

**Biological studies of the cottony camellia scale, *Puvitaria floccifera* (Hemiptera: Coccidae) with updating lists of host plants and natural enemies in Egypt**

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### ABSTRACT

The cottony camellia scale, *Pulvinaria floccifera* (Westwood) (Hemiptera : Coccidae) is considered one of the most important pest infesting different crops in Egypt. The aim of this work is to study the survey of host plants and natural enemies of the cottony camellia scale *P. floccifera* in Egypt as well as the biological studies of the cottony camellia scale *P. floccifera* on citrus, fig and guava. The obtained results indicated that the list of host plant including 12 species recorded infested the cottony camellia scale, *P. floccifera*. Seven species recorded here for the first time in Egypt. Also, the updating lists including 14 parasitoid and 17 predator species, four and five species of parasitoids and predators recorded here for the first time in Egypt associated with the cottony camellia scale, *P. floccifera*, respectively. Temperatures greatly influenced the development of *P. floccifera*. The lowering of the temperature increased the dimension of the cottony camellia scale and prolonged the developmental period. The results on citrus, fig and guava showed that the life cycle of *P. floccifera* at 30°C were 71.5±5.75, 80.7 ±5.00 and 58.7±0.35 days, respectively. These results indicated that the cottony camellia scale, *P. floccifera* prefers guava, followed by citrus and fig.

**Keywords:** Biological studies, the cottony camellia scale, natural enemies , Egypt

### INTRODUCTION

The cottony camellia scale, *Pulvinaria floccifera* (Westwood) (Hemiptera: Coccidae) attacked 39 host plant species and distributed in different parts of the world (Ben-Dov,1993). They attack all parts of the plants, leaves, stem, bark, crowns and root. The severity of damage caused by this scale is graded according to the level of infestation. This followed by the appearance of honey dew on the leaves. Resulting in spread of sooty mould, then, more serious symptoms appear, such as the fall of leaves extending gradually to an almost complete defoliation and entire branch dryness on tree. Severe infestation do not result in the death of tree, but cause the reduction or even absence of yield for a number of years (Hamon and Williams, 1984). Hall, 1922, 1923 and Ezzat and Hussein (1969) studied host plants of soft scale insects in Egypt including, *P. floccifera*. Natural enemies of *P. floccifera* recorded in Egypt by Abd-Rabou and Badary (2004).

The aim of this work is to study the survey of host plants and natural enemies of the cottony camellia scale *P. floccifera* in Egypt as well as the biological aspects of this pest on citrus, fig and guava at different temperatures.

### MATERIALS AND METHODS

#### **1. Host plants of the cottony camellia scale, *Pulvinaria floccifera*:**

Infested plants 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. Identification of the cottony camellia scale, *P. floccifera* was done by examining adults in Canada Balsam.

### **2. Natural enemies of the cottony camellia scale, *Pulvinaria floccifera*:**

Infested crops from different locations will be examined in the field, using a pocket lens. The parts of the plant from different locations will be collected and placed separately in paper bags for further examination in the laboratory. Materials will be kept in a well-ventilated container until the emergence of any natural enemies. Identification of natural enemies will be made by examining mounted adults in Hoyer's medium.

### **3. Biological studies of the cottony camellia scale, *Pulvinaria floccifera*:**

The cottony camellia scale *P. floccifera* was reared on three host plants i.e. citrus, fig and guava. For biological studies of the cottony camellia scale *P. floccifera* eggs and crawlers were obtained from mother *P. floccifera* reared on citrus, fig and guava under laboratory conditions 25-27°C, 65-75% RH and 18 hours Photoperiod. The incubation period of eggs was determined by using one day old egg of a mother soft scale. 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 of Petri dish for host each were kept at each temperature regime. The eggs were observed daily with a stereomicroscope (X15) for the emergence of the crawlers. For studying the development of the soft scale, citrus, fig and guava washed with clean water. Newly emerged crawlers were transferred from the mother scale on to the leaves of citrus, fig and guava 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 were kept at each of the temperatures used in the study. Twenty individual of *P. floccifera* exposed at each of the various constant temperatures were selected at random for studying their development. The development of the individual soft scale was observed daily using a stereomicroscope (x 15).

## **RESULTS AND DISCUSSION**

### **1. Updating list of host plants of the cottony camellia scale, *Pulvinaria floccifera* in Egypt:**

This list including 12 host plant species recorded infested the cottony camellia scale, *P. floccifera*. Seven species recorded here for the first time in Egypt (astrix denote to new records). Hall (1922, 1923) and Ezzat and Hussein (1969) recorded five host plant species recorded infested with the cottony camellia scale, *P. floccifera* in Egypt.

#### **Anacardiaceae**

1. *Mangifera indica*\*

#### **Araliaceae**

2. *Aralia longifolia*\*

3. *Aralia papyrifera*\*

#### **Asteraceae**

4. *Helianthus annuus*

#### **Chenopodiaceae**

5. *Chenopodium allum***Moraceae**6. *Ficus benghalensis*\*7. *Ficus cunninghamii*\*8. *Ficus trijuja*\***Myrtaceae**9. *Pisidium gujava***Rosaceae**10. *Rosa* sp.**Rutaceae**11. *Citrus* sp.**Solanaceae**12. *Solanum melongena*\***2. Natural enemies the cottony camellia scale, *Pulvinaria floccifera* in Egypt:****2.1. Updating list of parasitoids of the cottony camellia scale, *P. floccifera* in Egypt:**

This list including 14 parasitoids species recorded associated with the cottony camellia scale, *P. floccifera*, four species recorded here for the first time in Egypt (as-trix denote to new records). Abd-Rabou and Badary (2004) recorded ten parasitoid species recorded associated with the cottony camellia scale, *P. floccifera* in Egypt.

**Family: Aphelinidae**1. *Coccophagus lycimnia* (Walker)2. *C. qenai* Abd-Rabou\*3. *C. scutellaris* (Dalman)4. *Marietta leopardina* Motschulsky**Family: Encyrtidae**5. *Diversinervus elegans* Silvestri6. *Encyrtus inflex* (Embleton)\*7. *Metaphycus annecke* Guerrieri and Noyes\*8. *M. helvolus* (Compere)9. *M. lounsburyi* (Howard)10. *Microterys flavus* (Howard)11. *Paraceraptocherus africanus* Giralut**Family: Eulophidae**12. *Tetrasticus* sp.\***Family: Mymaridae**13. *Alaptus* sp.**Family: Pteromalidae**14. *Scutellista caerulea* (Fonscolombe)**2.2. Predators:**

This list including 17 predator species recorded associated with the cottony camellia scale, *P. floccifera*. Five species recorded here for the first time in Egypt. Abd-Rabou and Badary (2004) recorded 12 predator species associated with the cottony camellia scale, *P. floccifera* on Egypt.

**Coleoptera****Coccinellidae**1. *Chilocorus bipustulatus* L.2. *Clitostethus arcuatus* Rossi3. *Coccinella undecimpunctata* L4. *Exochomus flavipes* Thunb5. *Pharoscygnus varius* \*

6. *Rhyzobius lophanthae* (Blaisdell) \*

7. *Rhyzobius littura* Fab.

8. *Rodalia cardinals* Muls \*

9. *Scymnus interruptus* Goeze

10. *Scymnus seriacus* Mars.

11. *Stethorus* sp.\*

#### Steaphilinidae

12. *Paederus alfieri* Koch

#### Hemiptera

#### Anthocoridae

13. *Orius laevigatus* Fieb.

#### Neuroptera

#### Chrysopidae

14. *Chrysoperlla carnae* Steph.

15. *Chrysopa septempunctata* Wesm.

16. *Chrysopa vulgaris aegyptica* (Schneider)\*

#### Phloeothripidae

17. *Haplothrips andresi* Priesner

### 3. Biological studies of the cottony camellia scale, *Pulvinaria floccifera* under different host plants and temperatures:

#### 3.1. Biological studies of the cottony camellia scale, *P. floccifera* on citrus trees:

The biological studies of the cottony camellia scale, *P. floccifera* at three different constant temperatures (i.e. 18, 24 and 30°C) on citrus are presented in Table (1). Mean durations of the first instar were 10.6±0.80, 8.3±0.15 and 5.5±0.25 days at 18, 24 and 30°C, respectively. Second instar lasted for 14.9±0.45, 13.2±0.10 and 10.1±0.55 days, respectively. While third instar durations were 15.1±0.05, 12.6±0.30 and 9.4±0.05 days, respectively. Incubation periods were 9.6±0.30, 7.4±0.20 and 4.5±0.20 days, respectively. The generation period (Life cycle) was 107.9± 3.95, 91.1±5.05 and 71.5±5.75 days, respectively. The durations of the adult longevity were 67.6±1.00, 58.5±1.50 and 47.9±1.5 days, respectively (Table, 1). These results indicated that 30°C was the most adequate tested temperature for the cottony camellia scale *P. floccifera* life resulting the highest oviposition (373.3±6.65 eggs/female), the shortest incubation period (4.5±0.20 days) and adult longevity (47.9±1.5 days).

Table 1: Average duration (in days) of the cottony camellia scale, *Pulvinaria floccifera* stages at three constant temperatures (18, 24 and 30°C) on citrus.

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±0.30	7.4±0.20	4.5±0.20
1 <sup>st</sup> instar	10.6±0.80	8.3±0.15	5.5±0.25
2 <sup>nd</sup> instar	14.6±0.30	11.7±0.85	8.7±0.50
3 <sup>rd</sup> instar	15.1±0.05	12.6±0.30	9.4±0.05
Total instars period	40.3±0.15	32.6±1.30	23.6±1.5
Adult longevity	67.6±1.00	58.5±1.50	47.9±1.5
Total average of eggs/female (fecundity)	141.1±5.50	162.9±6.00	373.3±6.65
Life cycle	107.9±3.95	91.1±5.05	71.5±5.75

#### 3.2. Biological studies of the cottony camellia scale, *Pulvinaria floccifera* on fig trees:

The biological studies of the cottony camellia scale, *P. floccifera* at three different constant temperatures (i.e. 18, 24 and 30°C) on fig are presented in Table (2). Mean durations of the first instar were 12.2±0.10, 10.1±0.05 and 6.9±0.45 days at 18, 24 and 30°C, respectively. Second instar lasted for 15.9±0.45, 13.2±0.10 and 10.1±0.55 days, respectively. While third instar durations were 16.8±0.40, 14.9±0.45

and  $10.6 \pm 0.30$  days, respectively. Incubation periods were  $11.1 \pm 0.55$ ,  $8.7 \pm 0.35$  and  $5.6 \pm 0.30$  days, respectively. The generation period (Life cycle) was  $114.0 \pm 5.00$ ,  $101.0 \pm 5.50$  and  $80.7 \pm 5.00$  days, respectively. The durations of the adult longevity were  $69.1 \pm 2.50$ ,  $62.8 \pm 0.40$  and  $53.1 \pm 1.55$  days, respectively (Table, 1). These results indicated that  $30^\circ\text{C}$  was the most adequate tested temperature for the cottony camellia scale *P. floccifera* life resulting the highest oviposition ( $379.8 \pm 9.90$  eggs/female), the shortest incubation period ( $5.6 \pm 0.30$  days) and adult longevity ( $53.1 \pm 1.55$  days).

Table 2: Average duration (in days) of the cottony camellia scale, *Pulvinaria floccifera* stages at three constant temperatures (18, 24 and  $30^\circ\text{C}$ ) on fig.

Developmental stages	Duration (in days)		
	Mean $\pm$ SE at $18^\circ\text{C}$	Mean $\pm$ SE at $24^\circ\text{C}$	Mean $\pm$ SE at $30^\circ\text{C}$
Egg incubation period	$11.1 \pm 0.55$	$8.7 \pm 0.35$	$5.6 \pm 0.30$
1 <sup>st</sup> instar	$12.2 \pm 0.10$	$10.1 \pm 0.05$	$6.9 \pm 0.45$
2 <sup>nd</sup> instar	$15.9 \pm 0.45$	$13.2 \pm 0.10$	$10.1 \pm 0.55$
3 <sup>rd</sup> instar	$16.8 \pm 0.40$	$14.9 \pm 0.45$	$10.6 \pm 0.30$
Total instars period	$44.9 \pm 2.00$	$38.2 \pm 0.60$	$27.6 \pm 0.25$
Adult longevity	$69.1 \pm 2.50$	$62.8 \pm 0.40$	$53.1 \pm 1.55$
Total average of eggs/female (fecundity)	$143.0 \pm 6.50$	$167.0 \pm 3.50$	$379.8 \pm 9.90$
Life cycle	$114.0 \pm 5.00$	$101.0 \pm 5.50$	$80.7 \pm 5.00$

### 3. 3. Biological studies of the cottony camellia scale, *Pulvinaria floccifera* on guava trees:

The biological studies of the cottony camellia scale, *P. floccifera* at three different constant temperatures (i.e. 18, 24 and  $30^\circ\text{C}$ ) on guava are presented in Table (3). Mean durations of the first instar were  $8.5 \pm 0.25$ ,  $6.0 \pm 0.25$  and  $3.4 \pm 0.20$  days at 18, 24 and  $30^\circ\text{C}$ , respectively. Second instar lasted for  $11.5 \pm 0.13$ ,  $9.2 \pm 0.10$  and  $5.2 \pm 0.10$  days, respectively. While third instar durations were  $12.7 \pm 0.35$ ,  $10.0 \pm 0.50$  and  $6.0 \pm 0.15$  days, respectively. Incubation periods were  $7.3 \pm 0.15$ ,  $4.5 \pm 0.10$  and  $2.3 \pm 0.15$  days, respectively. The generation period (Life cycle) was  $95.2 \pm 2.60$ ,  $77.9 \pm 0.45$  and  $58.7 \pm 0.35$  days, respectively. The durations of the adult longevity were  $62.5 \pm 0.50$ ,  $52.7 \pm 1.00$  and  $44.1 \pm 0.05$  days, respectively (Table 3). These results indicated that  $30^\circ\text{C}$  was the most adequate tested temperature for the cottony camellia scale *P. floccifera* life resulting the highest oviposition ( $362.3 \pm 1.15$  eggs/female), the shortest incubation period ( $2.3 \pm 0.15$  days) and adult longevity ( $44.1 \pm 0.05$  days).

Table 3: Average duration (in days) of the cottony camellia scale, *Pulvinaria floccifera* stages at three constant temperatures (18, 24 and  $30^\circ\text{C}$ ) on guava.

Developmental stages	Duration (in days)		
	Mean $\pm$ SE at $18^\circ\text{C}$	Mean $\pm$ SE at $24^\circ\text{C}$	Mean $\pm$ SE at $30^\circ\text{C}$
Egg incubation period	$7.3 \pm 0.15$	$4.5 \pm 0.10$	$2.3 \pm 0.15$
1 <sup>st</sup> instar	$8.5 \pm 0.25$	$6.0 \pm 0.25$	$3.4 \pm 0.20$
2 <sup>nd</sup> instar	$11.5 \pm 0.13$	$9.2 \pm 0.10$	$5.2 \pm 0.10$
3 <sup>rd</sup> instar	$12.7 \pm 0.35$	$10.0 \pm 0.50$	$6.0 \pm 0.15$
Total instars period	$32.7 \pm 1.0$	$25.2 \pm 2.50$	$14.6 \pm 0.30$
Adult longevity	$62.5 \pm 0.50$	$52.7 \pm 1.00$	$44.1 \pm 0.05$
Total average of eggs/female (fecundity)	$136.1 \pm 3.00$	$158.7 \pm 5.00$	$362.3 \pm 1.15$
Life cycle	$95.2 \pm 2.60$	$77.9 \pm 0.45$	$58.7 \pm 0.35$

In the present work, the host plants and temperatures greatly influenced the development of the cottony camellia scale *P. floccifera*. The lowering of the temperature increased the dimension of the cottony camellia scale and lengthened the development period. The results on citrus, fig and guava showed that the life cycle of *P. floccifera* at  $30^\circ\text{C}$  were  $71.5 \pm 5.75$ ,  $80.7 \pm 5.00$  and  $58.7 \pm 0.35$  days, respectively. These results indicated that the cottony camellia scale, *P. floccifera* prefers guava, followed by citrus and fig. This pest had one generation (Williams and Kosztarab, 1972 and Takaha-

shi, 1955). The duration of development and fecundity on guava in Egypt was studied by El-Minshawy and Moursi (1976).

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## ARABIC SUMMARY

### الدراسات البيولوجية لحشرة الكاميليا القشرية الرخوة في مصر

شعبان عبدربه و نادية على وهدى بداري  
معهد بحوث وقاية النباتات - مركز البحوث الزراعية- الدقي- الجيزة- مصر

حشرة الكاميليا القشرية الرخوة من أهم الآفات التي تصيب الجوافة في مصر. تم في هذا العمل دراسة العوائل النباتية و الأعداء الحيوية والدراسات البيولوجية لحشرة الكاميليا القشرية الرخوة في مصر. وقد أشارت النتائج أن حشرة الكاميليا القشرية الرخوة تصيب 12 عائل نباتي سبعة منهم سجلوا هنا لأول مرة في مصر وتهاجم ب 14 طفيل و 17 مفترس تم تسجيل 4 و 5 أنواع منهم لأول مرة في مصر على الترتيب. ومن النتائج أيضا أتضح أن أختلاف درجة الحرارة و العائل النباتي يؤثر تأثيرا بالغا على تطور حشرة الكاميليا القشرية الرخوة. ومن خلال النتائج أيضا أتضح أن دورة حياة الحشرة على ثلاث نباتات ( الموالح والجوافة والتين ) عند درجة مئوية 30 كانت  $71.5 \pm 5.75$  و  $58.7 \pm 0$  و  $80.7 \pm 5.00$  أيام على الترتيب ومن هنا يتضح ان الكاميليا القشرية الرخوة في مصر تفضل الجوافة عن الموالح ثم التين.