

## INFLUENCE OF DIFFERENT PHOTOPERIODS ON SOME BIOLOGICAL ASPECTS OF THE TRUE SPIDER *Steatoda triangulosa* (WALCK.)

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### ABSTRACT

The true spider *Steatoda triangulosa* (Walck.) was reared on *Spodoptera littoralis* larvae under different four photoperiods 1, 8, 16 and 24 hours at  $25 \pm 1^\circ\text{C}$  and 65 % RH. The shortest incubation period was 11.24 days and ranged between 8-12 days with 1 hour photo period, the longest period was 14.22 and ranged between 13-16 days with 8 hours photo period. The highest rate of egg hatching was 97.8 % occurred with 24 hours photo period and the lowest was 94.4 % with 8 hours. For the total duration of immature stage, the total immatures period of females was longer than that of males. The longest period of males occurred with 1 hour. Photo period with an average of 82.4 days and the shortest period observed with 16 hours photo period with an average of 50 days. For females, the longest period was 89.7 days with 1 hour. and the shortest was 56.0 days with 16 hours photo period. For longevity, female longevity was longer than that of male. The longest periods of pre-oviposition, oviposition and post-oviposition were obtained on 16 hours with an average of 14.4, 58.43 and 40.2 days, respectively. For fecundity, the highest fecundity occurred with 16 hours, followed by 8, 24 and 1 hour, respectively.

Female deposited the highest number of oothecae with an average of 6.4 / female correlated with the highest number of eggs with an average of 106.24 eggs/female with 16 hours. On the other hand, the lowest number of oothecae 3.2 oothecae / female correlated with the lowest number of eggs laid 41.12 eggs occurred with 1 hour photo period.

**Keywords :** True spider, *Steatoda triangulosa*, Photoperiod, Biological aspects.

### INTRODUCTION

True spiders are arachnids and considered one of the most important pest predators, feeding mainly on other arthropods especially insects. (Sobhy and Negm, 1979, Breen *et al.* 1993, Nyffeler *et al.* 1994, Kamal *et al.* 1995, Asin and Pons 1996 and Sherif *et al.* 2002. *Steatoda triangulosa* (Walck.) is a predominant species on different crops at Fayoum governorate (Rahil, 1988 & 2001 and Mahmoud, 2004) and the biological aspects was studied under different temperatures and relative humidities..

No previous investigations studied the effect of photoperiods on the biology of the true spiders. Therefore, the present study is an attempt to throw some lights on some biological aspects of *S. triangulosa* under different photoperiods. Parameters includes incubation period, egg hatchability, durations of spiderlings, longevity of adults as well as fecundity.

### MATERIALS AND METHODS

#### Rearing of *Spodoptera littoralis* Poisd. :

Egg patches were collected from cotton fields and culture maintained on castor bean leaves in glass jars, (20 cm. diameter X 15 cm. height) such jars were covered with muslin held in position by rubber bands until egg hatch.

The jars were daily cleaned and fresh food was provided for larvae until pupation. The pupae were collected and placed in glass chimnies until adult emergence and provided with pieces of cotton soaked in 10% sugar solution as adult nourishment and with leaves of diafla, *Nerium oleander* Poir. as oviposition sites. From such culture, 3<sup>rd</sup> and 4<sup>th</sup> instar larvae were obtained.

**Rearing of spiders :**

A stock culture of the spider *Steatoda triangulosa* was maintained in incubator at  $25 \pm 1^{\circ}\text{C}$  and 65 % RH. This culture originated from adults collected from maize fields at Fayoum goveromate. Adults were singly placed in. Petri-dishes 8 cm. in diameter with surplus of *Spodoptera littoralis* larvae (3<sup>rd</sup> and 4<sup>th</sup> instars ). Some collected females were deposited after few days and others were collected with egg sacs . After emergence, spiderlings were singly reared in Petri-dishes at the above mentioned condition.

Individuals divided into 4 groups (each group include 15 males and 15 females) observations were noticed daily for a complete laboratory life span in order to obtain data on hatchability, durations of immature stages of males and females and fecundity of females under different four photoperiods 1, 8 , 16 and 24 hours.

## **RESULTS AND DISCUSSION**

### **1-Incubation period and hatchability : ( Table 1)**

The shortest period of incubation period was 11.24 days, obtained with exposure to one hour photoperiod and ranged between 8-12 days. The longest period, 14.22 was obtained with 8 hours photoperiod and ranged between 13-16 days. With exposure to 16 and 24 hours photoperiod , these periods were 12.58 and 13.08 days ranged between 11-13 and 12-14 days, respectively. However, these differences were insignificant except between 1 and 8 hours. The highest rate of egg hatching percentage was 97.8 % occurred with 24 hours photoperiod and the lowest was 94.4 with 8 hours photoperiod. With one and 16 hour photoperiods, these periods were 95.7 and 96.4% ,respectively. Insignificantly differences between these periods were evident .

### **2- Number of molts :**

From 60 females observed from hatchability to reach adulthood and divided into four groups . The spiderlings which exposed to 1 hour photoperiod passed through 5-6 molts, while with 8 hours all individuals reach to adults after 5 molts.

With 16 and 24 hours photoperiod , the number of molts varied from 4-5 molts. In the first case, 20 % matured after four molts and 80 % matured after 5 molts , while in the second case 33.3 % matured after 4 molts 66.7 % matured after 5 molts.

From 60 males in 4 groups, spiderlings which exposed to 1 hour photoperiod, passed through 5-6 molts 60 % matured after 5 molts and 40 % matured after 6 molts. Individuals which exposed to 8 hours photoperiod, passed through 4-5 molts he number of molts varied from 4-5 times. 26.7 % matured after 5 molts and 73.3 % after 4 molts, while all spiderlings which exposed to 16 and 24 hours reach to adults after 4 molts only .

**3- Duration of spiderlings : (Table 2 & Table 3)**

**With 1 hour photoperiod :**

From 15 females observed to maturity. The shortest period 6.2 days was observed for 1<sup>st</sup> instar ranging between 6-7 days and the longest period 19.9 days was observed for 3<sup>rd</sup> instar , ranging between 17-26 days. The second , 4<sup>th</sup> , 5<sup>th</sup> and 6<sup>th</sup> instars averaged 15.9, 12.9, 17.8 and 17.8 days and ranging between 9-22, 8-22, 9-22, and 9-23 days, respectively .

For males , the shortest period 6.4 days was observed for the 1<sup>st</sup> instar ranging between 6-7 days and the longest period 17.8 days was observed in 2<sup>nd</sup> instar , ranging between 9-22 days. The third , 4<sup>th</sup> , 5<sup>th</sup> and 6<sup>th</sup> averaged 16.2 , 17, 14 and 11 days and ranging between 10-27 , 12-18, 10-21 and 8-17 days, respectively

**With 8 hours photoperiod :**

The shortest period of females 10.8 days was observed in 4<sup>th</sup> instar ranging between 7-13 days and the longest period 19.8 days was observed in 5<sup>th</sup> instar ranging between 18-21 days. The first, 2<sup>nd</sup> and 3<sup>rd</sup> instars averaged 12.2 , 14.3 and 13.2 days and ranging between 12-13, 11-16 and 8-18 days, respectively .

For males, the shortest period 9.9 days was observed in 4<sup>th</sup> instar and ranging between 8-12 days and the longest period 15.7 days was observed in 5<sup>th</sup> instars, ranging betwn 7-20 days . The first, 2<sup>nd</sup> and 3<sup>rd</sup> instars averaged 12.0, 15.0 and 13.1days, ranging between 9-14 , 11-18 and 8-16 days, respectively .

**With 16 hours photoperiod :**

The shortest period of females 9.4 days was observed in 3<sup>rd</sup> instar ranging between 5-13 days and the longest period 14.3 days was observed in 5<sup>th</sup> instar , ranging between 11-21 days. The first, 2<sup>nd</sup> and 4<sup>th</sup> instars averaged 9.5, 11.9 and 10.9 days and ranging between 8-13 , 10-16 and 10-12 days, respectively .

The shortest period of males was 10.9 days and ranging between 8-13 days and the longest 14.3 (11-17) in 4<sup>th</sup> instar .Semilar periods were observed for 2<sup>nd</sup> and 3<sup>rd</sup> instars with an average of 12.4 days.

**With 24 hours photoperiod :**

For females, the shortest period 7.0 days was observed for the 1<sup>st</sup> instar ranging between 5-8 days and the longest period 13.8 days was observed in 3<sup>rd</sup> instar , ranging between 10-18 days. The second, 4<sup>th</sup> and 5<sup>th</sup> instars averaged 13.5, 11.0 and 13.4 days and ranging between 10-21, 9-15 and 8-17 days, respectively .

For males , the shortest period 7.0 was observed in the 1<sup>st</sup> instar and ranging between 4-8 days and the longest was 16.6 (10-25) in 3<sup>rd</sup> instar. The second and 4<sup>th</sup> instars averaged were 12.3 and 15.4 days and ranging between 7-20 and 14-18 days, respectively .

**Total immatures :**

In general , the total immatures period of females was longer than that of males. For the total duration of immature stage, the longest period of males occurred with one hour photoperiod with an average of 82.4 days and ranging 69 and 97 days. and the shortest period observed with 16 hour photoperiod with an average of 50 days and ranging 39 and 61 days. The

total immatures average were 65.7 and 51.3 days when exposed to 8 and 24 hours photoperiods, respectively. A significant differences were evident except between immature stages which exposed to 16 and 24 hours .

For females, the longest period was 89.7 days obtained with one hour photoperiod and the shortest was 56.0 days obtained with 16 hour photoperiod. Durations were 70.3 and 57.4 days with 8 and 24 hours, respectively. A significant differences were evident except between immature stages which exposed to 16 and 24 hours .

**Adults :**

**A) Females : ( Table 4 )**

**1- Longevity :**

Females lived longer than that for males and also affected by different photoperiods . The longest period occurred with exposed to 16 hours with an average of 113.0 days compared with 86.6, 108.4 and 85.2 days when exposed to 1 , 8 and 24 hours photoperiod, respectively.

**a) Pre-oviposition period :**

The longest period was obtained for 16 hours. This period shortened to record 11.57, 12.4 and 13 days when females exposed to 1, 8 and 24 hours, respectively .

**b) Oviposition period:**

This period was the longest with exposed to 16 hours photoperiod with an average of 58.43 days. The shortest period was 44.17 days with 24 hours photoperiod , while the periods 48.57 and 57.80 days were obtained with exposure to one and 8 hour photoperiod, respectively.

**c) Post-oviposition period:**

The same trend was observed, the longest period was obtained with exposed to 16 hours photoperiod 40.2 days . The shortest period was 26.42 with one hour photoperiod. With 8 and 16 hour, these periods were 38.2 days and 28 days, respectively .

**2- Fecundity : ( Table 1 )**

Data revealed that female fecundity was affected by different photoperiods . The highest fecundity was occurred with 16 hours followed by 8, 24 and one hour, respectively . Female deposited the highest number of oothecae with an average of 6.4 / female and correlated with the highest number of eggs with an average of 106.24 eggs / female with 16 hours . On the other hand , the lowest number of oothecae with an average of 3.2 oothecae /female and the lowest number of eggs laid 41.12 occurred with one hour photoperiod . The mean number of oothecae was 5 and 4.17 and the number of eggs laid / female were 81.4 and 63.72 with 8 and 24 hours, respectively .

**B) Males**

**1- Longevity : (Table 4)**

The longest period was 107.1 days obtained with 16 hours and the shortest period was 74.9 days obtained with 24 hours. With 1 and 8 hours these periods were 77.3 and 98.6 days, respectively.

Table 1: Effect of different photo periods on some biological aspects of *Steatoda triangulosa*.

Photoperiod	Range	No. oothecae	No. eggs/oothecae	% hatchability	Incubation period
1 Hour		5.7 ± 0.68	16.25 ± 0.69	95.7 ± 2.29	11.24 ± 0.60
	R	3-8	14-18	85-100	8-12
8 Hours		5.0 ± 0.32	17.18 ± 1.32	94.4 ± 3.30	14.22 ± 0.59
	R	4-6	13-20	82-100	13-16
16 Hours		6.4 ± 0.30	16.60 ± 1.06	96.4 ± 1.31	12.58 ± 1.30
	R	5-7	13-22	89-98	11-13
24 Hours		4.17 ± 0.48	15.28 ± 0.65	97.8 ± 3.06	13.08 ± 0.30
	R	3-6	13-17	81-100	12-14
LSD		1.48	4.02	7.36	2.41

Table 2: Effect of different photo periods on duration of spiderlings of *Steatoda triangulosa* females.

Photoperiod	Range	Immature stages						Total
		Duration in days (Instars)						
		I	II	III	IV	V	VI	
1 Hour		6.2 ± 0.16	15.9 ± 1.67	19.9 ± 1.66	12.9 ± 2.06	17.8 ± 1.59	17.8 ± 1.50	89.7 ± 4.1
	R	6-7	9-22	17-26	8-22	9-22	9-23	69-107
8 Hours		12.2 ± 0.17	14.3 ± 0.05	13.2 ± 1.51	10.8 ± 0.91	19.8 ± 2.56	-----	70.3 ± 2.5
	R	12-13	11-16	8-18	7-13	12-29	-----	51-83
16 Hours		9.5 ± 0.78	11.9 ± 0.91	9.4 ± 1.31	10.9 ± 1.61	14.3 ± 1.45	-----	56.0 ± 3.1
	R	8-13	10-16	5-13	6-17	11-21	-----	46-73
24 Hours		7.0 ± 0.35	13.5 ± 1.96	13.5 ± 1.13	11.0 ± 1.10	13.4 ± 2.13	-----	57.4 ± 2.6
	R	5-8	10-21	10-18	9-15	8-17	-----	43-65
LSD								9.14

Table 3 : Effect of different photo periods on duration of spiderlings of *Steatoda triangulosa* males.

Photoperiod	Range	Immature stages						Total
		Duration in days ( Instars )						
		I	II	III	IV	V	VI	
1 Hour		6.4 ± 0.20	17.8 ± 2.26	16.2 ± 2.50	17.0 ± 0.85	14.4 ± 0.69	11.0 ± 0.76	82.4 ± 1.3
	R	6-7	9-22	10-27	12-18	10-21	8-17	69-97
8 Hours		12.0 ± 0.20	15.0 ± 0.81	13.1 ± 1.13	9.9 ± 0.72	15.7 ± 1.1	----- -----	65.7 ± 0.93
	R	9-14	11-18	8-16	8-12	7-20	-----	58-81
16 Hours		10.9 ± 0.86	12.4 ± 1.57	12.4 ± 1.02	14.3 ± 0.94	----- -----	----- -----	50.0 ± 0.85
	R	8-13	6-16	10-17	11-17	-----	-----	39-61
24 Hours		7.0 ± 0.35	12.3 ± 1.87	16.6 ± 2.80	15.4 ± 0.68	----- -----	----- -----	51.3 ± 0.56
	R	5-8	7-20	10-25	14-18	-----	-----	40-63
LSD								10.18

Table 4: Effect of different photo periods on adults of *Steatoda triangulosa*.

Photoperiod	Range	Pre-oviposition	oviposition	Post-oviposition	Longevity	
					Female	Male
1 Hour		11.57 ± 0.91	48.57 ± 1.30	26.42 ± 0.70	86.57 ± 0.90	77.3 ± 1.00
	R	10-14	35-61	18-32	75-98	63-98
8 Hours		12.40 ± 0.75	57.8 ± 0.46	38.20 ± 0.50	108.48 ± 1.2	98.6 ± 1.96
	R	10-15	45-67	32-45	95-130	79-110
16 Hours		14.40 ± 0.39	58.43 ± 0.71	40.20 ± 0.90	113.03 ± 2.9	107.1 ± 2.6
	R	12-17	46-64	36-47	91-120	91-120
24 Hours		13.00 ± 0.34	44.17 ± 0.50	28.00 ± 0.31	85.17 ± 1.1	74.9 ± 1.9
	R	11-15	26-58	23-35	83-94	64-81
LSD		2.09	10.56	6.53	9.35	10.50

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## تأثير فترات الإضاءة المختلفة على بعض المظاهر البيولوجية للعنكبوت الحقيقي

### ستيتودا ترائ أنجيلوزا

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تعد العناكب الحقيقية من أهم المفترسات الحيوانية المنتشرة في الطبيعة والتي تتغذى على العديد من مفصليات الأرجل وبخاصة الحشرات . ونظرا لانتشار هذا النوع من العناكب *Steatoda triangulosa* فقد اهتمت بعض الأبحاث بدراسة بعض العوامل المؤثرة على بيولوجية هذا النوع مثل الحرارة والرطوبة النسبية وقد اهتم هذا البحث بدراسة عامل آخر وهو عامل الإضاءة حيث تم تربية هذا النوع على يرقانات دودة ورق القطن تحت تأثير أربع فترات اضاءة مختلفة وقد أوضحت النتائج مايلي :-

أطول فترة حضانة للبيض هو ١٤,٢ يوما وذلك تحت تأثير فترة اضاءة ٨ ساعات أما متوسط أقصر فترة حضانة هو ١١,٢ يوما وذلك تحت تأثير فترة اضاءة ١ ساعة . أما أعلى متوسط لنسبة الفقس فكان ٩٧,٨% تحت تأثير ٢٤ ساعة اضاءة وأقلها ٩٤,٤% تحت تأثير ٨ ساعات اضاءة .

أما بالنسبة لفترة حياة الأطوار غير الكاملة فكان أعلى متوسط للذكور هو ٨٢,٤ يوما تحت تأثير ١ ساعة اضاءة وأقلها ٥٠ يوما تحت تأثير ١٦ ساعة اضاءة أما بالنسبة للإناث فكان أعلى متوسط هو ٨٩,٧ يوما تحت تأثير ١ ساعة اضاءة وأقلها فترة ٥٦ يوما تحت تأثير ١٦ ساعة . وقد وجد بصفة عامة أن فترة الحياة غير الكاملة للإناث أطول منها للذكور.

أما بالنسبة لفترة ما قبل وضع البيض كان أعلى متوسط هو ١٤,٤ يوما تحت تأثير ١٦ ساعة اضاءة وأقلها ١١,٥٧ يوما تحت تأثير ١ ساعة اضاءة . وأعلى متوسط لفترة وضع البيض كان ٥٨,٤٣ يوما تحت تأثير ١٦ ساعة اضاءة وأقلها ٤٤,١٧ يوما تحت تأثير ٢٤ ساعة اضاءة . وأعلى متوسط لفترة ما بعد وضع البيض كان ٤٠,٢٠ يوما تحت تأثير ١٦ ساعة اضاءة وأقلها ٢٦,٤٢ تحت تأثير ١ ساعة اضاءة .