

Journal of Plant Protection and Pathology

Journal homepage: www.jppp.mans.edu.eg
Available online at: www.jppp.journals.ekb.eg

Effect of different Vegetable Crops on the Population Density of the Cotton Mealybug *Phenacoccus solenopsis* (Tinsley) (Hemiptera: Pseudococcidae) in Mansoura Region

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ABSTRACT

The experiments were carried out at private farm belonging to Mansoura region. Four host plants from different vegetable families were chosen as eggplant (Solanaceae), squash (Cucurbitaceae), okra (Molvaceae) and cowpea. (Leguminosae). The population density of the cotton mealybug, *Phenacoccus solenopsis* (Tinsley) (Hemiptera: Pseudococcidae) recorded the highest peaks of abundance on okra plants during the two successive seasons 2018 and 2019 and presented by 341 and 397 individuals in the third week of October 2018 and in the second week of October 2019, respectively. Moreover, on squash plants the highest peaks were recorded in the third week of October 2018 and in the second week of October 2019 and represented by 209 and 263, individuals respectively. Meanwhile, on eggplant, the highest peaks were recorded in the second week of October 2018 and in the third week of October 2019 and represented by 134 and 207 individuals, respectively. While, the population of the insect pest showed the highest peaks on cowpea plants in the fourth week of October in the two seasons and represented by 119 and 142 individuals, respectively. The highest average numbers of the insect pest on different vegetable crops were recorded in October for all tested host plants during the two successive seasons 2018 and 2019. Okra as vegetable host plant recorded the highest average number followed by squash, eggplant and cowpea with significantly differences during the two seasons. Also, okra attracted the highest total numbers of the insect during the two seasons.

Keywords: Host plants, *Phenacoccus solenopsis*, vegetable crops, population density

INTRODUCTION

The vegetable crops are considered the most important crops which used in human nutrition because of its value in providing the body with different vitamins and the mineral salts. Recently, large area from the sandy land was reclaimed and cultivated with the different vegetable crops.

The cotton mealybug, *Phenacoccus solenopsis* (Tinsley) is a polyphagous insect pest (Rashid et al., 2012) attacking different economic agricultural crops including vegetables, fruits and ornamental crop (Arif et al., 2009). This insect pest has a wide geographical distribution in central America (Fuchs et al., 1991), Pakistan and India (Hodgson et al., 2008), China (Wang et al., 2009) and Nigeria (Akintola and Ande, 2008). The first record for this insect pest in Egypt was found in weeds (Abd-Rabou et al., 2010), subsequently it was found on tomato plants (Ibrahim et al., 2015 and Awadalla et al., 2018) on cotton crop (El-zahi et al., 2016), on squash (Awadalla et al., 2018) and on faba bean (Awadalla et al., 2019). The cotton mealybug *P. solenopsis* sucks the large quantity of the plant sap from stems and leaves which causes general weakening and death the susceptible plants and indirectly damage by transmission plant diseases, honeydew deposition which causes sooty moulds growth (Ibrahim et al., 2015).

The sowing dates and the host plant preference are the essential factors for integrated pest management (IPM)

for the different insect pests (Abdel-Hady et al., 2014 and Refaei et al., 2016). The host plants divided to four categories as high infestation, medium infestation, low infestation, and incidental infestation (Arif et al., 2009). The mealybugs are abundant on the host plants during the dry seasons and more or less absent in rainy seasons (Suresh and Kavitha, 2008). During the rainy seasons, the insect pest individuals, especially crawlers were dislodged by the rainfall effect (Akintola and Ande, 2009). The cotton mealybug, *P. solenopsis* affected the life cycle by different host plants and the fecundity was significantly affected by different host plants. Also, the insect pest preferred the cotton plants than potato and tomato plants (Ata, 2019).

Therefore, the present experiments were carried out to study the influence of different host plants on the population density and the seasonal occurrence of the cotton mealybug, *P. solenopsis* during the two successive seasons 2018 and 2019 in Mansoura region.

MATERIALS AND METHODS

The experiments were carried out at private farm belonging to Mansoura region. Four host plants from different vegetable families were chosen as eggplant (Solanaceae), squash (Cucurbitaceae), okra (Molvaceae) and cowpea (Leguminosae). The experimental area was about 800 m² was divided to sixteen replicates. Each replicate was ca 80 m². Each host plant was sown in four

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DOI: 10.21608/jppp.2020.79162

replicates with completely randomized block design distribution. The vegetable host plants were planted in the first week of July for two successive seasons 2018 and 2019. The normal agricultural practices for preparation of the land, irrigation, mechanical weed control and without using insecticidal control were applied during this study. After one month from the sowing dates, samples were started for each season. To evaluate the population density of the cotton mealybug, *P. solenopsis* on the different host plants, weekly samples of 25 leaves picked randomly from each replicate. Each sample from each host plant consisted of 200 leaves. Samples were transferred to the laboratory in plastic bags. Two square inches from each leaf for each host plant were examined to evaluate the population density of the cotton mealybug *P. solenopsis*, i.e., two hundred square inches in each sample for each host plant were examined. The samples were continued until the harvesting of the vegetable crops. The immature stages and the adult stage of the cotton mealybug were weekly counted and recorded until the end of the two successive seasons.

The number of the insect pest on different vegetable host plants were analyzed statistically by using one-way ANOVA and the means were separated using Fisher LSD test (SigmaPlot, 2012).

RESULTS AND DISCUSSION

Data presented in Fig. (1) showed the population density of the cotton mealybug, *P. solenopsis* on different

host plants of vegetable crops during season 2018. The insect pest began to appearance on eggplant in the third week of August and the population increased gradually to reach the highest peak of abundance (134 individuals) in the second week of October and then the population decreased gradually until the end of the season to record 31 individuals in the third week of November. While, on squash plants, the insect began to appearance in the first week of August (3 individuals) then the population increased gradually to reach its highest peak of abundance (209 individuals) in the third week of October and then the population decreased gradually until the harvest of the crop to record 17 individuals in the third week of November. Moreover, on okra plants, the population of the insect pest occurred in the first week of August and presented by 3 individuals and the population increased to reach the highest peak of abundance (341 individuals) in the third week of October, then its population decreased until the end of the season to record 42 individuals in the third week of November 2018. In addition, the population density of *P. solenopsis* on cowpea plants during the first season 2018 began with small numbers (3 individuals) in the fourth week of August, then increased gradually to reach the highest peak of abundance in the fourth week of October and presented by 119 individuals. Afterwards, the population decreased to record 27 individuals in the end of the season.

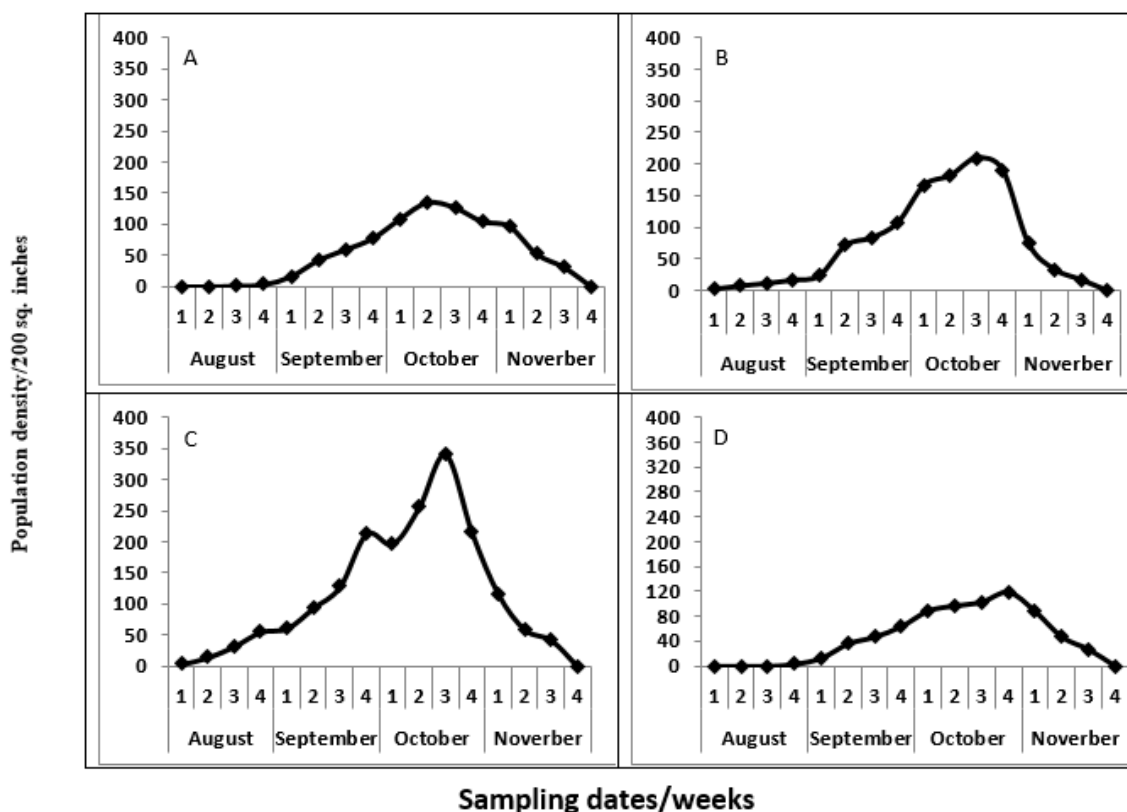


Fig. 1. The population density of the cotton mealybug *P. solenopsis* on different host plants (A: Eggplant, B: Squash, C: Okra, D: Cowpea) during the first season 2018 in Mansoura region.

Data presented in Fig. (2) showed the population density of the cotton mealybug, *P. solenopsis* on different host plants of vegetable crops during season 2019. The insect pest began to appearance on eggplant in the fourth week of August and the population increased gradually to reach the highest peak of abundance (207 individuals) in the third week of October and then the population decreased gradually until the end of the season to record 23 individuals in the third week of November. While, on squash plants, the insect began to appearance in the first week of August (4 individuals) then the population increased gradually to reach its highest peak of abundance (263 individuals) in the second week of October and then the population decreased gradually until the harvest of the crop to record 11 individuals in the third week of

November. Moreover, on okra plants, the population of the insect pest occurred in the first week of August and presented by 7 individuals and the population increased to reach the highest peak of abundance (397 individuals) in the second week of October, then its population decreased until the end of the season to record 56 individuals in the third week of November 2018. In addition, the population density of *P. solenopsis* on cowpea plants during the second season 2019 began with small numbers (3 individuals) in the first week of September, then increased gradually to reach the highest peak of abundance in the fourth week of October and presented by 142 individuals. Afterwards, the population decreased to record 17 individuals in the end of the season.

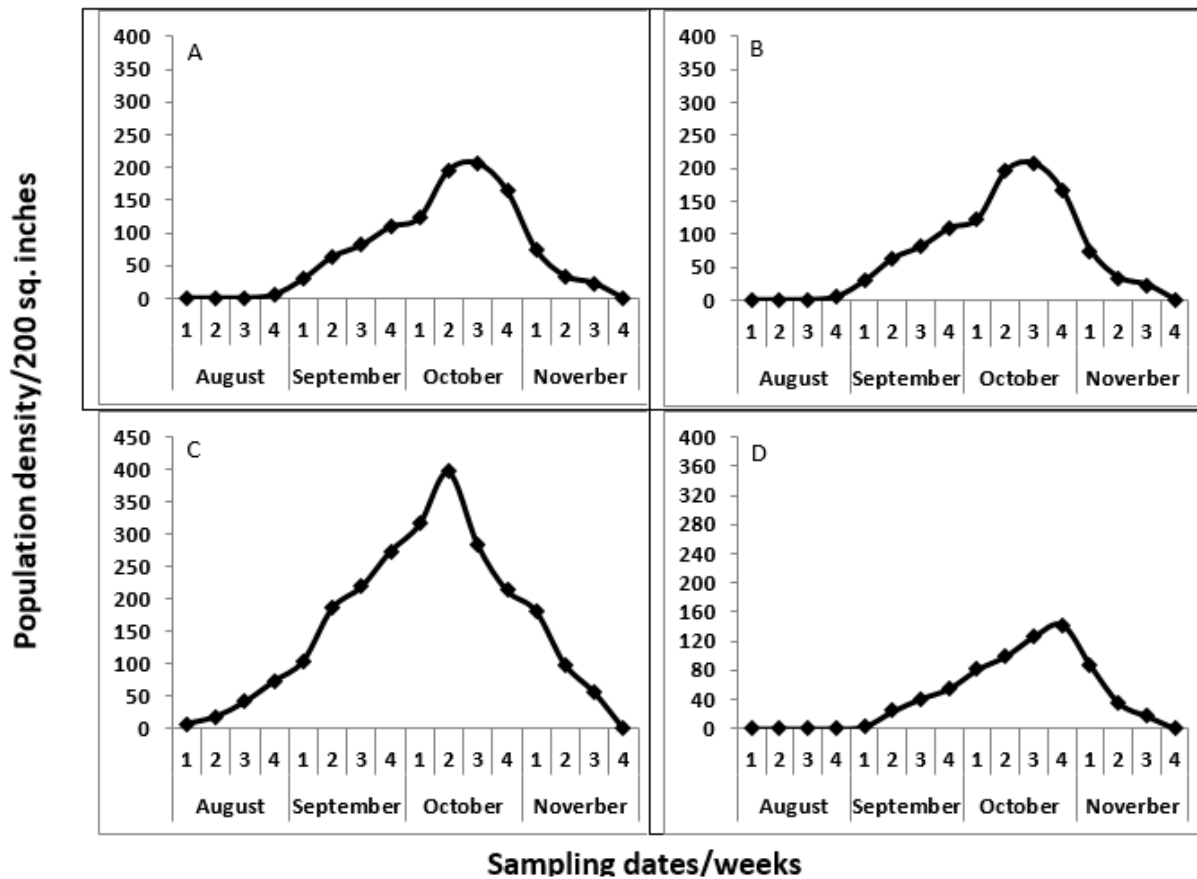


Fig. 2. The population density of the cotton mealybug *P. solenopsis* on different host plants (A: Eggplant, B: Squash, C: Okra, D: Cowpea) during the first season 2018 in Mansoura region.

As a conclusion, the obtained data in Figures (1 and 2) showed that the population density of the cotton mealybug, *P. solenopsis* recorded the highest peaks of abundance on okra plants during the two successive seasons 2018 and 2019 and presented by 341 and 397 individuals in the third week of October 2018 and in the second week of October 2019, respectively. Moreover, on squash plants the highest peaks were recorded in the third week of October 2018 and in the second week of October 2019 and represented by 209 and 263, individuals respectively. Meanwhile, on eggplant, the highest peaks were recorded in the second week of October 2018 and in the third week of October 2019 and represented by 134 and 207 individuals, respectively. While, the population of the

insect pest showed the highest peaks on cowpea plants in the fourth week of October in the two seasons and represented by 119 and 142 individuals, respectively.

The obtained results in Table (1) showed the seasonal population density of the cotton mealybug *P. solenopsis* on different vegetable crops during the first season 2018. The highest average numbers of the insect pest were recorded in October for all tested host plants and represented by 118.0, 186.8, 252.3 and 102.0 individuals/200 sq. inches on eggplant, squash, okra and cowpea, respectively. On the other hand, the lowest average numbers of *P. solenopsis* were appeared in August and presented by 1.0, 9.0, 26.0 and 0.8 individuals/200 sq. inches on the examined vegetable crops, respectively.

Statistical analysis showed that there were significant differences among the four host plants in the mean numbers of *P. solenopsis* during 2018 season.

The obtained results in Table (2) showed the seasonal population density of the cotton mealybug *P. solenopsis* on different vegetable crops during the first season 2019. The highest average numbers of the insect pest were recorded in October for all tested host plants and represented by 173.0, 210.8, 303.0 and 112.0 individuals/200 sq. inches on eggplant, squash, okra and cowpea, respectively. On the other hand, the lowest average numbers of *P. solenopsis* were appeared in August and presented by 1.3, 19.3, 34.8, 0.0 individuals/200 sq. inches on the investigated vegetable crops, respectively. Statistical analysis showed that there were significant differences among the four host plants in the mean numbers of *P. solenopsis* during 2019 season.

Table 1. The seasonal population density of the cotton mealybug, *P. solenopsis* on different vegetable crops during season 2018.

Month	Vegetable crops			
	Eggplant	Squash	Okra	Cowpea
August	1.0	9.0	26.0	0.8
September	48.5	71.0	124.0	40.0
October	118.0	186.8	252.3	102.0
November	59.7	41.3	72.3	54.0
Mean ± SE	56.80 ± 12.30 c	77.03 ± 19.86 b	118.65 ± 25.05 a	49.20 ± 10.71 c

Means followed by the different letters are significantly different at 0.05 level.

Table 2. The seasonal population density of the cotton mealybug, *P. solenopsis* on different vegetable crops during season 2019.

Month	Vegetable crops			
	Eggplant	Squash	Okra	Cowpea
August	1.3	19.3	34.8	0.0
September	70.5	106.8	195.8	30.8
October	173.0	210.8	303.0	112.0
November	44.7	33.3	112.3	46.0
Mean ± SE	72.20 ± 18.72 c	92.55 ± 22.48 b	161.48 ± 29.49 a	47.20 ± 12.13 c

Means followed by the different letters are significantly different at 0.05 level.

As shown in Table (3), okra plants attracted the highest total numbers and percentages during the two successive seasons 2018 and 2019 and presented by 1826 individuals (39.70 %) and 2471 individuals (43.06%), respectively. Meanwhile, cowpea plants attracted the lowest total numbers and percentages of the insect pest during the two seasons and presented by 733 individuals (15.94 %) and 709 individuals (12.36 %), respectively.

Table 3. Total numbers and occurrence percentage of the cotton mealybug, *P. solenopsis* on different vegetable crops during the two seasons 2018 and 2019.

Month	Season 2018		Season 2019	
	Number	%	Number	%
Eggplant	849	18.46	1111	19.36
Squash	1191	25.90	1447	25.22
Okra	1826	39.70	2471	43.06
Cowpea	733	15.94	709	12.36
Total	4599	100	5738	100

Awadalla et al. (2018) recorded that, the average number of *P. solenopsis* was the highest in February plantation than in September plantation on tomato plants during the two successive seasons 2016/17 and 2017/18 in Damietta Governorate. Singh and Kumar (2012) stated that, the peak period of the insect pest *P. solenopsis* population was recorded in September. They added that the most abundant was for the insect pest on cotton followed by China rose, okra, eggplant and tomato. On the other hand, the highest population was on okra in October and on tomato and potato host plants in February. Abd El-wareth (2016) showed that, tomato as a host plant for *P. solenopsis* affected with the high number of the insect and had one peak of abundance in the first week of August in Fayoum Governorate. Ata (2019) studied the biological aspects of the cotton mealybug *P. solenopsis* on three host plants (potato, tomato and cotton) under laboratory conditions. He found that, the immature stages of the insect pest were the shortest on the cotton plants followed by tomato and potato plants. He added that, the female fecundity was significantly affected by the different host plants and the female laid the highest number of eggs on cotton plants. Awadalla et al. (2018) stated that, the insect pest recorded the highest average number in August plantation followed by June plantation and March plantation during the two successive seasons 2014 and 2015 on squash plants. Bayoumy et al. (2017) mentioned that both leaf morphology and chemical composition play a potential role in forecasting the population abundance of the piercing-sucking insect pest attacking eggplant, squash and common bean. El- Mesawy (2018) mentioned that, watermelon plants were attracted the highest average number of *P. solenopsis* during the two seasons 2015 and 2015 followed by squash and cantaloupe, while snake cucumber and cucumber attracted the lowest average number of the insect pest. Badawy (2019) stated that, Sakha 4 faba bean variety attracted the highest seasonal average number of *P. solenopsis* followed by Sakha 1, Giza 843 and Misr 1 without significant differences during the two seasons 2015/16 and 2016/17.

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تأثير محاصيل الخضر المختلفة علي كثافة التعداد لحشرة بق القطن الدقيقي في منطقة المنصورة فرحة حسن فرج الله معهد بحوث وقاية النباتات- مركز البحوث الزراعية- جيزة- مصر

أجريت هذه التجارب في مزرعة خاصة تابعة لمنطقة المنصورة، حيث تم اختيار أربعة عوائل نباتية مختلفة وهل البانجان (العائلة البانجانجية)، الكوسة (العائلة القرعية)، الباميا (العائلة الخبازية)، واللويبا (العائلة البقولية). سجلت كثافة التعداد لحشرة بق القطن الدقيقي أعلى ذروة تعداد علي نباتات الباميا خلال موسمي الدراسة المتتالية 2018 و 2019، حيث كانت 341 و 397 فرد وذلك في الأسبوع الثالث من شهر أكتوبر 2018 والأسبوع الثاني من شهر أكتوبر 2019 علي التوالي. علاوة علي ذلك سجلت الحشرة علي نباتات الكوسة أعلى ذروة تعداد أيضا في الأسبوع الثالث من شهر أكتوبر 2018 والأسبوع الثالث من شهر أكتوبر 2019 وقد كانت 209 و 263 فرد علي التوالي، بينما سجلت الحشرة علي نباتات البانجان اعلي ذروة تعداد في الأسبوع الثاني من أكتوبر 2018 والأسبوع الثالث من أكتوبر 2019 وقد كانت 134 و 207 فرد علي التوالي. أما تعداد الحشرة علي نباتات اللويبا فقد كانت ذروة التعداد في الأسبوع الرابع من شهر أكتوبر في كلا موسمي الدراسة وكانت 119 و 142 فرد علي التوالي. سُجل أعلى متوسط تعداد للحشرة علي مختلف محاصيل الخضر في شهر أكتوبر خلال موسمي الدراسة المتتاليتين 2018 و 2019. سجل محصول البامية كعائل نباتي أعلى متوسط تعداد بلية الكوسة ثم البانجان واللويبا وذلك مع وجود اختلاف معنوي خلال موسمي الدراسة. أيضا محصول الباميا جذب أعلى تعداد من الحشرة خلال موسمي الدراسة.