

Biological Aspects of the Theridiid Spider *Theridion Melanostictum* Cambridge (Araneida: Theridiidae) Fed on Different Prey

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ABSTRACT

Theridion melanostictum spider was collected from El-Ameria region, Alexandria governorate in 2016 on citrus plants and reared under laboratory conditions of 25±2°C and 60-70 % R.H. when fed on the cotton leaf worm *Spodoptera littoralis* Bois. and *Gynaikothrips ficorum* (Marchal). Spider males and females passed through four spiderlings of male and five spiderlings for female. The incubation period lasted 12.2 and 15.2 days for female and 12.2 and 15.2 days for males when fed on *S. littoralis* and *G. ficorum*, respectively. During the total immature stages of *T. melanostictum*, the spider durated 59.6 and 38.2 days for female and male spiderlings, respectively when the individuals fed on *S. littoralis* and averaged of 88.6 and 63.0 days in case of feeding on *G. ficorum*, respectively. The life cycle of *T. melanostictum* averaged of 71.8, 50.4, 103.8, 78.2 days for female and male fed on a aforementioned preys, respectively. The spider longevity lasted 59.6, 36.4, 72.2 and 44.4 days for female Longevity and 59.6, 36.4; 72.2, 44.4 days for adult food of males individuals when reared on the some prey mentioned before, respectively. The preoviposition period lasted 13.82 and 15.62 days when females fed on *S. littoralis* and *G. ficorum*, respectively. The total mean number of consumed individuals of *S. littoralis* and *G. ficorum* was 148.0 and 414.8 prey for the total spiderling female, respectively. These values changed to 100.6 and 307.2 preys, respectively. The average number of consumed prey per adult female of *T. melanostictum* was more than those of male, as, the number of prey consumed was 137.0 and 94.0 prey of *S. littoralis* during the feeding of spider female and male, respectively. However, the average number of consumed *G. ficorum* during the life of *T. melanostictum* female was 200.8 prey and 89.0 prey of *G. ficorum* during the feeding of spider males. The mean number of consumed prey was 41.8 and 36.8 individuals of *S. littoralis* and *G. ficorum*, respectively during the pre-oviposition period. The average number of devoured prey was 58.2 and 97.0 prey of both prey during the oviposition period of spider female, respectively, while the spider consumed 37.0 and 68. prey, in case of the post-oviposition period, respectively. It was noticed that the average number of consumed prey per female was more than those of males. Moreover, spider preferred feeding on cotton leaf worm than thrips.

INTRODUCTION

Araneae constitute a large part of predatory fauna of the agro ecosystems. True spiders are one of the most abundance predatory groups in terrestrial ecosystems. Spiders have proved to be beneficial in regulation of agricultural pests and their role as natural enemies has recently been more and more stressed (Ghabbour *et al.*, 1999).and Ghavami, 2006 .They occur with considerable densities in agro-ecosystems in the old land of the Delta and Middle Egypt (Ghabbour and Mikhail, 1993). They fed on insects and small arthropods, and they can play an important role in pest control. All true spiders are considered as biocontrol agents, they attack most of pests infesting crops, vegetables, ornamental and orchard fruit trees (Jeppson *et al.*, 1975; Luczak, 1979; Sunderland, 1999 and Ghavami, 2006). True spiders are carnivorous. where many are specialized as snare builders web true spiders, whereas others hunt their victims (ground true spiders or wandering true spiders).The true spiders may found almost everywhere (Kaston, 1978). Prey preference, forging methods and timing of predation vary between spider species; but seem to be complementary and successful cases of pest suppression have been reported where spider act as multi-species assemblages (Riechert, 1999). True spiders can also control pest populations because they often capture and kill more preys kind than they consume. Members of family Theridiidae are small to medium size. They are usually found hanging inside down in an irregular web suspended on plants or hidden in rock crevices or fissures in soils (Levy, 1998 and ElErksosuy, 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 Amital, 1982). The genus

Theridion Walckenaer had five species till 2006, when another species *T. cairoense*, was added in 2011 by Wunderlich (2011). Finally, Thaler-Knoflacch and El-Hennawy, (2012) described two species to be eight species recorded of this genus in Egypt. So far this study was conducted under laboratory conditions when the true spider *Theridion melanostictum* CAMBRIDGE feeding on *Spodoptera littoralis* and *Gynaikothrips ficorum* under laboratory conditions of 25±2°C and 60-70 % R.H

MATERIALS AND METHODS

For making a pure culture of spiders, several adult females of *T. Melanostictum*, was collected by hand from three hosts In Alexandria Governorate, Egypt. Individuals were transferred to the laboratory and examined directly by using a stereomicroscope. Taxonomical key used for identification (Jones, 1983). It was kept in a small plastic vial of 3 cm diameter x 6 cm height and transferred to the Laboratory, supplied with prey and kept at room temperature and left until deposit their eggs. Newly deposited eggs of *T. melanostictum* were transferred singly from the laboratory cultures to rearing cells. Hatched Larvae were reared on the mentioned prey during its life span. The emerged females were allowed to mate and monitored for oviposition and these adults were observed daily until death. All biological aspects of the developmental stages, fecundity and fertility were estimated according to the Types of prey which were used as food source were calculated at 25±2 °C and 60-70 % R.H.

Rearing of *Spodoptera littoralis*:

Cotton leaf worm, *S. littoralis* was reared in the laboratory using the method of Mostafa (1988). Field-

collected egg batches of *S. littoralis* were cultured on castor bean leaves *Ricinus communis* L., in glass jar, 20 cm diameter by 15 cm high. The leaves were washed and cleaned. The jars were covered with muslin cloth held in position by rubber bands and kept in an incubator at 25±2°C and 60-70 % R.H. The jars were daily examined. Adult moths were confined in glass chimneys as oviposition cages and were provided with *Nerium* leaves (*N. oleander*) as oviposition sites. These oviposition cages were provided with pieces of cotton soaked in 10 % sugar solution for adult nourishment. The obtained cages were recultured as mentioned above. The batches were left until hatch and the different larval instars were taken as introduced prey to the spider. The insect, *Gnycothrips ficorum* was collected daily from the new fresh leaves of *Ficus nitida* Column.

Statistical analysis: One way anova was calculated by using SPSS program. In addition, LSD (Fisher's Significant Difference Test) was chosen to identify the significant difference within group.

RESULTS AND DISCUSSION

Feeding Behavior:

The spider attacked the preys from inter-secutar membrane between head and thorax of *S. littoralis* and then sucked their contents.

Mating behavior

Mating behavior of a couple of male and female, *T. melanostictum* was observed. After inserting female in a glass container, male was introduced to young females. The male then began the courtship process within four minutes. It started rubbing the two pedipalps by each other, then approached more toward her. Pedipalps of male come in contact with female's body that stopped movement and trying to reach her epigynum. After about five minutes, male inserted the left palpal organ about 10 minutes. Then, the male moved away from the female for a few minutes and the male approached again and inserted the right palpal organ in her epigynum for about 10 minutes, then the male left the female and stopped in the other side of the container. These results fed on both *S. littoralis* and *G. ficorum* agreed with Ahmed and Abd El-Maaboud (2014) and Abd El-Azim (2014).

Egg sac.

The egg sac of *T. melanostictum* was spherical in shape, pale white and become dark before hatching; the eggs inside the egg sac were circle, white pale and also become dark before hatching.

Incubation period:

Data in (Table 1) showed that, high significant differences were recorded in incubation periods when the spider individuals fed on *S. littoralis* and *G. ficorum* where they lasted 12.2 and 15.2 days for females and 12.2 and 15.2 days for males, respectively.

Table 1. Durations of the different biological aspects of the spider *Theridion melanostictum* feeding on *Spodoptera littoralis* and *Gynaikothrips ficorum*

Biological aspect	Duration of different staged (Days) ± Standard deviation			
	Females		Males	
	<i>S. littoralis</i>	<i>G. ficorum</i>	<i>S. littoralis</i>	<i>G. ficorum</i> ♂.
Incubation period	12.2±1.6 ^a (11.9-12.8)	15.2±1.2 ^a (14.6-15.9)	12.2±1.4 ^a (12.0-13.6)	15.2±1.2 ^a (14.7-16.0)
1 st spiderling	7.6±1.2 ^a (7.0-8.4)	10.8±1.1 ^a (10.0-11.5)	6.6±0.8 ^a (6.07.0)	(10.0-11.6) ^a
2 nd spiderling	7.6±1.3 ^a (7.0-8.4)	10.8±1.0 ^a (10.4-11.6)	6.6±0.6 ^a (6.0-7.0)	10.8±1.2 ^a (10-12)
3 rd spiderling	18.8±1.8 ^a (18.0-20.0)	23.0±1.7 ^a (22.0-24.0)	16.4±1.7 ^a (15.8-17.9)	21.8±1.4 ^a (20.5-22.5)
4 th spiderling	11.6±1.6 ^a (11.0-13.0)	21.0±1.6 ^a (20.2-22.0)	8.6±0.89 ^a (8.0-9.0)	19.6±1.8 ^a (19-21)
5 th spiderling	14.0±1.5 ^a (13.0-14.7)	23.0±2.0 ^a (21.0-25.0)	-	-
Total	59.6±3.5 ^a (61.5-65.4)	88.6±4.7 ^a (98.2-103.8)	38.2±3.2 ^a (40.1-44.0)	63.0±3.5 ^a (72.1-76.5)
Life cycle	71.8±3.6 ^a (72.6-77.5)	103.8±3.8 ^a (112.2-118.6)	50.4±3.4 ^a (52.4-56.7)	78.2±3.8 ^a (87.1-91.4)
Longevity	59.6±3.0 ^b (57.8-62.4)	72.2±3.2 ^b (70.2-74.3)	36.4±2.4 ^b (34.7-38.1)	44.4±2.7 ^b (42.5-46.3)

a= Significant

b= Not Significant

Spiderling:

The spider passed through four for males and five spiderlings for female. As shown in (Table 1), during the total immature stages of *T. melanostictum*, the spider durated 59.6 and 38.2 days for female and male spiderlings, respectively, while, in case of feeding on *G. ficorum* The duration were 88.6 and 63.0 days for female and male spiderlings, respectively. In addition, the data in table 1 recorded that, high significant differences were recorded between spiderlings duration

when the individuals fed on *S. littoralis* and *G. ficorum*. The life cycle was affected by food type where the statistical analysis showed high significant differences depended on prey species when it averaged 71.8, 50.4 & 103.8 and 78.2 days individuals for female and male of spider, fed on both *S. littoralis* and *G. ficorum*, respectively. On the other hand, no significant differences were recorded in the duration of longevity where the spider lasted 59.6, 36.4; 72.2 and 44.4 days for adult females and males when reared on the both

prey mentioned before, respectively. Data in Table (2) showed that the period between copulation and the first oviposition is 13.82 days and when the female spider fed on *S. littoralis* and *G. ficorum*, respectively. The oviposition period of spider, *T. melanostictum* lasted 26.4 and 34.6 days when fed on *S. littoralis* and *G. ficorum*, respectively, while, these periods shorted to recorded 19.44 and 220.0 days for the same predator on the same prey but during the postoviposition period, Table (2). The female of *T. melanostictum* encloses her eggs in a white globose sac 12-18 mm. long and 11-15 mm. wide, pointed on one side. Each female laid four egg sacs during its oviposition period, Table (2) and probably more. The interval between one egg laying and another depends on the food consumed by the female. Each egg sac contained 23.75 eggs when fed on *S.*

littoralis and 20.75 eggs when fed on *G. ficorum*. Similar results were obtained by Abd El-Azim (2014) who noticed that the total spiderlings of *T. melanostictum* averaged (105.0 and 136.6), (51.1 and 57.5) days for female and male when fed on *Tetranychus urticae* and *S. littoralis*, respectively. On the other hand, the life cycle of *T. aegyptiacum* Fawzy and El-Erksousy (Araneida: Theridiidae) when fed on the third nymphal stage of the cotton aphid, *Aphis gossypii* Glove was investigated under laboratory conditions at 26 C and 60-70 % R.H. by El-Erksousy *et al.*, (2002). He added that the duration of life cycle was 40.2 and 39.1 days for female and male, respectively. The food consumption of both spider female and male was 156.3 and 147.6 prey individuals, respectively.

Table 2. Fecundity of the spider *Theridion melanostictum* feeding on *Spodoptera littoralis* and *Gynaikothrips ficorum*

Biological aspect	Duration of different staged (Days) ± Standard deviation	
	<i>S. littoralis</i>	<i>G. ficorum</i>
Pre-oviposition	13.82±1.8 ^a	15.62 ±2.5 ^a
Oviposition	26.4±2.2 ^a	34.6±5.2 ^a
Post -oviposition	19.44±2.14 ^a	22.0±2.6 ^a
Number of egg.sacs/femal	4.0±0.0	4.0±0.0
Total Number of eggs/sac	23.75 ±7.62 ^a	20.75±2.22 ^a

Food consumption:

During the study of food consumption of spider *T. melanostictum*, different spiderlings instars and adult were fed on *S. littoralis* and *G. ficorum*, Table (3). Highly significant differences were recorded between food consumption of spider *T. melanostictum* when fed on *S. littoralis* and *G. ficorum*. The total mean number of consumed individuals of *S. littoralis* and *G. ficorum* was 148.0±3.8 and 414.8±4.5 prey for the total spiderling females, respectively, decreased to 100.6±3.5 and 307.2±4.8 prey of *S. littoralis* and *G. ficorum* when the spider males fed on the same preys, respectively. On the other hand, the average numbers of consumed preys per female of *T. melanostictum* adult was more than those of males, as, the number of prey consumed was 137.0±4.6 and 94.0±4.2 individuals of *S. littoralis* during the feeding of spider female and male, respectively. However, the average number of

consumed *G. ficorum* during the life of *T. melanostictum* adult female was 200.8±5.5 prey individuals and 89.0±3.2 individuals of *G. ficorum* during the feeding of spider males, Table (3). The obtained data in Table (4) showed that the mean total number of consumed individuals was 41.8 and 36.8 individuals of *S. littoralis* and *G. ficorum*, respectively during the pre-oviposition period of the spider females. On the other hand, the average numbers of devoured preys was 58.2 and 97.0 individuals of both preys during the oviposition period of spider females, respectively. While the spider females individuals consumed 37.0 and 68.0 of the introduced preys, in case of the post-oviposition period of spider, respectively. Generally, from the obtained results it was noticed that the average number of consumed preys per spider female were more than those of males.

Table 3. Food consumption of the spider *Theridion melanostictum* feeding on *Spodoptera littoralis* and *Gynaikothrips ficorum*

Developmental stage	Females		Males	
	<i>S. littoralis</i>	<i>G. ficorum</i>	<i>S. littoralis</i>	<i>G. ficorum</i>
1 st spiderling	15.4 ±1.35 ^a (14.2-16.7)	42.4±2.6 ^a (40.0-44.6)	15.2±1.58 ^a (14.0-16.8)	37.6±2.4 ^a (35.4-39.1)
2 nd spiderling	23.0 ±1.68 ^a (21.5-24.7)	82.0±3.2 ^a (78.8-85.5)	21.0±1.78 ^a (19.8-22.9)	84.8±3.0 ^a (81.6-87.2)
3 rd spiderling	36.8±2.5 ^a (35.4-39.1)	96.6±3.5 ^a (94.7-99.2)	36.0±2.6 ^a (34.1-28.9)	92.4±3.5 ^a (88.8-96.10)
4 th spiderling	34.2 ±2.2 ^a (31.8-36.0)	95.0±3.6 ^a (92.1-97.6)	28.4±2.7 ^a (26.0-30.1)	92.4±3.0 ^a (91.0-93.2)
5 th spiderling	38.8±2.5 ^a (36.5-40.)	98.8±3.8 ^a (95.4-100.2)	-	-
Total	148.2±3.8 ^a (144.0-152.3)	414.8±4.5 ^a (410.5-417.1)	100.6±3.5 ^a (98.2-102.4)	307.2±4.8 ^a (310-316)
Longevity	137.0±4.6 ^a (120.1-125.6)	200.8±5.5 ^a (134.7-143.8)	94.0±4.2 ^a (90.4-96.8)	89.0±3.2 ^a (86.2-91.4)

Table 4. Food consumption of the spider *Theridion melanostictum* during longevity period on *Spodoptera littoralis* and *Gynaikothrips ficorum*

Biological aspect	Duration of different staged (Days)	
	<i>Spodoptera littoralis</i>	<i>Gynaikothrips ficorum</i>
Pre-oviposition	41.8±5.5 ^a	36.8±5.4 ^a
Oviposition	58.2±5.8 ^a	97.0±8.9 ^a
Post-oviposition	37.0±8.5 ^a	67.0±9.8 ^a

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المظاهر البيولوجية للعنكبوت *Theridion melanostictum* Cambridge والمنتمى لعائلة Theridiidae عند تغذيتها على فرائس مختلفة

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تعتبر العنكبوت من اهم الاعداء الحيوية التي تلعب دورا هاما في مكافحة الافات الزراعية والتي تصيب معظم المحاصيل الزراعية وتسبب لها اضرارا بالغة كما ونوعا. ولقد تم جمع العنكبوت *Theridion melanostictum* والمنتمى لعائلة Theridiidae من على أشجار الموالح بمنطقة العامرية بمحافظة الاسكندرية وتربيته تحت ظروف معملية 25 م° ورطوبة نسبية 60-70 % على يرقات دودة ورق القطن *Spodoptera littoralis* وتريس الفيكس نندا *Gynaikothrips ficorum* وظهرت النتائج المتحصل عليها ان هذا العنكبوت يمر بخمسة اطوار غير بالغة Spiderlings قبل الوصول الى الطول البالغ ولقد لوحظ ان فترة حضانة البيض Incubation period قد استغرقت 12.2 و 15.2 للاثني والذكر عند التغذية على دودة ورق القطن وحشرة التريس على الترتيب كما دلت النتائج ان الاطوار الغير بالغة قد استغرقت 59.6 و 38.2 يوما للاناث والذكر على دودة ورق القطن بينما استغرقت 88.6 و 63.0 يوما في حالة التغذية على حشرة التريس ولقد استغرقت دورة حياة العنكبوت Life cycle 71.8 و 50.4 و 103.8 و 78.2 يوما لكل من الاناث والذكور عند التغذية على الفريستين على الترتيب. واتضح من النتائج المتحصل عليها ان اناث العنكبوت قد استهلكت عددا مقداره 148 و 414.8 فردا من دودة ورق القطن وحشرة التريس اثناء الاطوار الغير بالغة Spiderlings تغيرت الى 100.6 و 307.2 فرد من الفريستين في حالة ذكور العنكبوت على التوالي. ولقد لوحظ ان افراد العنكبوت اثناء الافراد البالغة قد قامت بالافتراس على 137 و 94 فردا من دودة ورق القطن اثناء تغذية الاناث والذكور على التوالي والتي تغيرت الى 148 و 89 عند التغذية على التريس على الترتيب. وقام بالتغذية على 41.8 و 36.8 يرقة من دودة ورق القطن وحشرة التريس على الترتيب اثناء فترة ما قبل وضع البيض لاثني العنكبوت والتي زادت الى 58.2 و 97.0 يرقة من الفريستين اثناء فترة وضع البيض واستغرقت 37 و 68 يرقة من الفرائس في فترة ما بعد وضع البيض على الترتيب. مما سبق يجب تعظيم دور المفترسات وخصوصا العنكبوت الحقيقية والتوسع في تربيتها واستخدامها في مجال مكافحة الحيوية للافات الحشرية وذلك ترشيدا لاستخدام المبيدات الحشرية الضارة وذلك لانتاج محصول نظيف خالي من اثار المبيدات ويكون صالحا للتصدير.