

# Population Density and Generation Determination of *Icerya seychellarum* (Westwood) on Guava Orchards in Qalubya Governorate

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## ABSTRACT

The seychellarum mealybug, *Icerya Seychellarum* (Westwood) (Homoptera: Monophelibidae) is one of the most important mealybug species in Egypt attacking guava orchards in Qalubya Governorate. The present study aimed to study the population fluctuations of this pest during two successive seasons, (2013-2014) and (2014-2015), in guava orchards (at Shebein El-Qanater district, Qalubya Governorate) in addition to explain the effects of certain weather factors (temperature degrees and relative humidity) on its population. The obtained data showed that *I. seychellarum* had two annual peaks of seasonal abundance on guava trees in the two years of study were recorded during (November and Jun.), its highest activity during autumn season of the first and second years (with means of 56 and 53 individuals/leaf). On contrary, the lowest activity of *I. seychellarum* was recorded during early February of the first and second studied year. Also, it recorded three generations during the two studied years. To study the relationship between the metrological factors and the total population of the tested pest, each year of study was divided to two periods. During the first period of each year leaf age is the effective factor but during the second period metrological factors were the effective factors. Data illustrated that there were simultaneous occurrence of the total population of *I. seychellarum* and its associated predator *Rodolia cardinalis*

## INTRODUCTION

Guava (*Psidium guajava*) are of the most important and popular fruits in Egypt (Attia, 2010). The guava fruit is rich in vitamin C, carbohydrates, proteins, calcium, phosphorus, vitamin A, pantothenic acid, riboflavin, thiamine and niacin and is also a commercial source of pectin and oil (Richard, 2005).

The guava trees can grow and produce in any season, so they can be harvested out of the period of high competition marketing (Summer), (Nava *et al.* 2014). As most fruit tree species, the guava tree shows different phenological stages through out its vegetative period in response to environmental conditions, (Salazar and Burguera 2006).

Several mealybug species are pests of different fruit trees and ornamental plants in Egypt (Awadalla, 2013). The seychellarum mealybug, *Icerya seychellarum* (Westwood) (Monophelibidae: Homoptera) is one of the most important mealybug species in Egypt attacking guava orchards (El-Sherbenie, 2004).

The pest can cause an indirect damage due to the interaction with other insect pests or fungal diseases that are attracted by honeydew (Mittler & Douglas, 2003 and Mohamed, 2015). The major damage is caused by the production of large amount of honeydew upon which saprophytic fungi develop, which fluctuates with photosynthesis and respiration (Zaki *et al.*, 2013 and El-Sayed, 2015).

Population of *I. seychellarum* had two annual peaks of seasonal abundance on guava trees in the two years of study at Dakahliya Governorate, Egypt (El-Sherbenie, 2004 and El-Serafi *et al.*, 2004).

Also, the four tested factors (maximum temperature, mean temperature, minimum temperature and mean relative humidity) effect of on the population density of *I. seychellarum* was previously investigated by (El-Sherbenie, 2004, Awadalla, 2013).

Also, there were other predators with very low population as *Chrysoperla carnea* (Stephens) and *Rodolia cardinalis* (Mulsant) associated with the presence of *I. seychellarum* (Ghanim *et al.*, 2013 and Mohamed, 2013).

The present work was carried out to study ecological aspects of *I. seychellarum* and to determine its

generations under the studied conditions using age structure method and the proper timing for its control.

## MATERIALS AND METHODS

The present work was carried out for two successive years in heavy infested guava orchards with *I. seychellarum* during (2013-2014) and (2014-2015) at Shebein El-Qanater area (Nawa), Qalubya Governorate. The selected orchard for present investigation did not receive any chemical control at least two years before this study. The examined orchard known as winter guava which was exposed to some agricultural practices to produce its yield in late winter or spring to avoid the infestation by fruit flies and obtain high yield price. The phenological stages of the examined locality was illustrated in (Fig.1), where the farmers start defoliation, prune and fasting of guava trees in early July. In early Aug. they start irrigation and fertilization, from this time the tree start its phenological stages as shown in following figure.

Therefore the year of study started on early September when the leaf grow enough and its infestation by the pest started and ended on early July when the farmers remove all the trees leaves.

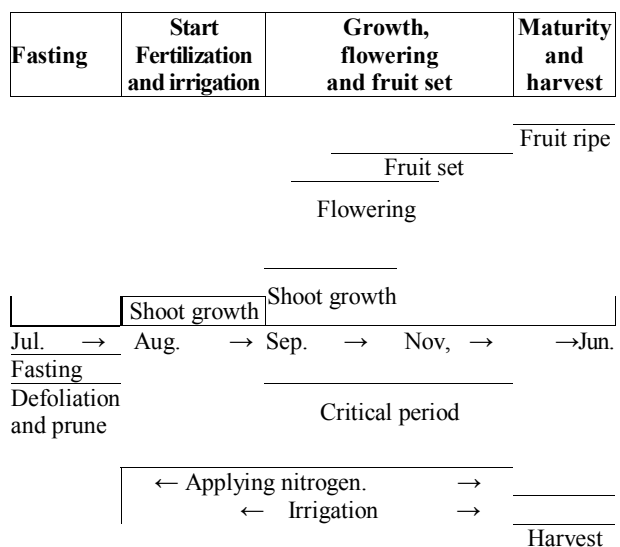


Fig. 1. Annual crop cycle of guava and its control by management in Egypt

The seasonal fluctuation of *I. seychellarum* population was carried out on 16 trees similar in size,

shape and vegetation. Biweekly samples of 160 leaves were picked up (10 leaves/tree) from the four directions of each tree divided in four replicates. The collected samples were put in paper bags and transferred to the laboratory for inspection with stereo-microscope.

The population of *I. seychellarum* per each sample was sorted into their developmental stages (nymphs, adult females and oviposting females). The total number of the individuals in each sample was taken as the population index. Identification of true mealybugs insects was done by taxonomy specialists at the Department of Scale Insects and Mealy bugs, Plant Protection Research Institute, Giza, Egypt.

**Age structure calculation**

To calculate the age structure per sample, the mean number of each stage was divided by the total and multiplied by 100. This way gave each stage a percent proportion of the total per sample regardless the total number of presented insects (i.e. population density). The number of generations was determined using the obtained data throughout the two successive years using the age-structure technique per sample over the year.

Generation was defined, as the time required for an insect to complete its life cycle (i.e. egg to egg). In the case of Monophelbid, eggs were oviposited under the female in ovisac until they hatch and crawl out. Oviposting females were defined as females with ovisac. The presence of oviposting females (i.e. the transformation of adult females to oviposting females) was considered in this study as presence of the egg stage. This phenomenon was used to determine the end of each generation and the beginning of the next one (Bakry, 2009).

**Meteorological factors**

Weather factors data assumed to affect studied insects (i.e. maximum and minimum daily temperatures and mean percentage of daily relative humidity) were obtained for the Qalubya area from the Egypt-Weather Underground <https://www.wunderground.com/global/EG.html>. Obtained data was summarized for each fourteen days previous to the sampling date. Considered weather factors means over each determined generation was calculated and presented.

**RESULTS AND DISCUSSION**

**\*Population density of *I. seychellarum* :**

Data presented in (Figs. 2 and 3) illustrated that nymphs, adult females and oviposting females stages curves had two peaks during two years (2013-2014) and (2014-2015) on guava leaves.

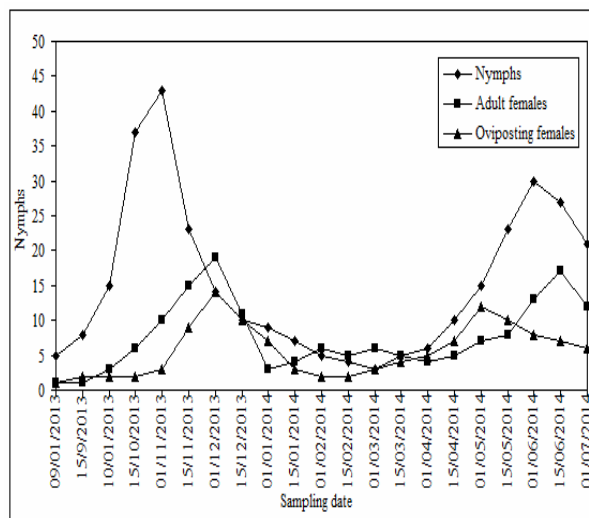
Nymphs recorded on [(1st Nov. and 1st Jun with 43 and 39 nymphs/leaf) and (1st Nov. and 1st Jun with 43and 24 nymphs/leaf)], respectively.

Also, adult females found in the [(1st Dec. & mid Jun. with 19 & 17 adult females/leaf) and (1st Dec. & mid Jun. with 13 &15 females/leaf)], respectively.

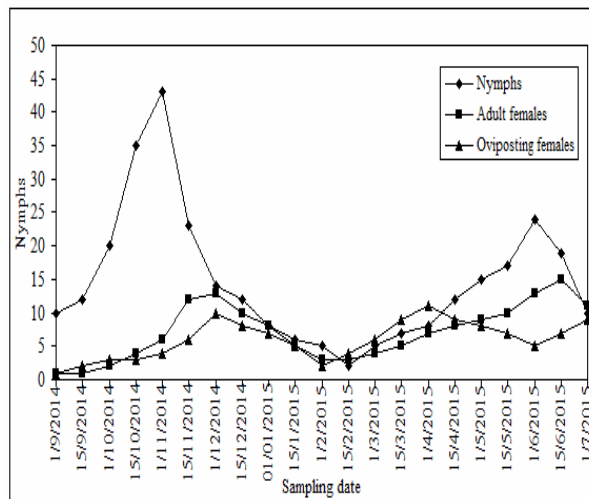
Finally oviposting females recorded on [(1st Dec. & 1st May. with 14 &12 oviposting females/leaf) and ((1st Dec. & 1st Apr. with 10&11 oviposting females/leaf)], respectively.

*Icerya seychellarum* on *Morus alba* trees had two peaks of seasonal abundance occurred in June and August during both seasons at Egypt (Tawfik and Mohamed 2001).

*Icerya seychellarum* mealybug species recorded 2-3 peaks of seasonal abundance on apple trees in Egypt. These peaks were occurred during late June



**Fig. 2. Population density of *I. seychellarum* on guava trees during 2013-2014**



**Fig. 3. Population density of *I. seychellarum* on guava trees during 2014-2015**

*Icerya seychellarum* had three annual peaks of seasonal abundance on mango trees in Qena Governorate, Egypt. These peaks occurred on May, August and November. The variation between the present results and others may be attributed to the variation of host plant species, climatic and/or cultural factors (Bakry 2009).

*Icerya seychellarum* highest average number was in Summer during the first year (2010/11) and in Autumn during the second year (2011/12) on guava and ficus trees (Awadallah, 2013).

*Icerya seychellarum* had three peaks of population density during the two years of study, whereas the highest one recorded in last week of Oct. in the first year and in the second week of Nov. in the second year on grapevine (Mohamed 2013).

**\*Age structure :**

The results of using the age structure technique to the obtained seasonal data of *I. seychellarum* along the two years on guava trees were graphically illustrated in Figs. (4 and 5).

*Icerya seychellarum* on winter guava trees indicated the occurrence of three generations/year over both years for at this location. The first generation was the highest generation (green shoots production period) and lasted about four months and occurred between early September and early January. The second generation was the lowest one (flowers and fruits production period), it lasted four months started from early January till early April. The third generation was the moderate one and it occurred within early April and the end of the year (after harvest period).

*Icerya seychellarum* had three annual generations per a year (Assem 1990 and EL-Borollosy *et al.* (1990).

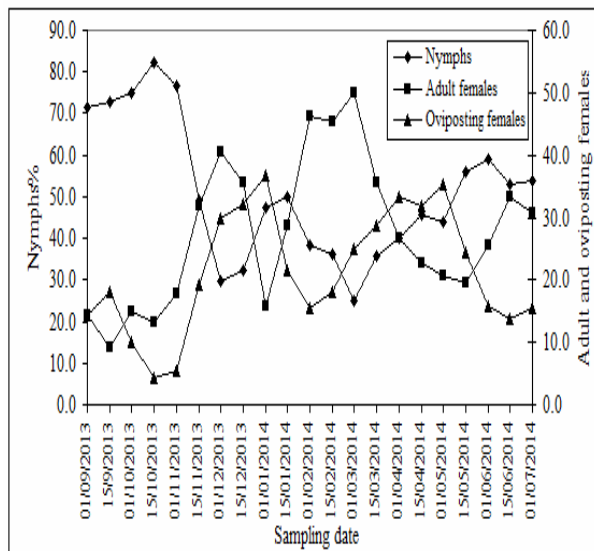


Fig. 4. Age structure of *I. seychellarum* on guava trees 2013-2014

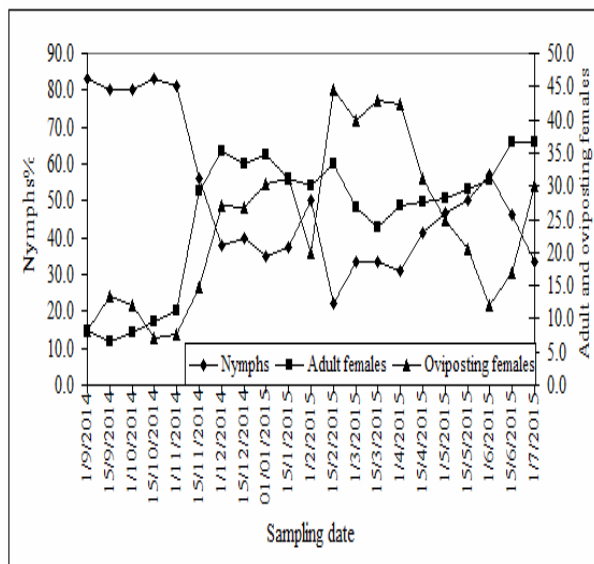


Fig. 5. Age structure of *I. seychellarum* on guava trees 2014/2015

*Icerya seychellarum* had 2-3 generations whereas their peaks recorded on late June, late October and mid-December Mangoud (2000). *I. seychellarum* had three overlapping generations on mango trees in Egypt (Sayed, 2008). *I. seychellarum* recorded three overlapping generations on coffee trees in Giza and Qaliobiya Governorates (Zaki *et al.*, 2013).

**\*Relationship between certain weather factors and the seasonal activity of *I. seychellarum* :**

The effect of Max., Min. temperatures and relative humidity on the total population of *I. seychellarum* during the two studied years illustrated in Figs. (6& 7). Each year of study was divided to two periods from 1/9 to 15/1 and from 15/1 to 1/7. during the first periods of the two studied years there were negative relationship between the total population of the studied pest and Max. and Min. temperatures where the low temperature simultaneous with high population in abnormal relationship.,

On the other side, during the second period of each studied year there were positive relationship between Max., Min. temperatures and the total population, while the higher population, the higher temperatures.

There were significant effects of temperatures on *I. seychellarum* total population during 2011 and there were insignificant effects of relative humidity during the two years of study in Qalyubia and Giza governorate (Zaki *et al.* (2013)

The population density of *I. seychellarum* on sago palm were significantly affected by the changes in both mean temperature and relative humidity (El-Borollosy *et al.* 1990).

Osman (2005) added that daily means temperatures and of relative humidity percentage could govern the seasonal activity of *I. seychellarum* on mulberry trees.

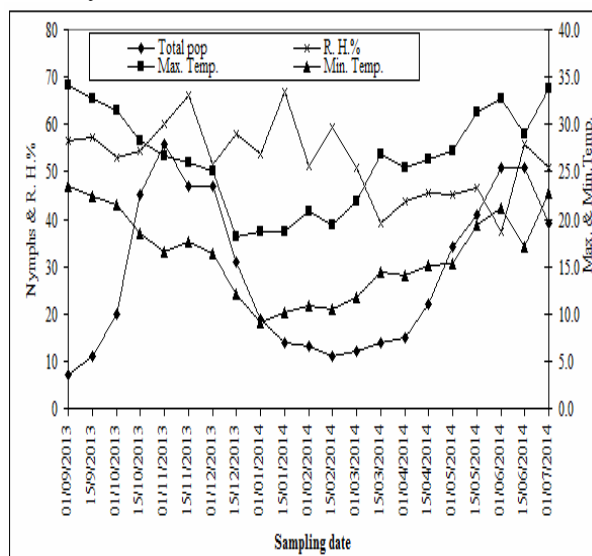


Fig. 6. Relationship between Max., Min. Temp., R.H. % and total population of *I. seychellarum* during 2013-2014

Abdel-Rahman *et al.* (2007) showed that *I. seychellarum* total population gave significant positive correlation with mean temperature(  $r = 0.74 \pm 0.14$ ) and insignificant negative correlation with mean percentage of relative humidity(  $r = -0.10 \pm 0.212$ ) on mango trees in Egypt. Also, Moustafa (2012) reported that there were positively high significant correlations between *I. seychellarum* population and both of mean temperature & relative humidity at Demyaata governorate.

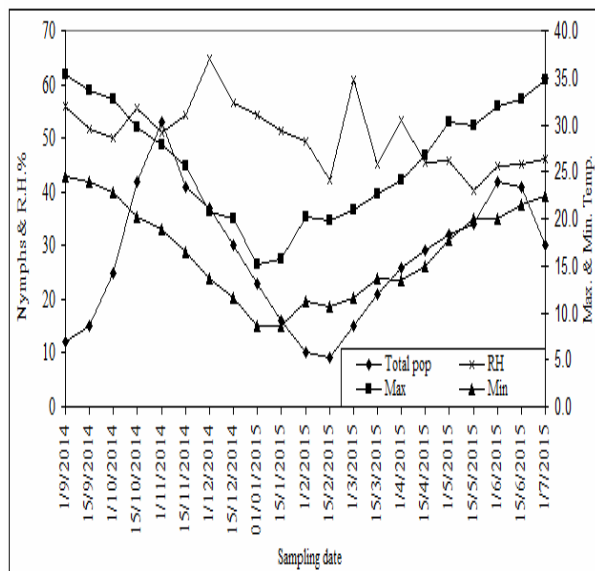


Fig. 7. Relationship between Max., Min. Temp., R.H. % and total population of *I. seychellarum* during 2014-2015

\* Relationship between the total population of *I. seychellarum* and *Rodolia cardinalis* :

The obtained results in (Figs. 8 and 9) illustrated that there were simultaneous occurrence of the total population of *I. seychellarum* and its associated predator *R. cardinalis*. These results are supported by those obtained by Ghanim *et al.* (2013) and Mohamed (2013); they mentioned *R. cardinalis* is a associated predators of *I. seychellarum* on citrus and grapevine orchards in Dakahlia Governorate.

Also, the above results are in agreement with those obtained by (El-Sherbenie, 2004) who mentioned that, *R. cardinalis* is a predator to *I. seychellarum* in guava orchards. (Abdel-Mageed , 2005, Abdel- Aleem, (2008) and Moustafa, 2012) recorded that *R. cardinalis* was the dominant insect predator on *I. seychellarum*. According to (Hamid and Hassanian, 1991), *R. cardinals* associated with monophlebid, *Icerya* spp.

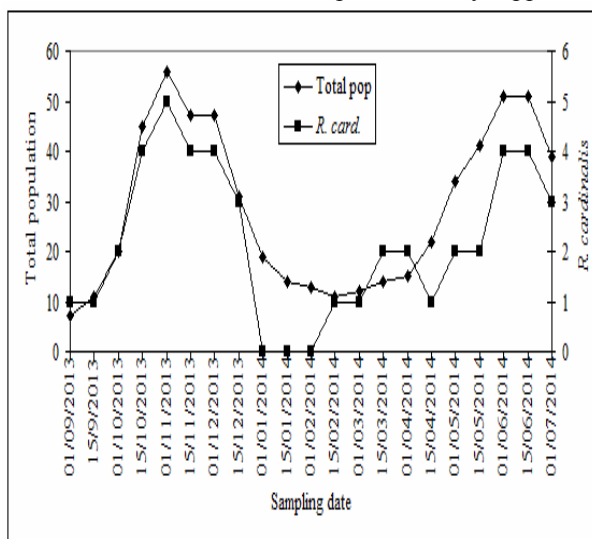


Fig. 8. Relationship between the total population of *I. seychellarum* and *R. cadinalis* during 2013-2014.

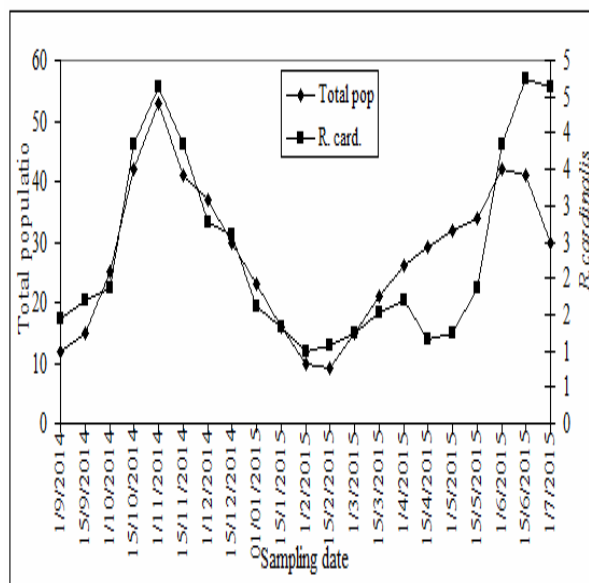


Fig. 9. Relationship between the total population of *I. seychellarum* and *R. cardinalis* during 2014-2015.

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### الكثافة العددية وتحديد اجيال بق السيشلارم على بساتين الجوافة في محافظة القليوبية

سحر على عطية و نجلاء محمد يوسف

معهد بحوث وقاية النباتات- مركز البحوث الزراعية- الجيزة- مصر

يعتبر بق السيشلارم من اهم واطخر انواع البق الدقيقي في مصر والتي تصيب بساتين الجوافة في محافظة القليوبية . حيث تهدف الدراسة الى تقدير التذبذب العددي لهذه الآفة خلال موسمين متتاليين 2013- 2014 و 2014- 2015 في بساتين الجوافة ( في منطقة شبين القناطر- محافظة القليوبية (بالاضافة الى تأثير العوامل البيئية ) درجات الحرارة والرطوبة) على التعداد. وقد اظهرت الدراسة ان لهذه الآفة ذروتين من النشاط خلال عامي الدراسة احدهما في شهر نوفمبر والاخرى في يونيو . في كلا العامين كانت ذروة النشاط في فصل الخريف ( حيث سجلت متوسط الإصابة 56 و 53 فرد / ورقة ) على التوالي . على الجانب الاخر فقد كانت الحشرة اقل نشاطا في بداية شهر فبراير في كلا عامي الدراسة . خلال موسمي الدراسة كان لهذه الحشرة لها ثلاث اجيال . وحتى يتم دراسة العلاقة بين العوامل البيئية والتعداد الكلي للآفة فقد تم تقسيم عامي الدراسة الى فترتين , الاولى من كل عام كان العامل الاكثر تأثيرا هو عمر الورقة بينما الثانية كانت العوامل البيئية هي الاكثر تأثيرا . خلال عامي الدراسة كان هناك تزامن بين التعداد الكلي للآفة ومفترس ابو العبد فيداليا المرتبط بها .