

EFFECT OF DIFFERENT CITRUS VARIETIES AS HOST PLANTS ON THE BIOLOGICAL ASPECTS OF THE SEYCHELLES FLUTED SCALE *Icerya seychellarum* (WESTWOOD).

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ABSTRACT

Laboratory experiments were carried out to study the effect of different citrus varieties as host plants on the biological aspects of the Seychelles fluted scale *Icerya seychellarum*. The experiments were carried out in the insectary of the Economic Entomology Department, Faculty of Agriculture, Mansoura University under Fluctuated temperature degree of $22.4 \pm 3.1^\circ\text{C}$ and R.H. $60 \pm 5\%$.

Results represented that, the total developmental period was the shortest when *I. seychellarum* reared on common balady orange which represented by 48.7 ± 1.3 days.

The survival rates during the nymphal stage of *I. seychellarum* were the highest on common balady orange, followed by Lemon, Navel orange and the lowest observed on Succari (sweet) orange and Mandarin. According to the previous results the index of suitability of different citrus host plants arranged in descending are as follows : on common balady orange, Lemon, Navel orange, Succari (sweet) orange and Mandarin.

The oviposition period, adult longevity and the fecundity was the highest when the adult females were reared on common balady orange (23.5 ± 1.1 , 59.4 ± 2.3 days and 56.2 ± 4.1 eggs/female), respectively.

INTRODUCTION

The Seychelles fluted scale seychellarum mealybug *Icerya seychellarum* (Westwood) is one of the several mealybug species considering as pests of different fruit trees and attacking the main citrus trees in Egypt (Bailey *et al.* 2010, Moustafa 2012, El-kady 2013 and Awadalla 2013).

Biological characteristics of *I. seychellarum* by rearing the insect either on palm leaves or sprouting potatoes under laboratory conditions, annual generations and the Ovipositional periods were studied (Abdel-Rahman *et al.* 2006 and Abdel-Aleem 2008).

Life span of *I. seychellarum* on ornamental palm under laboratory conditions ranged between 70 and 90 days (Valuli 1992). This insect pest had two overlapping generations on mulberry seedlings (Osman 2005).

Total developmental period of *I. seychellarum* was the shortest when reared on ornamental palm and the survival rates during the nymphal stage was the highest on ornamental palm followed by persimmon and the lowest survival rates were recorded on mango and guava (Awadalla *et al.* 2015). The chemical analysis of *I. seychellarum* was significantly different on crude protein, lipids and total carbohydrates when the insect reared on different host plants, where *I. seychellarum* when reared on the ornamental palm had the highest percentage of crude protein, lipids and total carbohydrates, while the insect had the lowest crude protein when reared on mango and pomegranate (Awadalla 2015).

Therefore, the present study has been carried out to obtain more information about the effect of different citrus varieties as host plants on the biological aspects of *I. seychellarum* under laboratory conditions.

MATERIALS AND METHODS

Laboratory experiments were carried out to study the effect of different citrus varieties as host plants on

the biological aspects of the Seychelles fluted scale *Icerya seychellarum*. The experiments were carried out in the insectary of the Economic Entomology Department, Faculty of Agriculture, Mansoura University under mean of daily fluctuated temperature degree of $22.4 \pm 3.1^\circ\text{C}$, R.H. $60 \pm 5\%$ and photoperiod of L:D 16 : 8 h.

Highly infested leaves from different host plants were selected in the field and transferred to healthy seedlings of different citrus host plants (Mandarin, Lemon, common balady orange, Navel orange and Succari (sweet) orange). These seedlings were transplanted in pots under the laboratory conditions. For estimating the incubation period, newly laid eggs were isolated from ovipositing females. The ovisacs were carefully kept in petri-dishes (9 cm diameter) and kept under the fluctuated temperature regime.

To study the duration of the nymphal instars under these conditions, newly hatched crawlers were transferred to each host plant seedling. Twenty crawlers were reared on each host plant. Investigations were daily conducted to record the moults until development completed. Furthermore, adult longevity and fecundity for *I. seychellarum* females were recorded on each citrus host plant at the fluctuated temperature regime. Moreover, survival percentages for the three nymphal instars of the insect were recorded. Daily main temperatures and relative humidity were recorded twice in the laboratory during the whole experimental period.

RESULTS AND DISCUSSION

1. Developmental stages :-

Data presented in Table (1) indicated that the incubation periods took the same period in all tested citrus host plants (10.5 ± 0.4 days). with insignificant differences .

The shortest nymphal instars for *I. seychellarum* when reared on common balady orange and represented by 10.3 ± 0.3 , 13.4 ± 0.2 and 14.5 ± 0.5 days for 1st, 2nd and 3rd nymphal instars, respectively. While, the longest

nymphal instars when *I. seychellarum* reared on mandarin and represented by 10.8 ± 0.4 , 13.7 ± 0.3 and 15.6 ± 0.6 days for the three nymphal instars, respectively. Statistical analysis indicated that there were a significant differences according to different citrus host plants for the three nymphal instars of *I. seychellarum*.

As a conclusion, the total developmental period were the shortest when *I. seychellarum* reared on common balady orange followed by lemon and navel orange and represented by 48.7 ± 1.3 , 48.8 ± 1.3 and 49.2 ± 1.4 days with insignificant differences, respectively. On the other hand, the longest developmental periods were recorded on succari(sweet) orange and mandarin and represented by 49.5 ± 1.5 and 50.6 ± 1.6 days, respectively .

The obtained data in Table (2) and Fig.(1) showed that the survival percentage of the three nymphal instars were the highest on common balady orange and represented by 89, 95.5 and 96.5 %, respectively. *I. seychellarum* when reared on lemon, the survival percentage came in the second category and represented by 86, 94.2 and 95.1 %, respectively.

As a conclusion, the survival rates during the nymphal stage of *I. seychellarum* were the highest on commom balady orange followed by lemon, navel orange and the lowest were reared on succari(sweet) orange and mandarin. Based on the survival rate as an index of suitability of different citrus host plants, the suitability in descending order was : on common balady orange (82.0 %), lemon (77.0%), navel orange (68.0%), succari(sweet) orange (57.0%), mandarin (56.0%).

Table (1) : Duration of the developmental stages of the Seychelles fluted scale *I. seychellarum* under fluctuated daily temperature degree 22.4 ± 3.1 °c (Range 16 :28) and R.H. 60 ± 5 % on different citrus host plants.

| Citrus host plants | Incubation period | 1 st instar | 2 nd instar | 3 rd instar | Total nymphal stage | Total developmental period |
|-----------------------|-------------------|------------------------|------------------------|------------------------|---------------------|----------------------------|
| Mandarin | 10.5 ± 0.4 a | 10.8 ± 0.4 a | 13.7 ± 0.3 a | 15.6 ± 0.6 a | 40.1 ± 1.1 a | 50.6 ± 1.6 a |
| Lemon | 10.5 ± 0.4 a | 10.2 ± 0.3 b | 13.5 ± 0.2 a | 14.6 ± 0.5 b | 38.3 ± 0.8 b | 48.8 ± 1.3 b |
| Common balady orange | 10.5 ± 0.4 a | 10.3 ± 0.3 b | 13.4 ± 0.2 a | 14.5 ± 0.5 b | 38.2 ± 0.8 b | 48.7 ± 1.3 b |
| Navel orange | 10.5 ± 0.4 a | 10.4 ± 0.3 ab | 13.5 ± 0.2 a | 14.8 ± 0.5 ab | 38.7 ± 0.9 b | 49.2 ± 1.4 ab |
| Succari(sweet) orange | 10.5 ± 0.4 a | 10.5 ± 0.4 ab | 13.6 ± 0.3 a | 14.9 ± 0.6 ab | 39 ± 1.0 ab | 49.5 ± 1.5 ab |

Means followed by the same letter in a column are not significantly difference at 0.05 level of probability (Duncan's Multiple Range Test).

Table (2) : Survival percentage for the three nymphal instars of the Seychelles fluted scale *I. seychellarum* under fluctuated daily temperature degree 22.4 ± 3.1 °c and R.H. 60 ± 5 % on different citrus host plants.

| Citrus host plants | 1 st instar | 2 nd instar | 3 rd instar | Nymphal stage |
|-----------------------|------------------------|------------------------|------------------------|---------------|
| Mandarin | 65 | 90.8 | 94.9 | 56 % |
| Lemon | 86 | 94.2 | 95.1 | 77 % |
| Common balady orange | 89 | 95.5 | 96.5 | 82 % |
| Navel orange | 78 | 92.3 | 94.4 | 68 % |
| Succari(sweet) orange | 67 | 92.5 | 91.9 | 57 % |

Fig (1) . Survival percentages for nymphal stage of the Seychelles fluted scale *I. seychellarum* under fluctuated daily temperature degree degree 22.4 ± 3.1 °c (Range 16 : 28) and R.H. 60 ± 5 % on different citrus host plants.

2. Adult stage :-

Data arranged in table (3) showed the ovipositional periods of *I. seychellarum* when reared on different host plants under insectary conditions of $22.4 \pm 3.1^\circ\text{C}$ and $60 \pm 5\%$ R.H. Pre-oviposition period was the shortest on lemon and common balady orange followed by succari(sweet) orange, navel orange and mandarin with insignificant differences. On the other hand, the longest oviposition period was observed on common balady orange (23.5 ± 1.1 days) and the shortest on mandarin (20.1 ± 0.9 days) with significant differences.

So, the adult longevity was the longest on common balady orange and lemon followed by navel orange and succari(sweet) orange, while, the shortest adult longevity was recorded on mandarin with significant differences. moreover, the fecundity was the highest on common balady orange and lemon.

As a conclusion, the longest oviposition period, the longest adult longevity and the highest fecundity were observed when the adult females were reared on common balady orange (23.5 ± 1.1 , 59.4 ± 2.3 days and 56.2 ± 4.1 eggs/female) respectively, followed by on lemon (22.8 ± 1.2 , 58 ± 2.1 days and 52.1 ± 3.3

eggs/female) and on navel orange (22.4 ± 1.1 , 57.5 ± 1.9 days and 44.4 ± 1.7 eggs/female), respectively. Meanwhile, the shortest oviposition period, the shortest adult longevity and the lowest fecundity were observed when the adult female reared on Succari(sweet) orange (22.7 ± 1.2 , 57.3 ± 1.9 days, and 50.4 ± 3.1 eggs/ female) followed by mandarin which represented by 20.1 ± 0.9 , 51.4 ± 1.7 days and 42.4 ± 2.1 eggs/female, respectively.

These result are in agreement with those of Valuli (1992), they found that *I. seychellarum* on ornamental plants in the laboratory, the life span ranged between 70 and 90 days. Ibrahim (2005) who found that *I. seychellarum* reared on persimmon trees the adult longevity was 51.12 ± 5.44 at 28.6°C , while fecundity was 68.2 ± 4.26 eggs/female at 28.6°C . Abdel-Rahman *et al.* (2006) mentioned that, *I. seychellarum* can complete its life cycle on mango trees. Awadalla *et al.* (2015) studied the influence of different host plants on the biological characteristics of the seychellarum mealybug *I. seychellarum* and they found that ornamental palm and persimmon trees were the suitable host plants for rearing the insect, survival rates during nymphal stage, adult longevity and fecundity.

Table (3) : Ovipositional periods, adult longevity and fecundity of the Seychelles fluted scale *I. seychellarum* under fluctuated daily temperature degree $22.4 \pm 3.1^\circ\text{C}$ and R.H. $60 \pm 5\%$ on different citrus host plants.

| Citrus host plants | Pre – oviposition | Ovi – position | Inter – oviposition | Adult longevity | Fecundity (No. of egg laying) |
|-----------------------|-------------------|----------------|---------------------|-----------------|--------------------------------|
| Mandarin | 19.1±0.8 a | 20.1±0.9 b | 12.2±0.2 b | 51.4±1.7 b | 42.4±2.1 b |
| Lemon | 18.7±0.7 a | 22.8±1.2 a | 16.5±0.6 ab | 58±2.1 ab | 52.1±3.3 a |
| Common balady orange | 18.7±0.7 a | 23.5±1.1 a | 17.2±0.6 a | 59.4±2.3 a | 56.2±4.1 a |
| Navel orange | 19.2±0.7 a | 22.4±1.1ab | 15.9±0.4 ab | 57.5±1.9 ab | 44.4±1.7 ab |
| Succari(sweet) orange | 18.9±0.7 a | 22.7±1.2 a | 15.7±0.4ab | 57.3±1.9ab | 50.4±3.1 a |

Means followed by the same letter in a column are not significantly difference at 0.05 level of probability (Duncan's Multiple Range Test).

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تأثير أصناف مختلفة من الموالح كعوائل نباتية على الصفات البيولوجية لبق السيشلارم الدقيقي
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التجارب المعملية أجريت لدراسة تأثير أصناف مختلفة من الموالح على بعض الخصائص البيولوجية للبق الدقيقي السيشلارم .
التجارب أجريت بمعمل الحشرات في قسم الحشرات الاقتصادية ، كلية الزراعة - جامعة المنصورة تحت درجات حرارة متغيرة 22.4 ± 3.1 °C.
أوضحت النتائج أن الأطوار غير الكاملة لحشرة البق الدقيقي السيشلارم كانت الأقصر عمراً عندما تم تربية الحشرة على أشجار البرتقال البلدي حيث كانت 48.7 ± 1.3 يوماً.
أظهرت النتائج أن معدل البقاء خلال طور الحورية للبق الدقيقي السيشلارم كانت الأعلى على أشجار البرتقال البلدي يليها أشجار الليمون يليها البرتقال ابو صرة وكانت الأقل على البرتقال السكري واليوسفي . باعتبار معدل البقاء كمؤشر لملائمة العوائل النباتية المختلفة يمكن ترتيبها تنازلياً كالآتي البرتقال البلدي - الليمون - البرتقال ابو صرة - البرتقال السكري - اليوسفي.
كما أظهرت النتائج أن أطول فترة وضع بيض ، أطول فترة حياة للحشرة الكاملة و أعلى خصوبة كانت للأنثى البالغة التي تم تربيتها على أشجار البرتقال البلدي (1.1 ± 23.5 ، 2.3 ± 59.4 يوماً و 4.1 ± 56.2 بيضة / الانثى).

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