

**Biology of the Theridiid Spider *Steatoda Paykulliana* (Walckamaer) When Fed on 1<sup>st</sup> Larvae Instar of Cotton Leaf Worm *Spodoptera Littoralis* (Boisd.)****Amal Ebrahim Abo-Zaed***Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza, Egypt***ABSTRACT**

The predacious spider, *Steatoda paykulliana* (Walckamaer) was reared on 1<sup>st</sup> larvae instar of the cotton leaf worm *Spodoptera littoralis* (Boisd) as a prey. The biological aspects of this spider were summarized as follows: Feeding behavior, spiderlings, adulthood duration, food consumption, mating, life cycle and life span. In addition to pre-oviposition, oviposition and post-oviposition periods, number of eggs/sac/female and total number of eggs/sac of the spider female were also estimated. The obtained results indicated that the number of spiderling for females and males was 5 different spiderlings and the durations of these spiderlings in case of female were longer than that obtained in males as well as adult longevity. Also, females spiderlings food consumption was more than males as well as adult longevity. During the oviposition period of adult female of *S. paykulliana*, the female deposited one egg sac/ female which contained about 65.2 eggs.

**Key words:** Spider, theridiid, *Steatoda paykulliana*, cotton leaf worm.

**Introduction**

Spiders are highly adaptable in nature and are known to have a rich diversity and varied behavior. Theridiidae (Sundevall, 1833) includes almost 2000 known species from the world. *Steatoda* belongs to the Family Theridiidae. *Steatoda* is also known as “The False Widow Spider” because of its slight resemblance to *Latrodectus* “The Black Widow Spider” (Gilbert and William, 2010, Eberhard *et al.*, 2008). *Steatoda* is a key species of food web and regulates population of insects also being food for Birds (Maelfait and Hendrickx, 1998). Most spiders are polyphagous and feed on a variety of available prey (Nyffeler *et al.*, 1994). Predation is not limited to adult insects only, but includes the egg and larval or nymphal stages as well (Whitcomb 1974; Nyffeler *et al.*, 1990). Spiders play an important role in biological control, not only through direct killing of prey, but also through indirect effects such as triggering cessation of feeding on the host plant and superfluous killing, i.e. prey dropping from the host plant to escape spiders and as a consequence die of starvation or are captured by other soil-dwelling predators (Riechert 1999). In Israel, wandering spiders have been observed to cause a disturbance effect in apple (*Malus domestica* Baumg.) orchards while wandering around and a larval mortality of about 30 % in Egyptian leaf worm (*Spodoptera littoralis* (Boisduval)), was attributed to this effect (Mansour *et al.*, 1980). Prey specialists, i.e. spiders with a narrow feeding niche in a particular environment, tend to specialise on abundant prey species (Nyffeler and Sterling 1994; Riechert 1999), while prey generalists such as *Cheiracanthium* spp. (Miturgidae) in south African cotton (Dippenaar-Schoeman *et al.*, 1999) and *Oxyopes salticus* Hentz (Oxyopidae) in Texas cotton (Nyffeler and Sterling 1994) can switch their diets to feed on the most abundant species, thus playing an important role in biological control. A laboratory study conducted by Samu and Bíró (1993) indicated that *Pardosa hortensis* Thorell (Lycosidae) could also play a role in controlling agricultural pests in a density-sensitive way. Therefore, this study aimed to study the biological aspects of the predacious spider *Steatoda paykulliana* (Walckamaer) when feeding on 1<sup>st</sup> larvae instar of cotton leaf worm *Spodoptera littoralis* (Boisd.) under laboratory conditions.

**Materials and Methods***A- Rearing technique:**1- Steatoda paykulliana as a predator:*

The individuals of *Steatoda paykulliana* (Walckamaer) were obtained from the date palm in Beni Suief Governorate by means of sweeping which were collected from plants. The spider adults identified in the laboratory. Adult females and males were confined together in a test tube (20 cm long and 0.5 cm in diameter) and closed with a cotton pad. The female spider was observed daily until laying the egg sac and immature emergence. Each spiderling was isolated separately in a test tube with a sufficient number of prey individuals. Thirty predator individuals (spiderlings) were noticed until reaching the adult stage. Numbers of prey

individuals (1 st larvae instar of *Spodoptera littoralis*) were counted for each stage of *S. paykulliana* males and females.

#### 2- Cotton leaf worm as a prey:

A laboratory strain of cotton leaf worm *S. littoralis* was reared in the Cotton Leaf Worm Department, Plant Protection Research Institute, Agricultural Research Center. The insect stages were reared for many successive generations. Groups of freshly emerged moths (5 pairs) were confined in glass chimney cages (17 cm high and 7-12 cm in diameter) covered with screening mesh kept in position by rubber bands according to El-Erksousy and Amer (2007). Cages were provided with a piece of cotton soaked in 10 % sugar solution for adult nutrition, the adult female deposited eggs through the screening mesh, one piece of paper placed over and under the cages in open Petri-dish that served as an oviposition site. The experiment was maintained at  $26\pm 1^{\circ}\text{C}$  and 60-70 % R.H. and cages were examined daily for collecting paper containing eggs. The eggs were kept in glass tubes 13.5 x 1.5 cm until hatching. The newly hatched larvae reared on Castor Oil leaves (*Ricinus communis* L.) in glass jar 20 cm diameter 15cm height. The leaves were previously washed and sterilized with formaline 0.5%. Such jars were covered with muslin held in position by rubber bands the jars were daily examined, cleaned and food was changed. The larvae were left until pupation. Pupae were separated and kept in rearing vials and plugged with absorbent cotton until moths emergence.

#### B- Biological aspects:

*S. paykulliana* different biological aspects were studied as follows: feeding behavior, spiderling duration (days), food consumption (prey/one spider/day), mating, life cycle, longevity and life span of spider females and males. Also, the pre-oviposition, oviposition and post-oviposition periods (in days), number of egg sac/female and total number of eggs/sac of the spider females were estimated.

### Results and Discussion

#### A- Biological aspects of *S. paykulliana*:

##### 1- Feeding behavior:

The spider, *S. paykulliana* catches their preys between its chelicerae by the help of its first and second pairs of legs, hence it inserts the chelicerae in the prey body to suck the fluid and leave the prey as external cuticle. After feeding on the prey, abdomen becomes inflated and rests for few minutes before searching a newly prey.

##### 2- Spiderlings duration and food consumption:

The spider females and males of *S. paykulliana* have the same number of spiderlings (5 spiderlings). The fifth spiderling was longer in their duration than other spiderlings in both females and males, it averaged 30.86 and 3.34 days, respectively as shown in Table (1) followed by 4th, 3<sup>rd</sup>, 2<sup>nd</sup> and 1<sup>st</sup> spiderlings in both sexes, respectively. As tabulated in Table (1), total immature spiderlings had long duration 78.89 days compared with the males spiderlings 66.36 days. The food consumption of the different spiderlings of *S. paykulliana* when fed on *S. littoralis* increased with spiderlings growth as shown in Table (1). The first stage of both females and males had the least prey consumption than the other spiderlings stages, consumed about 26.16 and 23.0 prey/spiderling/day for female and male, respectively. These values gradually increased depending upon the stage growth. The number of prey/spiderling/ day for the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> spiderlings were 49.24, 63.50, and 73.50, respectively. On the other hand, the fifth spiderling consumed about 324.58 and 304.86 prey/spiderling/day for female and male, respectively, The same table indicated that the females consumed more preys/day than males. The total food consumption of female spiderlings was 324.58 prey/spiderling/day, while that of male was 304.86 prey/spiderling/day.

##### 3- Mating:

The males of *S. paykulliana* was placed in the tube firstly, followed by the females. The females started to become close to male in movement. The male become close to her moving by his forelegs up and down and pedipalps alternatively. The mating behavior passed 23-28 minutes, while the mating process continued for about 3-5 minutes, then the male individual escape away.

#### 4- Female longevity:

The pre-oviposition, oviposition and post-oviposition periods of the *S. paykulliana* female averaged 6.82, 25.28 and 68.5 days, respectively, when fed on the newly emerged larvae of *S. littoralis* and consumed during these periods of about 22.0, 68.8 and 90.22 prey/female/day, respectively, Table (2). The female individuals stopped feeding for about two days after the pre-oviposition period passed and began to web semis, skity (egg sac) by her spinneret and deposited the eggs and covered it by a layer of dense skity webbing.

**Table 1:** Duration of different spiderlings and food consumption of *S. paykulliana* when fed on 1 st larvae instar of *S. littoralis*.

Biological aspects	Duration in days $\pm$ SE		Food consumption (Prey/spiderling/day) $\pm$ SE	
	Female	Male	Female	Male
1 <sup>st</sup> spiderling	5.52 $\pm$ 0.35	3.34 $\pm$ 0.65	26.16 $\pm$ 2.69	23.00 $\pm$ 3.67
2 <sup>nd</sup> spiderling	13.21 $\pm$ 2.5	10.00 $\pm$ 1.67	53.55 $\pm$ 3.69	49.24 $\pm$ 3.54
3 <sup>rd</sup> spiderling	13.65 $\pm$ 1.86	12.31 $\pm$ 1.62	69.25 $\pm$ 5.41	63.50 $\pm$ 6.02
4 <sup>th</sup> spiderling	15.65 $\pm$ 2.17	13.50 $\pm$ 1.29	77.02 $\pm$ 6.14	73.50 $\pm$ 5.36
5 <sup>th</sup> spiderling	30.86 $\pm$ 4.65	27.21 $\pm$ 3.68	98.60 $\pm$ 7.22	95.62 $\pm$ 6.13
Total spiderlings	78.89 $\pm$ 6.25	66.36 $\pm$ 5.69	324.58 $\pm$ 12.68	304.86 $\pm$ 16.35
L.S.D. at 0.05	4.236	3.657	4.256	3.998
P	0.0002***	0.000***	0.0003***	0.0006***

SE. = Standard error

L.S.D. = Least significant difference

#### 5- Eggs:

The spider *S. paykulliana* deposited one egg sac/female only, each egg sac contained an average of 65.2 eggs as shown in Table (2)

#### 5- Longevity, life cycle and life span:

Data in Table (3) showed that the spider *S. paykulliana* female longevity was significantly longer than that of male individuals (92.5 and 80.0 days), respectively, the spider consumed in this period about 184.5 and 178.8 prey/spider, respectively. On the other hand, during the period of life cycle of the tested spider, this period lasted about 79.5 and 77.5 days and consumed about 286.42 and 277.52 prey/spider for female and male spiders, respectively. However, the female and male spider consumed about 328.9 and 304.62 prey/spider during the life span of female and male which durated about 163.0 and 155.4 days, respectively, Table (3).

Generally, the spider *S. paykulliana* was considered one of the main biocontrol agents to control newly hatched larvae of the cotton leaf worm, *S. littoralis*.

Similar results were observed by El-Erksousy and Amer (2007) when reared the spider *Steatoda triangulosa* (Walckenaer) in Egypt when fed on the newly hatched larvae of the pink bollworm *Pectinophora gossypiella* (Saund.) as a prey and concluded that the spiderlings duration of the female individuals was longer than males as well as adult longevity. Also, females spiderlings food consumption was more than males. However, the obtained results were differed in case the number of deposited egg sacs, where, they noticed that the number of egg /sacs of *S. triangulosa* was 6.3 and each sac contained about 31.1 eggs.

**Table 2:** Longevity and fecundity of *S. paykulliana* fed on the cotton leaf worm *S. littoralis*.

Biological aspects	Duration in days $\pm$ SE	Food consumption (prey/spider $\pm$ /day) $\pm$ SE
Pre-oviposition (days)	6.82 $\pm$ 0.68	22.0 $\pm$ 3.45
Oviposition (days)	25.28 $\pm$ 2.25	67.8 $\pm$ 5.26
Post-oviposition (days)	68.5 $\pm$ 4.65	90.22 $\pm$ 6.27
Number of eggs sac/female	1.0 $\pm$ 0.0	-
Total number of eggs/sac	65.2 $\pm$ 6.4	-

**Table 3:** Some biological aspects of *S. paykulliana* fed on the cotton leaf worm *S. littoralis*.

Biological aspects	Duration in days $\pm$ SE		Food consumption (prey/spider)	
	Female	Male	Female	Male
Adult longevity	92.5 $\pm$ 5.26	80.0 $\pm$ 4.65	184.5 $\pm$ 6.59	178.8 $\pm$ 5.54
Life cycle	79.5 $\pm$ 4.69	77.5 $\pm$ 4.02	286.42 $\pm$ 8.46	277.52 $\pm$ 6.85
Life span	163.0 $\pm$ 6.54	155.4 $\pm$ 7.25	328.9 $\pm$ 7.61	304.62 $\pm$ 8.94

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