

LABORATORY STUDY ON THE WEB-WEAVER SPIDER, *ENOPLOGNATHA OVATA* (CLAERCK, 1757) (ARANEIDA: THERIDIIDAE) AS A BIOLOGICAL CONTROL AGENT
BY

Abla A. Ibrahim and Soheir I. Abdel-Rahman
 Plant Protection Research Institute, Agric. Res. Center, Dokki, Giza, Egypt.

ABSTRACT

The true spider, *Enoplognatha ovata* (Claerck, 1757) (Araneida: Theridiidae) was fed on two different prey species; the 1st instar larvae of the cotton leafworm, *Spodoptera littoralis* (Boisd.) and the adult females of the two spotted spider mite, *Tetranychus urticae* Koch at 25±20°C and 65±5% RH. The incubation periods for both males and females of *E. ovata* reached 15 days when fed on the 1st instar larvae of *S. littoralis*. Also, the two sexes of the spider pass through 4 spiderlings during its life. The total duration of these spiderlings of males lasted 32.40 days and they consumed an average of 224.6 prey individuals. While the four spiderlings of females lasted 34.80 days and they consumed an average of 254.30 prey individuals.

INTRODUCTION

At present, pollution is one of the major problems facing all nations. Therefore, pest control strategy is depending on different ways of pest control ways as Integrated Pest Management "IPM". True spiders are now one of the most important biological control agents of different pests infesting different crops. Family Theridiidae is upside down in an irregular web suspended on plants on hidden in rock crevices of fissures in soils (Levy, 1963 and El-Erksousy, 2000). Many of them use very fine threads often hard to notice unless they occasionally glitter in the sun light or covered with dust (Levy and Amitia, 1981). El-Erksousy (2000, 2002 & 2003) and El-Erksousy *et al.*, 2006 studied the biological

aspects of some species of Theridiidae as biological control agents against certain agricultural pests. Therefore, the present work aims to obtain some biological data on duration and the efficiency of prey consumption of the web-weaver spider, *Enoplognatha ovata* (Claerck, 1757) (Araneida: Theridiidae) when fed on females of spider mite, *Tetranychus urticae* Koch and the 1st instar larvae of the cotton leafworm, *Spodoptera littoralis* (Boisd.) under laboratory conditions of two constant temperatures (25 & 30°C) and 65±5% RH to evaluate its potential role as a biological control agents against the investigated prey pest.

MATERIALS AND METHODS

The spider samples were collected from cucumber fields (*Citrullus sativus* L.) in the private farm of The Plant Protection Research Institute, Agric. Res. Center, Dokki, Giza, Egypt by using sweeping or direct collection from cucumber plants. Individuals of *E. ovata* were selected from the cucumber samples. An adult female with adult male

were confined together in a test tube of 20 cm long and 0.5 cm in diameter and closed by a cotton pad. After female laid their egg-sac, the male and female were discarded and egg-sac was observed daily until hatching. Each individual of the 1st spiderling was put separately in test tube. Experiments were done to determine the maximum daily consumption of

all stages of spiderlings. A suitable number of prey individuals were put daily. The daily prey consumption and duration of spiderlings were determined. This study was undergoing under laboratory conditions (25 & 30°C) and (65±5% RH.).

Rearing technique:

T. urticae as prey:

The spider mite, *T. urticae* was reared on sweet potato plants, which cultivated in plastic trays full with soil and sandy 1:1 under laboratory conditions in the Plant Protection

Research Institute, Agric. Res. Center, Dokki, Giza, Egypt.

S. littoralis as prey:

Egg masses of *S. littoralis* were maintained at 27±1°C and 70-75% RH until hatching. Newly hatched larvae were reared on leaves of castor plant (*Ricinus communis*) and changed daily or when necessarily in clean glass jars covered with muslin and secured with rubber bands. Successive culture of the 1st and 2nd instar larvae used as prey.

RESULTS AND DISCUSSION

Feeding behaviour:

The spider *Enoplognatha ovata* is cosmopolitan that live in many ecological environments as a biocontrol agents, they play a considerable role in agroecosystem. The web-weaver spider *E. ovata* notice usually comes close and moves around its prey for few seconds they catches it between its chelicerae by the help of the front legs.

Oviposition and incubation period:

The gravid female of *E. ovata* deposited 2-3 egg-sacs during its oviposition period. Each sac contained about 55-60 eggs, the egg-mass white yellowish in colour, it has one layer only as a cover of sac, while the non-copulated females of the spider *E. ovata* laid one egg-sac during it oviposition period. The incubation periods stayed an average of 15.0 & 11.0 days for both female and male at 25 and 30°C, respectively. This results disagree with Putman (1967) who found that female *Philodromus praelustris* (Family: Philodromidae) produced up to 12 egg-sacs containing a total of over 299 eggs.

Development and adult longevity:

Data shown in Table (1) cleared that each female and male passes through four spiderlings before reaching adult stage, however, this number differs according to species as *Theridion aegyptium* has only two spiderlings when feed on spider mite, *Tetranychus urticae* Koch (El-Erksousy, 2003).

The durations of the 1st, 2nd, 3rd and 4th spiderlings for both female and male lasted (15.4 & 14.6), (6.0 & 6.4), (6.80 & 5.6) and

(6.60 & 5.8) days at the same pattern with a total immatures 34.8 and 32.4 days for female and male, respectively. This means that cotton leafworm accelerated development of the spider *E. ovata* immature stages than the two spotted spider-mite, *T. urticae*.

Female and male lifecycle durated (49.8&47.4) and (31.2&29.7) days at 25 & 30°C, when the spider fed on the 1st instar larvae of the cotton leafworm, *S. littoralis* as shown in Tables (1&2) and illustrated in Figs (1&2). These results disagree with those obtained by Hussein *et al.* (2003) and Rahil (1988) who studied the lifecycle of the spider, *Anelosimus aulicus* (C. L. Koch, 1838), which has 5 spiderlings before reaching adult stage for both female and male.

Female longevity durated (41.6 & 33.4) days at 25&30°C when fed on the 1st instar larvae of the cotton leafworm, *S. littoralis*, while male adulthood lasted (34.8 & 17.1) days at the same trend Tables (1&2) and Figs (1&2).

On the other hand, female and male life span (91.3&82.2) and (64.0&46.8) days, respectively, when they reared on 25&30°C Sallam & Yassin (2005) investigated the effect of temperature on the biological aspects of the spider, *Steatoda paykulliana* (Walckenaer) when fed on different instars of *S. littoralis* at 30°C. Tables (1&2) and Figs (1&2).

On the contrary, *E. ovata* did not complete its life cycle when fed on the adult

females of the adult females of the two-spotted spider mite, *Tetranychus urticae* Koch. It only completed the 1st and 2nd spiderlings only 25% of the individuals completed the 3rd spiderling and did not complete the rest spiderlings.

The first spiderling lasted 10.91 days and consumed 79.55 individuals, while the second spiderling last 17.00 days and consumed 157.36 individuals, whereas the third spiderling lasted 15.00 days with average mean consumption of 285.00 individuals (Table 1).

Table (1): Biological developmental stages of the spider *Enoplognatha ovata* and efficiency of predaciousness, when fed on 1st instar larvae of *S. littoralis* and the adult females of *T. urticae* at 25°C and 65±5% RH.

Developmental stages	<i>Spodoptera littoralis</i>				<i>Tetranychus urticae</i>	
	Duration (days)		Food consumption		Duration (days)	Food consumption
	Female	Male	Female	Male		
Egg	15.00±0.00	15.00±0.00	-	-	15.00±0.00	-
1 st spiderlings	15.40±0.52	14.60±0.52	54.40±8.09	51.20±6.14	10.91±1.87	79.55±9.14
2 nd spiderlings	6.00±0.82	6.40±0.52	57.40±8.93	56.40±8.51	17.00±1.61	157.36±18.47
3 rd spiderlings	6.80±0.79	5.60±0.84	70.90±7.98	59.40±5.60	15.00±1.41	285.0±9.90
4 th spiderlings	6.60±1.17	5.80±0.79	71.60±5.68	67.60±3.57	-	-
Total period	34.80±1.87	32.40±0.84	254.30±14.99	224.6±13.14	-	-
Life cycle	49.80±1.87	47.40±0.84	-	-	-	-
Longevity	41.60±5.54	34.80±1.32	398.60±40.23	309.50±18.30	-	-
Life span	91.30±4.64	82.20±1.62	653.90±45.51	534.10±26.99	-	-

± (SE)= Standard error

Table (2): Biological aspects and the efficiency of predaciousness of the spider, *Enoplognatha ovata*, when fed on 1st instar larvae of *S. littoralis* at 30°C and 65±5% RH.

Developmental stages	Duration (days)		Food consumption	
	Female	Male	Female	Male
Egg	11.00±0.00	11.00±0.00	-	-
1 st spiderlings	4.80±1.32	4.90±1.10	33.40±4.12	32.10±2.33
2 nd spiderlings	4.20±1.32	4.10±1.10	51.80±7.99	48.40±9.12
3 rd spiderlings	4.70±1.25	4.40±1.58	59.70±6.50	55.30±5.70
4 th spiderlings	6.50±1.78	5.30±1.64	72.80±11.44	61.60±8.21
Total period	20.20±3.61	18.70±3.43	217.70±17.36	197.40±18.06
Life cycle	31.20±3.61	29.70±3.43	-	-
Longevity	33.40±5.86	17.10±3.45	463.60±70.98	275.00±44.90
Life span	64.00±5.0	46.80±4.08	680.30±4.08	472.40±36.59

± (SE)= Standard error

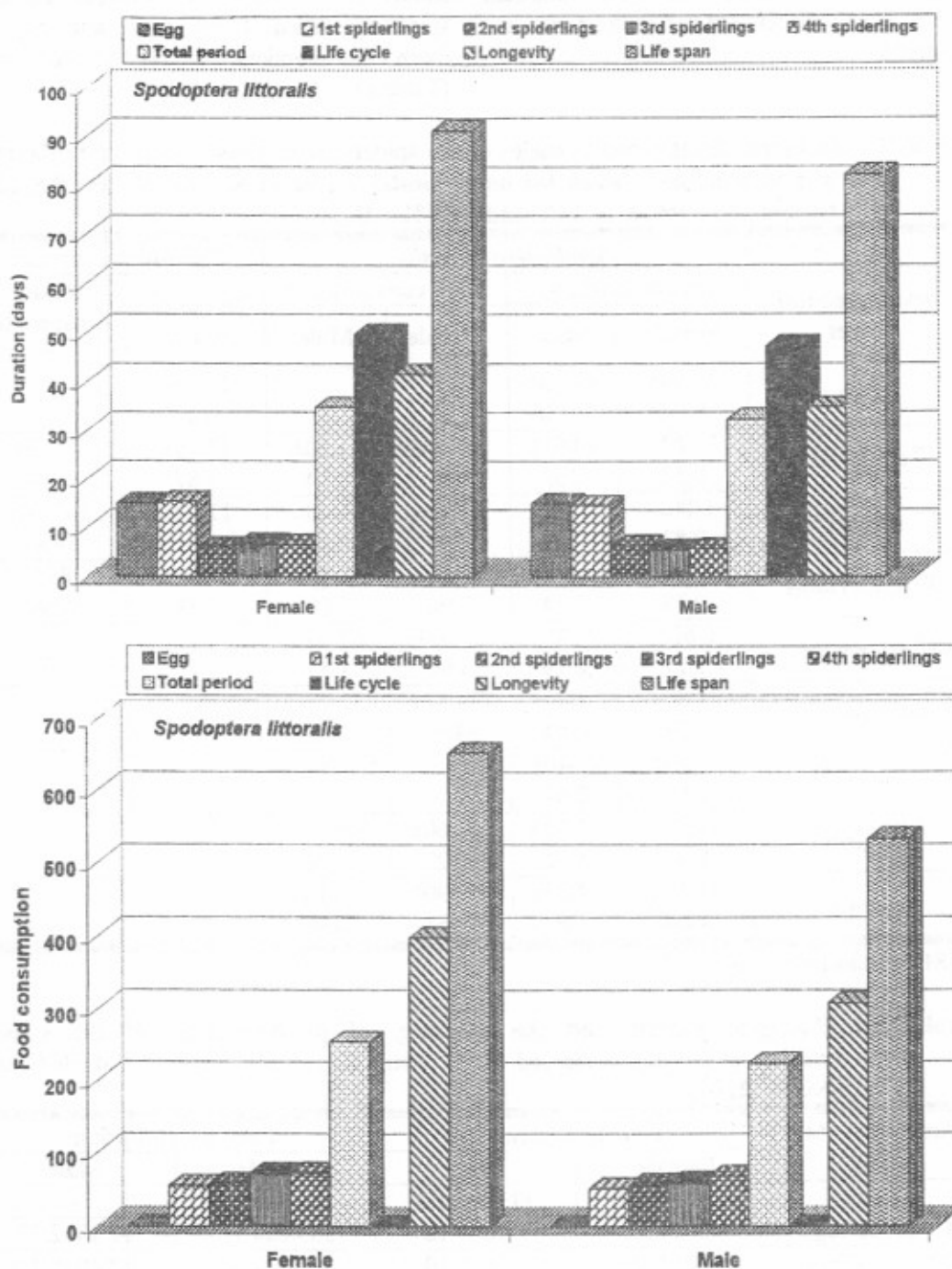


Fig. (1): Duration and prey consumption of the true spider, *Enoplognatha ovata* (Claerck, 1757) developmental stages when fed on the cotton leafworm, *Spodoptera littoralis* (Boisd.).

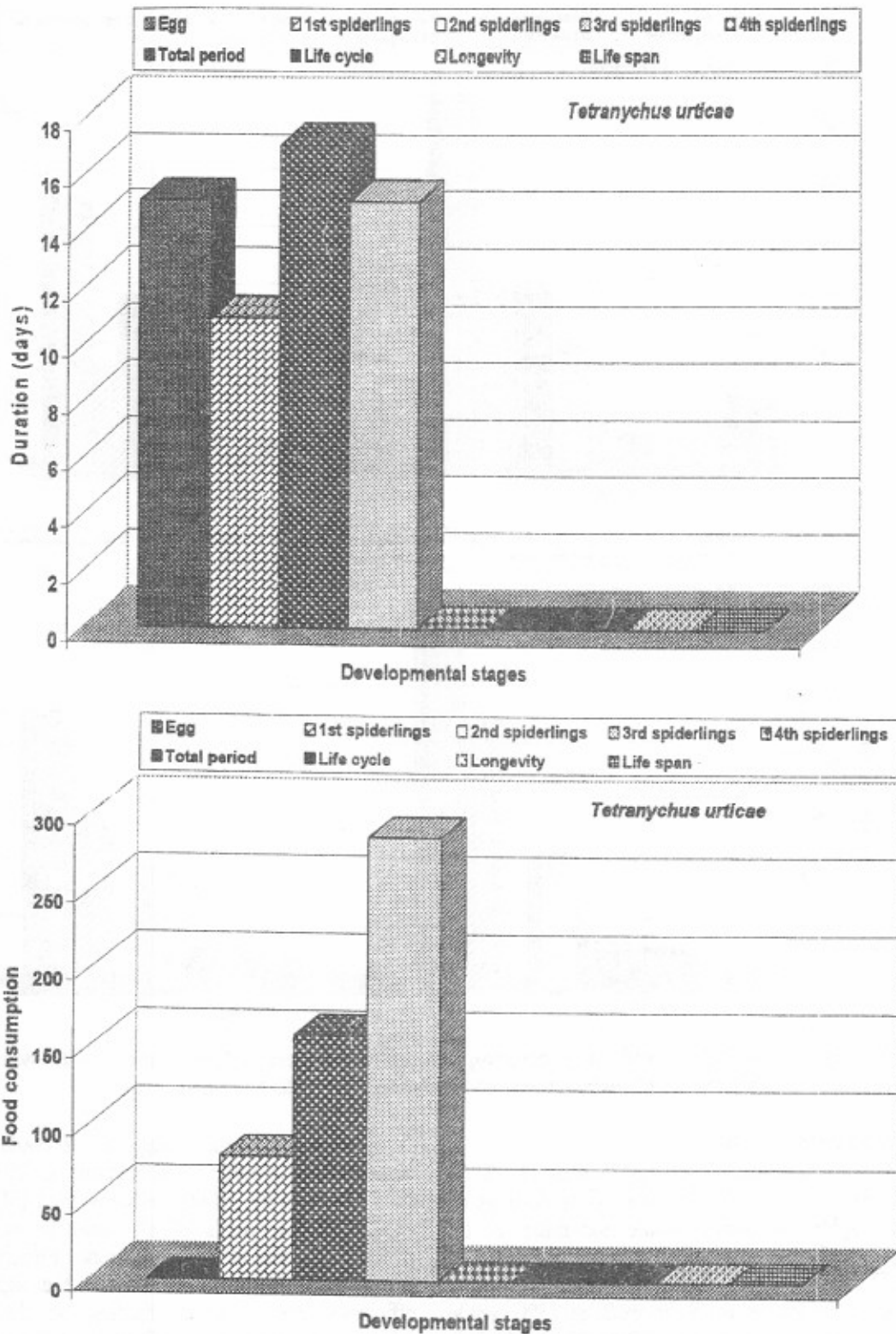


Fig. (2): Duration and prey consumption of the true spider, *Enoplognatha ovata* (Claerck, 1757) when fed on the adult females of the spider mite, *Tetranychus urticae* Koch.

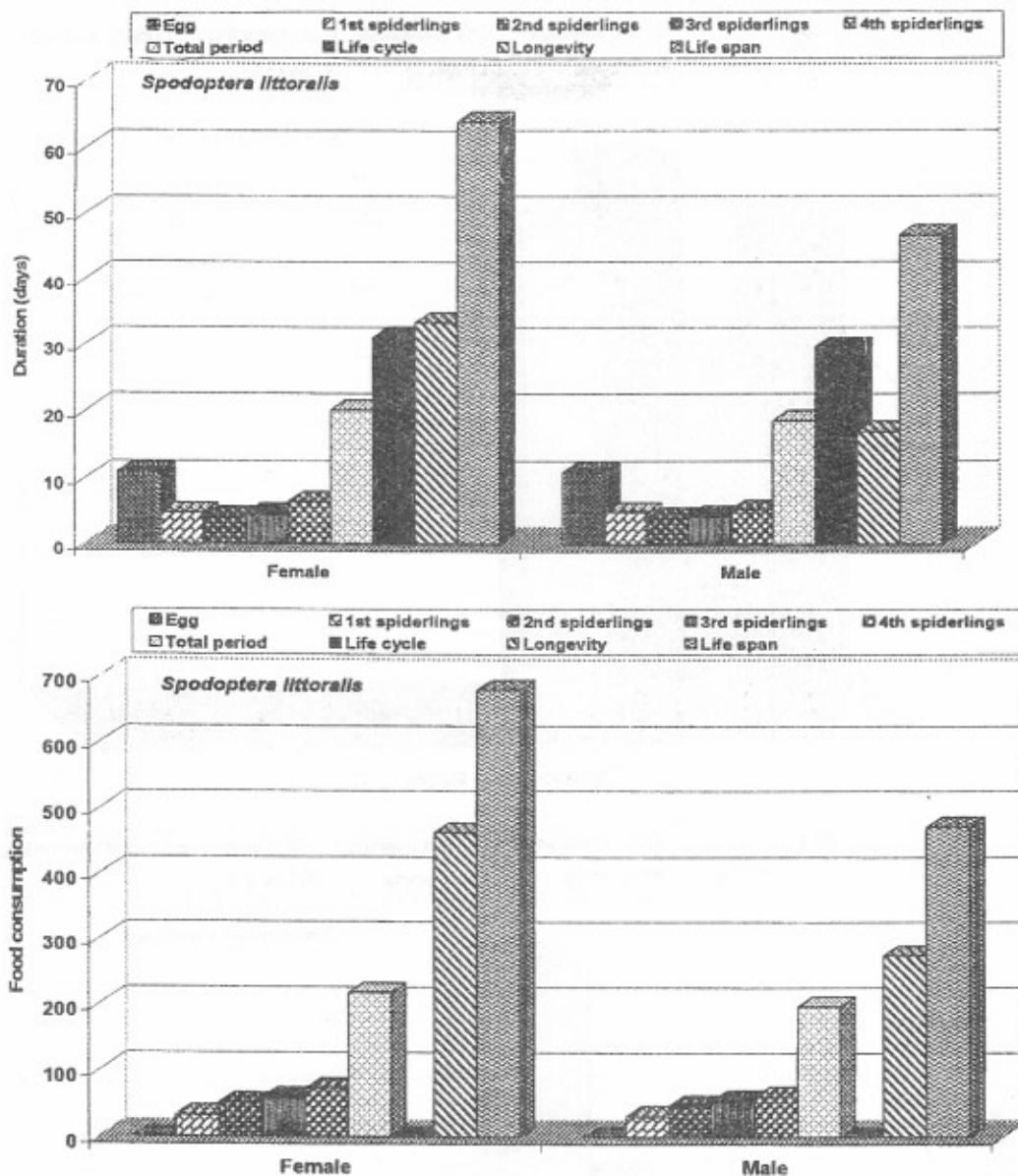


Fig. (3): Duration and prey consumption of the spider, *Enoplognatha ovata* when fed on the 1st instar larvae of *Spodoptera littoralis* (Boisd.).

Food consumption:

Data presented in Tables (1 & 2) showed that 1st, 2nd, 3rd, and 4th spiderlings of the spider *E. ovata* female and male fed on (54.4&51.2), (57.4&56.4), (70.9&59.4) and (71.6&67.6). Individual of the 1st instar larvae of cotton leafworm, *S. littoralis* at 25°C, while at 30°C, they consumed (33.4&32.1), (51.8 & 48.4), (59.7&55.3) and (72.8&61.6) individuals at the same pattern. The above mentioned data revealed that, male spiderlings relatively consumed lower numbers than female spiderlings with a total of 217.7 for female and 197.4 for male.

During female longevity, it could be observed (398.6&463.6) individuals, at 25 and 30°C, while male adulthood consumed (309.5 & 275.0) individuals of 1st instar larvae of cotton leafworm at the same trend. Finally, it can be concluded that female was the highest efficiency than male of feeding on the 1st instar larvae of cotton leafworm, *S. littoralis* Tables (1&2) and Fig. (3). These results agree with those obtained by El-Erksousy *et al.* (2006) they found that female and male of the spider *S. triangulosa* consumed 221.9 and 183.8 of *S. littoralis* larvae during adult stages.

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دراسة معملية على العنكبوت الناسج *Enoplognatha ovata* كأحد عناصر مكافحة البيولوجية

عيلة عبد الوهاب إبراهيم ، سهير إبراهيم عبد الرحمن

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي -جيزة- مصر

تعتبر العناكب الحقيقية من أهم العناصر الحيوية التي تلعب دوراً هاماً في خفض تعداد الآفات الحشرية والحيوانية التي تصيب معظم المحاصيل مسببة لها أضراراً بالغة فقد استهدف هذا البحث إلقاء الضوء على التطور والكفاءة الإفتراضية للعنكبوت *Enoplognatha ovata* من عائلة Theridiidae عند تغذيته على الإنث البالغة لأكاروس العنكبوت الأحمر *Tetranychus urticae* حيث لم يكمل دورة حياته وكانت فترة الحضانة ١٥ يوم على درجة حرارة ٢٥±٢م وكانت فترة العمر الأول والثاني والثالث ١٠،٩٠ ، ١٧،٠٠ ، ١٥،٠٠ يوماً على التوالي حيث استهلكوا ٧٩،٠٠ ، ١٥٨،٣٦ ، ٢٨٥،٠٠ فريسة على التوالي كما أكمل ٢٥% من الأفراد الطور الثالث فقط.

أما بالنسبة للتطور والكفاءة الإفتراضية للعنكبوت *E. ovata* عند التغذية على العمر اليرقي الأول لدودة ورق القطن (*Spodoptera littoralis* (Boisd.) كانت النتائج كالآتي:

١. بلغت فترة الحضانة لكلا الجنسين الذكر والأنثي ١٥ يوم عند ٢٥م ، ١١ يوم عند ٣٠م في حين أن الذكر والأنثي مر خلال أربعة أطوار عنكبوتية (أطوار غير كاملة) ٣٤،٨ و ٣٢،٤ يوماً عند ٢٥م و ٢٠،٢٠ و ١٨،٧٠ يوماً عند ٣٠م لكل من الأنثي والذكر على الترتيب.
٢. استغرقت فترة الأنثي البالغة ٤١،٦ ، ٣٣،٤ يوماً عند ٢٥م ، ٣٠م بينما كانت مرحلة الذكر البالغ ٣٤،٨ ، ١٧،١ يوماً على نفس الترتيب. كما أن الكفاءة الإفتراضية للحيوان عند درجة ٣٠م أعلى منها عند ٢٥م.
٣. من النتائج السابقة يجب تربية هذا النوع على العمر اليرقي الأول لدودة ورق القطن حيث يعتبر فريسة مناسبة له على درجة حرارة ٣٠م وذلك لأن دورة حياته أسرع ويتغذى على كمية أكبر من اليرقات. وبذلك يمكن إكثار هذا النوع بأعداد كبيرة لإطلاقه وهي طريقة فعالة من طرق مكافحة الحيوية.