

**BIOLOGY AND PREDATION RATES OF THE ASSASSIN  
BUG, *Coranus africana* El-Sebaey (HETEROPTERA:  
REDUVIIDAE) ON THE COTTON PESTS, *Spodoptera littoralis*  
(Boisd.) AND *Agrotis ypsilon* Rott**

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By

**I. I. A. El-Sebaey**

*Plant Protection Research Institute, Dokki, Cairo, Egypt*

**ABSTRACT**

*Coranus africana* El-Sebaey (Heteroptera: Reduviidae) has recently been described from Egypt. It occurs on various wild and cultivated plants, including cotton. Some biological aspects of this predaceous species were investigated using the third larval stages of the cotton pests, *Spodoptera littoralis* and *Agrotis ypsilon*, as restricted diets under the hygrothermal conditions of  $30 \pm 1$  °C and 70 % R. H. The five nymphal stadia of both sexes of this predator were estimated under the two cases of feeding. The total nymphal period and adult longevity were shorter on *S. littoralis* than on *A. ypsilon*. The former host increased the fecundity, survival rate and oviposition period. The number of host larvae consumed per predator was higher on *S. littoralis*.

**Key words:** *Agrotis ypsilon* , *Coranus africana* , *Spodoptera littoralis*.

**1. INTRODUCTION**

The possibility of reduviid augmentation in cotton agro-ecosystems is reflected from various publications (Ambrose & Livingstone, 1986; Schaefer & Ahmad, 1987; Vennison & Ambrose, 1989 and Ambrose & Claver, 1997). Data on the biology, bionomics and ecology of the assassin bugs have been accumulated in the last two decads (*e.g.* Tawfik *et al.*, 1983a, Haridass *et al.*, 1988; El-Sebaey, 1989, 1994, 1996, 1998; Sahayaraj 1994; Taylor & Schmidt, 1996a,b; Sahayaraj & Ambose, 1997; and Kumar & Kumar 1997).

The prey consumption as well as the influence of the prey species on the feeding response, development and reproduction of reduviid bugs were investigated by several authors (e.g. Tawfik *et al.*, 1983b., Inoue, 1985; James, 1994; and El-Shazly & El-Sebaey, 1997)

*Coranus africana* has recently been described from Egypt; associating with several insect pests on different economic plants including cotton in Egypt (El-Sebaey, 2001). Therefore, the aim of the present work was to shed light on the rate of prey consumption and the effect of two cotton pests, *Spodoptera littoralis* and *Agrotis ypsilon*, as preys, on the development and reproduction of this reduviid.

## 2. MATERIALS AND METHODS

Cultures of the cotton leaf Worm, *S. littoralis* and *A. ypsilon* were maintained according to the methods adopted by Abd-El wahab 1982 and El-Rahman 1984, respectively.

A laboratory culture of *C. africana* was initiated from adults collected from clover fields at Wadi El-Natroun district in the western desert of Egypt

### 2.1. Biological experiments

Experiments were conducted at  $30 \pm 1$  °C and 70 % R. H. in incubators of  $\pm 1$  °C sensitivity. A constant relative humidity was maintained in desiccators by means of a saturated solution of sodium chloride (Buxton and Melanby, 1934).

To obtain newly-emerged adults of the predator, mature nymphs were collected from the stock cultures, to be confined in Petri-dishes containing discs of moistened filter papers to facilitate insect movement and moulting. Third instar larvae of *S. littoralis* and *A. ypsilon* were used as preys for the predator. Rearing dishes were inspected daily and at time, newly-emerged adults were collected and paired. Fifty replicates were used.

For ovipositional experiments, plastic cages of 2.5 cm diameter and 5 cm height were used. Each cage, that contained one couple only, was provided with a filter paper disc and covered with a perforated plastic cover. A supply of 2-3 larvae of the tested prey was added daily to each cage. The cages were examined daily and the deposited eggs, after being counted were transferred to other cages; incubating egg

cages. Each cage, that was 2.5 cm diameter x 5 cm height contained 10 eggs and was provided with a filter paper disc and covered with a perforated plastic cover. Daily inspection took place to count the hatched nymphs for estimating the hatchability rate. Newly-hatched nymphs were immediately isolated in the individual rearing tubes. Each tube (1.5 cm diameter x 3.5 cm height) was provided with a filter paper disc and was covered with a perforated plastic cover. The predatory nymphs were provided daily with 1-2 *S. littoralis* or *A. ypsilon* larvae, and kept continuously at the same temperature and relative humidity. Moulting and mortality of the nymphs were recorded till emergence of adults, that were sexed and confined inside the ovipositional cages. Ten replicate were used.

### 3. RESULTS & DISCUSSION

#### 3.1. Egg stage

Data in Table (1) show that incubation periods 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, being significantly ( $P > 0.05$ ) varied. On the other hand, the hatchability rate showed an insignificant variation; (90.5 and 90% respectively) Table (1).

#### 3.2. Nymphal stage

Nymphal developmental period varied with the prey used (Table 1). Using *Spodoptera* larvae as a prey, the five nymphal instars lasted in respective 6, 3.7, 4.3, 6.5 and 23.88 days in female, opposed to 5.3, 3.6, 5.2, 6.3 and 21.6 days in male. The corresponding values associated with *Agrotis* larvae were 5.1, 4.3, 6.3, 7.1 and 24.78 days in female and 5.1, 4.8, 5.7, 6.8 and 24.33 days in males. The average total nymphal period increased from  $43 \pm 1.0$  and  $42 \pm 2.2$  days for females and males, respectively on *S. littoralis* to the respective periods of  $44.42 \pm 2.7$  and  $46.4 \pm 2.6$  days on *A. ypsilon*, being significantly ( $P > 0.05$ ) longer on *A. ypsilon*. Nymphal survivorship rate also varied with the prey species. Mortality rate was greater on *A. ypsilon* than on *S. littoralis*; the respective mortality rates were 30.3 and 25.8%. Most of the mortality occurred during the first two stadia (Table 1)

Table (1): Duration ( /day) and mortality percentage of the immature stages of *Coranus africana* fed on third instar larvae of *S. littoralis* and *A. ypsilon* at  $30 \pm 1^\circ\text{C}$  and  $70\% \text{ R. H.}$   
Average period of different stages (in days) when fed on third instar larvae of

Stages	<i>S. littoralis</i>				<i>A. ypsilon</i>			
	Female	Male	Mortality		Female	Male	Mortality	
Incubation stage	10.5±1.1 (9-15)	10.5±1.1 (9-15)	9.5 %		12.1±1 (10-14)	12.1±1 (10-14)	10%	
1 <sup>st</sup> stadium	6.0±0.4 (4-7)	5.3 ± 0.6 (4-6)	2.9 %		5.1±0.71 (4-6)	5.1±0.76 (4-7)	15.5 %	
2 <sup>nd</sup> stadium	3.7±0.9 (3-6)	3.6 ± 0.7 (3-5)	6.8 %		4.3 ± 0.9 (3-7)	4.8 ± 0.91 (4-8)	12.9 %	
3 <sup>rd</sup> stadium	4.3 ± 0.85 (4-7)	5.2 ± 0.9 (4-8)	3.7 %		6.3 ± 0.7 (5-8)	5.7 ± 0.92 (5-8)	6.2 %	
4 <sup>th</sup> stadium	6.5 ± 0.6 (4-6)	6.3 ± 0.6 (6-8)	-		7.1 ± 8.0 (6-10)	6.8 ± 0.9 (5.10)	-	
5 <sup>th</sup> stadium	23.88 ± 0.87 (23-33)	21.6±1.7 (20-26)	-		24.78±1.9 (18-26)	24.33±1.6 (18-26)	-	
Total nymgal period	43±1.0 (40-46)	42±2.2 (38-44)	25.8 %		47.42±2.7 (41-52)	46.4 ± 2.6 (40-50)	30.3 %	

\*Figures between brackets represent the range

\*No. of replicates = 40

### 3. 3. Adult stage

Data summarized on (Table 2) show that feeding females on *S. littoralis* larvae induced longer oviposition period ( $79 \pm 3.7$  days), compared to that ( $75 \pm 1.9$  days) on *A. ypsilon*. The difference between the recorded data was significant ( $P > 0.05$ ) However, females raised on the latter prey exhibited a longer life span. The average life spans were  $100 \pm 4.2$  and  $103.37 \pm 3.7$  days for females fed on first and second prey species, respectively.

The total number of eggs laid per female fed on *S. littoralis* was significantly ( $P > 0.05$ ) higher than those fed on *A. ypsilon*; the figures reported were in respective  $220 \pm 4.4$  and  $172 \pm 7.2$  eggs / female (Table 2). Also, the daily number of eggs deposited per female fed on the former prey was significantly higher than those fed on the latter one; being in respective 2.78 and 2.29 eggs (Fig. 1).

The weekly rate of deposited eggs per female (Fig. 1) varied during the successive weeks of oviposition in the two cases of feeding. This rate attained its highest value during the 7<sup>th</sup> week ( $31.3 \pm 3.1$  egg / week) on *S. littoralis*, and during the 8<sup>th</sup> week ( $24.9 \pm 0.9$  eggs / week) on *A. ypsilon*. In both cases this rate decreased gradually in the successive weeks till the end of oviposition period.

Estimating the survival rates of depositing female on *S. littoralis* (Fig 2), it was found that all the experimental females lived up to the 14<sup>th</sup> week after adult emergence. The survival rate was abruptly decreased to 70 % in the 15<sup>th</sup> week. In the case of *A. ypsilon* all females lived to the 13<sup>th</sup> week after their emergence and the survival rate declined to 72 % in the 14<sup>th</sup> week. In the successive weeks these rates decreased gradually to the end of oviposition period in both cases of feeding.

The male life span was 98.4 and 95.7 days when fed on *S. littoralis* and *A. ypsilon* respectively (Table 2).

### 3. 4. Food Consumption

*Coranus africana* developed and reproduced successfully when reared on third larval instar of *S. littoralis* or *A. ypsilon*.

Generally the daily number of consumed larvae increased with the development of various instars. The daily numbers of *Spodoptera* larvae consumed through the five nymphal stadia were in respective 5.33, 7.6, 9.5, 10.5 and 12 larvae. When *Agrotis* larvae were used, the

Table (2): Longevity of *Coranus africana* and No. of deposited eggs/female when fed on third instar larvae of *S. littoralis* and *A. ypsilon* at  $30 \pm 1^\circ\text{C}$  and  $70\%$  R. H. Preys

Preys	Periods ( /day) of			Longevity ( / day)		Gross rate of reproduction / female	Daily rate of reproduction / female
	Pre- oviposition	Oviposition	Post- oviposition	Female	Male		
	<i>S. littoralis</i>	10.1±1.0 (9-11)	79±3.7 (75-85)	10.0±1.0 (9-11)	100±4.2 (93-105)	98.4±1.1 (96-100)	220±4.4 (225-215)
<i>A. ypsilon</i>	15.1±1.04 (13-17)	75±1.9 (72-80)	13.36±2.23 (10-15)	103±3.7 (97-108)	95.7±2.5 93-100	172±7.2 (160-190)	2.29±0.09 (2.2±0.4)

No. of replicates = 10

Table (3): Daily consumption rates after starvation of *Coranus africana* fed on *S. littoralis* and *A. ypsilon* during the nymphal and adult stages at  $30 \pm 1^\circ\text{C}$  and  $70\%$  R. H.

Prey consumed	Daily number of consumed larvae				
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>
<i>A. ypsilon</i>	4±0.63 (3-5)	5.4±0.9 (4-7)	7.2±0.75 (6-8)	9±0.82 (8-10)	11±0.82 (10-12)
<i>S. littoralis</i>	5.33±0.82 (4-6)	7.6 ±0.49 (7-8)	9.5±0.5 (9-10)	10.5±0.5 (10-11)	12±0.58 (11-13)
				Female	Male
				14±0.6 (13-15)	13.7±0.75 (13-15)
				15.6±0.48 (15-16)	14.6±0.47 (14-16)

corresponding figures were 4, 5.4, 7.2, 9 and 11 larvae (Table 3). Statistically, significant differences ( $P > 0.05$ ) existed between the consumption daily rates of the five nymphal instars and between the two types of preys.

On the other hand, *Coranus* female consumed daily 15.6 and 14 larvae of *Spodoptera* and *Agrotis* respectively, while the male devoured daily 14.6 and 13.7 larvae of the two preys, respectively (Table 3). Statistically, significant differences ( $P > 0.05$ ) existed between the daily consumption rate of the two sexes and between the two types of preys.

*Coranus africana* has been recently described from Egypt; associating with several insect pests on various crops in different agroecosystems including tomatoes, cotton, clover and maize (El-Sebaey, 2001).

Nymphal developmental period of *C. africana* varied with the prey used; being significantly longer on *A. ypsilon* than on *S. littoralis*. The effect of the prey species on the nymphal development was also reported in different reduviids; e. g., *Allaeocranum biannulipes* (Mont. & Sign.), developmental period was shortest when reared on *Stegobium paniceum* and longest when reared on *Lasioderma serricornis* (El-Sebaey, 1989). Nymphal survival rate also varied with the prey species used; it was about 69.7 % for *A. ypsilon* and 74.2 % for *S. littoralis*. Most of this mortality occurred during the first two stadia. Similar results were also reported by Parajulee and Phillips (1993) on the anthocorid predator, *Lyctocoris campestris*. The sex ratio of the emerging adults *C. africana* was not significantly deviating from 1:1 for the two tested preys; a result that was similar to those reported by Tawfik *et al.*, (1983 b) and Parajulee and Phillips (1993) who found no distortion in the sex ratio of the antocorids *Xylocoris flavipes* and *Lyctocoris campestris*.

All the biological activity of *Coranus* adults varied with the prey 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. Tawfik *et al.*, 1983a and El-Sebaey 1989).

The prey used in adult feeding also affects incubation period and the hatchability rate of the deposited egg; using larvae of *S. littoralis*; gave better results.

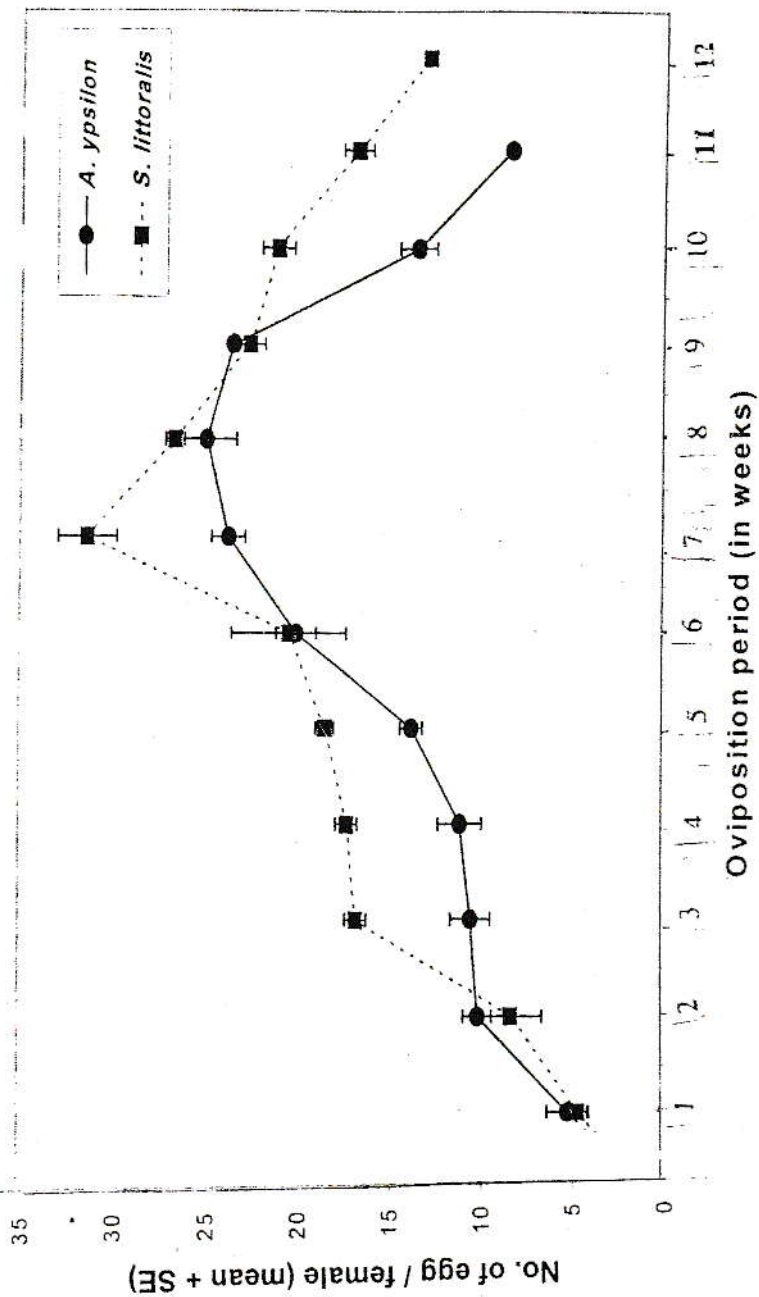


Fig.(1): Egg laying activity of *C. africana* when fed on third instar larvae of *S. littoralis* and *A. ypsilon* at  $30 \pm 1^\circ\text{C}$  and 70% R.H.



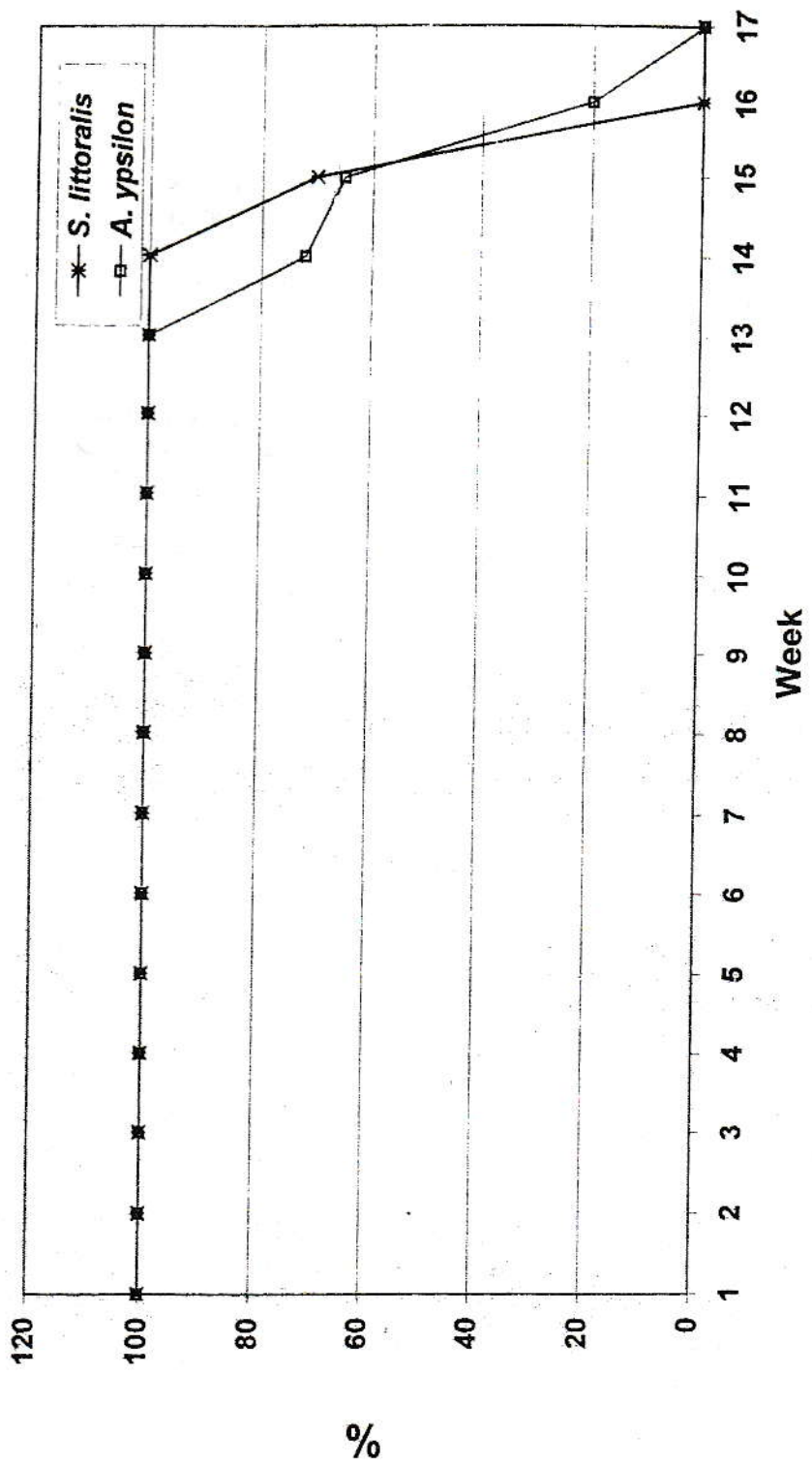


Fig. (2): Survival rate of *Coranus africana* females fed on third instar larvae of *S. littoralis* and *A. ypsilon* at  $30 \pm 1^\circ\text{C}$  and 70% R.H.

The use of natural enemies for the suppression of insect pests is a promising pest management tactic. The present investigation has indicated that *C. africana* is a candidate for the control of cotton pests tested in the present work (*S. littoralis* and *Agrotis ypsilon*).

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**بيولوجيا ومعدلات الافتراس للمفترس *Coranus africana* El-Sebaey**  
(رتبة نصفية الأجنحة - فصيلة البيق السفاح)  
باستخدام يرقات دودة ورق القطن والدودة القارضة كعوائل

إيمان إبراهيم عبد الرحمن السباعي

معهد بحوث وقاية النبات - مركز البحوث الزراعية-  
الدقى -القاهرة

**ملخص**

تم تسجيل المفترس *Coranus africana* كنوع جديد على عديد من النباتات الصحراوية والمزروعة مثل القطن في عديد من مناطق جمهورية مصر العربية.

تمت دراسة المظاهر البيولوجية لهذا النوع باستخدام يرقات العمر الثالث لكل مندودة ورق القطن و الدودة القارضة كعوائل عند درجة حرارة ٣٠ م° ورطوبة نسبية ٧٠%.

اتضح من الدراسة أن الأعمار الحورية الخمسة للأنثى تستغرق ٦، ٣، ٧، ٤، ٣، ٦، ٥، ٢٣، ٨٨، يوماً ، على التوالي بينما كانت في الذكر ٣، ٥، ٦، ٣، ٢، ٥، ٦، ٣، ٢١، يوماً ، على التوالي بالتغذية على يرقات العمر الثالث لدودة ورق القطن ، بينما استغرقت هذه الفترات بالتغذية على يرقات العمر الثالث للدودة القارضة في حالة الأنثى ١، ٥، ٣، ٤، ٦، ٣، ٧، ١، ٢٤، ٧٨، يوماً على التوالي بينما كانت في حالة الذكر ١، ٥، ٨، ٤، ٧، ٥، ٦، ٨، ٢٤، ٣٣، يوماً ، على التوالي.

تم أيضاً دراسة طول فترة حياة الأفراد الكاملة لكل من الذكور والإناث ومعدلات وضع البيض بالتغذية على كلا العائلين وكذلك معدلات الافتراس.

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المجلة العلمية لكلية الزراعة -جامعة القاهرة - المجلد (٥٢) العدد الرابع  
(أكتوبر ٢٠٠١): ٦٥٥-٦٦٨.

