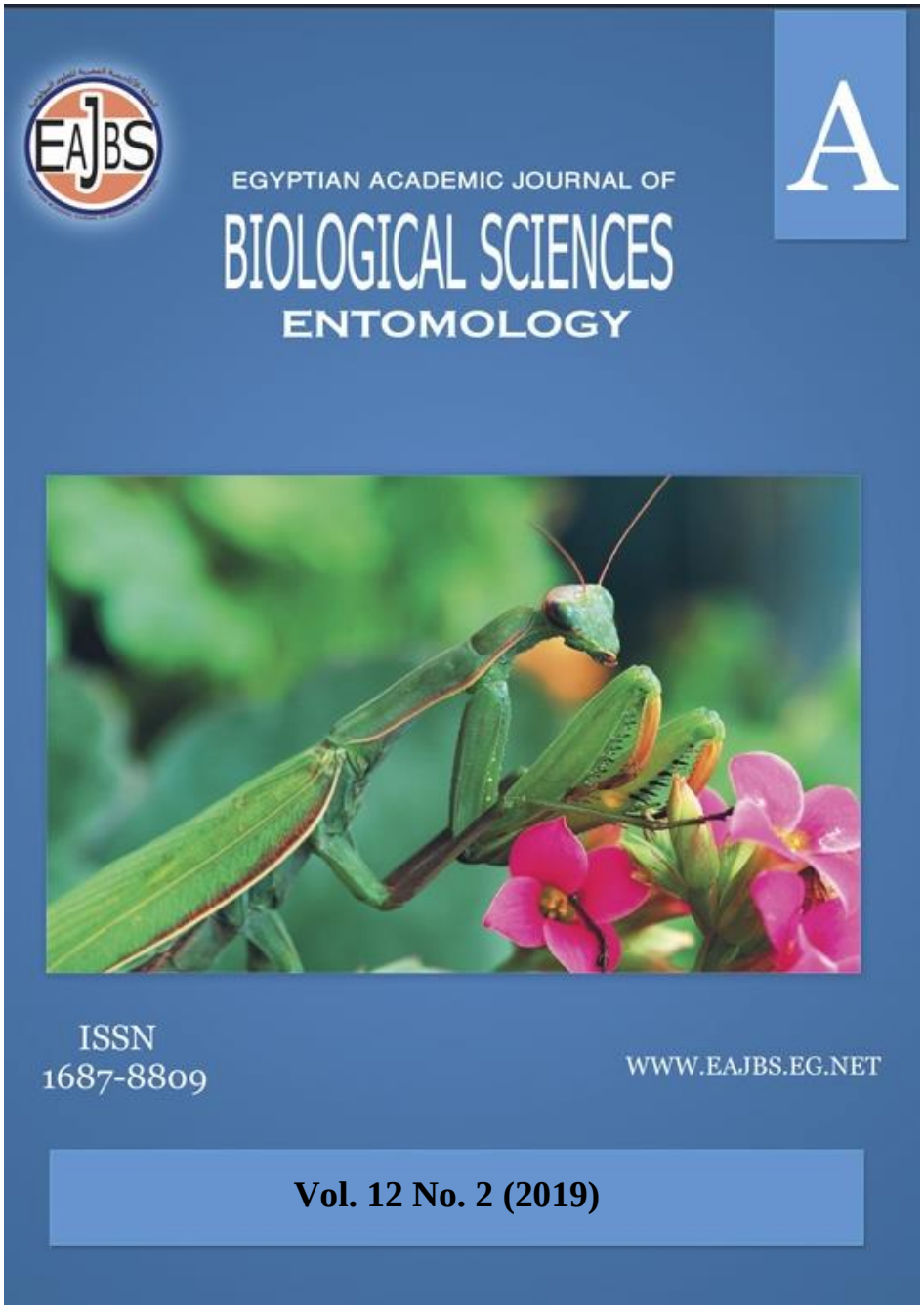

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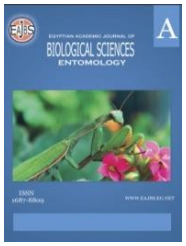

Effect of Two Food Types on the Biological Aspects of the Predatory Mite, *Coleoscirus horidula* (Tseng) (Acari: Prostigmata: Cunaxidae) at Various Constant Temperatures

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ABSTRACT

The cunaxid predacious mite, *Coleoscirus horidula* (Tseng) was extracted from leaf litter under cotton field plants in Qalyubia Governorate associated with spider mites, nematodes, scale insects as well as other small arthropods. The biological aspects of the predatory mite, *C. horidula* was determined on two preys, the free living nematode *Rhabditis scanica* Allegen and the acarid mite *Tyrophagus putrescentiae* (Schrank) at four different temperature degrees (20, 25, 30, 35°C) and 65-70 ± 5% RH. The predator passed through three nymphal stages, also the predator developed faster when reared at 35°C than 20°C. Obtained data showed that the type of prey and temperature affected significantly on biology of male and female of *C. horidula*. As it prolonged *C. horidula* life cycle, generation, longevity and life span when fed on free living nematodes *R. scanica* at 20ºC, while it was significantly decreased when fed on motile stages of acarid mite *T. putrescentiae* at 35ºC, as the periods decreased. Fecundity was significantly higher when the female fed on free-living nematodes recording 98.83 eggs/ female at 25°C and decreased to record the lowest number of deposited eggs at 35°C as 45.67 eggs/ female on the same prey.

INTRODUCTION

Cunaxidae (Acari: Trombidiformes) are important predatory mites. All members of this family are considered to be free-living predators feeding on a variety of prey including spider mites, nematodes, scale insects as well as other small arthropods (Youssef *et al.*, 1980; Skvarla *et al.*, 2014). Cunaxids are fast-running, red, brown or yellow generalist predators that attack small arthropods on diverse crops, in stored products and in litter. In the soil, they feed on root knot nematodes (*Meloidogyne* spp.), major pests of many crops. Some cunaxids hunt their prey and fasten it with silken threads that are excreted through their mouthparts (Alberti and Ehrnsberger, 1977). The first record of *Coleoscirus horidula* (Tseng) under cotton plant from Egypt was by (Youssef *et.al.*, 1980).

Cunaxa capreolus (Berlese) was reared by Zaher *et al.* (1975) on booklice (Psocoptera) and on *Eutetranychus orientalis* (Klein), the oriental spider mite, and a pest of citrus. At 30°C a generation was completed in about 4 weeks when feeding on either diet, each mite depositing around 45 eggs.

Soliman *et al.* (1975) found that the life cycle of *C. capreolus* passes through egg, larva, three nymphal stages, and adult. A quiescent one precedes each moving stage. Biological process such as hatching, molting and mating were investigated. Female

usually deposited its eggs singly in protected places. Number of deposited eggs per female, when fed on book lice (Psocoptera), was positively correlated with temperature. It averaged 24.6, 30.7, 40.7, and 43.5 eggs at 15, 20, 25, and 30°C. Incubation period as well as duration of immature stages and adult longevity was negatively affected with temperature. The generation period (from egg to egg) ranged from 24.8 to 64.2 days when temperature changed from 30°C to 15°C. Within these limits of temperature, the simple regression indicated that an increase of 15°C decreased the generation period for about 2.6 days.

Bioecological information about cunaxids was published by the following authors (Soliman *et al.*, 1975; Zaher *et al.*, 1975; Alberti and Ehrnsberger, 1977; Taha *et al.*, 1988; Walter and Kaplan, 1991; Sathiamma, 1995; de-Castro and Moraes, 2010, and Mostafa *et.al.*, 2016). Those studies have shown the ability of cunaxids to prey upon Eriophyoidea and Tetranychoidea, as well as upon other small arthropods and plant parasitic nematodes.

The aim of this study on first report on some biological aspects of the cunaxid mite, *C. horidula* when fed on different diets, free-living nematode, *Rhabditis scanica* and *Tyrophagus putrescentiae* at different laboratory conditions.

MATERIALS AND METHODS

Stock Colonies of *Coleoscirus horidula* (Tseng, 1980):

The cunaxid mite, *C. horidula* was extracted from leaf debris under cotton plants in Qalyubia Governorate. Debris samples were transferred to the laboratory and mite were extracted using modified Tullgren funnel. Five adult females and males of the mite were placed in screening cells (5 cm in diameter), with a layer of mixture of Plaster of Paris and charcoal (9:1) on its bottom to 5 mm depth and covered with slide cover and bended by rubber band. The cells were supplied with food and kept at 25±2ºC and about 65-70% R.H. About two water drops were added when needed; the method proposed by Hassan *et al.* (2014) was used with some modifications.

Biological Aspects:

The cells were kept at four different temperatures (15, 20, 25 and 30°C ± 2°C and 65-70 ± 5% R.H.), for 24 hours to allow mating process between males and females. Thereafter, males were removed, while females served as a source for known-age eggs, which in turn produced known-age larvae. About 50 newly hatching larvae were transferred and kept singly to a rearing plastic cell and left to continue their life span. Each newly hatched larva was supplied with different tested food, free living nematode, *R. scanica* and acarid mite *T. putrescentiae* and consumed food was replaced every 2 days interval with another new one till reaching maturity stage. Newly emerged females were copulated and left to deposit their eggs. Examination was made twice daily, early in the morning and before sunset. Essential records were noted.

Source of Food:

Free-Living Nematodes:

Broad bean and maize soil samples were put in Barman funnel for 24 hours for extracting nematodes (Abou-El-Sood, 1992). The extraction of free-living nematode *R. scanica* was cultured in Petri-dishes that contain slices of potatoes. Petri-dishes were kept under laboratory conditions at 25ºC. Camel hairbrushes were used to add drops of food in rearing cells of the predatory mite as the main source of food. All cultures of predators and preys were kept in laboratory at two different degrees of temperature (25 and 35°C) and 75+5 % R.H.

Acarid Mite:

For preparing pure culture of *T. putrescentiae*, plastic cups of (1.5 cm high x 2.5 cm in diameter) were filled up to 0.5 cm with plaster of Paris and activated charcoal in the rate

of 8:2, respectively. One adult female and male of *T. putrescentiae* were placed in the prepared cup, supplied with yeast and kept in an incubator at 25ºC and 70% R.H. Moisture was adjusted by adding drops of water every two days.

Statistical Analysis:

To compare the influence of prey species, developmental time, fecundity and duration of adult female reproductive stages was analyzed by one-way ANOVA and means were compared by using student's least significant difference. Significance level was P> 0.05. Analysis was conducted using SAS statistical software (SAS Institute, 2010). The relationship between the rate of development (Y) and temperature (X) (at a specific range) can be represented by a straight line resembled with the linear equation (Y= a + bXºC), a (intercept), b (slope of temperature). The threshold temperature for development (t_0) can be estimated using the equation, as –a/b (i.e. when Y=0). The reciprocal of the slope (b) of the straight line (i.e. 1/b) is (K), which is the number of degree-days (DDUs) above (t_0) required by an animal to complete its development as physiological time (Sharpe and De Michele, 1977).

RESULTS AND DISCUSSION

Biological Aspects:

To study the effect of temperature on the biology of the predatory mite *C. horidula* at four different temperatures (15, 20, 25, and 30°C ± 2°C and 65-70 ± 5% R.H.), on free living nematode, *R. scanica* and acarid mite *T. putrescentiae* as preys.

Hatching:

Egg is oval whitish when deposited, and then changes to creamy as time proceeds. Hatching occurs by longitudinal slit from which hatched larva crawls outside leaving the eggshell.

Behavior:

The predatory mite *C. horidula* was usually found around their prey individuals in field. When touching the prey, it quickly moved backward to attack it. The predator seized firmly the prey with the aid of its raptorial palps, then inserts its chelicerae in any part of the body and sucked its contents. The life history of the predator pass through one larval and three nymphal stages for female and male before reaching adulthood. The young larvae are colorless; the orange color begins to appear at the end of the larval period, becoming more intense at each succeeding stage. The first pairs of legs are abnormally long and each leg terminates in a small claw and is occasionally used in walking. Before proceeding to the ensuing stage, active immature individuals usually enter a resting or quiescent stage.

Mating:

Mating process is necessary for *C. horidula* production in this mite. Laboratory observations showed that the adults tended to mate immediately after their emergence. The male was able to copulate with three females, but the female accepted only one copulation. Just before mating, the male showed more activity by running around the female, and then it manipulated itself underneath the female, bending its opisthosomal region upward and forward to meet that of female. Copulation usually lasted about three minutes mating process was similar to that in other cunaxid species (Walter and Kaplen, 1991and Mostafa *et al.,* 2016).

Durations of *C. horidula* Reared on Free Living Nematode, *R. scanica* and Acarid Mite *T. putrescentiae* at 20°C:

The obtained data in Table (1) revealed that the incubation period of *C. horidula* non-significantly differed when the individuals fed on the two types of prey, as it recorded 7.28, 7.14, 7.47 and 7.5 days when female and male fed on free living nematode, *R. scanica* and acarid mite *T. putrescentiae*, respectively at 20°C. While it significantly

differed between male and female of the predatory mite during immature stages and it recorded 19.98, 17.74, 20.72, and 18.78 days when the same mites fed on free living nematode, *R. scanica* and *T. putrescentiae* at the same conditions.

The prey clearly affects the life cycle of *C. horidula.* It showed that the female life cycle lasted 27.26 and 28.18 days when fed on *R. scanica* and *T. putrescentiae* at 20°C, respectively, changed to 24.88 and 25.83 days when the male individuals fed on the same prey at the conditions, respectively.

The generation period of *C. horidula* female lasted 32.43 and 32.35 days when the individuals fed on *R. scanica* and *T. putrescentiae* at 20°C, with non-significant differences.

Concerning the adult female oviposition period of *C. horidula*, Table (1), it was observed that this period differed on the different tested food, reached to the highest level when the female individuals fed on *R. scanica* (37.83 days) and showed the lowest period when the female fed on *T. putrescentiae* (34.67 days) at 20°C.

Accordingly, the longevity of *C. horidula* also highly affected by the types of food. The female longevity of this mite was 47.57 and 34.67 days when the females and males of the predatory mite fed on *R. scanica* and as 43.47 and 32.67 for female and males fed on *T. putrescentiae* at 20°C, respectively, Table (1). On the other hand, when the free living nematode, *R. scanica* and *T. putrescentiae* were used as rearing source, the life span of *C. horidula* took 74.83, 59.55, 71.65 and 58.5 days, respectively at the same used conditions.

Maximum number of eggs produced by female was observed at 20°C as 74.17 eggs per female with daily rate 1.96 eggs/ female/ day when fed on *R. scanica*, while the minimum number of eggs per female was 62.67 eggs per female with daily rate of 1.81 eggs/ female/ day when the predator mite fed on *T. putrescentiae* at 20°C.

Table (1) Mean durations (days ± SD) of *C. horidula* reared on two prey types at 20±2°C and 65-70% RH.

Developmental stage		*R. scanica*		*T. putrescentiae*		L.S.D
		♀	♂	♀	♂	
Incubation period		7.28±0.32a	7.14±0.25a	7.47±0.41a	7.05±0.29a	0.38
Larval	A	4.87±0.29a	4.36±0.39b	4.55±0.34ab	4.35±0.40b	0.43
	Q	0.50±0.06b	0.35±0.08c	0.63±0.12a	0.45±0.12bc	0.12
Protonymph	A	4.50±0.45a	3.95±0.39b	4.58±0.38a	4.42±0.47ab	0.50
	Q	0.66±0.09a	0.27±0.08c	0.62±0.12a	0.45±0.14b	0.13
Deutonymph	A	4.15±0.21b	4.23±0.23ab	4.53±0.40a	4.15±0.21b	0.32
	Q	0.47±0.05b	0.35±0.05c	0.62±0.13a	0.43±0.05bc	0.09
Tritonymph	A	4.42±0.26ab	3.88±0.6b	4.53±0.33a	4.10±0.63ab	0.58
	Q	0.42±0.04b	0.35±0.05b	0.65±0.1a	0.43±0.05b	0.08
Immature stages		19.98±0.8a	17.74±0.93b	20.72±0.53a	18.78±1.18b	1.07
Life cycle		27.26±0.85a	24.88±0.77b	28.18±0.59a	25.83±1.02b	0.98
Generation		32.43±0.9a	.	32.35±0.66a	.	1.01
Pre-Oviposition		5.17±0.26a	.	4.17±0.26b	.	0.33
Oviposition		37.83±1.72a	.	34.67±2.58b	.	2.82
Post-Oviposition		4.57±0.5a	.	4.63±0.43a	.	0.59
Longevity		47.57±1.77a	34.67±0.82c	43.47±2.72b	32.67±1.75c	2.27
Life span		74.83±2.62a	59.55±1.58c	71.65±3.31b	58.50±2.77c	2.48
Fecundity (eggs/♀)		74.17±4.02a	.	62.67±5.79b	.	6.4
Daily rate (eggs/♀/ day)		1.96±0.13a	.	1.81±0.17a	.	0.19

A= Active , Q= quiescent, Means in the same row followed by the same letter are not significantly different ($P < 0.05$).

Durations of *C. horidula* Reared on Free Living Nematode, *R. scanica* and Acarid Mite *T. putrescentiae* at 25°C:

The mentioned results in Table (2) proved that, the incubation period of cunaxid mite *C. horidula* was greatly affected by different preys. The incubation period was long when it fed on individuals of *T. putrescentiae* averaged 6.45 and 5.2 days for the predator female and male at 25°C, while it was short when predator was fed on free-living nematode, *R. scanica* averaged 5.45 and 5.23 days, respectively at the same used conditions.

It could be observed that the duration of immature stages and life cycle was highly affected by the type of food. They average (13.95, 19.18, 14.48 and 19.68 days) for male and (15.08, 20.53, 15.63 and 22.08 days) for female when *C. horidula* was reared on *R. scanica* and *T. putrescentiae*, respectively, as shown in Table (2).

The longest period of generation averaged 26.64 days for *T. putrescentiae* and the shortest as on *R. scanica* averaged 24.66 days with significant difference between the two preys. Consequently, the female longevity lasted 43.25 and 33.5 days when the females and males of the predatory mite was fed on *R. scanica* and lasted 41.53 and 30.47 for female and males fed on *T. putrescentiae* at 25°C, respectively.

The highest number of eggs produced by female was 98.83 eggs/female with daily rate 2.86 eggs/ female/ day when fed on *R. scanica*, while the lowest value was 86.83 eggs/female with daily rate of 2.72 eggs/ female/ day when the predator mite was fed on *T. putrescentiae* at 25°C.

Table (2) Mean durations (days ± SD) of *C. horidula* reared on two prey types at 25±2°C and 65-70% RH.

Developmental stage		*R. scanica*		*T. putrescentiae*		L.S.D
		♀	♂	♀	♂	
Incubation period		5.45±0.23b	5.23±0.31b	6.45±0.43a	5.20±0.28b	0.38
Larval	A	3.35±0.21ab	3.07±0.16b	3.45±0.34a	3.17±0.26ab	0.30
	Q	0.45±0.05a	0.42±0.04a	0.46±0.07a	0.42±0.04a	0.06
Protonymph	A	3.25±0.27ab	3.08±0.2b	3.42±0.2a	3.12±0.2b	0.26
	Q	0.48±0.04a	0.42±0.04b	0.45±0.05ab	0.42±0.04b	0.05
Deutonymph	A	3.15±0.23ab	3.03±0.08b	3.35±0.38a	3.07±0.16ab	0.28
	Q	0.45±0.05a	0.43±0.05a	0.34±0.05b	0.40±0.06ab	0.06
Tritonymph	A	3.40±0.26ab	3.13±0.16b	3.73±0.27a	3.52±0.5ab	0.38
	Q	0.54±0.13a	0.37±0.05b	0.43±0.09b	0.38±0.04b	0.10
Immature stages		15.08±0.62b	13.95±0.45c	15.63±0.96a	14.48±0.6bc	0.83
Life cycle		20.53±0.63b	19.18±0.71c	22.08±1.02a	19.68±0.6bc	0.91
Generation		24.66±0.68a	.	26.64±1.3a	.	1.33
Pre-Oviposition		4.13±0.22a	.	4.57±0.5a	.	0.49
Oviposition		34.67±1.03a	.	31.97±1.65b	.	1.77
Post-Oviposition		4.45±0.39a	.	5.00±0.63a	.	0.67
Longevity		43.25±0.99a	33.50±1.22b	41.53±2.18a	30.47±1.24c	1.78
Life span		63.78±1.62a	52.68±1.94b	63.61±3.2a	50.15±1.86c	2.21
Fecundity (eggs/♀)		98.83±4.62a	.	86.83±7.25b	.	7.82
Daily rate (eggs/♀/ day)		2.86±0.22a	.	2.72±0.17c	.	0.24

A= Active , Q= quiescent, Means in the same row followed by the same letter are not significantly different ($P < 0.05$).

Durations of *C. horidula* Reared on Free Living Nematode, *R. scanica* and Acarid Mite *T. putrescentiae* at 30°C:

The findings in Table (3) indicate that developmental period (from egg to adult) of females and males were significantly affected by prey type. Immature stages ranged from 11.96 to 13.93 days under laboratory conditions of 35°C and 65-70% R.H. Developmental periods of both female and male *C. horidula* were longer when they were fed on *R. scanica* motile stages than on motile stages of *T. putrescentiae*. Mean developmental periods of *C. horidula* varied from 18.42 to 16.52 days for females and from 16.9 to 16.31 days for males when predatory mite was fed on *R. scanica* and *T. putrescentiae*, respectively at 35°C.

The adult longevity period differed with all food tested Table (3). Females of *C. horidula* reared on *R. scanica* had a significantly longer adult longevity than on *T. putrescentiae* food tested 38.62 and 34.62 days, respectively whereas adult males averaged 27.42 and 24.67 days.

The mean total fecundity of *C. horidula* fed on various diets is given in (Table 3). The highest mean total egg production of *C. horidula* was on *R. scanica*, motile stages (94.0 eggs/♀) with daily rate of (3.1 eggs/♀/day), and the lowest on motile stages of *T. putrescentiae* (81.17 eggs/ ♀), with daily rate of (2.97 eggs/♀/day).

Table (3) Mean durations (days) of *C. horidula* reared on two prey types at 30±2°C and 65-70% RH.

Developmental stage		*R. scanica*		*T. putrescentiae*		L.S.D
		♀	♂	♀	♂	
Incubation period		4.49±0.40a	4.35±0.39a	4.52±0.43a	4.35±0.39a	0.48
Larval	A	3.03±0.08a	2.92±0.1a	2.55±0.12b	2.90±0.13a	0.13
	Q	0.41±0.02a	0.39±0.05a	0.38±0.04a	0.41±0.06a	0.05
Protonymph	A	3.08±0.2a	2.87±0.25a	2.58±0.2b	2.33±0.2b	0.25
	Q	0.41±0.02a	0.39±0.04a	0.38±0.04a	0.37±0.05a	0.04
Deutonymph	A	3.07±0.16a	2.75±0.26b	2.55±0.12b	2.35±0.36c	0.29
	Q	0.43±0.04a	0.38±0.08a	0.40±0.06a	0.37±0.08a	0.08
Tritonymph	A	3.17±0.26a	2.45±0.48b	2.75±0.27ab	2.48±0.46b	0.49
	Q	0.33±0.05ab	0.43±0.1b	0.40±0.06b	0.75±0.25a	0.02
Immature stages		13.93±0.40a	12.58±0.52b	12.00±0.17b	11.96±1.03b	0.74
Life cycle		18.42±0.45a	16.93±0.71b	16.52±0.53b	16.31±0.02b	0.85
Generation		22.28±0.65a	.	19.58±0.79b	.	0.92
Pre-Oviposition		3.87±0.48a	.	3.07±0.48b	.	0.62
Oviposition		30.50±2.88a	.	27.67±3.39a	.	4.04
Post-Oviposition		4.25±0.27a	.	3.88±0.52a	.	0.53
Longevity		38.62±3.3a	27.42±1.28c	34.62±3.58b	24.67±1.51c	3.16
Life span		57.03±3.75a	44.35±1.99c	51.13±4.11b	40.97±2.52d	3.33
Fecundity (eggs/♀)		94.00±3.03a	.	81.17±2.32b	.	3.47
Daily rate (eggs/♀/ day)		3.10±0.26a	.	2.97±0.35a	.	0.39

A= Active , Q= quiescent, Means in the same row followed by the same letter are not significantly different ($P < 0.05$).

Durations of *C. horidula* Reared on Free Living Nematode, *R. scanica* and Acarid Mite *T. putrescentiae* at 35°C:

The obtained data in Table (4) revealed that the incubation period of *C. horidula* non-significantly differed when the individuals fed on the two types of prey at 35°C. In accordance with results obtained on the duration of total immature stages, life cycle and

generation of *C. horidula* differed according to kind of food used, the shortest period was 9.3, 12.53 and 14.68 days on *T. putrescentiae*, while the longest was 11.11, 14.41 and 16.91 days for female fed on *R. scanica* at 35°C, respectively. The longest pre-ovipostion, ovipostion and post-ovipostion period was 2.5, 26.17 and 2.77 days on *R. scanica*, whereas the shortest periods was 2.15, 24.0 and 3.25 days on *T. putrescentiae* at 35°C, respectively.

Therefore, the female longevity lasted 31.43 and 24.0 days when the females and males of the predatory mite were fed on *R. scanica*, while lasted 29.4 and 21.5 for female and males fed on *T. putrescentiae* at 35°C, respectively.

The highest mean total egg production of *C. horidula* was on *T. putrescentiae*, motile stages (67.0 eggs/♀) with daily rate of (2.81 eggs/♀/day), and the lowest on *R. scanica* individuals (45.67 eggs/ ♀), with daily rate of (1.75 eggs/♀/day) with highly significant differences.

Table (4) Mean durations (days) of *C. horidula* reared on two prey types at 35±2°C and 65-70% RH**.**

Developmental stage		*R. scanica*		*T. putrescentiae*		L.S.D
		♀	♂	♀	♂	
Incubation period		3.30±0.3a	3.22±0.31a	3.23±0.26a	3.12±0.34a	0.36
Larval	A	2.20±0.24b	3.13±0.5a	1.75±0.29b	3.15±0.47a	0.47
	Q	0.40±0.09a	0.35±0.08a	0.37±0.08a	0.33±0.1a	0.10
Protonymph	A	2.21±0.2a	1.40±0.49b	1.72±0.25b	1.63±0.29b	0.39
	Q	0.37±0.08a	0.33±0.05a	0.37±0.08a	0.33±0.05a	0.08
Deutonymph	A	2.15±0.18a	1.45±0.37b	1.65±0.21b	1.53±0.3b	0.33
	Q	0.37±0.08a	0.35±0.05a	0.33±0.05a	0.33±0.05a	0.07
Tritonymph	A	3.05±0.12a	1.65±0.27c	2.75±0.27b	1.35±0.14d	0.25
	Q	0.37±0.08a	0.38±0.12a	0.37±0.08a	0.33±0.05a	0.10
Immature stages		11.11±0.57a	9.05±0.86b	9.30±0.46b	9.00±0.71b	0.80
Life cycle		14.41±0.69a	12.27±0.88b	12.53±0.52b	12.12±0.7b	0.85
Generation		16.91±0.52a	.	14.68±0.47b	.	0.63
Pre-Oviposition		2.50±0.45a	.	2.15±0.21a	.	0.44
Oviposition		26.17±0.68a	.	24.00±2.1b	.	2.0
Post-Oviposition		2.77±0.26b	.	3.25±0.27a	.	0.34
Longevity		31.43±0.80a	24.00±0.89c	29.40±2.05b	21.50±1.38d	1.65
Life span		45.84±1.49a	36.27±1.79c	41.93±2.57b	33.62±2.08d	1.93
Fecundity (eggs/♀)		45.67±3.5b	.	67.00±1.41a	.	3.43
Daily rate (eggs/♀/ day)		1.75±0.16b	.	2.81±0.29a	.	0.30

The obtained results are in harmony with that detected by (Sathiamma, 1995), in India indicated that *Cunaxa setirostris* (Hermann) is one of a guild of predators suppressing the white spider mite, *Oligonychus iseilemae* (Hirst), a pest of coconut foliage. At 28°C the predator raised a generation in about a week, its females lived for a fortnight and each laid around six eggs. The predator larva preferred the larval prey, nymphal predator preferred the larvae and early nymphs of the prey and the adult preferred the prey nymphs and adults. Taha *et al.* (1988) evaluated the effect of acarine versus nematode prey on *Neocunaxoides andrei* (Baker and Hoffmann) in the laboratory at 30°C and 70% relative humidity. The cunaxid was more fecund when feeding on the nematode *Panagrolaimus rigidus* Schneider than on the astigmatid mite *Caloglyphus rhizoglyphoides* (Zachvatkin), producing 77 versus 68 eggs/female. However, the predator lived for about 10 days longer with mites as the only prey. The low temperature decreased female fecundity of the cunaxid mite, *Cunaxa setirostris* (Hermann) (El-Khateeb, 1998).

Ghallab (2002) studied the biological aspects of three cunaxid species, *Coleoscirus simplex* (Ewing), *C. tuberculatus* Den Heyer, and *Pulaeus subterraneus* Berlese when reared on the free-living nematode, *Rhabditella muscicola* Chitwood under laboratory conditions at 27ºC and 75-80% R.H. The author mentioned that female life cycle was longer than male being 12.8, 13.1 and 15.6 days, while those of male were 12, 11.7 and 13.4 days, respectively. Yassin (2006) found that the predacious mite, *C. capreolus* Berlese was significantly affected by the feeding on different diets. *Collembola Neanurodes* sp. proved to be the suitable prey as resulted in more deposited eggs and longer life span and contained higher relative concentration of glucose content followed by the free nematodes *Rhabditella muscicola* Chitwood and the acarid mite, *T. putrescentiae* (Schrank).

Linear Regression Analysis Values for the Effect of Temperature on *C. horidula* Developmental Rate:

Results of applying the linear model to the relation between temperature and rate of development in insects and mites is usually calculated as linear (Sharpe and De Michele, 1977). Table (5) and Fig. (1) indicate that, R^2 values of *C. horidula* ranged between 0.93 and 0.99 of egg, immature stages, generation, longevity and life span on *R. scanica* and *T. putrescentiae*. Using the equation resulted in determination of lower thresholds (t_0) as 7.79, -0.24, 2.89, -8.76 and -4.2°C for *R. scanica*, respectively whereas record 9.62, -8.38, 8.76, -8.38 and 0.29°C for *T. putrescentiae*, respectively. The thermal constant (K) was 93.46 & 87.72, 400 & 256.4, 555.5 & 400, 1428.5 & 1250 and 2000 & 1428.5 DDs on egg, immature stages, generation, longevity and life span for the two preys *R. scanica* and *T. putrescentiae*, respectively as physiological times required for this species phenomena.

Table (5) linear regression analysis values for the effect of temperature on *C. horidula* developmental rate.

Stage	Variety	a	b	t_0	K	R^2
Egg	Free nematodes	-0.0833	0.0107	7.79	93.46	0.97
	Acarid mite	-0.1097	0.0114	9.62	87.72	0.94
Immature stages	Free nematodes	0.0006	0.0025	-0.24	400.00	0.96
	Acarid mite	0.0327	0.0039	-8.38	256.41	0.99
Generation	Free nematodes	-0.0052	0.0018	2.89	555.56	0.95
	Acarid mite	-0.0219	0.0025	8.76	400.00	0.96
Longevity	Free nematodes	0.0061	0.0007	-8.71	1428.57	0.93
	Acarid mite	0.0067	0.0008	-8.38	1250.00	0.93
Life span	Free nematodes	0.0021	0.0005	-4.20	2000.00	0.96
	Acarid mite	-0.0002	0.0007	0.29	1428.57	0.97

a = Intercept, b = slope of temperature, t0 = (-a/b) K= DDUs (1/b)

The simple linear regression between temperature (X) and developmental rate (Y) of *C. horidula* (fig.1), the regression equation of egg, immature stages, generation, longevity and life span were y = 0.010x - 0.083, y = 0.002x + 0.000, y = 0.001x - 0.005, y = 0.000x + 0.006, y = 0.000x + 0.002 on *R. scanica*, respectively. In addition, the regression equation on *T. putrescentiae* was near to the previous values.

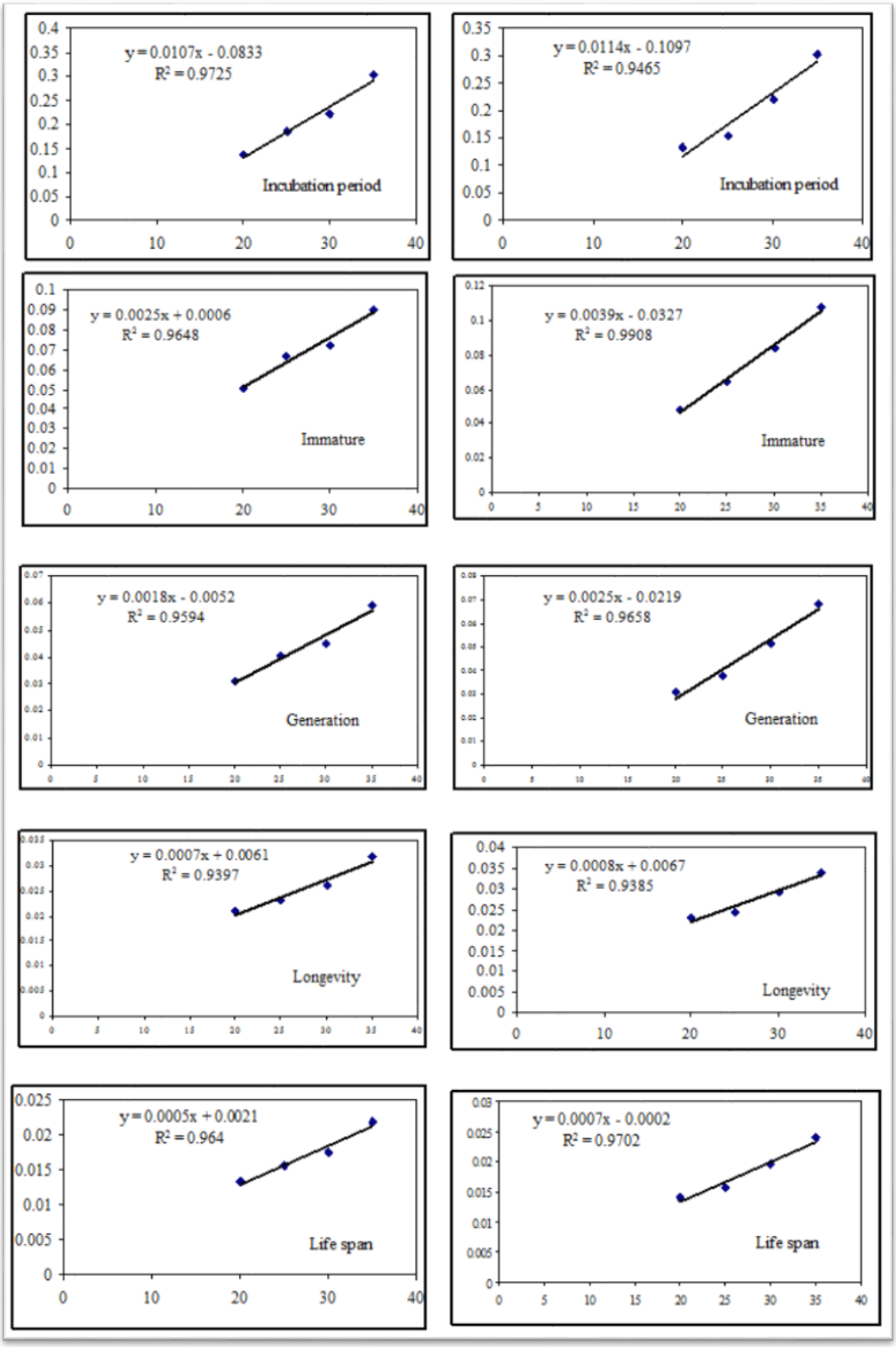

Fig. 1. Linear regression analysis values for the effect of temperature on *C. horidula* developmental rate.

Factorial Analysis of Obtained Biological Aspects of *C. horidula* as Affected by Temperature, and Preys:

This type of analysis considers the effect of each studied factor (i.e. temperature and prey types) regardless of other factors. As shown in Table (6), generally the different temperatures and diets had significantly affected on the duration of the cunaxid mite, *C. horidula*.

Effect of Temperature:

The mean female egg of *C. horidula* decreased as temperature increased; it averaged 7.37, 5.95, 4.5 and 3.26 days at 20, 25, 30 and 35ºC, respectively. The optimum temperature for development was 35ºC being faster than 30 and 25ºC, the lowest duration record at 20ºC. Significant differences occurred between all stages at the four levels of temperature.

Females of *C. horidula* longevity was maximal at 20ºC as 45.51 days and reduced at higher temperature. The highest fecundity and daily rate at 20 and 25ºC was 92.83 and 87.58 eggs/female and 3.03 and 2.78 eggs/♀/day; while the lowest was at 35ºC as 56.33 eggs/female and 1.88 eggs/♀/day (Table 6).

Effect of Preys:

The duration of all developmental, stages were longer on free-living nematode, *R. scanica* followed by acarid mite, *T. putrescentiae* (Table 6). Significant differences were found between developmental periods of mites exposed to different source of food. The shortest generation time, pre-oviposition and post-oviposition periods were on *T. putrescentiae*; while the longest of these periods were on *R. scanica*. Significant differences were also found between adult female longevity and life span when fed on acarid mite, *T. putrescentiae* was more favored to the predator followed free-living nematode, *R. scanica*. In addition, significant differences occurred between the two target diets, as fecundity was the highest on *R. scanica* and the lowest on *T. putrescentiae*.

Results in the current study are in agreement with those results observed but on different cunaxid species by (El-Khateeb, 1998) who reared the predator *Coleoscirus aegypticus* n.sp. fed on free living nematode *R. muscicola* Chitwood at 15, 20, 25, 28, 30 and 32ºC; she found that at 15ºC longest life cycle was recorded (30.11 and 19.36 days for female and male, respectively), while the shortest life cycle was achieved at 32ºC (15.59 and 11.66 days for female and male, respectively). Also, observed egg incubation, total immature stages, longevity of the predator was shortest at 32ºC and longest at 15ºC. In addition, maximum number of eggs produced /females were observed at 28 and 30ºC, and the minimum number was observed at 15 and 32ºC. Mostafa *et.al.* (2016) studied different biological aspects of the predatory mite, *C. capreolus* when fed on different diets mainly free living nematode, *R. scanica* Allgen and *Entomobrya musatica* Stach (Collembola) at 25 and 35±2°C and relative humidity 75±5% R.H. in laboratory. From the study, it was obvious that the different biological aspects (incubation period, life cycle, longevity and life span) of the predator were significantly affected by feeding on the different diets. When the two preys were compared as food, Collembola showed a higher fecundity source than using of free-living nematodes as rearing food, where the number of deposited eggs of the predator was 39.11 eggs at 25ºC, but the free-living nematodes as diet was the lowest favorable one, where the predator female deposited 33.05 eggs at 35ºC**.** Generally, Collembola proved to be the more suitable prey as resulted in more deposited eggs and longer life span.

Table (6) Factorial analysis of obtained biological aspects of *C. horidula* as affected by temperature, and preys**.**

Factor level	Preys		L.S.D.	Temperatures				L.S.D.
	Nematodes	Acarid		20°C	25°C	30°C	35°C	
Incubation period	5.13 b	5.41 a	0.23	7.37 a	5.95 b	4.50 c	3.26 d	0.33
Larval	3.80 a	3.53 b	0.17	5.27 a	3.85 b	3.18 c	2.35 d	0.24
Protonymph	3.70 a	3.52 a	0.18	5.17 a	3.80 b	3.22 c	2.32 d	0.25
Deutonymph	3.55 a	3.44 a	0.21	4.88 a	3.64 b	3.22 c	2.25 d	0.29
Tritonymph	3.92 a	3.90 a	0.18	5.0 a	4.05 b	3.32 c	3.26 c	0.25
Immature stages	15.02 a	14.41 b	0.51	20.34 a	15.35 b	12.96 c	10.2 d	0.73
Life cycle	20.15 a	19.87 a	0.61	27.72 a	21.3 b	17.46 c	13.47 d	0.87
Generation	24.06 a	23.31 b	0.72	32.28 a	25.65 b	20.93 c	15.79 d	1.02
Pre-Oviposition	3.91 a	3.48 b	0.27	4.66 a	4.35 a	3.46 b	2.32 c	0.38
Oviposition	32.29 a	29.57 b	1.22	36.25 a	33.31 b	29.08 c	25.08 d	1.73
Post-Oviposition	4.19 a	4.0 a	0.26	4.72 a	4.60 a	4.06 b	3.0 c	0.37
Longevity	40.21a	37.25 b	1.37	45.51 a	42.39 b	36.6 c	30.41 d	1.93
Life span	60.36 a	57.08 b	1.54	73.23 a	63.69 b	54.08 c	43.68 d	2.18
Fecundity (eggs/♀)	78.16 a	74.41 a	5.08	92.83 a	87.58 a	68.41 b	56.33 c	7.19
Daily rate (eggs/♀/ day)	2.4 a	2.57 a	0.20	3.03 a	2.78 a	2.28 b	1.88 c	0.29

Means within rows followed by the same letter were not significantly different at the 5% level.

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ARABIC SUMMARY

تأثير أنواع مختلفة من الغذاء على النواحي البيولوجية للمفترس الأكاروسى *Coleoscirus horidula* (Tseng) عند درجات الحرارة المختلفة (Acari: Prostigmata: Cunaxidae)

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تم تجميع المفترس الأكاروسى *Coleoscirus horidula* (Tseng) من الأوراق المتساقطة أسفل نباتات القطن بمحافظة القليوبية مصاحباً للأكاروسات والنيماتودا والحشرات القشرية ومفصليات الأرجل الصغيرة. يهدف البحث إلى دراسة بعض النواحي البيولوجية للمفترس الأكاروسى *C. horidula* عند التغذية على نوعين من الفرائس ، النيماتودا الحرة المعيشة *Rhabditis scanica* والأكاروس الأكاريدى *Tyrophagus putrescentiae* عند أربع درجات حرارة مختلفة (20، 25، 30، 35°م ورطوبة نسبية 65-70 ± 5%). تشير النتائج المتحصل عليها إلى أن إناث وذكور المفترس تمر خلال فترة حياتها بثلاثة أطوار من الحوريات وأتضح أيضا أن المفترس يتطور بسرعة على 35°م أسرع من 20°م. أظهرت النتائج التي تم الحصول عليها أن نوع الفريسة ودرجة الحرارة أثرت بشكل كبير على بيولوجية الذكور والإناث من *C. horidula*. نظرًا لإطالة فترة دورة الحياة وفترة الجيل وطول فترة حياة الأطوار البالغة وفترة الحياة الكلية لـ *C. horidula* عندما تتغذى على النيماتودا الحية *R. scanica* عند 20 درجة مئوية ، في حين انخفضت بشكل كبير عندما التغذية على الأطوار المتحركة لأكاروس عديم الثغر *T. putrescentiae* عند 35 °م. أوضحت النتائج أيضا أن أكبر عدد من البيض الذي وضعته الأنثى عند التغذية على النيماتودا الحرة المعيشة 98.83 بيضة لكل أنثى على درجة حرارة 25°م وسجل أقل كمية وضع بيض على درجة حرارة 35°م كانت 45.67 بيضة لكل أنثى على نفس الفريسة.