

BIOLOGICAL AND BIOCHEMICAL STUDIES ON PREDACEOUS SPIDER *THANATUS ALBINI* WHICH FED ON SOME AGRICULTURAL PESTS

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ABSTRACT

The spider of *Thanatus albini* Denis were fed on four different food groups as following:- First group (G1): the cotton leafworm, *Spodoptera littoralis* (Boisd.), the cowpea aphid, *Aphis craccivora* Koch and the two-spotted spider mite, *Tetranychus urticae* Koch. Second group (G2): *S. littoralis* and *A. craccivora*. Third group (G3): *S. littoralis* and *T. urticae*. Fourth group (G4): *A. craccivora* and *T. urticae*. The life cycle of the spider of 4 groups were investigated under laboratory conditions at 30±2°C and 70-80% RH. In this study, the life cycle of spider in 4 groups were decreasing from G4-G1-G2-G3 for both female and male. Also longevity of female was longer than that of male, averaging 56, 50, 32.5 and 69.3 days for G1, G2, G3 and G4, respectively, while averaging from 33.5, 31.7, 29.5 and 59.0 days for male in case of G1, G2, G3 and G4, respectively. The study also revealed that the male and female of spider *T. albini* pass through 7 and 8 spiderling stages, respectively and the spiderling development (immatures) differed according to feeding groups for female and male, it reached (59.3 to 58.3 days) and (59.3 to 53.5 days) for both female and male from G1 to G2 and dropped in case of G3, they were 46.5 and 45.3 days for female and male, respectively. Also food consumption was observed in 4 groups and showed that the third group had the highest rate of food consumption than first and second group. Other biological aspects of *T. albini* were studied such as egg incubation, post-pre oviposition, total number of eggs sac/female and feeding behavior. Biochemical study to know the effect of 4 feeding groups on total protein of predaceous spider and showed that the total protein was increased with 3rd group followed by 1st and 4th group.

INTRODUCTION

Spiders are considered an important and world wide predators of many agricultural pests. The Philodromid spider are usually found in ground, low plants and trees (Dick, 1983). In Egypt, few biological studies concerning this group of predators were carried out (Rahil, 1988, El-Naggar *et al*, 1999 and Abd El-Rahman *et al*, 2001). The present study deals with a biological control agent, the spider *Thanatus albini* to throw some light on using it to control some insects and mites injurious to economic plant.

MATERIALS AND METHODS

1. Used compounds

Trade name	Source of compound	Original + active ingredient
KZ oil 95% EC	KZ Company	Mineral oil, aliphatic hydrocarbon
Vertimec 108% EC	MSD Company	Microorganism product (<i>Streptomyces avermitilis</i>)
Pipernigrum 10% acetone	Prepared in PPRI	Plant extract piperene

2. Rearing of spider

For culturing spiders, adult females of *T. albini* were collected from cotton field were singly placed each in translucent plastic cylindrical container of 4X5 cm. length, supplied with prey (*S. littoralis*, *A. craccivora* and *T. urticae*) kept in an incubator at 30 ± 2 °C and 70-80 % R.H to deposit their eggs. The upper lid of the cell was perforated; the newly hatched spiderlings were transferred to a separated tubes 1.5 cm diameter X 16 cm length.

3. Rearing of prey

S. littoralis was reared using a method of Mostafa (1993). Field collected egg batches of *S. littoralis* were cultured on castor bean leaves in glass jars (20 cm diameter and 15 cm height). The jars were covered and kept in incubator at 25°C and 60-70% R.H, the adult moths were confined in chimney glasses as oviposition sites provided by cotton soaked in 10% sugar solution for adult nourishment.

A. craccivora were placed singly on 1-2 weeks old broad bean plant, *Vicia faba* kept in growth chamber maintained at a mean temperature of 21°C, 50% R.H. and under artificial light for 16 h. daily.

T. urticae was collected from heavily infested castor plant leaves. Samples

were brought to the laboratory, then adults were reared on sweat potato cutting (20 cm long) with leaves and stems were partially inserted in bottles filled with water and kept under laboratory conditions.

For biochemical studies adults of spider were weighted and kept under freezing conditions at -20°C , and for determination of total protein we used Mercko test (Biuret reaction, Gormal *et al*, 1949).

RESULTS AND DISCUSSION

The present study was done to throw some light on the biological control aspects of the predaceous spider *T. albini* (family: philodromida).

1. Biological studies

1.1. Feeding behavior

When the spider feeds on living stages of prey, it watches the prey comes close and suddenly catches the prey from the anterior part, between its chelicerae; while imbedding the chelicerae in prey and then suck its body contents. After feeding the abdomen of spider becomes inflected and it rests for few minutes before attacking another prey.

1.2. Moulting

When the spiderling grown take resting period (1-2 h.) before moulting, then it makes a twisting movement and a longitudinal lateral split in old cuticle along the two lateral sides of the body. The spiderling got ride its old cuticle through twisting movement to separate the old cuticle from new cuticle.

1.3. Mating

The virgin female stay feeding for an average of 8 days, then stop feeding and walks close to the male making courtship movement then male ride on her back in the same direction, then turned himself to be his anterior facing the posterior portion of female, the male caught the female with his leg, and then move his anterior region to face the ventral surface of the female and insert the right palpal organ in female genital opening, then it repeated the copulation with the same female using his left palpal organ.

1.4. Fecundity

Fecundity of the *T. albini* female were influenced by different prey (Table 1), the results indicated that the females requires a pre-oviposition period ranged between 10.8 ± 0.4 days to 12.4 ± 2.2 days in G1 and G4, respectively.

The female deposited her eggs in egg sac (1-3 egg sac / female) with averaged 10.5 ± 0.5 , 10 ± 0.7 , 6.5 ± 0.5 and 15.8 ± 1.3 eggs from G1 until G4, respectively. The post-oviposition periods were 32.8 ± 2.2 , 30.5 ± 5.2 , 26 ± 3.7 to 38.8 ± 2.5 days from G1 to G4, respectively.

The numbers of egg in each egg sac were 44.3 ± 18.6 , 44.5 ± 18.9 , 48 ± 18.7 and 26.3 ± 7.4 days from G1 to G4, respectively.

TABLE (I)
Fecundity of adult female of *T. albini* at $30 \pm 2^\circ\text{C}$ and 70-80% RH.

Feeding groups	Biological aspects				
	Pre-oviposition days	Oviposition days	Post-oviposition days	Total No. of eggs/sac	No. of eggs sac/female
G1	10.8 ± 0.4	10.5 ± 0.5	32.8 ± 2.2	44.3 ± 18.6	2.5 ± 0.8
G2	10.8 ± 0.8	10.0 ± 0.7	30.5 ± 5.2	44.5 ± 18.9	2.5 ± 0.5
G3	7.5 ± 0.5	6.5 ± 0.5	26.0 ± 3.7	48.0 ± 18.7	2.5 ± 0.8
G4	12.4 ± 2.2	15.8 ± 1.3	38.8 ± 2.5	26.3 ± 7.4	2.5 ± 0.8

1.5. Spiderling development

The male and female of *T. albini* pass through 7 and 8 spiderling stages, respectively. Data in Table (2) showed that the incubation period of eggs were influenced by different groups of prey they were 16.5, 15.8, 11.3 and 22.8 days for female in case of G1, G2, G3 and G4, respectively. The duration of eight spiderling of both females and males of *T. albini* reared on *S. littoralis*, *A. craccivora* and *T. urticae* also represented in Table (2). The 1st spiderling were 8.8 to 8.3 days both female and male in G1, G2 and G3, respectively and 9.8 and 9.5 days in G4, respectively on the contrary the 6th spiderling lasted from (9.8 to 9.3 days) and (10.0 to 9.5 days) in case of G1 and G2 for both female and male but increased to reach 13.5 and 11.3 days for both female and male, respectively in case of G4, they lasted 8.8 and 8.3 days for both female and male at G3, respectively.

From the above mentioned data, it could be concluded that the total period spiderling development affected by the groups of feeding, thus the highest life cycle at G4 averaged 121.1 and 115.3 days for female and male, respectively, and the lowest life cycle at G3 averaged 57.8 and 55.8 for female and male, respectively. Also longevity of female was longer than in male, they were 56, 50, 32.5 and 69.3 days for G1, G2, G3 and G4; while they ranged from 33.5, 31.7, 29.5 and 59.0 days for male in case of G1, G2, G3 and G4, respectively.

TABLE (II)

Duration of male and female stages (spiderling) of *T. albini* reared on *S. littoralis*, *A. craccivora* and *T. urticae* at $30\pm 2^\circ\text{C}$ and 70-80% RH.

Spiderling	G1		G2		G3		G4	
	♀	♂	♀	♂	♀	♂	♀	♂
Egg incubation	16.5±0.7	15.0±0.4	15.8±0.8	13.5±0.3	11.3±0.4	10.5±0.3	22.8±0.5	20.8±0.3
1 st	8.8±0.4	8.8±0.4	8.8±0.4	8.8±0.4	8.3±0.4	8.3±0.4	9.8±0.4	9.5±0.5
2 nd	7.5±0.5	7.8±0.4	8.8±0.4	8.8±0.4	8.0±0.7	7.0±0.7	15.3±0.4	12.3±0.4
3 rd	5.3±0.4	5.3±0.4	5.5±0.5	5.3±0.4	5.8±0.4	6.3±0.4	10.3±0.4	9.8±0.4
4 th	6.3±0.4	5.8±0.8	5.5±0.5	5.3±0.8	6.3±0.8	6.5±0.5	18.3±0.4	17.5±0.5
5 th	9.8±0.4	9.3±0.8	8.3±0.4	8.0±0.0	6.8±0.4	6.3±0.4	14.3±0.3	13.3±0.5
6 th	9.8±0.4	9.3±0.4	10.0±0.7	9.5±0.5	8.8±0.4	8.3±0.4	13.5±0.5	11.3±0.4
7 th	11.3±0.4	10.5±0.5	10.0±0.0	9.5±0.5	8.5±0.5	7.8±0.4	19.0±0.7	18.3±0.4
Total Immature	59.3±2.4	58.3±2.7	59.3±2.1	53.5±	46.5±3.2	45.5±3.2	98.3±3.1	94.5±3.0
Life cycle	76.3±3.9	73.3±4.1	75.3±3.7	67.0±3.3	57.8±4.0	55.8±3.5	121.1±3.6	115.3±3.3
Longevity	56.0±17.4	33.5±4.7	50.0±9.4	31.7±2.0	32.5±5.6	29.5±2.7	69.3±4.7	59.0±6.4

1.6. Food consumption

The results of predation capacity are represented in Table (3). It is obvious that the rate of consumption increased gradually according to the age of spiderling. The rate of prey consumption by total spiderling in 1st group (G1) were 388.3, 590 and 336 prey of *S. littoralis*, *T. urticae* and *A. craccivora*, respectively.

In the 2nd group (G2) were 462.8 and 633.5 prey of *S. littoralis* and *A. craccivora* were consumed by 7th spiderling; while in 3rd group (G3), total spiderling preyed 597.5 and 288.5 of *S. littoralis* and *T. urticae*, respectively. But in the 4th group (G4), the food consumption by all spiderling gradually increased to reach 109.58 and 349.3 prey for *A. craccivora* and *T. urticae*, respectively. Our results completely in some line with previous studies of El-Erksousy and Fawzy (2001) and El-Erksousy *et al.* (2002), El-Erksousy *et al.* (2006), also agreed with Abdel-Rahmane/fl/. (2001).

From the above mentioned results, it can be concluded that the tested spider may be considered one of the biocontrol agents that play a role in controlling this pests.

TABLE (III)

Food consumption of *T. albini* feeding on *S. littoralis*, *A. craccivora* and *T. urticae* at $30\pm 2^\circ\text{C}$ and 70-80% RH.

Spiderling	G ₁			G ₂			G ₃			G ₄		
	Sll	Ap1	Tu1	Sll	Ap2	Tu2	S3	Ap3	Tu3	S14	Ap4	Tu4
1 st	31.8 ±2.0	43.8 ±1.2	73.8 ±1.3	31.8 ±2	43.8 ±1.8		32.5 ±1.8		62.3 ±2.3		43.3 ±2.2	75.5 ±2.9
2 nd	41.5 ±1.1	53.3 ±2.4	126.3 ±6.5	41 ±1	63.5 ±2.7		62.8 ±2.3		101.3 ±2.1		64.5 ±2.7	121.5 ±2.1
3 rd	42.5 ±1.8	52.5 ±1.9	136.5 ±4.5	63 ±2.1	90.8 ±0.8		73 ±3.5		125 ±3.5		87.5 ±5.6	152.3 ±2.3
4 th	43.3 ±2.0	73.0 ±2.1		70.8 ±0.8	104.8 ±4.8		71.5 ±1.7				126 ±3.9	
5 th	62.5 ±1.8	106.3 ±7.6		72 ±1.2	98.5 ±1.5		83 ±2.1				188.8 ±7.4	
6 th	79.8 ±3.6	124.3 ±3.8		82.5 ±2.5	108.3 ±1.9		122 ±2.1				232 ±4.3	
7 th	87.5 ±2.5	136.5 ±8.0		97.3 ±1.8	124 ±3.9		141.3 ±4.1				353.8 ±29	
Total	388.3 ±7.7	590 ±13.1	336.5 ±9.4	462.8 ±5.1	633.5 ±3.5		587.5 ±10.3		288.5 ±5.4		1095.8 ±50.4	349.3 ±3.1

S1: *Spodoptera littoralis* Ap: *Aphis craccivora*

Tu: *Tetranychus urticae*

2. Biochemical studies

2.1. Total protein content

Colorimetric determination of the total protein of adult spider in different feeding groups (G1-G4), Tables (4&5) revealed that the protein concentration in body tissue of adults in G3 was much higher than other groups; they were 47.1%; while lowest concentration in G4 was 15.8%, the same results also obtained by El-Bokl *et al.* (1998).

TABLE (IV)

Total protein content (mg/gm) tissue of the body of *T. albini* which treated with three alternative pesticides.

Band No.	KZoil	Vertemic	<i>P. nigrum</i>	Control
Cone, mg/gm tissue	14.1	24.6	29.0	24.0

TABLE (V)

Total protein content (mg/gm) tissue of the body of *T. albini* which feeding on different groups.

Band No.	First group	Third group	Fourth group	Control
Cone, mg/gm tissue	24.1	74.1	15.8	24.0

TABLE (VI)

Molecular weight (MW) and relative front (Rf) of protein bands for adults (*T. albini*) which treated with alternative pesticides.

Band No.	MW maker	Rf	MW Control (1)	Rf	MW KZoil (2)	Rf	MW Vertimec (3)	Rf	MW <i>P. nigrum</i> (4)	Rf
1	-	-	171.95	0.07	-	-	-	-	170.70	0.07
2	-	-	-	-	-	-	-	-	168.02	0.08
3	-	-	-	-	-	-	-	-	162.10	0.10
4	-	-	-	-	-	-	-	-	152.83	0.33
5	-	-	-	-	148.16	0.15	-	-	147.02	0.15
6	-	-	-	-	-	-	-	-	140.01	0.18
7	-	-	-	-	-	-	-	-	134.49	0.20
8	-	-	133.33	0.21	129.79	0.23	131.37	0.21	130.87	0.21
9	-	-	-	-	126.84	0.23	-	-	-	-
10	116.0	0.38	111.56	0.31	112.57	0.30	110.97	0.31	-	-
11	-	-	108.40	0.33	-	-	109.23	0.32	107.49	0.33
12	-	-	-	-	-	-	-	-	101.06	0.36
13	-	-	98.74	0.38	-	-	99.11	0.37	97.35	0.38
14	-	-	-	-	-	-	95.76	0.39	-	-
15	-	-	-	-	-	-	-	-	93.25	0.40
16	-	-	88.90	0.43	-	-	88.77	0.43	88.04	0.43
17	-	-	83.69	0.47	-	-	84.07	0.46	84.21	0.46
18	97.18	0.51	78.11	0.50	73.86	0.53	-	-	78.03	0.50
19	-	-	71.86	0.54	70.03	0.56	-	-	-	-
20	66.41	0.58	-	-	67.85	0.58	-	-	68.28	0.57
21	-	-	65.55	0.59	-	-	-	-	65.58	0.59
22	-	-	62.96	0.61	62.24	0.62	-	-	62.91	0.62
23	45.00	0.64	-	-	-	-	-	-	60.26	0.64
24	-	-	-	-	-	-	-	-	-	-
25	-	-	53.14	0.70	-	-	-	-	53.41	0.70
26	-	-	-	-	50.74	0.72	-	-	51.60	0.72
27	-	-	-	-	-	-	-	-	48.72	0.75
28	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	42.50	0.82
30	-	-	-	-	-	-	-	-	-	-
31	-	-	37.74	0.87	38.61	0.86	40.07	0.85	39.22	0.86
32	-	-	35.28	0.90	-	-	35.99	0.90	35.62	0.90
33	-	-	-	-	-	-	34.38	0.92	-	-
34	36.49	0.94	33.94	0.93	34.17	0.93	-	-	-	-
Total bands	5		15		11		10		25	

2.2. Refraction of protein patterns

Table (6) and Figs. (1, 2 and 3) showed that the total number of bands in different feeding groups G₁, G₂ and G₃ were 15, 18 and 15 bands, respectively. There were seven common bands appeared in different samples, these bands were No 10, 11, 16, 18, 22, 31 and 34 with Molecular Weight (MW) (111.56, 111.65 & 110.5); (108.40, 108.27 & 106.41); (88.90, 86.54 & 89.39); (78.11, 77.19 & 75.11); (62.96, 63.17 & 62.64); (37.74, 38.79 & 37.91) and (33.94, 34.06 & 33.80), respectively.

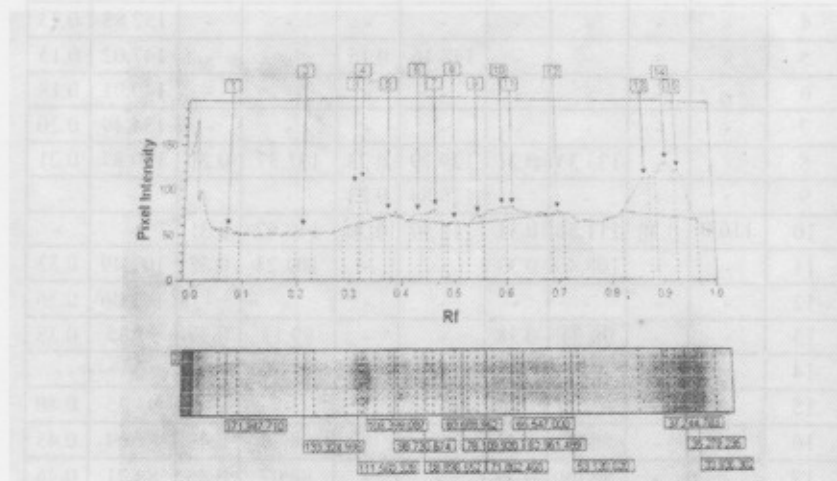


Fig. (1): Spectrophotometric scanning of total protein adult of spider (*T. albini*) F.: Philodromidae which feeding on G, (control).

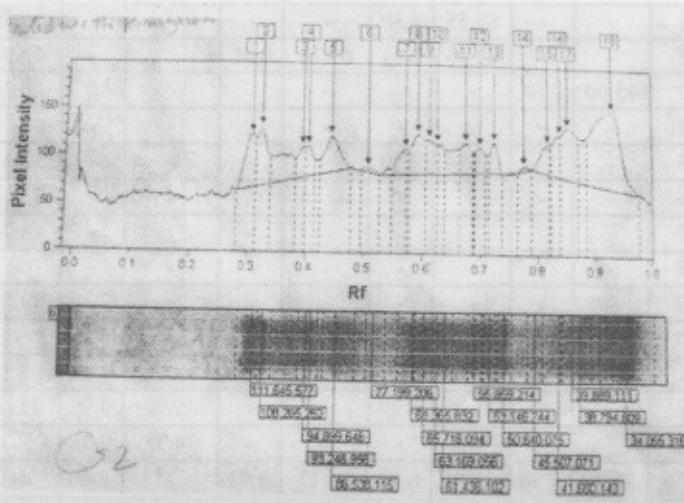


Fig. (2): Spectrophotometric scanning of total protein adult of spider (*T. albini*) F.: Philodromidae which feeding on G₂.

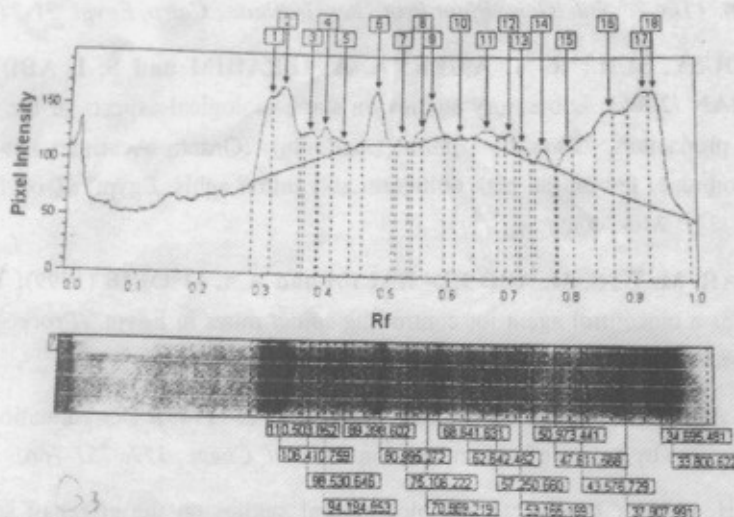


Fig. (3): Spectrophotometric scanning of total protein adult of spider (*T. albini*) F.: Philodroniidae which feeding on G_3 .

The results revealed that concentration of whole body tissue protein bands were increased in G_2 and G_3 than other group and control. These finding are in agreement with that obtained by Hassan (2002).

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