

**BIOLOGY OF THE COCCINELLID PREDATOR, *Clitostethus arcuatus* (ROSSI), IN WINTER , AS REARED ON EGG OF THE WHITE FLY , *Bemisia tabaci***



**Amany A. Khalifa<sup>1</sup> and M. M. El-Husseini<sup>2</sup>**

**1-plant protection Research Institute, Department of Biological control , Agricultural Research Center, Giza, Egypt.**

**2-Center of Biological control and IPM , Fac. of Agric, Cairo univ. Giza , Egypt .**

### **ABSTRACT**

The predator, *Clitostethus arcuatus* (Rossi) is an efficient natural enemy against several homopterous insects. It overwinters under cold conditions as an adult .In this investigation , the diapausing predator turned into active by rearing under laboratory condations of 15-20 ° C, and 59-80% R.H. At these conditions, incubation period lasted for  $9.8 \pm 0.20$  days, larval stage for  $23.5 \pm 0.13$  days, pupal stage for  $8.3 \pm 0.05$  days. Total development period took 40-49 days. Egg hatchability was quiet high ( 92 % ), and the sex ratio was 2 : 3 for the females and males, respectively. These results wuld be useful , if the mass-rearing of the predator was initiated early in the season. Thus, the predator could be available as early as possible for biological control procedures .

**Keywords :** *Clitostethus arcuatus*, *Bemisia tabaci*, biology, overwintering .

### **INTRODUCTION**

The coccinellid predator, *Clitostethus arcuatus* (Rossi) is one of the most important and effective specific predators of aleyrodids ( loi, 1978 , Bathon and pietrizik , 1986 ; Gerling 1990 , Mesbah *et al* 1998 and Javadjoh *et al* 2009 ). It is widely distributed in the Mediterranean and surrounding regions.

*C. arcuatus* was firstly recorded in Egypt as a predator of the whitehy, *Dialeurodes citri* by Mesbah *et al* (1998). It was the most dominating predatory species attacking *D.citri* immatures on citras trees at kafr El-Sheikh Governorate (north Egypt), constituting 41.9 % of the total population of the predators (Mesbah 1990 ). In 2011, khalifa recorded *C. arcuatas* preying upon pomegranate whitefly, *Siphoninus phillyrae*.

The biology and ecology of *C. arcuatus* were studied by many authors ( Agekan 1977 ; liotta 1981 ; Belwos *et al* 1992 ; Mesbah 2000 and 2001 ; Tavadjoh *et al* 2009 and Khalifa 2011) . It was found to be active from May until November ( Bathon and Piatrizik 1986 ), while Tavadjoh *et al* , 2009 detected *C. arcuatus* as adults until mid-December. Brown and Whitehead (2012) found *C. arcuatus* overwintering on underside the leaves of holly *Ilex aquifolium* and became active by third week of March when the whiteflies began to appear.

The objective of this study was to get the adults of the coccinellid predator, *Clitostethus arcuatus* out of hibernation. Also, the duration of the immatures were investigated under controlled conditions.

## **MATERIALS AND METHODS**

The coccinellid predator, *Clitostethus arcuatus* (Rossi) was reared on *Bemisia tabaci* eggs as prey. To get *B. tabaci* eggs, sweet potato sprig with only the three upper leaves were used for rearing *B. tabaci*. The sweet potato leaves were cleaned from any attached insects and mites. The sprig was then dipped in a glass tube (2 × 4 cm) filled with water to keep the sprig fresh (Hafez *et al*, 1979 and Mesbah, 2001). The glass tube was placed into a glass jar with two openings, the upper one was covered with a piece of thin muslin that was kept in place by rubber band, while the lower opening was fixed on a plastic can. The glass jar was placed into a box (50 × 60 cm) with a woody base. The door and three sides of the box of glass, while only one side was covered with a thin muslin to renew the air inside the box. Every box was supplied with a small electric lamp (5 Wat), controlled by key outside the box, to keep a suitable temperature for the activity of the reared predator, the lamp was operated when the temperature was low especially in the nighttime during January and February. Every box was supplied also with cylindrical thermometer and hygrometer. The conditions inside the rearing box throughout January and February were 15 – 20 °C and 59 – 80 % R.H. Sufficient numbers of whitefly, *B. Tabaci* adults as well as numbers of *C. arcuatus* adults were confined in a jar for oviposition. The sweet potato sprig was changed daily with a fresh one. The newly laid eggs (0 – 24 h.old) of the predator, *C. arcuatus* were placed individually on sweet potato leaves in Petri-dish and put into the boxes. Newly hatched larvae were provided with excess of *B.tabaci* eggs. The durations of immature stages; eggs, larvae and pupae of *C. arcuatus* were recorded.

## **RESULTS AND DISCUSSION**

This study was carried out as a trial to turn the diapausing predator, *Clitostethus arcuatus* into active individuals during cold months in winter. This was induced by adjusting temperature as 15 – 20 °C, and relative humidity as 59 – 80 % R.H. Eggs of *Bemisia tabaci* were offered for feeding the adult predator. In such concern, Gerling *et al* (2001) reported that *C. arcuatus* preyed upon several species of Homoptera, including *B. tabaci*

### **Durations of immature stages :**

#### **Egg stage :**

At the abovementioned conditions, *C. arcuatus* became active, and the females laid their eggs. Data in Table (1) showed that the incubation period ranged between 9 and 10 days, with an average of  $9.8 \pm 0.20$  days. The egg hatchability was quite high, as it accounted for 92%. Tavadjoh *et al* (2009) reared *C. arcuatus* on *Siphoninius phillyreae* and had mortality rate from egg to adult under laboratory conditions as 22.7, % while under field

conditions it was 38.8 % , the mean number of eggs laid by each female was 181.

**Larval stage :**

The larval stage had three molts during the four larval instars . The larval duration ranged between 22 and 25 days , with an average of  $23.5 \pm 0.13$  days .

**Pupal stage :**

The pupal stage ranged between 7 and 11 days , with an average of  $8.3 \pm 0.05$  days.

**Table (1). Duration of the immature stages of the cocceinellid predator, *C.arcuatus* (Rossi) under laboratory conditions (15 - 20 °C, 59 - 80 % R.H.)**

Stage	Duration ( days )	
	Range	Mean $\pm$ S
Egg	9 - 10	$9.8 \pm 0.20$
Larva	22 - 25	$23.5 \pm 0.13$
Prepupa	2 - 3	$2.3 \pm 0.06$
Total larval stage	24 - 28	
Pupa	7 - 11	$8.3 \pm 0.05$
Total development period	40 - 49	$43.9 \pm 0.44$

**Total development period :**

Data presented in Table (1) showed that the total development period of *C.arcuatus* ranged between 40 and 49 days . The sex ratio was 2: 3 , as about 40 % of the emerging adults were females , and about 60% were males.

Mota *et al* (2008) reported that temperatures ranging from 20 °C to 30 °C were suitable for the development of *C. arcuatus*, suggesting that this species is well adapted to the temperatures usually found inside greenhouses or in open fields in temperate regions. They found that 25 °C is the most suitable for mass-rearing and development. However, Loi (1978) and Liotta (1981) obtained only the imago in winter in natural shelters as citrus groves, Loi ( 1978 ) described the predatory status in winter as pseudodiapause. Bellows *et al* ( 1992 ) explained the longer durations recorded for immatures or adults of *C.arcuatus* as simple poikilothermic reduction in the developmental physiology. Mesbah (2000) reared *C. arcuatus* adults during winter in outdoor, and found that the adults lived longer, fed little , stopped egg laying , and concealed under filter paper , or plant tissues in the Petri dishes.

## REFERENCES

- Agekyan N.G. 1977. *Clitostethus arcuatus* (Rossi) (Coleoptera, Coccinellide), the predator of the citrus whitefly in Adzharia. Entomol . Rev., 56 (1) : 22 - 23.

- Bathon, V.H. and J. Pietrizik. 1986. Zur Nahrungsaufnahme des Begen-Marienkfers, *Clitostethus arcuatus* (Rossi) (Col : Coccinellidae), einem Vertilger der Kohlmottenlaus , *Aleurodes proletella* Linne (Hom : Aleurodidae ) . J. Appl. Ent , 102 : 321 – 326 .
- Bellows , T. S ; T. D. Paine and D. Gerling . 1992. Development, survival , longevity . and fecundity of *Clitostethus arcuatus* (Coleoptera : Coccinellidae ) on *Siphoninus Philyreae* ( Homoptera : Aleyrodidae ) in the laboratory. Environ. Entomol. 21 (3) : 659 – 663.
- Gerling, D. 1990. Whiteflies : their bionomics, pest status and management. Intercep Ltd, Andover, UK, 348 pp.
- Gerling, D; O. Alomar and J. Arno (2001). Biological control of *Bemisia tabaci* using predators and parasitoids. Crop Protection, 20 : 779 – 799.
- Khalifa, 2011 . Studies on the insects attacking pomegranate trees and their associated natural enemies. Ph . D. Thesis , Dept . of Econ . Entomology, Faculty of Agriculture . Mansoura University . 159 PP.
- Liotta, G. 1981. Osservazioni bio-etologiche su *Clitostethus arcuatus* (Rossi ) ( Col : Coccinellidae ) in Sicilia Redia 64 : 173 – 185 .
- Loi, G. 1978. Osservazioni eco-etologiche sul coleottero Coccinellidae scimmino *Clitostethus arcuatus* (Rossi) , predatore die *Dialeurodes citri* (Ashm) in Toscana . Frust. Entom, 1 : 123 – 145.
- Mesbah, A.H . 1999 . Studies on certain natural enemies of the whiteflies. Ph . D. Thesis. Dept. of Econ. Entomology, Faculty of Agriculture, kafr El-Sheikh, Tanta University . 133 pp.
- Mesbah. A.H. 2000. Development and efficiency of *Clitostethus arcuatus* (Col , Coccinellidae) predator on *Siphoninus phillyreae* (Hom , Aleurodidae ) at Kafr El-Sheikh Governorate, Egypt. Egypt. J.Biol. pest .control, 10 (2) : 123 – 127
- Mesbah, A.H. 2001. Biology and efficiency of *Clitostethus arcuatus* (Rossi ) ( Coleoptera : Coccinellidae ) as a predator of *Bemisia tabaci* Homoptera : Aleyrodidae ). Egypt, J.Bio. pest control 11 (2) 95 - 100.
- Mesbah, A.H; El-Heneidy; S.M Metwaly; Z. Shenishen and A.H. Boraie. 1998, *Clitostethus arcuatus* (Rossi) (Coleoptera : Coccinellidae), A new recorded predator species, of the citrus whitefly, *Dialeurodes citri* (Ashm) (Homoptera : Aleyrodidae ) in Egypt, J. Biol. pest control, 8 (2) : 99 – 100 .
- Mota , J. A , A. O Soares , and P.V . Garcia ( 2008 ). Temperature dependence for development of the whitefly predator *C. arcuatus* (Rossi ). Biocontrol , 53 (4) : 603 – 613 .
- Tavadjoh, Z; H. Hamzehzarghani; H.Alemansoor; J. Khalghani and A. Vikram (2009). Biology and feeding behaviour of ladybird, *Clitostethus arcuatus* , the predator of the ash whitefly, *Siphoninus phillyreae*, in fars province, Iran. Journal of Insect science, 10, article No. 120.

## دراسة بيولوجي مفترس أبو العيد كليتو ستيتيسس أركوتس على بيض ذبابة القطن البيضاء

أماني عبد الحكيم خليفه<sup>١</sup> و منير محمد الحسبي<sup>٢</sup>

١- معهد بحوث وقاية النباتات - قسم بحوث مكافحة الحيوية - مركز البحوث الزراعية - الجيزة - مصر.

٢- مركز مكافحة الحيوية والمتكاملة - كلية الزراعة جامعة القاهرة - الجيزة - مصر.

المفترس *Clitostethus arcuatus* من المفترسات الفعالة ضد الكثير من أنواع الحشرات متشابهة الأجنحة. يدخل المفترس شتاءً في حالة بيات شتوي في صورة أفراد كاملة. في هذه الدراسة، تم تربية المفترس خلال شهور الشتاء (ديسمبر - فبراير) لتصبح ١٥ - ٢٠ م، ورطوبة نسبية ٥٩ - ٨٠ % تحت هذه الظروف أمكن تحويل الأفراد الكاملة من حالة البيات الشتوي إلى حالة النشاط وبدأت الإناث في وضع البيض الذي بلغت نسبة الفقس به حوالي ٩٢ % استمرت فترة حضانة البيض لمدة ٩.٨ ± ٠.٢٠ يوماً، واليرقات ٢٣.٥ ± ٠.١٣ يوماً والعنقاء ٨.٣ ± ٠.٥ يوماً. كما بلغت مدة النمو الكلية ٤٠ - ٤٩ يوماً، وكانت النسبة الجنسية ٢ إناث : ٣ ذكور.

تفيد هذه النتائج في إمكانية تنشيط المفترس خلال شهور الشتاء، وتربية الأفراد تربية جماعية لاستغلالها في الإطلاق لمكافحة الذبابة البيضاء أو غيرها من الحشرات متشابهة الأجنحة في العروات المبكرة وخاصة الطماطم.

