

TEMPERATURE DEGREES AS MAIN FACTOR AFFECTING THE BIOLOGICAL ASPECTS OF THE SPIDER, *Thomisus spinifer* (ARANEIDA : THOMISIDAE)

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ABSTRACT

The effect of temperatures on biological aspects of spider *Thomisus spinifer* (Sundevall, 1833) (Araneae : Thomisidae) were studied under laboratory conditions of (25±2°C and 60-70% R.H.). Results indicated that, females reached maturity after 7.9 spiderling instars, (175.83 days) and males after 6-8 spiderling instars, (156.80 days) at 20°C, while females reached maturity after 6-8 spiderling instars 240 days) and males after 5-7 spiderling instars at 30°C. females life span durated 320.42 and 277.80 days for males at 20°C. while at 30°C these periods were increased to 397.38 and 360.30 days for females and males, respectively. Food consumption was also noticed at 20 and 30°C.

Keywords: life cycle, longevity, life span, food consumption, spiders, Thomisidae, *Thomisus spinifer*, Egypt.

INTRODUCTION

Spiders constrictive a majour group among predators of the ecosystem and considered important natural control agent for a wide range of economically injurious pests. The influence of the environment on spider population in nature is a well-documented fact. However, the extend of this influence varies in spider species because of the diversity of inherent characteristics and capacities that interacts with numerous environmental factors of which temperature and humidity are of the most importance. Temperature and humidity affect spider populations in nature since these two factors affect simultaneously. Few contributions have been made to evaluate the effect of temperature and relative humidity on the biology of this spider under the laboratory conditions (Levy, 1970; Nyffeler and Breene 1990).

Thomisidae family is one of the most important dominant spider families in the world, it includes 2208 different species of 80 genera distributes allover the world (Platick, 2003). *Thomisus spinifer* was recorded in Dakahlia and Menoufya and Qalubiya Governorates (El-Sebaay, 2003). El-Hennawy and Mohafez (2003) reared this species on different instars (first to fourth) of *Spodoptera littoralis* at room temperature, (26 and 28°C and 70±5% R.H.). Therefore it is necessary to throw light on the biological aspects of this spider to evaluate the effect of different temperatures on its biology.

MATERIALS AND METHODS

Adult females of *Thomisus spinifer* (Sundevall, 1833) were collected on 28th March 2009 from Sallant Tonamal-Aga Village, El-Mansoura City,

Dakahlia Governorate. This species was found among wild plants adjacent to cultivated plants. It was reared inside a test tube where it laid an egg sac which was observed till hatching. The first generation was reared individually on the cotton leafworm, *Spodoptera littoralis* (Biosd.) under laboratory conditions. The second hatched generation, coming after mating in laboratory, the individuals divided into two groups; i.e. 17 individuals (1st spiderling) were reared on 20±2°C and 60±5% R.H., and the second group (17 individuals, 1st spiderling) was reared on 30±2°C and 70±5% R.H. the two groups were reared individually inside translucent plastic containers was perforated for ventilation. All obtained spiderlings were fed once every two days on different stages of 1st-4th instars of larvae of *S. littoralis*. Longevity and life span for adult female and male were calculated on 6 and 5 replicates, respectively at 20±2°C and 60±5% R.H. On the other hand, the number of the same replicates of females and males were carried out for longevity and life span at 30±2°C and 70±5% R.H.

RESULTS AND DISCUSSION

The influence of environment on spider population in nature is well known. However, the extent of this includes variances among spider species because of the diversity of inheriting characteristics and capacities that interaction with numerous environmental factors of which temperature and relative humidity are of the most important. A few contributions have been made to evaluate the effect of temperature and relative humidity on spider biology.

Egg sac and incubation period:

The egg sac was spherical in shape white in colour at first and become dark before hatching. The eggs inside egg sac were circular and yellow at the beginning of laying and became dark before hatching. Thirty four individuals hatched and emerged from the egg sac, which was laid after mating in laboratory. These individuals emerged through around pore at the tip of the egg sac, they were reared under two degrees of temperature, i.e. 20 and 30°C. The incubation period of eggs lasted for 18 days at 20°C and 25 days at 30°C.

Effect of temperature on different spiderlings:

During rearing the first group (17 individuals) of *T. spinifer* spiderlings, 4 individuals were early died, and 13 individuals reached maturity at 20°C, the spiderlings passed through 6-8 instars for males and 7-9 instars for female during their development. The ratio (36.36%) of males became adult after six moults, while (9.09%) of males became adults after 7 moults, and also, the same ratio of males reached adulthood after 8 moulting. The highest ratio (45.45%) females reached maturity after 7 moults, while 36.36% of the individuals reached maturity after 8 moults and 18.18% reached maturity for females after 9 moults (Table, 1).

Also, 17 individuals were reared at 30°C, two individuals died before reaching to mature stage and 15 individuals are reaching the adulthood reaching to the adulthood. The spiderlings passes through 5-7 instars for males and 6-9 instars for female during their development. The ratio of 16.6%

of males reached adult after 5 moults 50% reached maturity after 6 moults and the rest percentage 33.4% reached maturity after the moults. The highest ratio (33.4%) of females reached maturity after 6 moults, while 22.2% of the individuals reached maturity after 7,8 and 9 molts (Table, 2).

Life cycle:

Statistical analysis of data presented in Tables (1&2) and graphically illustrated in Fig. (1) show the life cycle of spider, *T. spinifer* at 20 and 30°C feeding on different instars of *S. littoralis*. Life cycle increased as well as temperature decreased, therefore, male life cycle lasted (156.8) days, while, female life cycle stayed (179.83) days at 20°C (Table, 1). On the other hand, these periods lasted 260.67 days for male and 240.00 days for female at 30°C for females (Table, 2), respectively. These results confirmed by **Sallam (2004)** who noticed that the life cycle of this spider durated 370.20 days with an average of 311-410 days for male, while female life cycle lasted 4.8 days with an average 322-498 days for female at the room temperature (26 and 28°C and 70±5%RH).

Longevity

Concerning the adult longevity, it was noticed from the obtained data in Table (3) that female longevity at 20°C ranged from 45-357 days with an average of 145.00 days, while it ranged between 65-172 days with an average of 121.00 days for male at the same temperature.

Table (1): Life cycle of spider, *Thomisus spinifer* (Sundevall, 1833) (Araneida : Thomisidae) at 20°C.

Developmental stages	Duration (days)					
	Male			Female		
	Range	Mean	SD	Range	Mean	SD
1 st spiderling	11-16	12.00	2.24	11-16	12.67	2.58
2 nd spiderling	5-20	13.00	5.70	5-10	8.17	1.83
3 rd spiderling	3-33	12.20	12.11	5-19	11.33	5.54
4 th spiderling	3-36	24.00	12.43	3-21	12.17	6.52
5 th spiderling	10-93	45.80	28.07	3-49	24.83	18.21
6 th spiderling	10-94	43.50	36.12	18-99	43.83	30.78
7 th spiderling	6	60.00	-	12-60	33.40	20.95
8 th spiderling	15	15.00	-	10-62	29.75	22.72
9 th spiderling	-	-	-	42-49	45.50	4.95
Life cycle	102-198	156.80	40.54	101-207	175.83	43.47

Table (2): Life cycle of spider, *Thomisus spinifer* (Sundevall, 1833) (Araneida : Thomisidae) at 30°C.

Developmental stages	Duration (days)					
	Male			Female		
	Range	Mean	SD	Range	Mean	SD
1 st spiderling	11-19	12.33	3.27	11-21	14.13	4.33
2 nd spiderling	8-23	12.67	5.72	7-38	15.33	9.46
3 rd spiderling	8-35	16.87	9.99	3-18	9.33	5.43
4 th spiderling	18-65	42.50	21.50	3-28	18.00	6.98
5 th spiderling	37-162	85.17	50.09	3-106	50.89	29.59
6 th spiderling	15-132	77.00	50.26	15-159	75.56	47.73
7 th spiderling	71-150	110.50	55.86	12-64	45.25	23.00
8 th spiderling	-	-	-	7-105	63.00	50.48
9 th spiderling	-	-	-	59-99	31.45	28.28
Life cycle	219-300	260.67	30.25	142-311	240	55.93

On the other hand, at 30°C, female longevity ranged between 115.0-200.00 days with an average of 156.60 days but the male adulthood ranged between (35.00 – 163.0) days with an average of 114.00 days.

Pre-oviposition, oviposition and post- oviposition:

As shown in Table (3) and Fig. (2) noticed that the pre-oviposition period for female lasted 11-15 days with an average 13.0 days at 20°C decreased 3-9 days with an average 6.0 days when the temperature increased to 30°C on the other hand, data indicated that female oviposition period took 13-14 days with an average 13.0 days at 20°C, but this period lasted 11-75 days with an average 40.4 days at 30°C. The adult female post oviposition period of *T. spinifer* durated from 14-20 days after stopping deposited eggs with an average 17 days at 20°C and 82.5 days with an average 76-89 days at 30°C.

Sex ratio:

From the obtained data it was noticed that the number of males : females when the individuals reared on *S. littoralis* at 20°C was 7:6 by, i.e. (1.6 male : 1 female), but this ratio 6 males and 9 females at 30°C for the same predator when fed on the same prey. These results are in harmony with Etman *et al.* (1991) who found male : female that ratio was differed according to the temperature used, where it was (1male : 1.1 female) of *Steatoda thangulosa* Walckenaer when fed on *Musca domestica* Vicina at 25°C changed to 1 male : 1 female at 30°C with constant relative humidity of 57%.

Oviposition:

Adult female of *T. spinifer* requires pre-oviposition period before depositing eggs. This period ranged from 11-15 days with an average of 13 days where the oviposition period lasted for an average of 13.5 days. The post-oviposition period ranged from 14-17 days with an average 17 days.

Table (3): Duration of *Thomisus spinifer* longevity when fed on *Spodoptera littoralis* at 20 and 30°C.

Biological aspects	Female		Male	
	20°C	30°C	20°C	30°C
Pre-oviposition period	13.0±2.8 (11-15)	6.00±4.24 (3-9)	-	-
Oviposition period	13.25±0.71 (13-14)	40.4±27.4 (11-75)	-	-
Post-oviposition period	17.31±4.24 (14-20)	82.5±9.2 (76-89)	-	-
Longevity	145.8±44.07 (45-357)	156.6±31.8 (115-200)	121.0±40.0 (65-172)	114.0±59.02 (35-163)
Life span	320.4±82.9 (232.5-458)	397.4±36.2 (342-451)	277.0±42.3 (211-314)	360.3±71.7 (254-412)

Table (4): Food consumption of different stages of the spider, *Thomisus spinifer* (Saundevoll 1833) (Araneae : Thomisidae at 20°C.

Developmental stages	Average No. of <i>S. littoralis</i> larvae (4 th instar)					
	Male			Female		
	Range	Mean	SD	Range	Mean	SD
1 st spiderling	22-30.5	26.1	3.54	22-39	31.25	5.86
2 nd spiderling	18.5-33	22.2	6.08	23-32.5	27.25	3.46
3 rd spiderling	20-34	26.4	6.58	33-60	43.33	9.04
4 th spiderling	45-65	52.2	8.37	50-122	79.33	27.59
5 th spiderling	55-115	89.9	22.08	55-130	97.58	24.90
6 th spiderling	72.5-102	90	11.01	55-100.5	85.08	17.40
7 th spiderling	80	80	-	75-90	84.33	8.14
8 th spiderling	55	55	-	45-66	52.16	11.98
9 th spiderling	-	-	-	42-90	62.66	24.68
Life cycle	294-380.5	333.80	37.77	344-579.5	463.41	127.41
Longevity	162.5-430	302.5	99.13	112.5-560	305	158.8
Life span	472-797	634.3	129.93	586.5-910	768.42	120.79

Life span:

According the life span also positively affected by temperature degrees as shown in Table (3) and illustrated in Fig. (1), the female life span of *T. spinifer* resulted from feeding on *S. littoralis* was high at 30°C (397.4 days) than at 20°C (320.4 days). The same trend was observed in case of male individuals where this period was 360.3 at 30°C decreased to 277.8 days at 20°C.

Food consumption:

Results in Tables (4&5 and Figs 3&4) reported that female immatures of *T. spinifer* were more devouring prey than male. The number of *S. littoralis* (4th instar) was go and 85 prey for 6th and 7th male spiderlings at 20 and 30°C, respectively, while in case of female these number increased to 97.85 and 113.44 prey for both fifth female spiderlings at 20 and 30°C, respectively. However, the number of devoured *S. littoralis* during the spider life cycle was 333.8 and 463.47 for male and female at 20°C decreased to 274.75 and 382.87 of the 4th instars of *S. littoralis*, respectively.

Considering female longevity of *T. spinifer*, consumed 305 of *S. littoralis* individuals at 20°C and 391.56 at 30°C while adult male consumed 302 at 20°C and 257.7 individuals of *S. littoralis* at 30°C. Concerning the live span of *T. spinifer* adult female consumed 768.42 of *S. littoralis* individuals at 20°C and 774.38 individuals at 30°C, while the adult male consumed 634.30 of *S. littoralis* individuals at 20°C and 575.75 of *S. littoralis* individuals at 30°C finally, it could be concluded that the low temperature decreased the length of life cycle and in the same time increased the food consumption for spider.

Table (5): Food consumption of different stages of the Thomisidae spider, *Thomisus spinifer* (Saundevoll 1833) (Araneae : Thomisidae at 30°C.

Developmental stages	Average No. of <i>S. littoralis</i> larvae (4 th instar)					
	Male			Female		
	Range	Mean	SD	Range	Mean	SD
1 st spiderling	15-30	22.58	6.34	15-29	22.12	5.24
2 nd spiderling	15-30	23.50	5.75	12.5-32.5	19.18	6.35
3 rd spiderling	15-30	22.18	4.87	10-60	30.00	15.35
4 th spiderling	37.5-55	43.18	6.14	20-122	55.43	38.30
5 th spiderling	50-105	80.83	20.04	77-170	113.44	27.69
6 th spiderling	57-100	80.25	20.20	40-95	70.00	21.01
7 th spiderling	80-90	85.00	7.07	65-85	75.00	10.00
8 th spiderling	-	-	-	45-102	82.33	32.34
9 th spiderling	-	-	-	80-99	89.50	13.43
Life cycle	181-370	274.75	72.83	261.5-606	382.81	129.7
Longevity	87.5-407.5	285.00	147.51	287.5-500	391.56	79.54
Life span	457.5-737	575.75	121.65	599-893.5	774.38	89.7

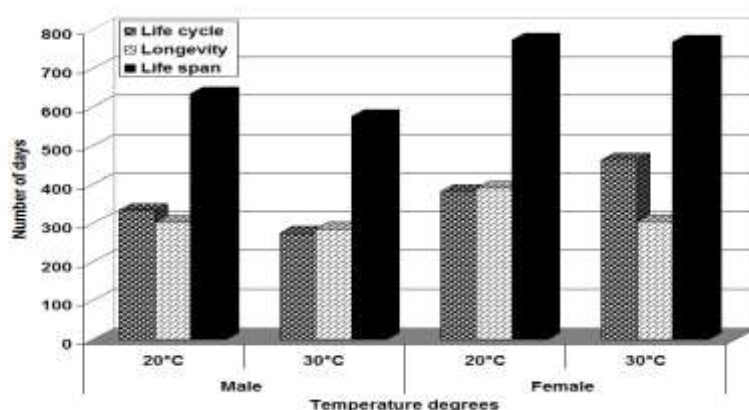


Fig. (1):Effect of temperature degrees on some biological aspects of the spider, *Thomisus spinifer* (Saundevoll 1833).

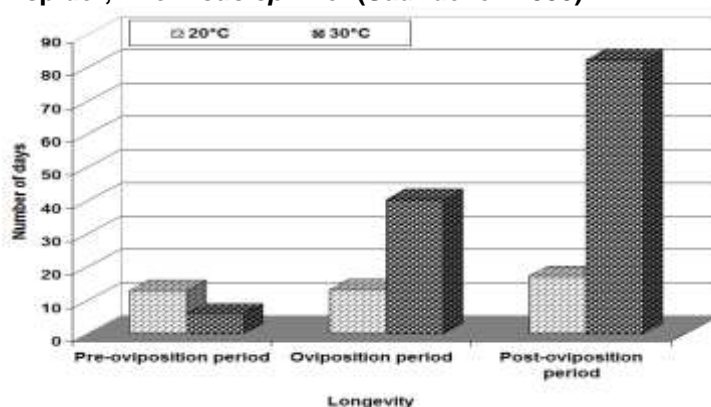


Fig. (2):Effect of temperature degrees on longevity of the spider, *Thomisus spinifer* (Saundevoll 1833) adult female.

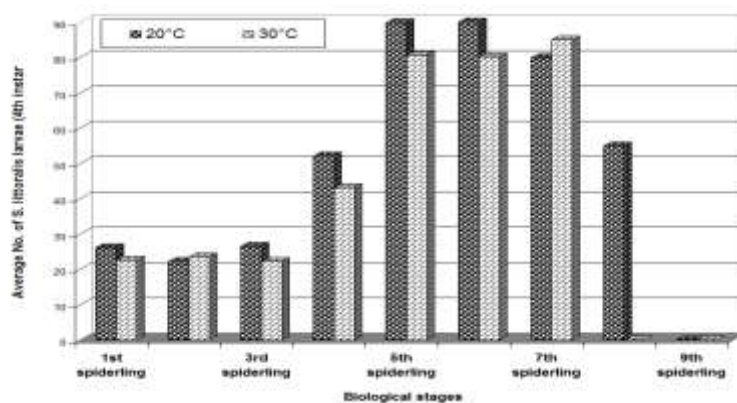


Fig (3): Food consumption of different stages of *Thomisus spinifer* (Saundevoll 1833) male when fed on *Spodoptera littoralis*.

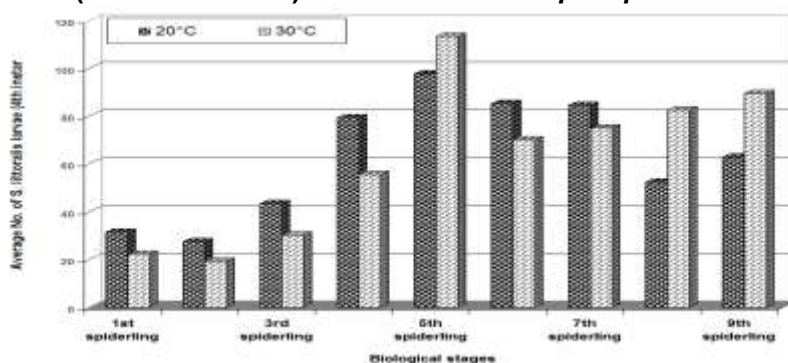


Fig (4): Food consumption of different stages of *Thomisus spinifer* (Saundevoll 1833) female when fed on *Spodoptera littoralis*.

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الحرارة كأحد العوامل الرئيسية علي المظاهر البيولوجية للعنكبوت THOMISUS SPINIFER (ARANEAE : THOMISIDAE)

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

تم دراسة تأثير درجة الحرارة علي المفترس العنكبوتي *Thomisus spinifer* حيث استخدمت أطوار مختلفة من يرقات دودة ورق القطن *Spodoptera littoralis* كمصدر رئيسي للتغذية.

تمر كل من الأنثي والذكر بـ 7-9، 6-8 أطوار غير كاملة (175,83، 156,80 يوما) علي درجة حرارة 20°م علي التوالي. بينما إستغرقت الإناث 6-9 أطوار غير كاملة (55,93 يوما) والذكور من 5-7 أطوار غير كاملة 260,67 يوما حتي بلغت طور البلوغ علي درجة حرارة 30°م.

وإستغرقت دورة حياة كل من الأنثي والذكر 320,40 ، 277,80 يوما علي التوالي عند درجة حرارة 20°م.

بينما كانت هذه المدة عند درجة حرارة 30°م (397,38، 360,30 يوم) لكل من الأنثي والذكر علي التوالي كما تم دراسة معدل الإقتراس عند درجة حرارة 20، 30°م.

قام بتحكيم البحث

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