

BIOLOGY AND PREDATION EFFICIENCY OF THE SPIDER SPECIES *STEATODA ALBOMACULATA* (DE GEER, 1778) (ARANEIDA: THERIDIIDAE) FEEDING ON THE THREE DIFFERENT PREYS

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Abstract

The spider *Steatoda albomaculata* (De Geer) was reared on three different types of prey i.e. motile stages of the two spotted spider mite, *Tetranychus urticae* Koch, the cotton aphid, *Aphis gossypii* (Glover) and first and second larval instars of the cotton leafworm, *Spodoptera littoralis* (Boisd.). Incubation period averaged 10 days for both male and female. They pass through three spiderlings before reaching adult. The life cycle averaged (48.4&36.8), (39.8&33.7) and (33.1&27.1) days for female and male when fed on the three above mentioned prey, respectively at $27\pm 2^{\circ}\text{C}$ and $70\pm 5\% \text{R.H.}$ Female oviposition period durated 15.9, 14.7 and 12.7 days and the deposited egg sacs averaged 2.8, 3.2 and 3.1 when fed on *T. urticae*, *A. gossypii* and *S. littoralis*, respectively. Total number of prey consumed averaged 329.7 & 344.6, 191.5&295.0 and 194.9&293.0 of the aforementioned prey individuals for spider female and male, respectively through its life span.

INTRODUCTION

Spiders are cosmopolitan that live in many ecological environments. as predators, they play a considerable role in agroecosystem as biocontrol agents (Levy, 1998).

Members of family Theridiidae are small to medium size. They are usually found hanging upside down in an irregular web suspended on plants or hidden in rock crevices or fissures in soils (Levy, 1998 and El-Erkousy, 2000). Many of them use very fine threads often hard to be noticed unless occasionally glitter in the sun light or covered with dust (Levy and Amitai, 1981).

In Egypt, some species of this family were usually found in different field and truck crops and orchards. Due to its spread and importance El-Erkousy, 2003, El-Erkousy *et al.*, 2006 and Hussein *et al.*, 2003 studied the biology of three species of this family. The present work throw light on biological aspects and predation efficiency of the spider *Steatoda albomaculata* (DE GEER, 1778) as a common species in different localities.

MATERIALS AND METHODES

Rearing technique

S. albomaculata individuals were collected from maize fields in Ismailia governorate by using sweeping or directly from maize plants. Identification took place in the laboratory by helping of stereoscopic binocular using taxonomic key Jones, 1983. Newly emerged adult female and male were confined together in a test tube (20 cm long and 0.5 cm in diameter), closed with cotton pad and supplied daily with prey. The female was noticed daily until laying the egg sac and hatched spiderlings. Each spiderling was isolated separately in a test tube together with surplus numbers of prey individuals and noticed till reaching adult stage.

The three types of prey, moving stages of the two-spotted spider mite, *Tetranychus urticae* Koch, the cotton aphid, *Aphis gossypii* (Glover) and 1st and 2nd larval instars of the cotton leafworm, *Spodoptera littoralis* (Boisd.) were used as food through the life span of the true spider. The numbers of consumed prey individuals were recorded daily and replaced by fresh ones. Behaviour and some biological aspects were also recorded.

Experiment was carried out under laboratory conditions ($27 \pm 2^\circ\text{C}$ and 70 ± 5 R.H.%).

RESULTS AND DISCUSSION

Feeding behavior

When the predator *S. albomaculata* notice the prey, it usually comes close and moves around it for few seconds, then catches it between its chelicerae by the help of the front legs. Embedding its chelicerae in the prey, the predator starts to suck prey contents till leaving it as exuvium. The predator abdomen becomes enlarged and usually rests for few minutes before searching again for another one. No differences in feeding behavior were noticed when spider fed on the three tested prey.

Mating behavior

1- Preparing period

The virgin female stayed for about 5 days as a pre-mating period. The male was firstly placed in the test tube and then followed by the female. The latter started to come close to the male in relative movements for about 2 minutes. The male came close to it, moving his front legs up and down and

pedipalps alternatively. it then touched the tips of the female legs and pidipalps, before the beginning of copulation. Both sexes must pass through the preparing period before copulation occurs. otherwise, the female refuses the male, threatening by its chelicerae to enforce male to move away.

2- Copulation

The male holds the female using its first pair of legs, leg I to hold her leg II, and his leg II to hold her leg III. it then inserts his right palp into the female genital opening. The sperms are transferred in female seminal receptacles. The mating process continued for about 1-2 minutes, then the male escaped away.

Oviposition and incubation period

The gravid female of *S. albomaculata* deposited 2-3 egg sacs during its oviposition period. Each sac contained about 21 eggs. The egg sac is white yellowish measures 2 cm in long and 0.9 cm wide. The incubation period averaged 10.0 days for both male and female.

Development and adult longevity

Each female and male passes through three spiderlings before reaching adult. However, this number differs according to species as *S. triangulosa* (Walkenear) has five spiderlings when fed on the 1st larval stage of the pink bollworm, *Pectinophora gossypiella* (Saund) El-Erksousy and Amer 2007, while *Anelosimus aulicus* (Koch) of the same family (Theridiidae) has five spiderlings when fed on aphids, *Aphis craccivora* (Hussein *et al.*, 2003), *Theridion egyptium* (Koch) has only two spiderlings when fed on the two spotted spider mite *T. urticae* (El-erksousy, 2003). When tested spider feeding on the two spotted spider mite *T. urticae* moving stages, *A. gossypii* and *S. littoralis* 1st and 2nd instar larvae, the average female *S. albomaculata* 1st spiderling durated 8.7, 6.6 and 4.9 days, the 2nd spiderling durated 18.8, 15.9 and 11.3 days and the 3rd spiderling durated 10.9, 7.3 and 6.9 days with total immatures 38.4, 29.8 and 23.1 days, respectively (Table 1). This means that cotton leaf worm accelerated development followed by cotton aphid then the two spotted spider mite. Also the duration of the second spiderling was nearly twice as that of the 1st and 3rd spiderling. Adding 10.0 days incubation period the female life cycle durated 48.4, 39.8 and 33.1 days, respectively (Table 1) Male followed similar trend as female. Female longevity averaged 48.7, 41.7 and 37.3 days (Table 1) when fed on 1st and 2nd instar larvae of *S. littoralis*, *A. gossypii* and moving stages of spider mite *T. urticae*, respectively. Statistical analysis proved that the duration of female life cycle and adult longevity were

significantly shorter when fed on the cotton leaf worm larvae than on the two spotted spider mite.

After pre-oviposition period female stopped feeding about two days and began to web the egg sac by its spinnerets, then laid all eggs in the same day and covered it with a layer of dense silky webs. The spider female laid on average of 2.8, 3.2 and 3.1 egg sacs, each containing average of 21.3, 20.0 and 21.8 eggs, when fed on *T.urticae*, *A.gossypii* and *S.littoralis* respectively (Table 2).

When female of *Anelosimus aulicus* (Koch) of family Theridiidae was feeding on *Aphis*, *Aphis craccivora*, passes through five spiderlings and laid an average of 8.6 egg-sacs (Hussein *et al.*, 2003)

Putman (1967) described the life cycle of *Philodromus praelustris* Keyserling (Family: Philodromidae). Females produced up to 12 egg sacs containing a total of over 299 eggs in insectory, but the later eggs did not hatch.

During the oviposition period, the females deposited 6.3 sac/female, each egg-sac contained about 31.1 eggs, the incubation period was 16 days. The spider females passed life cycle and life span longer than males. Also, the females consumed individuals of prey higher than males during life cycle and life span.

Food consumption

Data presented in Table (3) showed that 1st, 2nd and 3rd spiderlings of the spider *S. albomaculata* female fed on 40.1, 113.9 and 90.7 individuals of *T. urticae* or 31.6, 39.2 and 36.0 individuals of *A. gossypii* or 30.5, 38.3 and 35.0 of 1st instar larvae of *S. littoralis*, respectively. Male spiderlings followed similar trend but with relatively lower numbers of these prey. During adult female longevity, the spider consumed 135, 84.5 and 81.1 individuals of *T. urticae*, *A. gossypii* and *S. littoralis*, respectively, while those averaged 141.6, 81.23 and 78.22 individuals for male, respectively. This proved that the second spiderling fed on the greatest total number of prey due to its longest period.

Finally, it can be concluded that, the spider *S. albomaculata* fed and developed successively on the three tested prey, yet 1st & 2nd instar larvae of the cotton leafworm considered the most suitable prey, as it accelerated predator development, relatively increasing female productivity and predation capacity.

Table 1. Duration of developmental stages of *Steatoda albomaculata* when fed on *Tetranychus urticae*, *Aphis gossypii* and *Spodoptera littoralis* under laboratory condition (27±2°C and 70±5% R.H.).

Spider stages	Sex	Average duration in days		
		<i>T. urticae</i>	<i>A. gossypii</i>	<i>S. littoralis</i>
Incubation period	-	10.0±0.82	10.0±0.82	10.0±0.82
1 st spiderling	♀	8.7±0.48	6.6±0.96	4.9±1.37
	♂	8.3±0.48	6.7±0.94	4.4±1.07
2 nd spiderling	♀	18.8±2.66	15.9±2.99	11.3±2.11
	♂	11.5±0.52	10.4±1.07	7.1±1.20
3 rd spiderling	♀	10.9±1.20	7.3±1.33	6.9±1.66
	♂	7.0±1.20	6.6±0.97	5.6±1.17
Total spiderlings	♀	38.4±4.34	29.8±3.05	23.1±4.09
	♂	26.8±2.2	23.7±1.88	17.1±2.02
Life cycle	♀	48.4±4.34 ^a	39.8±3.08 ^d	33.1±3.90 ^c
	♂	36.8±2.38 ^b	33.7±2.26 ^c	27.1±2.18 ^e
Longevity	♀	48.7±13.82 ^a	41.7±10.15 ^b	37.3±6.47 ^c
	♂	34.4±3.65 ^b	35.1±3.87 ^a	33.2±3.32 ^c
Life span	♀	97.1±15.88	81.5±10.82	70.4±8.60
	♂	71.2±3.30	68.8±2.78	60.3±2.58

LSD_{0.05}

For longevity	♀	1.19
	♂	0.52
For life cycle	♀	7.28
	♂	0.84

Table 2. Longevity and fecundity of *Steatoda albomaculata* female when fed on *Tetranychus urticae*, *Aphis gossypii* and *Spodoptera littoralis* under laboratory condition (27±2°C and 70±5% R.H.).

prey	Average period in days			Fecundity	
	Pre-oviposition	Oviposition	Post-oviposition	No. of egg sacs/female	No. of eggs/sac
<i>T. urticae</i>	13±0.82	15.9±0.88	19.8±2.86	2.8±0.84 ^a	21.3±0.47
<i>A. gossypii</i>	11.6±0.66	14.7±0.78	15.4±3.2	3.2±0.74 ^a	20.0±1.95
<i>S. littoralis</i>	10.4±0.92	12.7±0.9	14.2±2.27	3.1±0.83 ^a	21.8±2.27

LSD_{0.05}

For No. of egg sacs = 0.96

Table 3. Food consumption of *Steatoda albomaculata* when fed on *Tetranychus urticae*, *Aphis gossypii* and *Spodoptera littoralis* stages at 27±2°C and 70±5% R.H.

Spider stages	Sex	No. of devoured prey individuals		
		<i>T. urticae</i>	<i>A. gossypii</i>	<i>S. littoralis</i>
1 st spiderling	♀	40.1 ± 4.9	31.6 ± 4.10	30.5 ± 1.43
	♂	40.7 ± 3.9	30.6 ± 2.11	28.7 ± 1.41
2 nd spiderling	♀	113.9 ± 23.4	39.2 ± 1.6	38.3 ± 1.1
	♂	110.7 ± 23.7	32.5 ± 1.96	30.2 ± 2.52
3 rd spiderling	♀	90.7 ± 20.9	36 ± 1.41	35 ± 1.41
	♂	112.2 ± 21.4	36.6 ± 1.8	29.6 ± 1.8
Total immature	♀	244.7±3.94 ^a	106.8±7.11 ^b	103.8±49.2 ^b
	♂	263.6±5.73 ^a	99.7±5.87 ^b	88.5±49.00 ^c
Longevity	♀	135.00±1.00 ^a	84.5±8.35 ^b	81.1±8.11 ^c
	♂	141.6±1.53 ^a	81.23±5.41 ^b	78.22±4.87 ^c
Life span	♀	329.7±58.9	191.5±11.50	184.9±41.14
	♂	344.6±49.0	295.0±24.29	293.0±20.36

LSD_{0.05}

For Total immature =	♀	5.62
	♂	1.21
For Longevity =	♀	1.73
	♂	1.65

Statistical analysis revealed that, there are non significant difference between the total immature stages which consumed on *A.gossypii* and *S.littoralis* and high significant difference between the previous and which consumed on *T.urticae*. where LSD = 5.62 and 1.21, for female and male, respectively, also highly significant difference for adult longevity in females and males, where LSD = 1.73 and 1.65 respectively, (Table, 3).

El-Erksousy *et al.*, (2003) found that spiders *Theridion egyptium* when fed on *T. urticae* at 26°C and 60-70 R.H.% the life cycle averaged 43.1, 42.1 days for female and male, respectively. Dinter (2004) reared *Erigone atra* (Blackwall) (Araneae: Linyphiidae) within a few days females started to produce egg-sacs. The mean rearing success (from 1 to 2-day-old spiderlings to adults) was 59.3%. After 3-5 weeks most of the spiderlings developed to adults. Within a few days females started to produce egg-sacs.

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النواحي البيولوجية والسلوكية والقدرة الإفتراسية للعنكبوت *STEATODA* *ALBOMACULATA* عند التغذية علي ثلاث فرائس مختلفة

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تعتبر العناكب الحقيقية من أهم الأعداء الحيوية التي تلعب دوراً هاماً في خفض تعداد الأفات الحشرية والحيوانية التي تصيب معظم المحاصيل وتسبب لها أضراراً بالغة كماً ونوعاً مما وجهنا إلى تعظيم دور العناكب الحقيقية في البيئة لذلك أجرى هذا البحث لتربية ودراسة الكفاءة الإفتراسية للنوع *Steatoda albomaculata* من عائلة Theridiidae على ثلاث عوائل هم العنكبوت الأحمر العادى والمن ودودة ورق القطن حيث بلغ متوسط دورة الحياة (٤٨.٤، ٣٦.٨) و (٣٣.٧، ٣٩.٨) و (٣٣.١، ٢٧.١) يوم لكل من الأنثى والذكر علي الترتيب عند التغذية علي العنكبوت الأحمر العادى والمن ودودة ورق القطن. ووصلت فترة وضع البيض للأنثى ١٥.٩، ١٤.٧، ١٢.٧ يوماً علي الثلاث فرائس السابق ذكرها بالترتيب و وضعت الأنثى ٢.٨، ٣.٢، ٣.١ كيس بيض عند التغذية علي العنكبوت والمن ودودة ورق القطن علي الترتيب. كما وصل معدل التغذية الي (٣٤٤.٦، ٣٢٩.٧) فرداً و (١٩١.٥، ٢٩٥.٠) فرداً و (١٩٤.٩، ٢٩٣.٠) فرداً لكل من الأنثى والذكر علي الترتيب عند التغذية علي أفراد العنكبوت والمن ودودة ورق القطن.

مما سبق يجب تعظيم دور هذه المفترسات والتوسع في تربيتها واستخدامها في برامج مكافحة المتكاملة لترشيد استخدام المبيدات وانتاج محصول نظيف صالح للتصدير .