiency of Metarhizium spp. (Sorokīn) Strains and Insecticides Against Cotton Mealybug *Phenacoccus solenopsis* (Tinsley). Pakistan Journal of Zoolgy, 47(2): 351-360.

Vennila, S. ,Y.G. Prasad , M. Prabhakar , R. K. V. Nagrare , M. Amutha , A. M. Dharajyothi , G. Sreedevi , B. Venkateswarlu , K. R. Kranthi and O. M. Bambawale (2011). Spatiotemporal distribution of host plants of cotton mealybug, *Phenacoccus solenopsis* Tinsley in India. NCIPM, Tech. Bull., 26: 1-50.

Waqas, M. S. , L. Qian , A. A. Z. Shoaib , X. Cheng , Q. Zhang , A. S. S. Elabasy and Z. Shi (2019). Lethal and Sublethal Effects of Neonicotinoid Insecticides on the Adults of *Phenacoccus solenopsis* (Hemiptera: Pseudococcidae) on Tomato Plants. Journal of Economic Entomology,112(3):1314–1321.

Zia A. and M. Haseeb (2019). Seasonal incidence of cotton mealybug, *Phenacoccus solenopsis* (Tinsley) on okra, *Abelmoschus esculentus* (L.) and comparative efficacy of insecticides on the mortality.Journal of Entomology and Zoology Studies, 7(4): 421-425.

رصد بعض الحشرات الثاقبه الماصه ومكافحتها على الباذنجان

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إجريت تجربتان حقليتان لدراسة ديناميكية تعداد حشرة الذبابة البيضاء(.Bemisia tabaci (Genn وحشرة البق القطن الدقيقى *phenacoccus solenopsis* Tinsley بالإضافة إلى تقييم كفاءة بعض المبيدات الحشرية ضد الحشرتين التى تصيب نباتات الباذنجان فى محافظة الشرقية أثناء موسمين متعاقبين 2016و2017. اشارت النتائج المتحصل عليها أن *B. tabaci* سجل لها أربعة قمم تعداد موسمية وكانت أعلى قمة تعداد هى القمه الرابعه خلال موسمى 2016و2017 على التوالى، علاوة على إن *P. solenopsis* سجلت لها قمتين تعداد فى الموسم الأول 2016 وكانت أعلى قمة تعداد هى القمة الثانية، بينما سجلت لها ثلاث قمم تعداد فى الموسم الثانى 2017 وكانت أعلى قمة تعداد هى القمة الثالثة ، كانت الإصابة بتلك الحشرتين ذات وفرة موسمية عالية فى الموسم الثانى بالمقارنة بالموسم الأول، ربما يكون ذلك بسبب تأثير العوامل الجوية تحت الدراسة. علاوة على أن النتائج وضحت ان اكثر المبيدات فعالية ضد حشرة *B. tabaci* مبيدى لمباداثهالوثرين + ثياميثوكسام وأميداكلوبريد ، تلى ذلك فى الفعالية مبيدات بيربروكسيفين ، أبامكتين+ ثاميثوكسام، بيروفيزين وسبيروميثوفين حيث أعطت سمية متوسطة للحشرة المختبرة خلال الموسمين على التوالى. وأيضا اظهرت الدراسة إن مبيدى ثياميثوكسام وأبامكتين كانا أكثر المبيدات المختبرة فعالية ضد حشرة *P. solenopsis* ، تلى ذلك فى الفعالية مبيدات أميداكلوبريد، أبامكتين بنزوات، بيروثرين و كلوربيروفوس في كلا من الموسمين على التوالى. هذه الدراسة تؤدى إلى فهم إيكولوجية تلك الآفتين والتى سوف تساعد في تصميم برامج مكافحة متكاملة لتلك الآفات، ومن ناحية اخرى تظهر دور المبيدات الجهازية التى قد تكون أقل ضررا على أعدائها الحيوية.