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ORIGINAL ARTICLE

SOME LIFE ASPECTS AND SPATIAL DISTRIBUTION OF GRAPE MEALYBUG *PLANOCOCCUS FICUS* ON FIGS

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Abstract: The experiments were conducted in the orchards of Al-Madaen region (30 km south of Baghdad) during the period 2019 to study the prevalence mealybug (Planococcus Ficus) on figs and some morphological traits (length and width) and spatial distribution of this pest on fig trees. The results show the morphological description of the life phase of the pest. The body length pest in the second and third nymphs, adult males and adult females recorded 1.74, 1.42, 1.45, 2.49 mm, respectively. While the body width of the same phases recorded (0.76, 0.84, 0.63, 1.37 mm, respectively. The results of the spatial distribution and the population density of mealybug P. ficus on fig trees recorded the highest population density on the lower part of the trees and on the branches and leaves near the soil surface. While the results did not show the presence of insects in the upper part on the stem, branches and leaves.

***Key words*:** Mealybugs, *Planococcus ficus*, Figs (*Ficus carica),* Spatial distribution.

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1. Introduction

Vine mealybug, *Planococcus ficus* (Signoret) is a type of Afro-tropical pest with a widespread origin in the Mediterranean basin and entered America in the second half of the 20th century [Ben-Dov (1994)]. Previously, it was mistakenly diagnosed as citrus mealybug *Planococcus citri* (Risso) because of its great similarity in morphological traits [Joubert (1943), Cox (1989)]. In 1975, it was identified by Delotto (1975) as a mealybug *P. ficus*. This diagnosis was confirmed by Ben-Dov (1994), as was noted in Iraq [Cox (1989), Ben-Dov (1994)]. The mealybug bugs *P. ficus* affects 12 plant families but prevails a lot on grapes, figs and pomegranates. Zada *et. al.* (2008), Ben-Dov (1994) and Hassan *et al.* (2021) noted that this specie is widespread and affects grape and fig trees and cause severe damage.

Walton and Pringle (2004) have noted that mealybug bugs have a wide family range of plants and cause direct losses to the crop, causing dryness of the branches as a result of the honey symposium creates on the branches and leaves. It also transmits the virus GLRa V-3, which causes leaf wrap disease, which leads to reduced photosynthesis [Engelbrecht and Kasdrof (1984), Cabaleiro *et al.* (1999)]. Three generations of the bugs were recorded during the year in Italy [Duso (1990)] and 5-6 generations in South Africa [Walton (2003)]. This variation may be due to temperature differences between these countries.

The life of *P. ficus* was studied by Krigeter (1954). Walton (2003) showed that the female is a convex oval covered with a white wax cover and her body is divided into clear rings containing edges which are not winged. The male has a pair of wings and the female lays eggs in aggregates and covers it with a waxy layer. The larvae go through three evolutionary stages [Shihab and

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Abood (2019)]. This research aims to study the presence and spread of vine mealybug *Planococcus ficus* (Signoret) on some plants families in Iraq and on figs in particular and study its seasonal presence and spatial distribution on fig trees in the Iraqi environment.

2. Materials and Methods

(i) Monitoring and field observations: Monitoring of the appearance of mealy bugs on fig trees, as well as other fruit trees (grapes and citrus) in orchards in Al-Mada district (30 km south of Baghdad) during 2017, 2018 and 2019. And relative humidity in 2019.

(ii) Sample collection: Parts of fig trees (stem, branches, leaves) containing mealybug infection were cut and transferred to the laboratory during spring and autumn 2019 for diagnostic purposes.

(iii) Diagnosis: The samples were diagnosed based on Ben-Dov (1994) using anatomical and compound microscopy.

(iv) Number of generations and spread: Branches and leaves of fig trees containing mealy bugs were collected periodically every 10 days during the period October 2018 until November 2019 then samples were transferred to the laboratory and examined under a microscope and recorded the life stages of the insect at each examination. The life stages and the number of generations of the insect were noted.

(v) Morphological characteristics of the insect: Leaves and branches of fig trees infected by mealy bugs were brought in October 2019. The samples were examined using the anatomical microscope with a segmented and electronically Vernier slice, and the width and length of both the egg and the the nymph were recorded in the last stage (3), Pupa male, adult male, adult female and some other morphological traits.

(vi) Spatial distribution of mealybug on fig trees: The population density of mealybug was estimated at 5 fig trees and on the parts: main stem, new branches, leaf sheath, leaf blade, upper leaf face, lower leaf face, upper tree part, middle tree part and the bottom tree. The following criterion was used: - No insect, + Low population density, ++ Medium population density, +++ High population density, ++++ Very high population density including the spatia distribution and preference of insect over fig tree parts.

3. Results and Discussion

(i) Monitoring and field observations: Field observation indicates that the grape bugs *P. ficus* spread in the orchards of the site of theexperiment and that its population density increased during the years of observation. The results, shown in Table 1, indicate the presence of this pest on figs and we did not record it on citrus and grape trees, although they exist in the same orchard and close. These results are inconsistent with Ben-Dov (1994) and Zada *et al.* (2008) in terms of their injury to grape and citrus trees as well as figs. It is noted that in our study, we recorded its infection for fig trees only.

(ii) Diagnosis: The diagnostic results indicated that this type of mealybug is a vine mealybug *Planococcus ficus* (Signoret), which was previously thought to be a citrus mealybug *P. citri*. They are quite similar with some minor differences in the arrangement of the skingl ands channels where they are smaller and less in number in *P. citri* [De Lotto (1975)]. It was also formerly called Vine yards mealybug *Planococcus vitis* (Niedietski), later named *P. Ficus* that infects figs.

(iii)Number of generations and spread: The results in Table 1 showed that the mealybugs on fig (*P. ficus)* are three generations per year, first generation in spring with low population density, second generation in autumn with high population density. The insect entered two stages of hibernation in the stage of eggs between the cracks of the sheath of the stem coinciding with the rise in temperature during June and July, as well as when temperatures drop from mid-December until the end of February as shown in Table 2. The number of mealybug generations on fig *P. ficus* varies according to the countries, where it is widespread, in Italy has a record of three generations per year [Duso (1990)], in South Africa has a record 5-6 generations in a year [Walton (2003)]. This difference in the number of generations may be due to differences in environmental conditions, especially temperatures between the countries where it is spread. Williams and Granara (1992) also

Table 1: Plant families and generations of *Planococcus ficus* under the conditions of Baghdad orchards during the period 2018 - 2019.

Season and year	Host plant			Number of generations	Temperature ° C at hibernation
	Grapes	Figs	Citrus		
Autumn 2018	none	All stages	none	2	-
Winter 2019	none	Hibernate as eggs	none	0	14.59
Spring 2019	none	All stages	none	1	-
Summer 2019	none	Hibernate as eggs	none	0	31.53
Autumn 2019	none	All stages	none	2	-

Table 2: Temperature and relative humidity at the research site.

Date	Temperature ° C			Relative Humidity %		
	Min	Max	Mean	Min	Max	Mean
December 2018	10.19	19.00	14.59	56.22	93.32	74.82
January 2019	6.41	17.42	12.91	38.32	86.35	62.33
February 2019	8.14	20.14	14.14	34.10	84.14	59.12
March 2019	11.00	23.29	17.14	23.03	76.09	49.56
April 2019	15.00	29.00	22.00	18.00	68.00	43.00
May 2019	23.06	40.00	31.53	9.38	37.16	23.49
June 2019	30.00	49.00	39.50	7.46	22.00	14.73
July 2019	30.00	45.12	38.56	8.00	20.29	14.14
August 2019	30.12	46.03	38.07	8.06	25.00	16.53
September 2019	27.00	42.36	34.68	8.00	28.00	18.00
October 2019	22.00	36.00	29.00	15.00	46.37	30.68

Table 3: Some morphological characteristics of *Planococcus ficus* mealybug on figs under conditions of the central region of Iraq.

Stage	Width (mm)	Length (mm)	Note
Nymph	0.76	1.74	Yellowish brown
Male pupa	0.87	1.42	Contains side
Adult male	0.63	1.45	The wings are
Adult female	1.37	2.49	Without wings

showed that this species affects fig trees and is spread in the world's wine-growing regions, especially the Mediterranean basin, South Africa and Pakistan.

(iv) The stages of life development of mealybug in fig: The results show that the male passes through the egg stage, three nymph stages, the stage of pre-pupa, pupa and adult, whereas the female develops from the egg stage, three nymph stages and then the adult (Table 3). These findings are consistent with those found by Walton (2003), who studied the life cycle of mealybugs on figs. He described the stages of its evolutionary life and the optimal conditions for its spread.

(v) Morphological characteristics of mealybug on fig *Planococcus ficus*: The results of the laboratory test conducted on the life stages of mealybug on figs showed that the eggs have an elongated form of light brown or reddish, the females lay eggs in the base of the leaves in the form of blocks covered with a wax layer In hibernation, eggs are placed in wounds and cracks on the stems to protect against inappropriate environmental conditions hatch at the beginning of spring and autumn, and the nymphs move towards new branches and feed on leaves and the branches of trees. Table 3 shows the some morphological characteristics of the mealybug on the fig trees. Males evolve to the pre-pupa stage and then the pupa becomes an adult insect 0.63 mm wide and 1.45 mm long. It carryies one pair of wings coincide with the emergence of new females. The female develops from the egg then the nymph and turns into an adult insect 1.37 mm wide and 2.49 mm long. It is convex oval and grey in color covered with white wax powder and the body is divided into clear rings Walton (2003) described this species and showed that the female is 2 mm wide, 4 mm

Table 4: Spatial distribution of *Planococcus ficus* mealybug on fig tree during autumn season under conditions of central region of Iraq.

Part of the tree	Population intensity	Notes
Tree stem	+	Wax material and egg covers are found in the cracks of the stem
Branches	+++	New branches
Leaf Sheath	++++	Leaves near soil surface
Leaf blade -upper face	+	Dust and stiffness
Leaf blade -lower face	++	Dust-free
The top of the tree	-	None
The middle part of the tree	+	
The lower part of the tree	++	Near soil surface

- None, + Low density, ++ Medium density, +++ High density, ++++ Very high density.

long and grey in a convex shape. De Lotto (1975) has shown that this species is similar to *P. citri* mealybug but there are minor differences between them in the order of skin glands where they are smaller and fewer in *P. citri.*

(v) Spatial distribution of mealybug Planococcus ficus on fig trees: The results in Table 4 showed that mealybug *P. ficus* varies its space distribution over fig trees according to the length of the tree and its various parts, the population density on the part of the trees near soil surface is higher than on the middle part of the trees while the insect was not found on the top of the trees. The spread on the parts of the tree, the sheath of the modern leaves was the most preferred and densely populated, followed by the modern branches and then the blade of the leaf from the lower face and the least was on the upper face of the leaf blade and the main stem of the tree. The damage caused to the trees was observed as stiffness in the leaves and gather a layer of dust on the top of the leaf and branches covered with wax material secreted by the insect and this leads to a decrease in the photosynthesis process, which reflects negatively on the quantity and quality of yield, as indicated by both Engelberecht and Kasdrof (1984) and Cabaleiro *et al*. (1999) that this type of tree infestation causes leaf wrapping and stiffness of branches as a vector of the GLRa V-3 virus, which results in poor production and poor quality.

4. Conclusions

Results indicated the increased spread of mealybug vine mealybug *Planococcus ficus* (Signoret) on fig trees. Its population density increased from 2017 to 2019, and the results also showed that its spatial distribution varies according to the height of the tree. As well as, the existence of differences in preference for infection according to the parts of the tree, the sheath of the leaf was the most favoured compared to the stem and upper face of the leaf which were the least preferred. These results can illustrate the similarity and confusion that some believe that this type of mealybug is the mealybug on citrus *P. citri.* We can also use these results when applying the work of integrated control programs for this pest according to the distribution of parts of the tree and according to the dates of its activity.

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