Distribution of Citrus mealybug, *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae) Within Ficus tree *Ficus microcarpa* var. *nitida* (King) (family : Moraceae)

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ABSTRACT

For the first time in Egypt, this study aimed to discover and identify the Citrus mealybug insect, [*Planococcus citri* (Risso) (Hemiptera: Pseudococcidae)] distribution herbivore on Ficus nitida [*Ficus microcarpa* var. *nitida* (King) (family : Moraceae)] during May, 2008 tell April, 2010, which help us to know, how could this insect can be controlled?.

More insects were found on the western direction of the ficus trees compared to the other directions that have not significant differences, while fewer insects were found on the foliage in the northern direction. Winter season have the highest detected population of citrus mealybug infested ficus trees followed by spring then autumn and summer.

The highest distribution of the insect always occurred on leaves in the bottom third of the tree followed by middle and top thirds where insect distribution decreasing going up the tree vertically. Leaves in the interior of the tree had more insects than the periphery of the canopy and the border on all categories of leaf area taken by the insect had less population. More insects were found on the median region of the leaf compared to the other areas. Otherwise, under a severe infestation level insects became abundant on the distal leaf portion.

CAPL2 mineral oil was the most effective one against the citrus mealybug all over the *Ficus nitida* leaves positions followed by Kz oil then Pirimiphos-methyl. All treatments were more effective against the insects in the leaf mid vein position of transversal region followed by central and border positions, and so they were more effective against the insects in the proximal position of longitudinal region followed by median and Distal positions.

INTRODUCTION

For the first time in Egypt, this study aimed to discover and identify the Citrus mealybug insect, [*Planococcus citri* (Risso) (Hemiptera. Pseudococcidae)] detect the favorite position and distribution herbivore on Ficus nitida [*Ficus microcarpa* var. *nitida* (King) (family : Moraceae)] which help to use less insecticides for partially spray for heavy infestation area only to protect the natural enemies and environment.

Citrus mealybug is a serious pest of many agricultural and horticultural crops, it is one of the most common pests has a pan tropical distribution that sometimes extends into subtropical regions. It is a sporadic, and extremely damaging and difficult to control pest of citrus, primarily in Egypt. It prefer humid conditions and are most often

problem in groves planted on heavier soils or with large and/or closely planted trees where a great deal of tree shading occurs. In citrus, mealybugs spread by crawling from tree to tree, wind, on bird's feet, machinery, and labor crews, (Fernandes, 1990 and 1994).

Ficus nitida is an evergreen woody plant usually grows into a dense shade tree that exhibits a spreading growth habit. As a fast-growing evergreen tree, Ficus nidita is widely used as street or lawn tree. Other than being a dense tree, and can also be in the form of a dense rounded canopy with its globe-shaped top looking dense and heavy with its beautiful leaves. As a container plant, it is great on large containers Tagawa, and Fukushima (1993) and Auslander, *et al.*, (2003).

Extensive uses of chemical toxicants for pest control caused many problems, such as acute and chronic human and animal toxicity, development of insect resistance to chemicals and environmental pollution. So, alternative effective and environmental safe insecticides such as mineral oils are urgently needed (Abdel Salam, 1993 and Anonymous, 1997).

MATERIAL AND METHODS

The study was done at the public gardens in Alexandria Governorate, (31° 11' 53" North, 29° 55' 9" East) at the north of Egypt, has a climate : subtropical ridge with very hot summers and very mild (not so cold) winters, according to the classification of Köppen, (1984) (it most widely used system for classifying the world's climates. Its categories are based on the annual and monthly averages of temperature and precipitation) during May, 2008 tell April, 2010.

During the field study Meteorology recorded average of summer months temperature 22.4°C; air relative humidity 66.1% and winds speed 11.7 m/sec but it was 16.8°C; 58.8% and 12.0 m/sec for average of temperature; air relative humidity and winds speed respectively during winter months.

- Tested insect : Citrus mealybug, *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae).
- Tested Plant : Ficus nitida, *Ficus microcarpa* var. *nitida* (King) (family : Moraceae).
- Tested Chemicals :

Pesticides	Rate	Company	Formula
KZ oil® (Kz)	1.5%	Kafr El-Ziat Pesticides and Chemicals Co.	E.C
CAPL2 oil® 96.62% E.C	1.5%	Central Agricultural Pesticides Laboratory (CAPL)	E.C
Actellic® (Pirimiphos-methyl)	0.15%	Zeneca Agrochemical Company	E.C

Field experiment was carried out in early Spring 2009 at the public gardens in Alexandria Governorate, to evaluate the efficacy of certain compounds: two mineral oils with different purification percentages [Kz oil® 95% E.C. and CAPL2 oil® 96.6% E.C.] and an organophosphorus insecticide [Pirimiphos-methyl (Actellic®)], against

the Citrus mealybug insect [*Planococcus citri* (Risso) (Hemiptera: Pseudococcidae)] infested Ficus nitida, *Ficus microcarpa* var. *nitida* (King) (family : Moraceae). Experiment was designed as a complete randomized block. Spraying was accomplished by means of a conventional knapsack sprayer with a capacity of 20 liters/tank; at rate of 10-12 liters per tree to ensure complete coverage of all parts of the tree.

Three treatments as well as the untreated check were replicated four times with three trees per replicate. Random samples leaves from each replicate were selected for laboratory counts (0, 2, 4, 6 and 8 weeks) before and after spraying.

The reduction of the inspection of both insects numbers was expressed as reduction percentages which have been calculated according to Henderson and Tilton (1955). Statistical analysis of variance and LSD value for comparing the mean effects of each treatment were adopted according to Snedecor (1970).

To obtain the insect 100 highly infested leaves were picked monthly out at random and numbered from outer to inner of the tree (25 leaves from each direction) from 10 haphazardly selected trees (in the same age and similar in size, shape and height) in the public garden (n = 1.000 leaves). Leaves were put in clothes sacks and transported to the laboratory, where the upper and lower surfaces of numbered leaves were detected respectively, using a stereoscopic binocular microscope. The pre-adult (other than crawlers), adult (males and females) of the inspected insects were counted and recorded.

As the tested insect density of our study species per leaf was highly variable among leaves, all data were reported considering the area of the leaf taken by the insect. To evaluate the distribution of citrus mealybug within the tree crown we recorded the number of insects on the leaves of Ficus nitida of four randomly positioned (north, south, east, and west) facing sides of tested trees (average height: 3.9±0.1 m; average width: 2.2±0.1 m).

The leaves were classified according to the percent of the leaf area covered by the insect as 0, 1, 2, 3, 4 and 5 watch mean infestation percentage 0, 20, 40, 60, 80 and 100%. To evaluate the distribution of citrus mealybug among the leaves we recorded : (1) insect abundance according to foliage orientation (slope); (2) insect abundance on the distal, median, and proximal region [A, B and C] of a leaf and (3) insect abundance on the leaf border, central area, and adjacent to the mid leaf vein [i, ii, and iii].

To evaluate the possible effects of meteorology on the distribution of citrus mealybug among the leaf zones, the density was recorded and type of insect present on the adaxial and abaxial leaf laminas. One leaf on each position was sampled at each slope orientation (n= 10 individuals). The same observations were done for

the insect along the leaf transverse zonation (border, central, adjacent to the mid vein). All data were analyzed by analysis of variance at the significance level of α= 0.05.

RESULTS AND DISCUSSION

Citrus mealybug insect, [*Planococcus citri* (Risso)] induced on young, expanding leaves of Ficus nitida [*Ficus microcarpa* var. *nitida* (King) (family : Moraceae)].

The average number of Citrus mealybug varied according to slope orientation of the tree crown. More insects were found on the western direction of the ficus trees compared to the other directions whom have not significant differences, (Fig. 1) while fewer insects were found on the foliage in the northern direction. The dispersion of many insects is strongly influenced by wind direction (Pathak *et al.*, 1999; Tixier *et al.*, 2000; Schooley and Wiens 2003; Feng *et al.*, 2004, 2005).

On the other hand the west and south sides of the trees were the most infested among the four directions all over the year. This may be due to longer exposure of the other sides to direct sun, Khalifa and Habib (1958) and Al-ahmed and Badawi (1991). There is a possibility that wind may have played an important role in their within tree distribution.

As the prevalent winds in the region are northeasterlies/easterlies (data obtained from the "The General Authority for Meteorology" at Kobri El-Kobba, Cairo), we postulate that the foliage on the eastern slope of the host trees are the most exposed to higher winds and strong sunlight.

Studying of tested insect distribution on the cardinal quadrants of the tested tree, Data illustrated in Fig. (1) showed that generally winter season have the most population of citrus mealybug infested ficus trees followed by spring then autumn and summer, where there were no significant differences between winter and spring and so between summer and autumn, but there were significant differences between (winter and spring) and (summer and autumn).

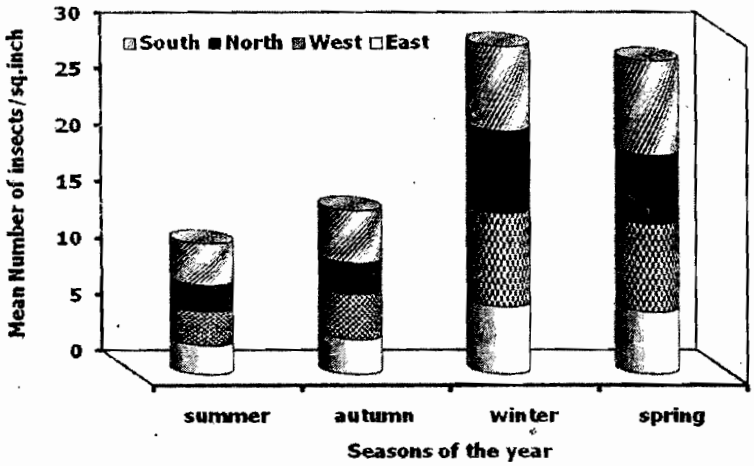

Fig. (1) : Abundance of citrus mealybug on the four geographical directions of ficus nitida tree during seasons of the year.

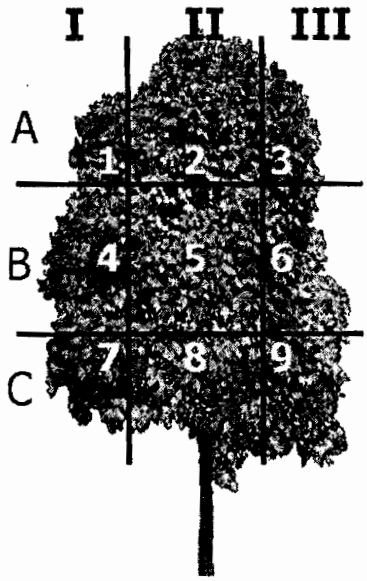

Fig. (2) : Distribution of citrus mealybug on the *ficus nitida* tree vertically and horizontally during seasons of the year.

To study the vertical and horizontal mean distribution of citrus mealybug on the *ficus nitida* tree, all insect stages was observed and recorded by the numbered leaves samples then illustrated in Fig. (2) where the tree divided vertically to (A, B and C) and horizontally to (I, II and III). The observation could be concluded that the highest distribution always occurred on leaves in the bottom third [C] of the

tree which differ significantly with the middle [B] and top [A] thirds where insect distribution decreasing going up vertically without significant differences in between. These results are in agreement with Habib and Khalifa (1957) and Hafez, *et al.,* (1967) who stated that the lower and middle zones of the tree expose to more favourable conditions than the upper zone where its leaves expose to direct sun all over the year. These observations corroborate previous findings in which insect are most abundant on sunlight-exposed foliage (Hartman 1984; Fernandes and Price 1988 and 1992).

Leaves in the interior (central zone) of the tree [II] had more insects than the periphery of the canopy. The border [I and III] on all categories of leaf area taken by the insect had less population without significant difference in between.

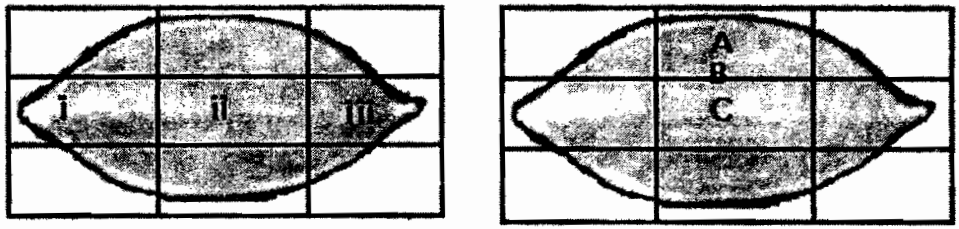

Fig. (3) : Distribution of citrus mealybug on the leaves [Transversal [border (A), central (B) and mid vein (C)] and Longitudinal [Distal (i), median (ii) and proximal (iii)] regions] of *ficus nitida* tree during seasons of the year.

Data showed in Figs. (3 and 4) illustrate how did citrus mealybug distribution on the leaves were studied where trend existed for less *Planococcus citri* (Risso) on the leaf margin (A) compared to the other transversal leaf areas (B and C). Only after the percent cover of insect reached 50%, the central portion of the leaf began to be colonized, this findings are in agreement with Hawthorne *et al.,* (1992). More insects were found on the median (ii) region of the leaf compared to the other areas (i and iii). Otherwise, under a severe infestation level insects became abundant on the distal leaf portion.

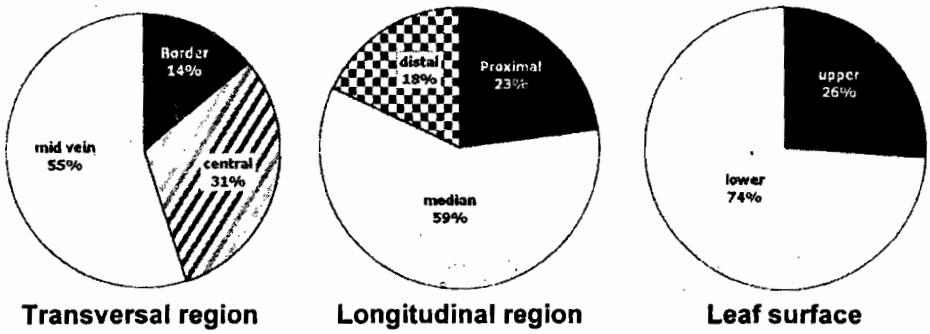

Fig. (4) : mean percentages of citrus mealybug distributed on *ficus nitida* leaves along the transversal, longitudinal regions and Leaf surface.

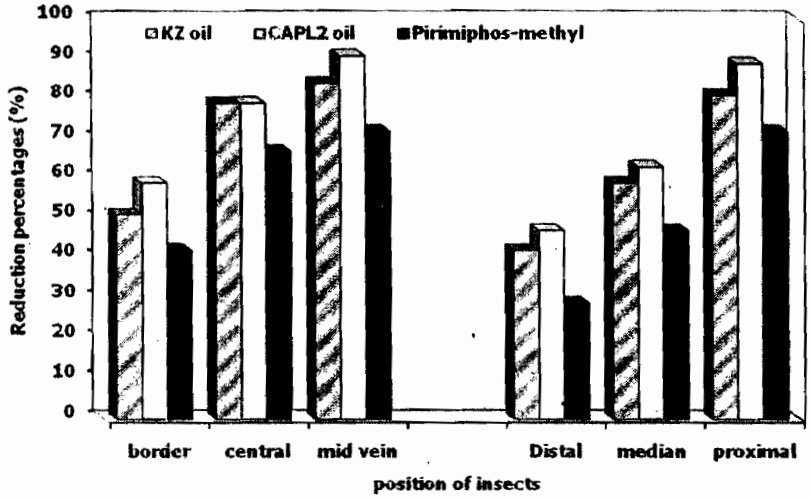

Fig. (5) : Reduction effect of two mineral oils (Kz and CAPL2) and Pirimiphos-methyl organophosphorus insecticde against citrus mealybug attacked *ficus nitida* trees in Alexandria Governorate 2009.

The data in Fig. (5) showed the effect of tested chemicals against citrus mealybug where the CAPL2 oil was the most effective one against the citrus mealybug all over the *Ficus nitida* leaves positions without significant differences with the Kz oil but they showed significant differences with the Pirimiphos-methyl. Moursi *et al.*, (1991), Moursi *et al.*, (2010), and Mesbah *et al.*, (2010).

The three treatments were more effective against the insects in the mid vein position of transversal region followed by central and border positions. And so they were more effective against the insects

in the proximal position of longitudinal region followed by median and Distal positions. These results are in agreement with those obtained by El-Sebae *et al.*, (1976), Helmy *et al.*, (1984), Yigit *et al.*, (1992), Gomma *et al.*, (1995), El-Deeb, (1999), Hussien, (2000) and Moursi *et al.*, (2011),

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الملخص العربى

توزيع حشرة بق الموالح الدقيقى (Risso) *Planococcus citri* داخل اشجار الفيكس نتدا *Ficus microcarpa* var. *nitida* (King)

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تم اجراء دراسة لاكتشاف سلوك توزع حشرة بق الموالح الدقيقى داخل اشجار الفيكس خلال الفترة من مايو ٢٠٠٨ حتى ابريل ٢٠١٠ وذلك للمساعدة فى مكافحة هذه الحشرة بكفاءة
اظهرت نتائج الدراسة الاتى :

١) ان حشرة بق الموالح الدقيقى تتوجد بكثافة اكثر فى الاتجاه الغربى لشجرة الفيكس نتدا مقارنة بالاتجاهات الاخرى التى لا يوجد اختلاف معنوى فيما بينها، واقل كثافة للحشرة ظهرت على الجانب الشمالى للشجرة.
٢) ان اشجار الفيكس تحوى اكثر كثافة لحشرة بق الموالح الدقيقى خلال فصل الشتاء يعقبها فى الكثافة فصل الربيع ثم فصل الخريف واقل الكثافة ظهرت خلال شهر الصيف.
٣) اكثر تعداد للحشرة ظهر على الثلث السفى للشجرة يعقبه فى الكثافة تنازليا الثلث الوسطى ثم الثلث العلوى للشجرة.
٤) الاوراق فى قلب الشجرة (الداخلية) ظهر عليها كثافة حشرية اكثر من الاوراق الخارجية للشجرة.
٥) تواجدت الحشرات اكثر فى المنطقة الوسطى للاوراق عند مقارنتها بباقى مساحة الورقة، وحمل الجزء الاعلى من الاوراق عدد اقل من الحشرات.
٦) بتطبيق برنامج لمكافحة حشرة بق الموالح الدقيقى على اشجار الفيكس نتدا باستخدام اثنين من الزيوت المعدنية (كابل٢ ، كزد) ومبيد فوسفورى (اكتيلك) اتضح ان الزيت المعدنى (كابل٢) كان اكثر المبيدات كفاءة حيث ادى الى اكثر نسبة خفض فى تعداد الحشرة على كل الاوراق بمختلف مكان توزعها على الشجرة، ويليه فى ذلك زيت كزد المعدنى ثم المبيد الفوسفورى (اكتيلك).
٧) جميع المعاملات اظهرت كفاءة اكثر ضد الحشرات الموجودة (فى التقسيم العرضى لورقة النبات) على العرق الوسطى يليه الحشرات التى فى منتصف الاوراق ثم القريبة على الحواف. وكذلك اظهرت النتائج فاعلية اعلى للمبيدات ضد الحشرات (فى التقسيم الطولى لورقة النبات) القريبة من عنق الورقة يليه الحشرات فى الوسط ثم طرف الورقة العلوى.