

## **BIOLOGICAL ASPECTS AND PREDATION EFFICACY OF *CORANUS AEGYPTIUS* (F.) ON THE SECOND LARVAL INSTAR, *SPODOPTERA LITTORALIS* (BOISD.) UNDER THE LABORATORY CONDITIONS**

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### **ABSTRACT**

Laboratory experiments were carried out in plant protection research Institute, Sharkia Branch, to study, some biological aspects and predation efficacy of the predator, *Coranus aegyptius* (Fabricius) (Hemiptera: Reduviidae) which recorded last decades on several economic and wild plants in El-Khattara district, Sharkia Governorate, Egypt, during 2012 and 2013 years. Some biological aspects and predation of this predator was investigated using the second larval instar of the cotton leaf worm, *Spodoptera littoralis* (Boisd.) as restricted prey under the conditions of  $30 \pm 1^\circ\text{C}$  and  $65 \pm 5\%$  R.H. Egg stage incubation period lasted 7.30 days for the male and female. The five nymphal instars were recorded. The total developmental period and adult longevity were shorter in case of male 36.86 and 21.2 days, respectively than in case female, it were 38.85 and 61.2 days, respectively. Pre, oviposition and post oviposition periods were 4.4, 50.7 and 6.6 days, respectively. The feeding capacity of nymphal stage and adult were 219.15 and 744.3 *S. littoralis*, larvae respectively for female. Its were 200.0 and 236.7 larvae respectively in case of male. The total number of deposited eggs were  $220.5 \pm 11.69$  eggs, throughout an ovipositional period of  $50.7 \pm 3.93$  days. These results showed that *C. aegyptius* can play an important role in biological control of cotton leaf worm *S. littoralis* in the field in economic crops in Egypt.

### **INTRODUCTION**

Reduviids are abundant, occur world wide and are highly successful polyphagous predators play a vital role in the biocontrol of insect pests (El-Shazly and El-Sebaey 1997, El-Sebaey 2001, El-Sebaey & El-Bishry 2001 and Kumar *et al.*, 2011). They exploit the most adverse microhabitats of agroecosystem. However, they exhibit a certain amount of hosts as well as stage preferences. Hence, they should be conserved and augmented to be effectively utilized in the Integrated Pest Management (IPM) programs (Ambrose, 2003, Ambrose *et al.*, 2007 & 2009 and Kumar *et al.*, 2011). *Coranus aegyptius* (F.) is distributed in Palma de Mallorca, Canary Islands, Palearctic Region to Equatorial Africa (Capriles, 1990). In Egypt, *C. aegyptius* was found all over the country on several wild and cultivated host plants including *Ranthium spinosum* L. (compositae), *Chenopodium murale* L. (Malvaceae) and *Ammimajus* L. (Umbellifera), in addition to citrus trees and tomatoes (El-Sebaey 1994). Certain biological aspects of *C. aegyptius* was studied in the laboratory according to literature for the first time by using *Anagasta kuehniella* Zell. Larvae as prey (El-Sebaey 1998). *Coranus africana* (El-Sebaey) has recently been described from Egypt, associating with several

insect pests on different economic plants including cotton, tomato, clover and several wild desert plants in Egypt (Ali 1996, El-Sebaey and El-Bishry, 2001 and Ali, 2008). It was collected from different localities in Egypt including kom Oshim, El-Khattara, Sharkia, Behera, Wadi El-Natroun district, Giza and Sinai Governorate. Some biological aspects of this species were investigated using third larval instar of the cotton pests, *Spodoptera littoralis* and *Agrotis ipsilon* (Rott.) (El-Sebaey, 2001) and other pests (Awadalla *et al.*, 1990 ; El-Shazly & El-Sebaey , 1997 and Kumar *et al.*, 2011) Reduviidae can suppression of whitefly, aphids and cotton leaf worm (El-Sebaey and El-Wahab 2003, Faragalla 2004 and Amro and Abdel-Galil 2012). The present work was urged to study some biological aspects, feeding capacity and predation efficacy of *C. aegyptius* to facilitate its possible use in integrated pest management programs in economic crops in Egypt.

## MATERIALS AND METHODS

### Laboratory cultures

A culture of the cotton leaf-worm, *Spodoptera littoralis* (Boisd) was maintained according to the methods adopted by El-Maghraby (1984).

A laboratory culture of *Coranus aegyptius* (F.) was initiated from adults collected from the fields at El-Khattara district, Sharkia Governorate, Egypt. Biological experiments.

Experiments were conducted at  $30 \pm 1^{\circ}\text{C}$  and  $65 \pm 5\%\text{R.H.}$  Adults and immature stages of *C. aegyptius* were collected from fruit, ornamental trees and cotton field infested with aphids, whitefly and cotton leaf worm in newly reclaimed sandy area of El-Khattara district, Sharkia Governorate, Egypt by means of an insect sweep net or picking by hand, brought to the laboratory in Plant Protection Research Institute, Sharkia branch, where they were reared on cotton leaf worm and cotton aphid.

Deposited eggs of the predator were collected daily, kept separately in plastic vials 7x2cm., until hatching and the newly hatched nymphs were supplied with enough numbers of the second larval instar of *S. littoralis*. Number of offered preys was increased as the predator nymphs grew older. Number of consumed larvae and predator nymphs molted were recorded daily until each nymph was developed to the adult stage. Other fifty newly hatched nymphs were supplied with enough numbers of *Aphis gossypii* individuals.

The number of offered preys was increased as the predator nymphs grew older. Number of consumed individuals and nymphs molted were recorded daily. Fifty replicates were individuals used. Newly emerged adults were sexed and each pair (one male and female) was placed in plastic vials 7x2 cm for mating and egg deposition. Eggs laid by mated females were collected daily, counted and recorded. Pre, ovi, post oviposition periods, total number of eggs / female and longevity (female and male) were recorded. Ten couples were used as replicate.

### Data analysis

The means were separated using Duncan's Multiple Range Test (CoHort Software, 2004).

## RESULTS AND DISCUSSION

### Egg stage

The obtained data in Table (1) showed that the incubation period of egg stage lasted  $7.30 \pm 0.07$  days with a range of (7-8) days, for eggs laid by females fed on the second instar larvae of *S. littoralis*. Meanwhile, El-Sebaey (1998) found that incubation period of *C. aegyptius* egg when the females fed on *Anagasta kuehniella* Zell larvae as prey was  $11.0 \pm 1.0$  days (7-12) at  $30 \pm 1^\circ\text{C}$  and  $70.0 \pm 5\%$  R.H. and El-Sebaey (2001) mentioned that incubation periods of *Coranus africana* were 10.5 and 12.1 days for eggs laid by females fed on the third instar larvae of *S. littoralis* and *A. ypsilon* respectively. Also, El-Sebaey and El-Bishry (2001) reported that the incubation period of *C. africana* eggs when the females fed on the two tested preys *Anagasta Kuehniella* Zell. or *Corcyra cephalonica* larvae were 9.5 and 8.5 days respectively.

### Nymphal stage

*Coranus aegyptius* nymphal stage passes through five instars (Table 1), under the laboratory conditions of  $30 \pm 1^\circ\text{C}$  and  $65 \pm 5\%$  R.H., and with feeding on the second instar larvae, *S. littoralis*. The first nymphal instar lasted  $5.73 \pm 0.13$  and  $5.89 \pm 0.14$  days for male and female, respectively. The second instar recorded  $4.09 \pm 0.15$  and  $4.33 \pm 0.14$  days for male and female, respectively. The third instar occupied  $3.91 \pm 0.09$  days for male and  $3.96 \pm 0.12$  days for female showing insignificant variation. The fourth instar lasted  $6.09 \pm 0.28$  and  $7.03 \pm 0.19$  days for male and female, respectively, being highly significantly ( $F=9.28$ ) varied. While the fifth instar nymphal period recorded  $9.77 \pm 0.27$  days for male and  $10.33 \pm 0.20$  days for female. No mortality could be detected during the first, 2<sup>nd</sup>, 3<sup>rd</sup>, 5<sup>th</sup> instars except the fourth one as it recorded 2% mortality. El-Sebaey (1998) mentioned the first to fifth nymphal instars lasted 6.5, 6.1, 5.7, 5.9 and 9.4 days, respectively for male. The respective values for female were 6.3, 4.6, 5.1 and 6.8 days by using *A. kuehniella* larvae as prey, under conditions of  $30 \pm 1^\circ\text{C}$  and  $70 \pm 5\%$  R.H.

Total nymphal period: Feeding on the second larval instar of *S. littoralis* the total nymphal period lasted 36.86 days in male, opposed to 38.85 days for female; being highly significant ( $F=35.84$ ) varied. These findings are in full agreement with those of El-Sebaey (1998) found that total nymphal period averaged 24.6 and 27.6 days for male and female respectively, by feeding *A. kuehniella* larvae, El-Sebaey (2001) in Egypt who used *S. littoralis* larvae as a prey for *Coranus africana*, as the five nymphal instars lasted in respective 6, 3.7, 4.3, 6.5 and 23.88 days for female, opposed to 5.3, 3.6, 5.2, 6.3 and 21.6 days in male. On the other hand, the corresponding values associated with *A. ypsilon* larvae were 5.1, 4.3, 6.3, 7.1 and 24.78 days for female and 5.1, 4.8, 5.7, 6.8 and 24.33 days for males. The average total

nymphal period increased from 43.0 and 42.0 days for females and males, respectively on *S. littoralis* to the respective periods of 44.42 and 46.4 days on *A. ipsilon*.

#### **Adult stage**

The female and male longevity of *C. aegyptius* when fed on *S. littoralis* lasted  $61.2 \pm 3.75$  and  $21.2 \pm 1.02$  days, respectively (Table 2). Meanwhile, El-Sebaey (1998) found the female lived an average of 154.9 days, while male exhibited a shorter adult longevity 96.5 days.

#### **Ovipositional periods**

The female of *C. aegyptius* deposits eggs singly in the close vicinity of the prey. First eggs were laid after a pre-ovipositional period of  $4.4 \pm 0.16$  days. The total number of deposited eggs were  $220.5 \pm 11.69$  eggs, throughout an ovipositional period of  $50.7 \pm 3.93$  days. At the end of the life span, ovipositional ceased for a postovipositional period of  $6.6 \pm 0.70$  days (Table 2). El-Sebaey (1998) found that first egg of *C. aegyptius* was laid after an average preoviposition period of 7.2 days, the female deposited an average of 241.4 eggs throughout an oviposition period of 145 days, postoviposition period was 3.43 days, by using *A. kuehniella* larvae, El-Sebaey (2001) found that mean of pre, ovi, postoviposition and total longevity periods of *C. africana* fed on the third larval instar of the cotton leaf worm, *S. littoralis* were 10.1, 79.09, 10.0 and 100 days, while male life span was 98.4 days. Generally, biological activity of *Coranus* adults depended on prey type used. The oviposition period, egg laying activity and survivorship rate were better on *S. littoralis* than on *A. ypsilon*. Variation of these parameters is well documented and emphasized by previous authors (e. g. El-Sebaey 1989 & 2001). However, the total number of eggs laid per female fed on *S. littoralis* larvae was 220 eggs higher than those fed on *A. ypsilon* (172.0 eggs/female).

#### **Food consumption**

*Coranus aegyptius* developed and reproduced successfully when reared on the second larval instar of *S. littoralis*.

The average number of consumed larvae, increased generally with the development of various nymphal stage. The mean number of larvae consumed during the five nymphal instars were  $23.0 \pm 0.74$ ,  $24.27 \pm 0.86$ ,  $24.36 \pm 0.59$ ,  $43.45 \pm 2.23$  and  $84.91 \pm 2.06$  larvae respectively, in case of male. It were  $23.11 \pm 0.68$ ,  $27.15 \pm 0.82$ ,  $24.37 \pm 0.81$ ,  $50.74 \pm 1.34$  and  $93.78 \pm 1.90$  larvae respectively, per female. The total nymphal stage consumed  $219.15 \pm 1.61$  larvae / female, while it were  $200.0 \pm 2.63$  larvae / male. This indicated a significant differences ( $F=5.919$ ). Adult consumed  $744.3 \pm 38.65$  and  $236.7 \pm 11.05$  larvae during the longevity of female and male, respectively. With a highly significant differences ( $F= 159.42$ ) (Table 3). The daily numbers of *S. littoralis* larvae consumed through the five nymphal stadia were in respective 5.33, 7.6, 9.5, 10.5 and 12 larvae, *C. aegyptius* female and male consumed daily 15.6 and 14.6 larvae of *S. littoralis* (El-Sebaey 2001).

Table (1): Duration period (in days) of immature stages of *Coranus aegyptius* when fed on the second instar larvae of *Spodoptera littoralis* at 30± 1 °C and 65 ± 5 % R.H.

Biological aspects Sex	Duration period of immature stages (in days)						Total developmental period
	Incubation period of egg stage	Nymphal stage					
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	
Female	7.30±0.07 <sup>a</sup> (7-8)	5.89±0.14 <sup>a</sup> (5-7)	4.33±0.14 <sup>a</sup> (3-6)	3.96±0.12 <sup>a</sup> (3-5)	7.03±0.19 <sup>a</sup> (5-9)	10.33±0.20 <sup>a</sup> (8-12)	38.85±0.16 <sup>a</sup> (38-41)
Male	7.30±0.07 <sup>a</sup> (7-8)	5.73±0.13 <sup>a</sup> (5-7)	4.09±0.15 <sup>a</sup> (3-5)	3.91±0.09 <sup>a</sup> (3-5)	6.09±0.28 <sup>b</sup> (4-8)	9.77±0.24 <sup>a</sup> (8-12)	36.86±0.27 <sup>b</sup> (34-39)
F. value	0.403	0.047	2.053	0.074	9.28**	1.919	35.84***
L.S.D. at:							
0.05 level	0.288	0.422	0.447	0.335	0.692	0.662	0.735
0.01 level	0.385	0.564	0.598	0.448	0.925	0.885	0.983

Table (2): Longevity of adult *Coranus aegyptius* and number of deposited eggs/ female when fed on the second instar larvae of *Spodoptera littoralis* at 30± 1 °C and 65 ± 5 % R.H.

Adult stage	Minimum	Maximum	Average
Longevity / days			
Preoviposition period	4	5	4.4±0.16
Oviposition Period	35	74	50.7±3.93
Post oviposition period	5	11	6.6±0.70
A- Female	45	83	61.2±3.75
B- Male	17	26	21.2±1.02
Total No. of eggs/female	173	288	220.5±11.69

Table (3): Feeding capacity of nymphal stage and adults of *Coranus aegyptius* fed on the second instar larvae of *Spodoptera littoralis* at 30± 1°C and 65 ± 5 % R.H.

Biological aspects Sex	Average and range of consumption					Total consumption/ nymph	Total consumption / adult
	Nymphal stage						
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>		
A- Female	23.11±0.68 <sup>a</sup> (19-32)	27.15±0.82 <sup>a</sup> (19-36)	24.37±0.81 <sup>a</sup> (17-32)	50.74±1.34 <sup>a</sup> (35-64)	93.78±1.90 <sup>a</sup> (72-113)	219.15±1.61 <sup>a</sup> (204-236)	744.3±38.65 <sup>a</sup> (550-918)
B- Male	23.0±0.74 <sup>a</sup> (18-30)	24.27±0.86 <sup>b</sup> (16-34)	24.36±0.59 <sup>a</sup> (18-31)	43.45±2.23 <sup>b</sup> (23-58)	84.91±2.06 <sup>a</sup> (70-104)	200.0±2.63 <sup>b</sup> (175-219)	236.7±11.05 <sup>b</sup> (195-280)
F. value	0.004	5.876*	0.219	9.693**	0.557	5.919*	159.417***
L.S.D. at:							
0.05 level	2.681	2.535	2.545	5.303	10.069	11.839	84.462
0.01 level	3.585	3.389	3.403	7.090	13.463	15.828	115.720

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### **الخصائص البيولوجية والافتراضية للمفترس الروديفيدي *Coranus aegyptius* (F.)**

#### **على العمر اليرقي الثاني لدودة ورق القطن *Spodoptera littoralis* (Boisd.) تحت الظروف المعملية**

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أجريت التجارب المعملية فى معهد بحوث وقاية النباتات ، فرع الشرقية ، لدراسة الخصائص البيولوجية والافتراضية للمفترس (*Coranus aegyptius* (F.) (Hemiptera: Reduviidae) الذى سجل كمفترس لبعض الحشرات الضارة على النباتات الاقتصادية والبرية فى منطقة الخطارة ، محافظة الشرقية ، بمصر خلال عامى 2012 ، 2013 تم دراسة بعض الخصائص البيولوجية والافتراضية لهذا المفترس باستخدام يرقات العمر الثانى لدودة ورق القطن *Spodoptera littoralis* تحت ظروف المعمل ( درجة حرارة  $30 \pm 1$ °م ، رطوبة نسبية  $65 \pm 5$  % ) استغرقت فترة حضانة البيض 7.3 يوما ، وتم تسجيل مدد الأعمار الحورية الخمسة للطور الحورى من البيضة حتى الحشرة الكاملة لحساب مجموع فترة النمو للأطوارالغير كاملة وطول عمر الحشرة الكاملة فوجد أنها فى الذكور أقصر منها مقارنة بالإناث وكانت  $36.86$  ،  $38.85$  يوما على التوالي بينما عاشت الحشرات الكاملة للإناث فترة أطول من الذكور مسجلة  $61.2$  ،  $21.2$  يوما على التوالي 0 وكانت الكفاءة الافتراضية لطور الحورية والحشرة الكاملة عند تغذيتها على العمر اليرقى الثانى لدودة ورق القطن  $219.15$  ،  $744.3$  يرقة على التوالي فى حالة الانثى 0 بينما كانت أقل بكثير  $200$  ،  $236.7$  يرقة على التوالي فى حالة الذكر وكان مجموع ماتضعة الانثى من بيض  $220.5$  +  $11.69$  بيضة خلال فترة وضع البيض وهى  $50.7$  +  $3.93$  يوما 0 توضح هذه النتائج أن هذا المفترس يمكن أن يلعب دورا هاما فى السيطرة البيولوجية لدودة ورق القطن والاستعانة به عند وضع برامج السيطرة الكاملة على هذه الآفة فى الحقل 0