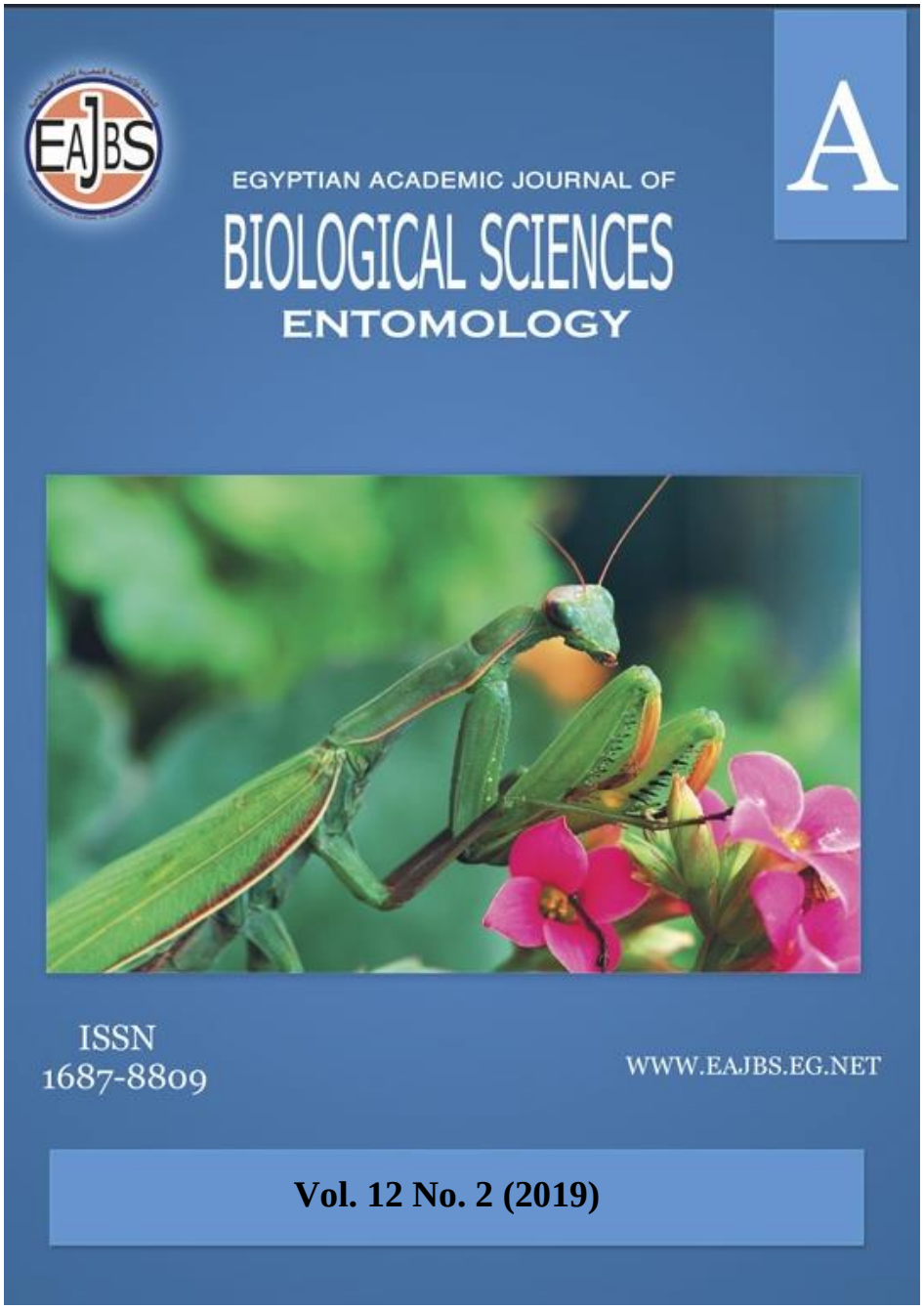

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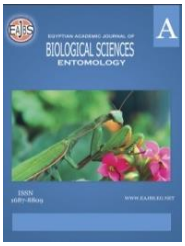

Impact of Some Weather Factors on the Population Density of *Phenacoccus solenopsis* Tinsley and its Natural Enemies

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ABSTRACT

The aimed of this investigation was to estimate the seasonal abundance and activity periods of the cotton mealybug, *Phenacoccus solenopsis* Tinsley and its associated parasitoid on okra plants. **T**he present experiment was conducted at Hihhya distract, Sharkia Governorate during two consecutive seasons 2017 and 2018. Plant samples were taken weekly to calculate the population density of different stages of tested pest and its parasitoid, the effect of some weather factors, the number of generations and the best leaf surface. **T**he present work was found a reverse relation between the populations of the cotton mealybug (CMB) and its associated parasitoids. The population dynamic of CMB was high while the population of its parasitoids was low in the first season. On the other hand, the opposite results were obtained during the second season. The *P. solenopsis* had two to three generations during the first and second seasons, respectively. There was significantly positive correlation between maximum temperature and the population females of this insect whereas, a significant negative correlation was found with mean of relative humidity during the period of this investigation. The results of this study may help the researchers for designing a comprehensive pest management program and prediction models for the cotton mealybug to restrict their further spread.

INTRODUCTION

Okra plant, *Ablmoschus esculentus* L., is one of the most important Malvaceae crops which used as human food in Egypt, which infested by polyphagous mealybug throughout the growing season. The mealybug caused large damages of the quantity of yield either directly by sucking plant juice, weakening and death of some parts of plants or indirectly by excreted honeydew, which caused growth of sooty mould and inhibited photosynthesis process in plant. Also, it may transmit the pathogens to plants (Hodgson *et al.*, 2008; Arif *et al.*, 2009; Saini *et al*., 2009; Abbas *et al.*, 2010 and Vennila *et al.*, 2011). The *P. solenopsis* had found on a wide range of vegetable crops including species of economically important families such as Malvaceae, Solanaceae and Cucurbitaceae which reported by many authors such as Abd-Rabou *et al.* (2010), Wang *et al*., (2010), Zhu *et al*., (2011), Ibrahim *et al.*, (2015), Nabil *et al.,* (2015) and Nabil (2017).The outbreaks often occur when mealybugs get introduced to new locations in the absence of their natural enemies. So, the biological agent should be

considered an effective factor for decreasing the populations of the tested insect in different parts of the world (Sagarra *et al*., 2001; Bokonon-Ganta *et al*., 2002; Muniappan *et al*., 2006and Roltsch *et al*., 2006). Despite of the economic importance of cotton mealybug, which caused considerable economic damage to agriculture and vegetable plants, accordingly the researchers are interested in studying the ecology and activity periods of this insect to select the most suitable time to control. Therefore, the current study aimed to determine some ecological parameters of the different stages of this insect and its associated parasitoids on okra plants during 2017 and 2018 seasons. So, this study may help the researchers in the integrated pest management against the cotton mealybug and prediction models for this pest.

MATERIALS AND METHODS

The experiment was conducted in an area of about half feddan for okra plants, *Abelmoschus esculentus* L. which located at Hihhya district, Sharkia Governorate, Egypt. The study was continued from the third week of July to the second week of November for two successive seasons 2017 and 2018.The normal agricultural practices were applied in due time and all plots were kept without any insecticide treatments. Sampling started when the age of plants reached about one month after sowing dates and continued weekly intervals throughout the growing season.

Survey and Population Density of Cotton Mealybug:

Forty leaves were taken randomly from both diagonal directions of the experimental area. These samples were transferred to the laboratory and examined using a stereomicroscope in the same day. The different stages of *P. solenopsis* on both surfaces of the leaves were counted and recorded. According to the work of Audemard and Milaire(1975). The weekly data of the stages nymph were indicated on millimeter papers to calculate the number of generations and their durations.

Estimation the Percentage of Parasitism:

To study the percentage of parasitism of *P. solenopsis*, the insects on each sample were separated into healthy alive insects and Mummies of its insect which bearing emerging holes of parasitoid adults. Mummies of these insects were preserved in glass jars, covered with muslin cloth by the aid of rubber bands and kept under laboratory conditions until parasitoids emergence for each sample. The parasitoids emerged were identified with helping of Prof. Dr. A.R. Hamed, Chief Researcher emeritus, Biological Control Department, Plant Protection Research Institute, Agricultural Research Center, Giza, Egypt. The numbers of mummies, parasitoids and the percentages of parasitism were recorded.

Effect of Some Weather Factors on the Insect Populations:

The maximum of temperature, minimum of temperature, relative humidity and solar radiation were obtained from the Meteorological Central Laboratory, Agricultural Research Center, and Ministry of Agriculture. Light intensity (Lux) was measured at mid-day (12 *a.m.*) Using Luxmeter during the period of this studying. To indicate the effect of each factor of the tested climatic factors on the population of tested insect and its associated parasitoids.

Statistical Analysis:

Simple correlation values (r) and coefficient of determination percentage (C.D. %) were calculated using CoStat, Computer Program (2005).

RESULTS AND DISCUSSION

Population Density of *Phenacoccus solenopsis* and Its Parasitoids On Okra Plant:

1. Females Population Density:

The infestation with Females of *P. solenopsis* started on the fourth week of July and the first week of August during 2017 and 2018 seasons, respectively. Data in Tables (1 and 2), illustrated the population of females had two peaks, the first one occurred on the third week of August with 199 females / 40 leaves and the second peak recorded on the fourth week of September with 552 females during 2017 season. While, in the second season 2018, three peaks of females activity were noticed on the fourth week of August, the first week of September and the first week of October with values of 64, 44 and 19 females, respectively.

2. Nymphs Population Density:

The population trend started to increase in July and was maximum during September and October, declined afterwards during the month of November at crop maturity. Results arranged in Tables (1 and 2), demonstrated that the population of nymphs had one peak of activity which recorded during the first season on the fourth week of September with a value of 31263 nymphs. While, in the second season the nymphs population showed four peaks of activity on the last week of July, the second week of August, the first week of September and the first week of October with values of 36, 39, 239 and 220 nymphs, consecutively.

3. Total Number of a Live Stage:

One peak of the total number of a live stage was observed on the 4th week of September and represented by 31815 individuals during 2017 season. On the other hand, Three peaks of activity were noticed on the last week of July, the first week of September and the first week of October with values of 36, 283 and 239 individuals, respectively during 2018 season Tables (1and 2). Obtained results were in agreement with the finding of Jaydeep *et al*.,(2015) and Nabil(2017) studied that, the occurrence of *P. solenopsis* on some vegetable crops such as tomato, brinjal (eggplant) and okra observed that the mealybug infested eggplant from July to August.

4. The Percentage of Parasitism:

During the course of this study, *Aenasius arizonensis* (Girault) was observed as associated parasitoid of *P. solenopsis* and *Prochiloneurus aegyptiacus* (Mercet) and *Pachyneuron* sp. were recorded as hyperparasitoids associated with the primary one. Data in Tables (1 and 2), revealed that the three and four peaks of parasitism percentages were recorded during the first and second seasons, respectively. These peaks were observed on the second week of September, fourth week of September and third week of October with 0.85, 0.54 and 6.86%, respectively for the first season. While, in the second one the parasitism percentage peaks occurred on the second week of August ,the fourth week of August , last week of September and the second week of October by 33.63, 23.59, 57.60 and34.48%, constructively. Attia and Awadallah(2016),recorded that, *Prochiloneurus aegyptiacus* (Encyrtidae) and *Pachyneuron* sp. (Pteromalidae) as hyperparasitoids associated with the primary parasitoids. Vinay *et al*.,(2016), found that, *Aenasius* sp. is the associated parasitoid of *P. solenopsis* .

Table 1. Population density of *Phenacoccus solenopsis* Tinsley infesting okra plant at Hihhya distract, Sharkia Governorate during 2017 season

Date	Number of insects / sample					Weekly average of climatic factors				
	Females	Nymphs	Total alive stages	Parasitized individuals	% parasitism	Max.of Temp. (°C)	Min. of Temp. (°C)	RH (%)	Solar radiation (MJ/m²)	Light intensity (Lux)
22/7/2017	0	2	2	0	0.00	31.0	18.0	52.0	14.0	86000
29/7/2017	4	40	44	0	0.00	33.5	16.5	55.1	15.0	88500
5/8/2017	5	61	66	0	0.00	31.5	15	56.0	13.0	88000
12/8/2017	11	85	96	0	0.00	31.0	18.0	55.0	12.5	86000
19/8/2017	199	405	604	0	0.00	32.0	19.0	53.0	13.0	90000
26/8/2017	154	454	608	1	0.16	36.2	21.1	55.0	14.5	86000
2/9/2017	116	922	1038	5	0.48	37.0	21.2	50.5	14.6	85000
9/9/2017	504	3701	4205	36	0.85	37.5	20.2	51.0	14.0	84000
16/9/2017	520	5269	5789	6	0.10	37.5	20.0	50.0	14.3	83000
23/9/2017	552	31263	31815	174	0.54	32.5	18.5	54.5	14.0	82000
30/9/2017	144	13710	13854	57	0.41	32.0	17.0	55.2	15.0	82000
7/10/2017	79	5303	5382	156	2.82	31.0	16.5	56.0	15.0	80000
14/10/2017	8	1749	1757	62	3.41	31.0	17.1	55.0	12.5	77000
21/10/2017	5	579	584	43	6.86	31.0	17.7	55.0	14.0	76000
28/10/2017	1	38	39	2	4.87	31.0	17.0	55.2	11.5	73000
4/11/2017	0	20	20	1	4.76	30.2	17.5	55.3	12.5	68000
11/11/2017	0	5	5	0	0.00	30.4	17.6	54.1	13.0	67000
Total	**2302**	**63606**	**55908**	**543**						

- Each sample is forty leaves

Table 2. Population density of *Phenacoccus solenopsis* Tinsley infesting okra plant at Hihhya distract, Sharkia Governorate during the 2018 season

Date	Number of insects / sample					Weekly average of climatic factors				
	Females	Nymphs	Total alive stages	Parasitized individuals	% parasitism	Max.of Temp. (°C)	Min. of Temp. (°C)	RH (%)	Solar radiation (MJ/m²)	Light intensity (Lux)
18/7/2018	0	10	10	0	0.00	35.0	20.0	56.0	17.0	86000
25/7/2018	0	36	36	0	0.00	35.0	21.0	56.3	16.6	88000
1/8/2018	3	14	17	0	0.00	35.2	21.7	55.0	15.5	88000
8/8/2018	36	39	75	38	33.63	36.0	21.8	54.0	14.0	87000
15/8/2018	58	31	89	16	15.24	36.0	20.0	54.0	14.2	90000
22/8/2018	64	166	230	71	23.59	37.0	21.0	50.5	14.0	87000
29/8/2018	33	235	268	34	11.26	37.5	20.0	52.0	13.0	85000
5/9/2018	44	239	283	63	18.21	37.1	19.0	51.0	14.1	84000
12/9/2018	18	67	85	44	34.65	32.0	17.0	54.5	13.0	83000
19/9/2018	9	37	46	28	37.84	31.0	16.0	55.1	11.0	82000
26/9/2018	2	51	53	72	57.60	30.0	17.5	55.0	11.5	81000
3/10/2018	19	220	239	89	27.13	30.5	16.5	54.0	12.5	80000
10/10/2018	4	129	133	70	34.48	30.0	16.1	55.0	12.5	75000
17/10/2018	2	55	57	20	25.97	30.0	16.7	55.0	12.0	74000
24/10/2018	1	23	24	8	25.00	30.0	16.0	55.2	11.5	71000
31/10/2018	0	12	12	2	14.29	29.4	16.5	55.3	12.5	67000
7/11/2018	0	6	6	1	14.28	29.2	16.6	54.1	12.0	67000
Total	**293**	**1370**	**1663**	**556**						

- Each sample is forty leaves

Finally, it was concluded that the total numbers of females, nymphs and a live stage were higher in the first season than in the second one because of the lack of natural enemies of its pest in the first season but after the increase of parasitoids associated with them in the second season, reduction the population of this pest was observed. The several control measures were applied to reduce the pest population in different areas but all went unsuccessful because of the loss of natural enemies on this invasive pest (Shylesha *et al.,* 2010; Mahmood *et al.*, 2011and Sahito *et al.,* 2011).

2. Effects of Some Weather Factors on Different Stages of *P. solenopsis* :

Results presented in Table (3), illustrated that the correlation between the maximum of temperature and the population of females was positive and highly significant during the two seasons where r_1=0.653** and 0.700**, consecutively.

While it was positively significant between the population of females and the minimum of temperature (r_2=0.543*) in the first season .On the other hand, there was a negative and significant correlation between the percentage of parasitism and the minimum temperature in 2018 season (r_2=-0.489*).

Relative humidity had a highly negative significant effect on the population density of females, nymphs and the total alive stages in the second season where r_3= -0.816**, -0.749** and-0.831**, respectively. Meanwhile, in the first season relative humidity had negatively significant effect on females populations (r_3 = -0.552*).

The correlation coefficient between the percentage of parasitism and solar radiation was negative and highly significant effects where r_4 = -0.725** in the second season. The correlation coefficient for light intensity with the percentage of parasitism had negative highly significant (r_5= -0.627**) in the first season .While it was positively significant with the number of females in the second season (r_5 =0.550*).

The R^2 values and coefficient determination by the five aforementioned meteorological factors indicating that the considered factors had played a conspicuous role in detecting the activity of these insect pests during the investigated seasons Table (3). It is worth mention that the temperature and humidity had significant effects on the cotton mealybug population under study on some vegetable crops (Jeyakumar *et al.,* 2009*;* Singh *et al.,* 2012*;* Hameed *et al.,* 2014 and Tehniyat *et al.,* 2015).

Table 3. Statistical analysis based on correlation coefficient indicating the effects of climatic factors on different stages of *Phenacoccus solenopsis* Tinsley infesting okra plants at Hihhya distract, Sharkia Governorate during the first and second seasons 2017 and 2018

	Simple correlation coefficient					Coefficient of Determination (%)
1st season (2017)	**r_1**	**r_2**	**r_3**	**r_4**	**r_5**	**R^2**
Number of females	**0.653****	**0.543***	**- 0.552***	**0.316**	**0.259**	**44.35**
Number of nymphs	**0.054**	**0.038**	**0.042**	**0.292**	**0.051**	**10.83**
Total number of alive stages	**0.069**	**0.051**	**0.028**	**0.0295**	**0.057**	**10.65**
Parasitized individuals	**- 0.136**	**- 0.152**	**0.254**	**0.323**	**- 0.069**	**26.25**
Percentages of parasitism	**- 0.396**	**- 0.259**	**0.358**	**- 0.337**	**- 0.627****	**43.85**
2nd season (2018)	**r_1**	**r_2**	**r_3**	**r_4**	**r_5**	**R^2**
Number of females	**0.700****	**0.473**	**- 0.816****	**0.144**	**0.550***	**80.45**
Number of nymphs	**0.361**	**0.039**	**- 0.749****	**- 0.082**	**0.206**	**68.78**
Total number of alive stages	**0.469**	**0.141**	**- 0.831****	**- 0.039**	**0.302**	**79.58**
Parasitized individuals	**0.011**	**- 0.159**	**- 0.516***	**- 0.320**	**0.147**	**72.64**
Percentages of parasitism	**- 0.446**	**- 0.489***	**- 0.051**	**- 0.725****	**- 0.183**	**75.96**

r_1 =Simple correlation coefficients for maximum temperature, **r_2**= for minimum temperature, **r_3**= for mean relative humidity, **r_4**= for solar radiation and **r_5**= for light intensity. **r*** with 1 star indicates that the correlation coefficient is significant and with 2 stars **(r**)** indicates highly significant correlation at 0.01% level of probability

3. Number of Generations:

Data in Figures. 1 and 2 revealed that the *P. solenopsis* had two generations during the first season. The duration of the first generation was nine weeks, which occurred during the period from the fourth week of July to the third week of September. While the second one took eight weeks from the fourth week of September to the second week of November. On the other hand, the *P. solenopsis* had three generations in the second one. The first generation period was extended from the third

week of July until the fourth week of August. While the second period occurred from the last week of August until the last week of September and the third generation period extended from the first week of October till the first week of November.

4. Preferable Leaf Surface:

Data in Table (4), illustrated the total number of alive stages of *P. solenopsis* was higher on the lower leaf surface (44757 and 1430 individuals) than those the upper leaf surface (21151 and 233 individuals) during the first and second seasons, respectively. Nabil (2017), who reported that the *P. solenopsis* had three generations during the first and second seasons and its population was higher on the lower leaf surface than those on the upper leaf one.

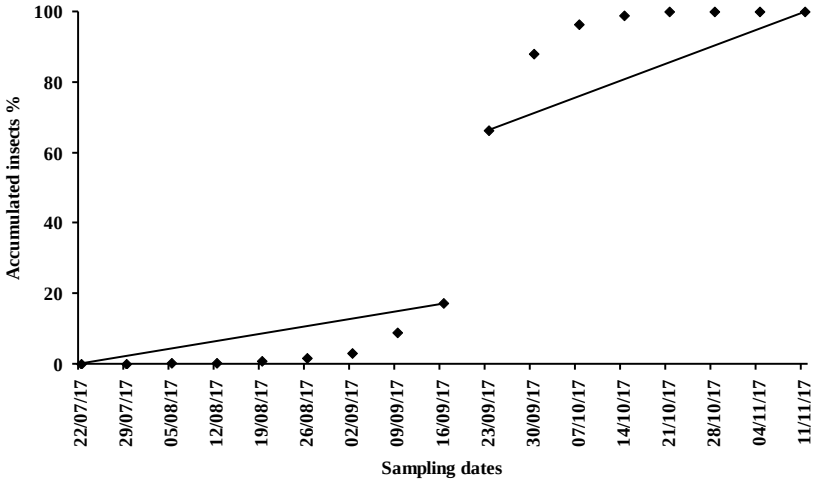

Fig.1. Generations and durations of *Phenacoccus solenopsis* Tinsley on okra plants at Hihhya distract, Sharkia Governorate during 2017 season

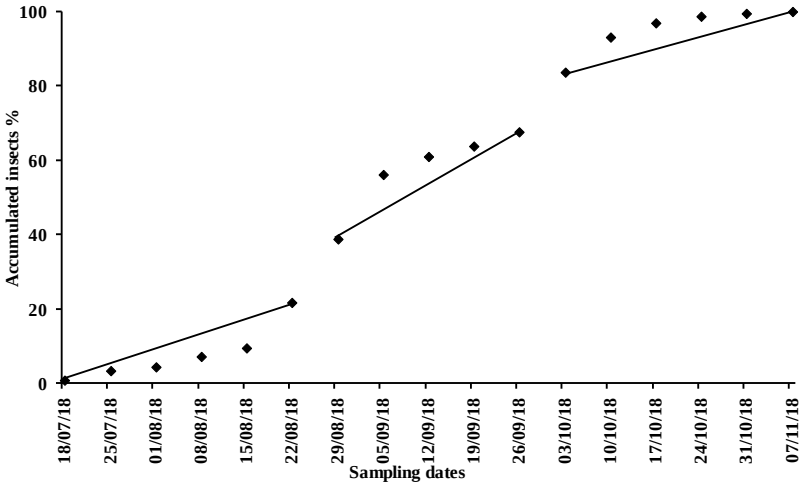

Fig.2. Generations and durations of *Phenacoccus solenopsis* Tinsley on okra plants at Hihhya distract, Sharkia Governorate during 2018 season

Table 4. Weekly numbers of *Phenacoccus solenopsis* Tinsley on upper and lower surface of okra plant leaves at Hihhya distract, Sharkia Governorate during 2017 and 2018 seasons

Weeks	First season								Second season							
	Upper surface				Lower surface				Upper surface				Lower surface			
	Females	Nymphs	Total	parasitized individuals	Females	Nymphs	Total	parasitized individuals	Females	Nymphs	Total	parasitized individuals	Females	Nymphs	Total	parasitized individuals
1st week	*0	0	0	0	0	2	2	0	0	0	0	0	0	10	10	0
2nd week	0	0	0	0	4	40	44	0	0	33	33	0	0	3	3	0
3rdweek	0	0	0	0	5	61	66	0	3	14	17	0	0	0	0	0
4th week	4	8	12	0	7	77	84	0	36	39	75	38	0	0	0	0
5th week	24	84	108	0	175	321	496	0	7	5	12	4	51	26	77	12
6th week	20	36	56	0	134	418	552	1	4	3	7	2	60	163	223	69
7th week	33	167	200	1	83	755	838	4	0	9	9	0	33	226	259	34
8th week	174	1452	1626	9	330	2249	2579	27	1	10	11	0	43	229	272	63
9th week	175	1997	2172	1	345	3272	3617	5	5	8	13	2	13	59	72	42
10th week	189	9627	9816	51	363	21636	21999	123	1	7	8	7	8	30	38	21
11th week	43	2788	2831	4	101	10922	11023	53	1	3	4	5	1	48	49	67
12thweek	58	3151	3209	74	21	2152	2173	82	1	30	31	12	18	190	208	77
13th week	5	761	766	22	3	988	991	40	0	7	7	0	4	122	126	70
14th week	5	332	337	28	0	247	247	15	0	5	5	0	2	50	52	20
15th week	1	17	18	0	0	21	21	2	0	1	1	0	1	22	23	8
16th week	0	0	0	0	0	20	20	1	0	0	0	0	0	12	12	2
17th week	0	0	0	0	0	5	5	0	0	0	0	0	0	6	6	1
Total	731	20420	21151	190	1571	43186	44757	353	59	174	233	70	234	1196	1430	486

Each sample is forty leaves

Conclusion

This study demonstrated that the population of cotton mealybug (CMB) was higher in the first season than in the second one. The population density of tested insect was indirectly correlated with the percentage of parasitism during the period of this investigation. The study highlighted the climatic changes which had a great impact on the population dynamics of cotton mealybug and its parasitoids .Therefore, the natural enemies of cotton mealybug should be introduced and utilized in the integrated pest management programs to control this pest. On the other hand, the continuous monitoring of the population dynamics of this pest is required to avoid crop losses.

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REFERENCES

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

Abd-Rabou, S., Germain, J.F. and Malausa,T.(2010). *Phenacoccus parvus* Morrison et *P. solenopsis* Tinsley, deux *Cochenilles nouvelles* pour l'Egypte (Hemiptera: Pseudococcidae). Bulletin de la Société Entomologique de France, 115 (4) : 509-510.

Arif, M.I., Rafiq,M. and Ghaffar,A. (2009). Host plants of cotton mealybug (*Phenacoccus solenopsis*): a new menace to cotton agroecosystem of Punjab, Pakistan. International Journal of Agriculture and Biology, 11: 163-167.

Attia, Angel R. and Awadallah, K.T. (2016). Predators, parasitoids and hyperparasitoids associated with the cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) infesting different host plants at Giza

region. Egyptian Academic Journal of Biological Sciences (A. Entomology) Vol. 9(4): 97–103.

Audemard, H. and Milaire, H.G. (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. Anal. Zoll. Ecol. Anim., 7 – 61.

Bokonon-Ganta, A.H., Groote, H. and Neuenschwander, P. (2002). Socio-economic impact of biological control of mango mealybug in Benin. Agriculture Ecosystem and Environment, 93(1):367-378.

CoStat Statistical Software, (2005). Microsoft computer program for the design and analysis of agronomic research experiments. Version 6.311. CoHort Software, Monterey, California, USA.

Hameed, A., Shahzad, M.S., Mehmood,A. , Ahmad,S. and Islam,N. (2014). Forecasting and modeling of sucking insect complex of cotton under agro-ecosystem of Multan- Punjab, Pakistanpak. Pakistan Journal of Agricultural Sciences, 51(4): 997-1003.

Hodgson, C.J., Abbas,G., Arif, M.J., Saeed, S. and Karar, H. (2008). *Phenacoccus solenopsis* Tinsley (Sternorrhyncha: Coccoidea: Pseudococcidae), a new invasive species attacking cotton in Pakistan and India, with a discussion on seasonal morphological variation. Zootaxa, 1913: 1-35.

Ibrahim, S.S., Moharum, F.A. and Abd El-Ghany, N.M. (2015). The cotton mealybug *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) as a new insect pest on tomato plants in Egypt. Journal of Plant Protection Research, 55 (1): 48-51.

Jaydeep, H., Rai, A.B. and Debjani, D. (2015). Occurrence of *Phenacoccus solenopsis* (Tinsley) in vegetable ecosystem and host mediated effects on its dominant parasitoid, *Aenasius bambawalei* Hayat. Vegetable Science, 42 (2): 30-33.

Jeyakumar, P., Tanwar, R.K., Singh, J., Singh, S. and Dhandapani, A. (2009). Impact of weather factors on cotton mealybug, *Phenacoccus solenopsis* Tinsley. Proceedings of National Symposium IPM strategies to combat emerging pests in the current scenario of climate change, January 28-30, 2009, College of Horticulture and Forestry Central Agricultural University, Pasighat, Arunachal Pradesh, pp. 39.

Mahmood, R., Aslam, M.N., Solangi, G.S. and Samad, A.(2011). Historical perspective and achievements in biological management of cotton mealybug, *Phenacoccus solenopsis* Tinsley in Pakistan. In Proceedings of 5thMeeting of ICAC's Asian Cotton Research and Development Network, 23-25.

Muniappan, R., Meyerdirk, D.E. , Sengebau, F.M., Berringer, D.D. and Reddy, G.V.P. (2006). Classical biological control of the papaya mealybug, *Paracoccus marginatus* (Hemiptera: Pseudococcidae) in the republic of Palau. Florida Entomologist, 89:212-217.

Nabil, H.A. (2017). Ecological studies on cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Sternorrhyncha: Coccoidea: Pseudococcidae) on eggplant at Sharkia Governorate, Egypt. Egyptian Academic Journal of Biological Sciences Entomology, 10 (7): 195–206.

Nabil, H.A., Hassan, A.SH. and Ismail, SH.A.A. (2015). Registration of the cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Sternorrhyncha: Coccoidea: Pseudococcidae) for the first time on four economical crops in Egypt. Zagazig Journal of Agriculture Research, 42 (6): 1555-1560.

Roltsch,W.J., Meyerdirk, D.E., Warkentin, R., Andress, E.R. and Carrera, K.(2006). Classical biological control of the pink hibiscus mealybug, *Maconellicoccus hirsutus*(Green), in Southern California. Biological Control, 37(2):155-166.

Sagarra, L., Vincent, C. and Stewart, R. (2001). Body size as an indicator of parasitoid quality in male and female *Anagyrus kamali* (Hymenoptera: Encyrtidae). Bulletin of Entomological Research, 91(5):363-368.

Sahito, H.A., Abro, G.H. , Mahmood, R. and Malik, A.Q. (2011). Survey of mealybug, *Phenacoccus solenopsis* (Tinsley) and effect of bio-ecological factors on its population in different ecological zones of Sindh. Pakistan Journal of Agriculture Engineering and Veterinary Sciences, 27:51-65.

Saini, R.K., Sharma, S.S.P. and Rohilla, H.R. (2009). Mealybug *Phenacoccus solenopsis* Tinsley and its survival in cotton ecosystem in Haryana. In: Proceedings of National Symposium on Bt cotton: opportunities and prospectus, Central Institute of Cotton Results, Nagpur, Indie, 17–19 November 2009.

Shylesha, A.N., Joshi, S., Rabindra, R.J. and Bhumannavar, B.S. (2010). Classical biological control of the papaya mealybug. National Bureau of Agricultural Important Insects, Bang lore, India, 1-4.

Singh, A. and Kumar,D. (2012). Population dynamics, biology of mealybug *Phenacoccus solenopsis* Tinsley and its natural enemies in Vadodara, Gujarat. Recent Research in Science and Technology, 4(11): 22-27.

Tehniyat, N.S., Ahmed, A.M. and Memon, N.(2015). Population dynamics of cotton mealybug, *Phenacoccus solenopsis* Tinsley in three talukas of district Sanghar (Sindh). Journal of Entomology and Zoology Studies, 3(5): 162-167.

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

Vinay, S., Sood, A.K., Verma, K.S., Mehta, P.K. and Sood,S. (2016). Record of host plants and natural enemies of *solenopsis* mealybug, *phenacoccus solenopsis* Tinsley:a potential pest under protected cultivation in himachal Pradesh. The bioscan, 11(1): 251-254.

Wang, Y.P., Watson, G.W. and Zhang, R.Z. (2010). The potential distribution of an invasive mealybug *Phenacoccus solenopsis* and its threat to cotton in Asia. Agricultural and Forest Entomology, 12: 403-416.

Zhu, Y.Y., Fang, H. and Yao-Bin (2011). Bionomics of mealybug *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) on cotton. Acta Entomolog Sinica, 54 (2): 246-252.

ARABIC SAMMARY

تأثير بعض العوامل الجوية على كثافة المجموع لحشرة *Phenacoccus solenopsis* Tinsley واعدائها الحيوية

حسن احمد نبيل [1]– محمد على مرسى حجاب [2]
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هدفُت الدراسه لتحديد الوفرة الموسمية وفترات النشاط لحشرة البق القطن الدقيقى *Phenacoccus solenopsis* Tinsley وطفيلاتها المصاحبه على نباتات الباميه. حيث إجريت هذه التجربة في منطقة ههيا- محافظة الشرقية خلال موسمين متعاقبين 2017 و2018 ، تم أخذ عينات نباتية إسبوعية لحساب كثافة المجموع للإطوار المختلفة للأفة الحشرية وطفيلاتها ، تأثير بعض العوامل الجويه عليهم ،عدد الاجيال وأفضل سطح نباتى لها ، حيث وجد إن هناك علاقة عكسية ما بين تعداج مجموع البق القطن الدقيقى وتعداد الطفيليات المصاحبه لها حيث كان ديناميكة تعداد الافه CMB عالى بينما كان تعداد الطفيليات المصاحبة لها منخفض وذلك فى الموسم الأول، من ناحية اخرى تم التحصل على نتائج عكسية خلال الموسم الثانى ، حيث وجد لحشرة البق القطن الدقيقى من أثنين إلى ثلاثة أجيال خلال الموسمين الأول والثانى على التوالى، ويوجد إرتباط موجب معنوى مابين درجات الحرارة العظمى ومابين تعداد الاناث لتلك الحشرة على حين يوجد إرتباط سالب معنوى مع متوسط الرطوبة النسبية خلال فترة الدراسة، ويُمكن لنتائج هذه الدراسة مساعدة الباحثين عند تصميم برنامج مكافحة شامل للآفه وكذلك يمكن التنبؤ بمعدلات الإصابة بتلك الافة للحد من إنتشارها في المستقبل.