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Influence of Various Host Plants on Population Density of the Citrus Mealybug *Planococcus citri* Risso at Mansoura District

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ABSTRACT

The current study was carried out at the experimental farm of the Faculty of Agriculture, Mansoura University, as well as at various gardens affiliated with the university, located in Egypt, to assess the population density of the common mealybug *Planococcus citri* on the ficus trees, *Ficus nitida*, the red sage, *Lantana camara*, and the Brazilian pepper trees, *Schinus terebinthifolius* during two successive years, 2021/22 and 2022/23. During the first year, the highest average numbers (141.5 and 3565.0 individuals/sample) of *P. citri* was recorded on Ficus trees and Red sage trees during October, 2021, respectively, while the highest number (554.3 individuals/sample) was recorded during November, 2021 on Barazilian pepper trees. In contrast, the lowest numbers per sample was recorded during February 2022 which represented by 59.0, 584.0 and 169.0 individuals, respectively. During the first and years, the citrus mealybug *P. citri* attracted more to Red sage trees than Barazilian pepper trees and Ficus trees. The annual average numbers were 1748.8 ± 144.22 , 326.6 ± 22.98 and 107.8 ± 3.91 individuals/sample, respectively during the first year and 1061.8 ± 39.43 , 319.1 ± 21.71 and 100.9 ± 2.01 individuals/sample, respectively during the second year. The mean numbers of *P. citri* significantly differed among host plants and seasons of each year of the study.

Keywords:- *Planococcus citri*, population, Ornamental plants, citrus mealybug.



INTRODUCTION

Ornamental plants hold significant ecological, economic, and aesthetic value. They enhance the beauty of gardens, public spaces, and interiors while contributing to environmental sustainability by improving air quality, reducing heat, and promoting biodiversity. According to Kaydan *et al.* (2004), ornamental plants also play a crucial role in reducing stress and improving mental health, making them vital for urban and residential landscapes.

Ficus nitida is known for its glossy green leaves and elegant appearance. It is a popular indoor plant and used in gardens for its versatility and ability to thrive in various environments. However, mealybugs (as noted by Williams and Granara de Willink, 1992) pose a significant threat to Ficus plants. They feed on the plant's sap, weakening it and causing leaf yellowing, wilting, and defoliation. Furthermore, their honeydew secretion encourages the growth of sooty mold, diminishing the plant's ornamental appeal.

Lantana camara is valued for its clusters of bright flowers and its ability to thrive in low-maintenance environments (Mani and Krishnamoorthy 2000). However, mealybugs can infest lantana plants, resulting in curled, discolored leaves and diminished flowering. Mani and Krishnamoorthy (2000) highlighted that the honeydew secreted by mealybugs fosters the growth of sooty mold, which can obscure the vibrant flowers and negatively affect the plant's visual appeal.

Schinus terebinthifolius (Brazilian pepper tree) is a versatile plant that adds a fragrant aroma and lush greenery to gardens. Despite its resilience, it is vulnerable to mealybug infestations. These pests drain the plant's sap, causing leaf yellowing and defoliation. As Williams and Granara de Willink (1992) pointed out, the honeydew produced by

mealybugs promotes sooty mold growth, further harming the plant's aesthetics and health.

Ornamental plants like Ficus, Lantana Camara, and Brazilian pepper trees are crucial in landscaping due to their aesthetic and environmental benefits. However, they are highly susceptible to pest infestations, particularly mealybugs, which can significantly affect their health and ornamental value.

However, ornamental plants are often vulnerable to pest infestations, which can compromise their health, growth, and appearance. Among these pests, mealybugs (family: Pseudococcidae) are particularly destructive. The citrus mealybug, *Planococcus citri* is sap-sucking insect species that weaken plants by feeding on their nutrient-rich sap, causing wilting, yellowing of leaves, and stunted growth. It also excretes honeydew, which promotes the growth of sooty mold, further reducing the plant's aesthetic appeal (El-Kady, 2013; Abdel-Salam *et al.*, 2013; Ghanim *et al.*, 2013; Awadalla and Ghanim, 2016; El- Batran *et al.*, 2016 and Awadalla, 2017).

Therefore, the present experiment aims to study the population density of the citrus mealybug *P. citri* on different ornamental trees at Mansoura district.

MATERIALS AND METHODS

The current study was carried out at the experimental farm of the Faculty of Agriculture, Mansoura University, as well as at various gardens affiliated with the university, located in Egypt, to assess the population density of the common mealybug, *P. citri* on the ficus trees, *Ficus nitida*, the red sage, *Lantana camara*, and the Brazilian pepper trees, *Schinus terebinthifolius* during the two successive years, 2021/22 and 2022/23. No insecticides were applied during the entire period of investigation.

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Sampling:

Five trees of the same age and size from each ornamental host plant were chosen and used as replicates. Samples were collected biweekly during the two successive years from 21st of September 2021 till 6th of September 2022. Each sample consisted of 100 leaves, and 25 twigs were randomly collected from each host plant (20 leaves and 5 twigs from each tree for the four directions and the middle of each tree). The collected leaves and twigs from each host plant were taken to the laboratory in polyethylene bags for further investigation to record the number of mealybugs.

Effect of different seasons:**Statistical analysis:**

To study the effect of host plants and different seasons (winter, spring, summer, and autumn) of each year of the study on the population density of insect pest *P. citri*, data collected throughout the year were analyzed using One-way ANOVA using the SPSS software program. When significant results were found, means were compared using Duncan's Multiple Range Test (1955), with the analysis conducted using CoStat for Windows, Version 5.0 Stern (1991).

RESULTS AND DISCUSSION

The results presented in Figure 1 illustrate the population density of the citrus mealybug, *P. citri* on various ornamental host plants during the first year (2021/22) at Mansoura district. On ficus trees *Ficus nitida*, the population of *P. citri* fluctuated, reaching its highest peak of abundance on October 19, 2021, with 145 individuals per sample. In contrast, on red sage trees *Lantana camara*, *P. citri* reached its peak abundance of 3,615 individuals per sample on November 2, 2021. Similarly, on Brazilian pepper trees *Schinus terebenthifolius*, the population fluctuated until it peaked at 637 individuals per sample on November 2, 2021.

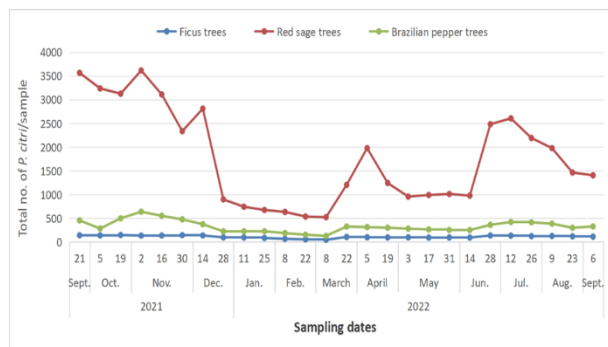


Fig. 1. The population density of *P. citri* on different ornamental host plants during the first year, 2021/22.

As a conclusion, the highest population density of the citrus mealybug *P. citri* on ficus trees, red sage trees and Brazilian pepper trees during the first year 2021/22 were recorded on the third week of October and the first week of November 2021/22 and presented by 145, 3615 and 637 individuals/sample, respectively. While, the lowest density population for *P. citri* on the ornamental host plants were recorded on the second week of March 2022 and represented by 45, 522 and 127 individuals/sample, respectively.

The present data illustrated in Figure (2) showed the population density of *P. citri* on different ornamental host plants during the second year 2022/23. On ficus trees, *P. citri* fluctuated in its number until reached the highest abundance on 20th of September 2022 and presented by 125

individuals/sample. While, *P. citri* on red sage trees reached the highest peak of abundance on 1st of November 2022 and presented by 1671 individuals/sample. Moreover, on Brazilian pepper trees, *P. citri* fluctuated in its numbers until reached the highest abundance on 1st of November 2022 and presented by 659 individuals/sample.

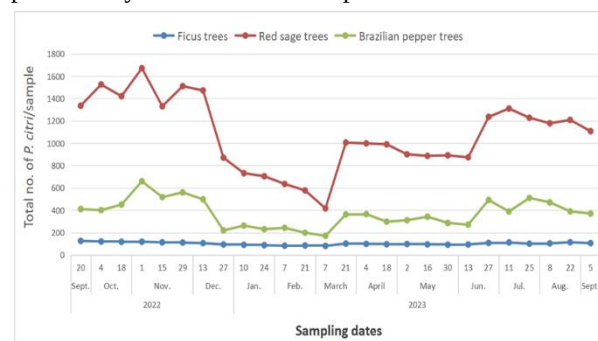


Fig. 2. The population density of *P. citri* on various ornamental host plants during the second year, 2022/23.

The highest population densities of the citrus mealybug *P. citri* on ficus trees, red sage trees, and Brazilian pepper trees during the second year (2022/23) were recorded during the third week of September, and the first week of November 2022, with 125, 1,671, and 659 individuals per sample, respectively. In contrast, the lowest population densities on these ornamental host plants were observed during the first week of February 2023 and the first week of March 2023, with 80, 416, and 170 individuals per sample, respectively.

The results presented in Table 1 show the monthly average number of *P. citri* on different ornamental host plants during the first year (2021/22) at the Mansoura district.

Table 1. The monthly average number of the citrus mealybug *Planococcus citri* on various ornamental host plants during the first year (2021/22) in the Mansoura district.

years	Months	Host plants		
		Ficus trees	Red sage trees	Brazilian pepper trees
2021	Sep.	139.0	3565.0	454.0
	Oct.	141.5	3181.5	390.0
	Nov.	136.7	3020.0	554.3
	Dec.	116.0	1853.5	297.5
2022	Jan.	88.5	707.5	224.5
	Feb.	59.0	584.0	169.0
	Mar.	75.0	862.0	226.0
	Apr.	96.5	1610.5	305.5
	May.	94.3	985.0	265.0
	Jun.	114.0	1729.5	304.5
	Jul.	127.0	2398.0	416.5
	Aug.	121.5	1720.5	341.5
	Sep.	111.0	1405.0	327.0

It can be noticed that, The citrus mealybug recorded the highest average number on October 2021 and presented by 141.5 individuals/sample on ficus trees, While, the lowest average number of *P. citri* on February 2022 and presented by 59.0 individuals/sample on Ficus trees. Moreover the highest average number of *p. citri* on September 2021 and reached by 3565.0 individuals/sample on Red sage trees, While the lowest average number of *p. citri* on February 2022 and presented by 584.0 individuals/sample on Red sage trees. Meanwhile the highest average number on November 2021 and reached 554.3 individuals/sample, Moreover the lowest average number of *p. citri* on February 2022 and presented by 169.0 individuals/sample on Brazilian pepper trees.

As a conclusion, during the first year, October 2021 recorded the highest average number of *P. citri* on ficus trees and red sage trees while November 2021 for Barazilian pepper trees and represented by 141.5, 3565.0 and 554.3 individuals/sample, respectively. Meanwhile, February 2022 recorded the lowest average number and presented by 59.0, 584.0 and 169.0 individuals/sample, respectively.

The results presented in Table (2) illustrate the monthly population average of *P. citri* on various ornamental host plants during the second season (2022/23). It can be noticed that the citrus mealybug recorded the highest average number on October 2022 and presented by 118.5 individuals/sample on Ficus trees. While the lowest average number of *P. citri* on February 2023 and presented by 83.0 individuals/sample on ficus trees. Moreover, the highest average number of *P. citri* on November 2022 and reached 1503.7 individuals/sample on red sage trees, While the lowest average number of *P. citri* on February 2023 and presented by 606.0 individuals/sample on red sage trees. Meanwhile the highest average number on November 2022 and reached 578.3 individuals/sample, Moreover the lowest average number of *P. citri* on February 2023 and presented by 220.0 individuals/sample on Brazilian pepper trees.

Table 2. The monthly average number of the citrus mealybug *P. citri* on various ornamental host plants during the second year (2022/23) at Mansoura district.

years	Months	Host plants		
		Ficus trees	Red sage trees	Brazilian pepper trees
2022	Sep.	125.0	1335.0	410.0
	Oct.	118.5	1472.5	425.0
	Nov.	113.3	1503.7	578.3
	Dec.	99.0	1171	358.0
2023	Jan.	88.5	717.5	246.0
	Feb.	83.0	606.0	220.0
	Mar.	90.5	710.5	266.0
	Apr.	96.5	994.0	331.0
	May.	94.0	892.3	312.7
	Jun.	100.0	1054.0	380.5
	Jul.	105.5	1268.5	449.0
	Aug.	108.0	1193.0	429.5
	Sep.	105.0	1107.0	370.0

During the second season, October 2022 recorded the highest average number of *p. citri* on Ficus trees while November 2021 for Red sage trees and Brazilian pepper trees and represented by 118.5, 1503.7 and 578.3 individuals/sample, respectively. Meanwhile, February 2023 recorded the lowest average number and presented 83.0, 606.0 and 220.0 individuals/sample, respectively.

Data arranged in Table (3) show the mean number of the citrus mealybug *p. citri* on ficus trees, red Sage trees and Brazilian pepper during the first season 2021/22. The highest average number of *P. citri* were recorded on autumn season and presented by 138.3 ± 1.57 individuals on ficus trees, 3114.0 ± 166.83 individuals on red sage trees, and 467.1 ± 43.70 individuals on Brazilian pepper trees. The lowest average number of *P. citri* were recorded on winter season and presented by 72.7 ± 8.79 individuals on ficus trees, 667.0 ± 57.16 individuals on red sage trees and 189.3 ± 17.16 individuals on Brazilian pepper trees.

The results are consistent with those reported by Abdel-Salam *et al.* (2013), who studied the attractiveness of various mealybugs to different host plants. Their findings revealed that *Icerya purchasi* was particularly attracted to mandarin during the season of 2010/11 and 2011/12.

Similarly, *Maconellicoccus hirsutus* was found to be attracted to hibiscus trees as a host plant. *P. citri* showed a preference for both guava and mandarin trees. *Icerya aegyptiaca* exhibited attraction to three different host plants, with the highest preference for ficus trees, followed by guava and mandarin trees. Finally, *Icerya seychellarum* showed the greatest insect attraction to guava trees, followed by persimmons; ficus; and mandarins over the two study years.

Table 3. The seasonal average number of *Planococcus citri* on various ornamental plants during the first year (2021/22) in the Mansoura district.

Seasons	Host plants		
	Ficus trees	Red sage trees	Brazilian pepper trees
Autumn	138.3 ± 1.57	3114.0 ± 166.83	467.1 ± 43.70
Winter	72.7 ± 8.79	667.0 ± 57.16	189.3 ± 17.16
Spring	96.3 ± 1.66	1193.6 ± 137.73	282.9 ± 11.33
Summer	123.8 ± 3.63	2020.7 ± 206.17	367.2 ± 19.71
Total	431.1 ± 15.65	6995.3 ± 567.89	1306.5 ± 91.9
Means $\pm$ SE	107.8 ± 3.91 c	1748.8 ± 144.22 a	326.6 ± 22.98 b

Means followed by the same letters at level 5% of probability are insignificant differences for the first year 2021/22.

Data illustrated in Table (4) shows the average number of the citrus mealybug *P. citri* on Ficus trees, red Sage trees and Brazilian pepper trees during the second year 2022/23 at Mansoura district.

Table 4. The seasonal average number of the citrus mealybug *Planococcus citri* on various ornamental plants during the second season (2022/23) at Mansoura district.

Seasons	Host plants		
	Ficus trees	Red sage trees	Brazilian pepper trees
Autumn	115.3 ± 2.54	1466.1 ± 45.05	498.9 ± 34.38
Winter	86.0 ± 2.21	655.5 ± 62.72	22.2 ± 13.33
Spring	95.6 ± 1.27	934.7 ± 22.52	318.9 ± 14.27
Summer	106.5 ± 2.00	1210.8 ± 27.41	436.3 ± 24.85
Total	403.4 ± 8.02	4247.1 ± 157.7	1276.3 ± 86.83
Means $\pm$ SE	100.9 ± 2.01 c	1061.8 ± 39.43 a	319.1 ± 21.71 b

Means followed by the same letters at level 5% of probability are insignificant differences for the second year 2022/23.

The highest average number of *P. citri* were recorded on autumn season and presented by 115.3 ± 2.54 individuals on ficus trees, 1466.1 ± 45.05 individuals on red sage trees and 498.9 ± 34.38 individuals on Brazilian pepper trees. The lowest average number of *P. citri* was recorded during winter season and presented by 86 ± 2.21 individuals on ficus trees, 655.5 ± 62.72 individuals on Red sage trees and 22.2 ± 13.33 individuals on Brazilian pepper trees. Those results are related to those of El-Kady (2013), who found that, *P. citri* had two peaks of abundance for nymphal stage and three peaks of abundance for adult stage during the two years of the study 2009/10 and 2010/11. The highest nymphs and adults numbers were recorded throughout the period between April and June on citrus trees. He added that clementine mandarin and balady mandarin were the least infestation by the insect pest *P. citri* while, lemon and the sour orange were the heaviest infestation by *P. citri* during the two years.

In conclusion, during the first year of the study, the citrus mealybug *P. citri* exhibited the highest abundance on Red Sage trees, followed by Brazilian Pepper trees, whereas ficus trees recorded the lowest infestation levels. The annual mean numbers were 1748.8 ± 144.22 , 326.6 ± 22.98 , and 107.8 ± 3.91 individuals per sample, respectively. Similarly, in the second year, *P. citri* remained most abundant on Red Sage trees, followed by Brazilian Pepper trees, with Ficus trees showing the lowest infestation. The corresponding

annual mean numbers were 1061.8 ± 39.43 , 319.1 ± 21.71 , and 100.9 ± 2.01 individuals per sample, respectively.

Statistical analyses (Tables 3 and 4) revealed that there were significant differences among the three host plant species and between the four seasons of each year in the annual mean numbers.

Previous research has highlighted the substantial impact of host plant variability on the biological characteristics and population dynamics of insect species (Price *et al.*, 1980; Kaydan *et al.*, 2004). Host plants are recognized as key ecological factors influencing insect development, survival, and reproduction, and numerous studies have examined these host-insect relationships (Gullan, 2000; Chong *et al.*, 2003; Polat, 2005; Artar, 2008; Ataş and Kaydan, 2014).

Öncüler (2004) emphasized that pest control strategies are more effective when all factors influencing pest population dynamics are evaluated using early warning systems. Moreover, implementing and monitoring an economic threshold for damage can help predict the optimal intervention time and guide farmers in developing efficient management programs.

Similarly, Ghanim *et al.* (2013) in Egypt reported that the dominant mealybug species infesting mandarin trees in Mansoura District during 2010/11 and 2011/12 were *P. citri*, *Icerya purchasi*, *I. aegyptiaca*, and *I. seychellarum*. The highest population densities of these mealybug species were recorded during the summer season in both years. Statistical analysis indicated highly significant differences among the insect species across the four seasons during the two successive years.

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تأثير العوائل النباتية المختلفة على الكثافة العددية لحشرة البق الدقيقي الحمضية *Planococcus citri* (Risso) في منطقة المنصورة

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المخلص

أجريت الدراسة الحالية في المزرعة التجريبية التابعة لكلية الزراعة، جامعة المنصورة، بالإضافة إلى عدد من الحدائق التابعة للجامعة، والواقعة في جمهورية مصر العربية، وذلك بهدف تقييم الكثافة العددية لحشرة البق الدقيقي الشائع *Planococcus citri* على أشجار الفيكس (*Ficus nitida*)، والمريمية الحمراء (*Lantana camara*)، والفلل البرازيلي (*Schinus terebenthifolius*) خلال عامين متتاليين ٢٠٢٢/٢٠٢١ و ٢٠٢٣/٢٠٢٢. وخلال العام الأول، سُجل أعلى متوسط لأعداد حشرة *P. citri* على أشجار الفيكس والمريمية الحمراء في شهر أكتوبر ٢٠٢١، حيث بلغت ١٤١،٥ و ٣٥٢٥،٠ فرداً/عينة على التوالي، في حين تم تسجيل أعلى عدد على أشجار الفلل البرازيلي خلال شهر نوفمبر ٢٠٢١ وبلغ ٥٥٤،٣ فرداً/عينة. وعلى النقيض، سُجلت أقل الأعداد خلال شهر فبراير ٢٠٢٢، إذ بلغت ٥٩،٠ و ١٦٩،٠ فرداً على التوالي. وخلال العامين معاً، أظهرت النتائج أن حشرة البق الدقيقي الحمضية *P. citri* كانت أكثر انجذاباً إلى أشجار المريمية الحمراء مقارنةً بأشجار الفلل البرازيلي وأشجار الفيكس. وقد بلغت المتوسطات السنوية للأعداد 1748.8 ± 144.22 و 326.6 و 22.98 ± 10.7 و 39.1 ± 10.6 فرداً/عينة على التوالي خلال العام الأول، و 319.1 ± 39.43 و 21.71 ± 2.01 و 100.9 ± 2.01 فرداً/عينة على التوالي خلال العام الثاني. كما أظهرت النتائج أن المتوسطات العددية لحشرة *P. citri* اختلفت معنوياً بين العوائل النباتية المختلفة وبين مواسم الدراسة في كل عام.