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# Host plants, geographical distribution, natural enemies and biological studies of the citrus mealybug, *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae)

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## ABSTRACT

The citrus mealy bug, *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae) is attacks many host plants including all orchard trees in Egypt. The aim of this work is to study the survey of host plants, geographical distribution and natural enemies of the citrus mealy bug, *P.citri* in Egypt as well as the biological studies of this pest on citrus, grape and guava. The results indicated that the citrus mealy bug infested 65 plant species belonging to 56 genera in 36 families and distributed in 20 governorates. Twelve species of parasitoids were collected and recorded one of them is new record. This is *Leptomastix abnormis* Girault (Hymenoptera: Encyrtidae). Also nine species of predators recorded here attacked *P.citri*. The results also observed the host plants and temperatures greatly influenced on the development of *P. citri.* The lowering of the temperature increased the dimension of the mealy bug and lengthened the developmental period. The results on citrus, guava and grape showed that the life cycle of *P. citri* at 30$^{o}$C were 21.4±2.45, 32.6±2.44 and 38.8±1.56 days, respectively. These results indicated that *P. citri* preferes citrus followed by guava and grape.

**Keywords:** Plants, natural enemies, biological, mealybug

## INTRODUCTION

The citrus mealybug, *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae) is an important pest attacking several crops. Biotic and abiotic factors, as well as the substrate they feed on influence its population (Correa *et al.*, 2008; Angeles-Martinez, 1991; Bazarov, 1988 and Gaaboub *et al.*, 1979).

It attacks new shoots and leaves of a wide range, including apple, avocado, citrus, English ivy, ficus, gardenia, jasmine, oleander, persimmon, "pothos" (*Scindapsis* sp.), pittosporum, rhododendron. Plant damage is caused by loss of sap extracted by high numbers of mealy bugs, resulting in wilted, distorted and yellowed (chlorotic) leaves, premature leaf drop, stunted growth, and occasionally death of infested plants or plant parts. The sticky, sugary sap excreted by mealy bugs is called honeydew and falls on objects underneath the site of infestation. A black fungus called sooty mold colonizes the honeydew-coated leaves causing them to look dark and unsightly (Hill, 1983).

*P. citri* is controlled most effectively with pesticides during early stages before protective wax secretions and sooty mold form. Monitoring activities must be concerned with identification and quantitative assessment of first and second stage larvae. Mature mealy bugs are highly resistant to contact pesticides. Clusters of fruit-usually the higher quality, inner canopy fruit are preferred by *P. citri*. Heavy infestations interfere with fruit development and may cause fruit drop. Sooty mold is difficult to remove at the packing shed, often resulting in downgrading of fruit. The citrus mealy bug have several predatory and parasitic natural enemies. Severe outbreaks in orchards not normally affected by mealy bugs usually are the result of

pesticide related reductions or other unfavorable circumstances affecting natural enemies (Su and Wang, 1988 and Smith *et al*. 1997).

The aim of this work is to study the survey of host plants, geographical distribution and natural enemies of the citrus mealy bug, *P.citri* in Egypt. Considering the great environmental variability to which this insect is subjected, this study was also aimed to investigate the biological aspects of this pest on citrus, guava and grape at different temperatures.

## MATERIALS AND METHODS

**1. Host plants and distribution of the citrus mealy bug, *Planococcus citri*:**

Infested plants infested were examined in the field using a pocket magnification lens. Infested leaves, flowers or fruiting structures were collected from different host plants and different locations in Egypt during 2009-2010. The samples placed separately in paper bags for further examination in the laboratory. Identification of taxa was then made by examining adult the citrus mealy bug that were slide-mounted in Canada balsam, following the methods described in Abd-Rabou (1997).

**2. Natural enemies of the citrus mealy bug, *Planococcus citri*:**

Infested crops with the citrus mealy bug collected and examined in the field, using a pocket lens during 2009-2010. The parts of the plant from different crops collected and placed separately in paper bags for further examination in the laboratory. Materials kept in a well-ventilated container until the emergence of any natural enemies. Identification of natural enemies made by examining by mounted adults in Hoyers medium and on card as follows:

**Preservation:** The specimens of natural enemies are best preserved as slide mounts and card. It may not be possible to see all the characters and measure some structures in carded specimens. However, when more specimens are available, it is preferable to have both slide mounted and carded specimens. Since body colour is likely to fade during clearing process, it might be necessary to note the colour and sculpture either from dried or freshly collected specimens preserved in alcohol. The smaller size of the specimens and their soft, less sclerotized bodies, make the specimens almost useless for study if preserved in alcohol for longer periods.

**The procedures of slide mounts as follows:** Dried specimens are soaked in glacial acetic acid (7 drops) mixed with chloral phenol (5 drops) in small watch glasses.

a. After 48 hours specimens should be satisfactorily cleared.
b. The cleared specimens are then mounted in Hoyer's medium.

After drying for about two weeks under 40 ºC, the slide cover is ringed with a suitable sealer.

The specimens identified and confirmed by the second author, Dr. Gerg Evans, USDA, USA., Mohammed Hayat, Aligah Muslim University, India and Dr. Hassan Ghahari, Department of Entomology, Azad Islamic University, Iran.

**3. Biological studies of the citrus mealy bug, *Planococcus citri* under different host plants and temperatures:**

The citrus mealybug, *P. citri* (Risso) (Hemiptera: Pseudococcidae) was reared on three host plants, citrus, grape and guava. For biological studies of *P. citri* eggs and crawlers were obtained from mother mealy bug reared on citrus, grape and guava under laboratory conditions 25-27C, 65-75% RH and 18 hours Photoperiod. The eggs incubation period was determined by using one day old egg of a mother mealy bug. Fifty eggs from each host plant were spread on blotting paper in a small Petri dish. This Petri dish was in turn placed within a bigger dish containing some distilled

water. The latter dish was covered with fine muslin so as to give maximum humidity to the eggs. The Petri dish containing the eggs was kept in a constant temperature incubator. Ten replicate Petri dish for each plant were kept at the following temperatures: 18°C, 24°C and 30°C. The procedure for determining egg viability was, similar to that of egg incubation. Fifty eggs from each host plant were kept in each Petri dish at the following temperatures: 18°C, 24°C and 30°C. Four replicate Petri dish for host each were kept at each temperature regime. The eggs were observed daily with a stereomicroscope (X 15) for the emergence of the crawlers. For studying the development of the mealy bug, citrus, guava and grape washed with clean water. Newly emerged crawlers were transferred from the mother scale on to the leaves of citrus, guava and grape using a fine paint brush. Each pot was infested with 100 crawlers. The infested pot was then kept in a ventilated polystyrene box (175 mm X 115 mm X 52mm). Two boxes each were kept at each of the temperatures used in the study. Twenty individual mealy bugs exposed at each of the various constant temperatures were selected at random for studying their development. The development of the individual mealy bugs was observed daily using a stereomicroscope (x 15).

The obtained data of the biological studies were analyzed following Birch (1948) using Life 48 Basic Computer Program (Abou-Setta *et al*., 1986). Sex ratio was considered as one (since all progeny developed to females).

## RESULTS AND DISCUSSION

### 1. Host plant of the citrus mealy bug, *Planococcus citri*:

The citrus mealy bug, *P. citri* were observed infesting 65 plant species belonging to 56 genera in 36 families in Egypt (Table 1). No country side work was conducted on the host plants of citrus mealy bug.

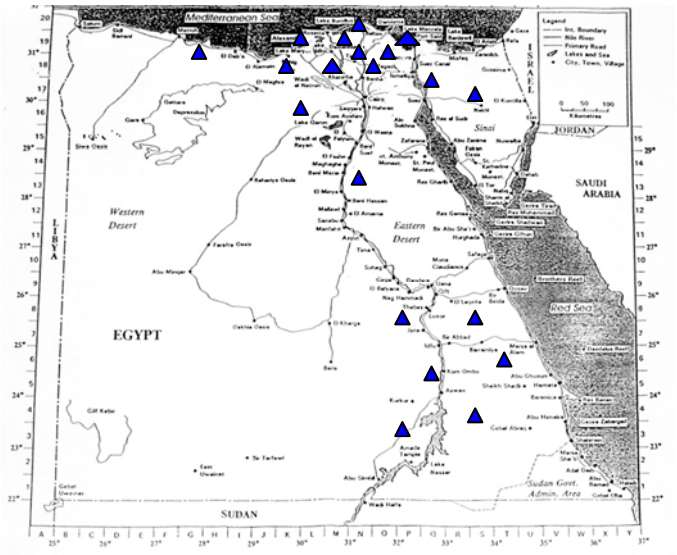
Table (1): Host plants of the citrus mealy bug, *Planococcus citri* in Egypt:

| Species | Host plant | Family |
|---|---|---|
| ***Planococcus citri* (Risso)** | *Acacia* sp. | Leguminoseae |
| | *Albizzia lebbekh* (L) | Leguminoseae |
| | *Ambrossia* sp. | Cyperaceae |
| | *Annona squamosa* L | Annonaceae |
| | *Aralia* sp. | Araliaceae |
| | *Asparagus* sp. | Brassicaceae |
| | *Begonia* sp. | Begoniaceae |
| | *Bougainvillea* sp. | Nyctagineae |
| | *Brassica oleracea* L | Cruciferaceae |
| | *Cactus* sp. | Rutaceae |
| | *Canna* sp. | Cannaceae |
| | *Cassia* sp. | Leguminoseae |
| | *Casuarina equisetifolia* L | Casuarinaceae |
| | *Chenopodium album* L | Chenopodiaceae |
| | *Citrullus vilgaris* Scharad | Rutaceae |
| | *Citrus decumanus* L | Rutaceae |
| | *Citrus medica* L | Rutaceae |
| | *Citrus nobilis* L | Rutaceae |
| | *Citrus sinensis* L | Rutaceae |
| | *Cocos nucifera* L | Arecaceae |
| | *Coleus* sp. | Lamiaceae |
| | *Convolvulus* sp. | Convolvulaceae |
| | *Croton* sp. | Euphorbiaceae |
| | *Cucumis melo* L | Cucurbitaceae |
| ***P. citri*** | *Cucurbita* sp. | Cucurbitaceae |
| | *Cycas* sp. | Cycadeceae |
| | *Cyperus* sp. | Cyperaceae |
| | *Cyperus alternifolius* L | Cyperaceae |
| | *Dianthus caryophyllus* L | *Caryophyllaceae* |
| | *Dioscorea* sp. | Dioscoreaceae |

| | | |
|---|---|---|
| | *Duranta* sp. | Verbenaceae |
| | *Euphorbia* sp. | Euphorbiaceae |
| | *Ficus sycamorus* L | Moraceae |
| | *Gardenia* sp. | Rubiaceae |
| | *Geranium* sp. | Geraniaceae |
| | *Impatiens* sp. | Balsaminaceae |
| | *Imperata cylindrical* (L) | Graminae |
| | *Ipomoea batatas* L | Convolvulaceae |
| | *Latania* sp. | Palmaceae |
| | *Lippia* sp. | Verbenaceae |
| | *Mangifera indica* L | Anacardiaceae |
| | *Mentha silvestris* L | Labiateae |
| | *Musa* sp. | Musaceae |
| | *Musa sapientum* L | Musaceae |
| | *Myoporum pictum* L | Myoporaceae |
| | *Nerium oleander* L | Apocynaceae |
| | *Nicotiana* sp. | Solanaceae |
| | *Oryza latifolia* Desv. | Poaceae |
| **Species** | **Host plant** | **Family** |
| ***P.citri*** | *Panicum colonum* L | Poaceae |
| | *Pelargonium* sp. | Poaceae |
| | *Persea americana* Mill | Lauraceae |
| | *Phaseolus limensis* Macfad | Leguminosae |
| | *Phoenix* sp. | Arecaceae |
| | *Phoenix dactylifera* L | Arecaceae |
| | *Psidium guajava* L | Myrtaceae |
| | *Punica granatum* L | Punicaceae |
| | *Pyrus communis* L | Rosaceae |
| | *Pyrus malus* L | Rosaceae |
| | *Pyrus malus* L | Rosaceae |
| | *Solanum melongena* L | Solanaceae |
| | *Solanum tuberosum* L | Solanaceae |
| | *Tacoma capensis* (Thunb.) | Begoniaceae |
| | *Tacoma smithi* W. Watson | Begoniaceae |
| | *Theobroma cacao* L | Sterculiaceae |
| | *Trifolium alexandrinum* L | Leguminosae |
| | *Zygophyllum album* L | Zygophyllaceae |

## 2. Geographical distribution of the citrus mealy bug *Planococcus citri*:

This mealy bug species distributed in 20 governorates (Map 1). These are Alexandria, Assuit, Aswan, Behira, Cairo, Daqhliya, Gahrbiya, Giza, Helwan, Ismailia, Qalyubiya, Qena, Marsa Matruoh, Minufiya, Minyia, New Valley, Port Said, Sinai, Sohag and Suez.). No country side work was conducted on the geographical distribution of citrus mealy bug.




Map (1): Geographical distribution of the citrus mealy bug, *Planococcus citri* in different localities in Egypt.

## 3. Natural enemies of the citrus mealy bug *Planococcus citri*:

### 3.1. Parasitoids:

Twelve species of aphelinids and encyrtids were collected and recorded from concerned specimens under investigation (Table 2). Abd-Rabou (2001) recorded 11 parasitoids associated with *P. citri.* So here one species recorded for the first time in Egypt this is *Leptomastix abnormis* Girault (Hymenoptera: Encyrtidae).

Table (2): Parasitoids of the citrus mealy bug, *Planococcus citri* in Egypt

| Host mealy bugs | Parasitoids | |
|---|---|---|
| | Family | Species |
| *P.citri* | Aphelinidae | *Anagyrus greeni* (Howard), |
| | | *A. pseudococci* (Girault), |
| | | *Marietta picta* (Andre) |
| | Encyrtidae | *Blepyrus insularis* (Cameron) |
| | | *Encyrtus* sp., |
| | | *Gyrunusoidea* sp., |
| | | *Leptomastidae abnormis* (Girault), |
| | | *Leptomastix abnormis* Girault new record |
| | | *Leptomastix dactylopii* Howard |
| | | *L. flava* Mercet |
| | | *Cheiloneurus* sp., |
| | | *Prochiloneurus aegyptiacus* (Mercet). |

### 3.2. Predators:

Nine species of predators recorded here attacked the citrus mealy bug, *P.citri*. These species belonging to 3 species in order Coleoptera, one species in order Diptera, 4 species in order Lepidoptera and one species in order Neuroptera (Table 3). No country side work was conducted on the predators of citrus mealy bug.

Table (3): Predators of the citrus mealy bug, *Planococcus citri* in Egypt

| Host mealy bugs | Predators | | |
|---|---|---|---|
| | Order | Family | Species |
| ***P.citri*** | Coleoptera | Coccinellidae | *Rodolia cardinalis* (Muls.) |
| | | | *Scymnus interruptus* Goeze |
| | | | *Scymnus seriacus* Mars. |
| | Diptera | Cecidomyiidae | *Diadiplosia* sp. |
| | Lepidoptera | Noctuidae | *Autoba beraudi* Joannis |
| | | | *Autoba gayncri* Rothsch |
| | | | *Rivula sericealis* Scop. |
| | | Oecophoridae | *Stathmopoda auriferella* Mayr. |
| | Neuroptera | Chrysopidae | *Chrysopa vulgaris aegyptica* (Schneider) |

## 4. Biological studies of the citrus mealy bug, *Planococcus citri* under different host plants and temperatures:

### 4.1. Biological studies of the citrus mealy bug, *Planococcus citri* on citrus:

The biological parameters of the citrus mealybug, *P. citri* at three different constant temperatures (i.e. 18, 24 and 30$^{o}$C) on citrus are presented in Table ( 4 ). Mean durations of the first instar were 8.5±0.53, 6.0±0.67 and 3.4±0.52 days at 18, 24 and 30$^{o}$C, respectively. Second instar lasted for 11.5±0.71, 9.2±0.92 and 5.2±0.79 days, respectively. While third instar durations were 12.7±0.82, 10.0±0.67 and 8.2±0.82, respectively. Incubation periods were 7.3±0.67, 4.5±0.53 and 2.3±0.48 days, respectively.

Table (4): Average duration (in days) of the citrus mealy bug, *Planococcus citri* stages on citrus plants at different constant temperatures (18, 24 and 30°C).

| Developmental stages | Duration (in days) | | |
|---|---|---|---|
| | Mean ± SE at 18°C | Mean ± SE at 24°C | Mean ± SE at 30°C |
| Egg incubation period | 7.3±0.67 | 4.5±0.53 | 2.3±0.48 |
| 1st instar | 8.5±0.53 | 6.0±0.67 | 3.4±0.52 |
| 2nd instar | 11.5±0.71 | 9.2±0.92 | 5.2±0.79 |
| 3rd instar | 12.7±0.82 | 10.0±0.67 | 8.2±0.82 |
| Total nymphal period | 40.0±2.7 | 29.7±2.8 | 19.1±2.6 |
| Pre-oviposition period | 4.1±0.34 | 3.2±0.34 | 2.9±0.12 |
| Oviposition period | 9.6±0.95 | 7.3±0.5 | 6.7±0.21 |
| Post-oviposition period | 3.6±0.76 | 2.6±0.93 | 2.1±0.55 |
| Total average of eggs/female (fecundity) | 136.1±3.25 | 158.7±3.92 | 362.3±4.95 |
| Life cycle | 47.3±2.11 | 34.2±1.95 | 21.4±2.45 |

The generation time was 47.3±2.11, 34.2±1.95 and 21.4±2.45 days, respectively. As a result the durations of the adult longevity were 17.3± 0.57, 13.1± 0.66 and 11.7± 0.95days, respectively (Table 5). These results indicated that 30°C was the most adequate tested temperature for the citrus mealybug, *P. citri* life and because it resulted in the highest oviposition (362.3±4.95eggs/female), the shortest incubation period (2.3±0.48 days) and adult longevity (11.7± 0.95 days).

Table (5): Average duration (in days) of adult period (female) of the citrus mealy bug , *Planococcus citri* and number of eggs laid by the adult females on citrus plants at different constant temperatures (18, 24 and 30°C).

| Developmental stages | Duration (in days) | | | | | |
|---|---|---|---|---|---|---|
| | Mean ± SD at 18°C | | Mean ± SD at 24°C | | Mean ± SD at 30°C | |
| | Female | Eggs/ Female | Female | Eggs/ female | Female | Eggs/ Female |
| Pre-oviposition | 4.1 ± 0.34 | - | 3.2 ± 0.34 | - | 2.9 ± 0.12 | - |
| Oviposition | 9.6 ± 0.95 | - | 7.3 ± 0.5 | - | 6.7 ± 0.21 | - |
| Post-oviposition | 3.6 ± 0.76 | - | 2.6 ± 0.93 | - | 2.1 ± 0.55 | - |
| Longevity | 17.3 ± 0.57 | 136.1 ± 3.25 | 13.1 ± 0.66 | 158.7 ± 3.92 | 11.7 ± 0.95 | 362.3 ± 4.95 |
| Adult's life span | 57.3 ± 0.67 | - | 42.8 ± 0.98 | - | 30.8 ± 0.87 | - |

## 4.2. Biological studies of the citrus mealy bug, *Planococcus citri* on guava:

The biological parameters of the citrus mealybug, *P. citri* at three different constant temperatures (i.e.18, 24 and 30°C) on guava are presented in Table ( 6 ).

Mean durations of the first instar were 10.6±0.70, 8.3±0.48 and 5.5±0.53 days at 18, 24 and 30°C, respectively. Second instar lasted for 14.6±0.70, 11.7±0.82 and 8.7±0.67 days, respectively. While third instar durations were 15.1±0.99, 12.6±0.52 and 9.4±0.52, respectively. Incubation periods were 9.6±0.70, 7.4±0.52 and 4.5±0.53 days, respectively. The generation time was 59.5±2.55, 47.4±1.76 and 32.6±2.44 days, respectively.

Table (6): Average duration (in days) of the citrus mealy bug, *Planococcus citri* stages on guava plants at different constant temperatures (18, 24 and 30°C).

| Developmental stages | Duration (in days) | | |
|---|---|---|---|
| | Mean ± SE at 18°C | Mean ± SE at 24°C | Mean ± SE at 30°C |
| Egg incubation period | 9.6±0.70 | 7.4±0.52 | 4.5±0.53 |
| 1st instar | 10.6±0.70 | 8.3±0.48 | 5.5±0.53 |
| 2nd instar | 14.6±0.70 | 11.7±0.82 | 8.7±0.67 |
| 3rd instar | 15.1±0.99 | 12.6±0.52 | 9.4±0.52 |
| Total nymphal period | 49.9±3.1 | 40.0±2.3 | 28.1±2.3 |
| Pre-oviposition period | 3.8±0.55 | 2.7±0.12 | 1.7±0.11 |
| Oviposition period | 8.4±0.23 | 6.2±0.64 | 5.2±0.43 |
| Post-oviposition period | 2.5±0.43 | 1.8±0.45 | 1.5±0.42 |
| Total average of eggs/female (fecundity) | 141.1±1.45 | 162.9±1.66 | 373.3±1.70 |
| Life cycle | 59.5±2.55 | 47.4±1.76 | 32.6±2.44 |

As a result the durations of the adult longevity were 14.7± 0.55, 10.7±0.88 and 8.4±0.21days, respectively (Table,7) . These results indicated that 30°C was the most adequate tested temperature for the citrus mealybug, *P. citri* life and because it resulted in the highest oviposition (373.3±1.70eggs/female), the shortest incubation period (4.5±0.53 days) and adult longevity (8.4±0.21days).

Table (7):Average duration (in days) of adult period (female) of the citrus mealy bug , *Planococcus citri* and number of eggs laid by the adult females on guava plants at different constant temperatures (18, 24 and 30°C).

| Developmental stages | Duration (in days) | | | | | |
|---|---|---|---|---|---|---|
| | Mean ± SD at 18°C | | Mean ± SD at 24°C | | Mean ± SD at 30°C | |
| | Female | Eggs/ Female | Female | Eggs/ female | Female | Eggs/ Female |
| Pre-oviposition | 3.8± 0.55 | - | 2.7± 0.12 | - | 1.7± 0.11 | - |
| Oviposition | 8.4± 0.23 | - | 6.2± 0.64 | - | 5.2± 0.43 | - |
| Post-oviposition | 2.5± 0.43 | - | 1.8± 0.45 | - | 1.5± 0.42 | - |
| Longevity | 14.7± 0.55 | 141.1±1.45 | 10.7± 0.88 | 162.9±1.66 | 8.4± 0.21 | 373.3±1.70 |
| Adult's life span | 32.0± 0.75 | - | 23.8± 0.56 | - | 20.1± 0.11 | - |

## 4.3. Biological studies of the citrus mealy bug, *Planococcus citri* on grape:

The biological parameters of the citrus mealybug, *P. citri* at three different constant temperatures (i.e.18,24 and 30°C) on grape are presented in Table ( 8 ). Mean durations of the first instar were 12.2±0.63, 10.1±0.57and 6.9±0.74days at 18, 24 and 30°C, respectively.

Table (8): Average duration (in days) of the citrus mealy bug, *Planococcus citri* stages on grape plants at different constant temperatures (18, 24 and 30°C).

| Developmental stages | Duration (in days) | | |
|---|---|---|---|
| | Mean ± SE at 18°C | Mean ± SE at 24°C | Mean ± SE at 30°C |
| Egg incubation period | 11.1±0.88 | 8.7±0.48 | 5.6±0.52 |
| 1st instar | 12.2±0.63 | 10.1±0.57 | 6.9±0.74 |
| 2nd instar | 15.9±0.74 | 13.2±0.63 | 10.1±0.57 |
| 3rd instar | 16.8±0.42 | 14.9±0.99 | 10.6±0.52 |
| Total nymphal period | 56.0±2.7 | 46.9±2.7 | 33.2±2.4 |
| Pre-oviposition period | 6.5±0.76 | 4.3±0.45 | 3.2±0.52 |
| Oviposition period | 12.6±0.44 | 10.7±0.75 | 8.9±0.42 |
| Post-oviposition period | 4.7±0.65 | 4.1±0.55 | 3.6±0.53 |
| Total average of eggs/female (fecundity) | 143.0±1.76 | 167.0±1.89 | 379.8±2.97 |
| Life cycle | 67.1±1.76 | 55.6±1.65 | 38.8±1.56 |

Second instar lasted for 15.9±0.74, 13.2±0.63 and 10.1±0.57days, respectively. While third instar durations were 16.8±0.42, 14.9±0.99 and 10.6±0.52, respectively. Incubation periods were 11.1±0.88, 8.7±0.48and 5.6±0.52days, respectively. The generation time was 67.1±1.76, 55.6±1.65and 38.8±1.56days, respectively. As a result the durations of the adult longevity were 23.8± 0.54, 19.1± 0.76 and 15.7± 0.76 days, respectively (Table 9). These results indicated that 30$^{o}$C was the most adequate tested temperature for the citrus mealybug, *P. citri* life and because it resulted in the highest oviposition (379.8 ± 2.97 eggs / female), the shortest incubation period (5.6±0.52days) and adult longevity (15.7± 0.76 days).

In this research work the host plants and temperatures greatly influenced the development of *P. citri* . The lowering of the temperature increased the dimension of the mealy bug and lengthened the developmental period. The results on citrus, guava and grape showed that the life cycle of the citrus mealy bug, *P. citri* at 30$^{o}$C were 21.4±2.45, 32.6±2.44 and 38.8±1.56 days, respectively. These results indicated that *P. citri* preferes citrus followed by guava and grape. Correa *et al.* (2005) studied biological aspects of *P. citri* on citrus plants. The experiment was conducted in a climatic chamber, set to 25±1 degrees C, 70±10% RH and 12 h photophase.

Table (9): Average duration (in days) of adult period (female) of the citrus mealy bug, *Planococcus citri* and number of eggs laid by the adult females on grape plants at different constant temperatures (18, 24 and 30°C).

| Developmental stages | Duration (in days) | | | | | |
|---|---|---|---|---|---|---|
| | Mean ± SD at 18°C | | Mean ± SD at 24°C | | Mean ± SD at 30°C | |
| | Female | Eggs/ Female | Female | Eggs/ female | Female | Eggs/ Female |
| Pre-oviposition | 6.5±0.76 | - | 4.3±0.45 | - | 3.2±0.52 | - |
| Oviposition | 12.6±0.44 | - | 10.7±0.75 | - | 8.9±0.42 | - |
| Post-oviposition | 4.7±0.65 | - | 4.1±0.55 | - | 3.6±0.53 | - |
| Longevity | 23.8±0.54 | 143.0±1.76 | 19.1±0.76 | 167.0±1.89 | 15.7± 0.76 | 379.8±2.97 |
| Adult's life span | 79.8±2.56 | - | 66.0±2.11 | - | 34.2±1.55 | - |

Forty eggs of *P. citri* were individualized in Petri dishes, sealed with PVC film containing leaf disks of *C. sinensis* cv. 'Bahia', arranged onto a 1% agar-water slide. The length of the nymphal stage of the males was longer than that of the females, corresponding to 30 and 24 days, respectively, with longevity of 2 days for males and 56 for females. The rate of survival of males and females at the nymphal stage was 70%, showing a satisfactory development of this mealybug on foliar discs of 'Bahia' under laboratory conditions. The incubation period lasted 3.35 days. The female had three and the males four nymphal instars. Nymphal development in males and females was completed in 20.05 and 28.10 days, respectively, when reared on pumpkin fruits in the laboratory. Fecundity ranged from 152 to 356 eggs. These studies were carried out in the laboratory at a room temperature ranging from 25 to 29 degrees C and relative humidity from 65 to 70% **(**Malleshaiah *et al.*, 2000).

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## ARABIC SUMMERY

### العوائل النباتية و التوزيع الجغرافى و الأعداء الحيوية والدراسات البيولوجية لبق الموالح الدقيقى فى مصر

**نها أحمد حسين ـ شعبان محمود عبدربه**
معهد بحوث وقاية النباتات ـ مركز البحوث الزراعية- الدقي- الجيزة- مصر

يعتبر بق الموالح الدقيقى من أهم الآفات التى تصيب الموالح فى مصر والعالم . تم فى هذا العمل دراسة العوائل النباتية و التوزيع الجغرافى و الأعداء الحيوية و الدراسات البيولوجية لبق الموالح الدقيقى فى مصر. وقد أشارت النتائج أن بق الموالح الدقيقى يصيب 65 عائل نباتى ممثلة فى 36 فصيلة تابعة ل 56 جنس و تنتشر هذه الآفة فى 20 محافظة وتهاجم ب 12 طفيل سجل منهم احد هذة الآنواع لأول مرة فى مصر وكما تم أيضا تسجيل 9 مفترسات مصاحبة لهذه الآفة . ومن النتائج أيضا أتضح أن أختلاف درجة الحرارة و العائل النباتى يؤثر تأثيرا بالغا على تطور بق الموالح الدقيقى. ومن خلال النتائج أيضا أتضح أن فترة دورة حياة الحشرة على ثلاث نباتات الموالح والجوافه و العنب عند درجة مئوية كانت 21.4 ±2.45 و32.6 ±2.44 و 38.8 ±2.44 أيام على الترتيب ومن هنا يتضح ان بق الموالح الدقيقى يفضل الموالح عن الجوافة عن العنب.