



**Effect of different diets on the development and fecundity of the predacious cunaxid mite
Neocunaxoides arboreus (Acari: Cunaxidae) at different laboratory conditions**

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Abstract:

This study was undertaken to study the biological aspects on the common predacious cunaxid mite species, *Neocunaxoides arboreus* (Den Heyer) (Acari: Cunaxidae). It was reared on free living nematode (*Rhabditella muscicola* Chitwood), acarid mite, *Tyrophagus putrescentiae* (Shrank) and *Aspergillus flavus* Link. at different laboratory conditions. Current studies showed that, the lower temperature 20 °C significantly increased the life periods of individuals in comparison with 35°C. The study showed that the obtained incubation period when the males of *N. arboreus* fed on different diets showed slightly differences between the different individuals and recorded 6.79, 6.81 and 6.77 days when the males fed on the free living nematode, acarid mite and *A. flavus*, at 20 °C, respectively. The results cleared that the life cycle of obtained males significantly differed according to the introduced diets, as, it longest when the mite fed the acarid mite (29.09 days) and shortest on *A. flavus* (24.09 days), but the resulted life cycle on the living nematode recoded (27.74 days). However, the results indicated that the averaged longevity of *N. arboreus* male individuals recorded 28.96, 26.48 and 31.81 days when the mite fed on free living nematodes, acarid mite and *A. flavus*, respectively at 20 °C. The same trends were observed for the different males and females at 25, 30 and 35 °C, as the kind of foods significantly affected on the biological aspects (incubation period, life cycle, longevity and life span of *N. arboreus*) males and females.

Introduction

Mites of the family Cunaxidae (Acari) are cosmopolitan predators that occur in soil, leaf litter, compost, moss, plants and stored products (Zhang, 2003). A little is known about the biology of cunaxids, the life cycle

of only seven species of this family has been studied (Castro and Moraes, 2010). The prey preference of a predator may be affected not only by characteristics of a prey item as food, but also by the microenvironment or

architecture produced by a prey species (Furuichi *et al.*, 2005). Their potential as control agents of plant pests has not been adequately investigated but it has been suggested that mass production of these mites could be hampered by their strong tendency towards cannibalism (Gerson *et al.*, 2003). Feeding capacity of the cunaxid mite *Neocunaxoides andrei* (Baker and Hoffmann) (Acari : Cunaxidae) and its feeding capability on the rootknot nematode *Meloidogyne javanica* Chitwood, under laboratory or semi field conditions were studied (Shoala and El Kady , 2009). Zaher *et al.* (1975) stated that *Cunaxa capreolus* (Berlese) (Acari: Cunaxidae) failed to develop on diets of plant material but developed equally well on diets of book lice or citrus brown mites, *Eutetranychus orientalis* (Klein) (Acari: Tetranychidae) which were eaten in their active stages and not as eggs. Taha *et al.* (1988) studied the effect of feeding by *N. andrei* on *Panagmlaimus rigidus* (Schneider) and immature stages of *Caloglyphus rhizoglyphoides* (Zachvatkin) on development time and fecundity of the mite in the laboratory at 30 °C and 70% RH. Predators fed on nematodes developed faster (21.2 and 18.1 days for development of immature females and males, respectively) than those fed on acarid mite (23.1 and 19.85 days). However, female longevity was 55.7 days with mites as prey and 45.8 days with nematodes.

The aim of the present work is to study the effect of different diets on the development and fecundity of the predacious cunaxid mite *Neocunaxoides arboreus* (Den Heyer) (Acari: Cunaxidae) at different laboratory conditions.

Materials and methods

The mite samples were collected under tomato plants in Qalubiya Governorate (Qaha region). The cunaxid mite, *N. arboreus* extraction was carried out using modified

Tullgren funnels. Each funnel has 60-Watt electric lamp. Samples of tested mites exposed to light for 24 hrs., and the extracted mites were received in petri-dishes (diameter 9 cm, high 1.5 cm) filled with water. Three adults females and males of the cunaxid mite were placed in screening cells (2.5 cm in diameter), with a layer of mixture of plaster of Paris and charcoal (9:1) on its bottom to depth 5 mm and covered with slide cover and binded by robber band. The cells were supplied with food and kept at 25±2°C and about 75±5% RH. About two water drops were added when needed. For individual unit rearing, newly deposited eggs were transferred each to a rearing plastic cell. Each newly hatched larva was supplied with different tested food, free living nematode, acarid mite, *Tyrophagus putrescentiae* (Schrank) (Acari: Acaridae) and the fungus *Aspergillus flavus* and consumed food was replaced every 2 days interval with another new one till reaching maturity stage.

1. Rearing cells:

Mites were reared as individuals using small hemispherical of ½ inch in diameter and less than ¼ inch in depth. Bottom of each cell was covered with mixed of plaster of Paris and charcoal, and the top of each cell covered with small slide glass.

1.1. 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 *Meloidogyne javanica* Chitwood was cultured in petri-dishes that contain slices of potatoes. Petri-dishes were kept under laboratory conditions at 25°C. Camel hair brushes 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 % RH. All obtained data were

presented as means +S.D. often replicates, and all observations were recorded by means of a stereomicroscope. The obtained data were subjected to one-way analysis of variance (ANOVA) and means were separated by Duncan's multiple range test (Duncan, 1955).

1.2. Acarid mite *Tyrophagus putrescentiae*:

The astigmatid mite, *T. putrescentiae*, was extracted from the same fauna (debris of tomato plants at Qaha region, Qalubiyah Governorate) by aiding of a Berlese funnel. For preparing pure culture of tested mite, 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.

2. Biological studies of *Neocunaxoides arboreus*:

Eggs of *N. arboreus* were incubated until hatching. The newly hatched larvae were reared singly in rearing cell and fed during its life span on one of the tested diets. In all cases, number of surviving *N. arboreus*, the duration of each stage in days and egg product were assessed twice daily.

2.1. Behavior :

Field observations showed that the predatory mite *N. arboreus* was usually found around their active prey individuals only. 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 inserted its chelicerae in any part of the body and sucked its contents. Life history of *N. arboreus* females pass through one larval and three nymphal stages (protonymph, deutonymph, and tritonymph) before reaching adulthood, while male has one larval and two nymphal stages (protonymph and deutonymph). An active immature individual enters a resting or quiescent stage before entering the following stage.

2.2. Mating:

Laboratory observations showed that the mating process is necessary for *N. arboreus* production in this mite. 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, then it manipulated itself underneath the female, bending its opithosoma upward and forward to meet that of female. Copulation usually lasted about 5 minutes.

2.3. Oviposition:

Females of *N. arboreus* usually deposited its eggs singly.

Results and discussion

1. Effect of different food types on the biological aspects of *Neocunaxoides arboreus* male at 20 °C :

The tabulated data in Table (1) showed that the resulted incubation period of *N. arboreus* male fed on different diets showed slightly differences between the different individuals and recorded 6.79, 6.81 and 6.77 days when the males fed on the free living nematode, acarid mite and *A. flavus*, at 20 °C, respectively. On the other hand, the same obtained data cleared that the life cycle of obtained males significantly differed according to the introduced diets, as, it longest when the mite fed the acarid mite, *T. putrescentiae* (29.01 days) and shorted on *A. flavus* (24.09 days), but the resulted life cycle on the living nematode recoded (27.74 days) (Table,1). However, the tabulated data in Table (1) indicated that the averaged longevity of *N. arboreus* male individuals recorded 28.96, 26.48 and 31.81 days when the mite fed on free living nematodes, acarid mite and *A. flavus*, respectively at 20° C. The same study showed that the life span of *N. arboreus* male individuals lasted 55.61, 55.5 and 55.9 days when the cunaxid mite fed on the same previously mentioned diets at 20 °C (Table,1).

Table (1): Effect of food types on the biological aspects of *Neocunaxoides arboreus* male at 20 °C.

Biological aspects	Hosts			L.S.D. at 0.05 level		
	A	B	C	Temp.	Diet	
Incubation period	6.79±0.04	6.81±0.03	6.77±0.01	0.0140	0.014	
Larva	a	4.63±0.04	4.93±0.03	3.8±0.06	0.042	0.053
	q	0.56±0.03	0.65±0.02	0.49±0.03	0.005	0.004
Protonymph	a	4.58±0.05	4.94±0.02	3.84±0.4	0.035	0.041
	q	0.64±0.23	0.67±0.02	0.50±0.03	0.003	0.004
Deutonymph	a	4.67±0.03	4.89±0.06	3.81±0.04	0.023	0.027
	q	0.76±0.03	0.76±0.02	0.50±0.02	0.005	0.005
Tritonymph	a	4.64±0.03	4.79±0.05	3.79±0.03	0.013	0.013
	q	0.56±0.03	0.65±0.01	0.49±0.02	0.003	0.004
Total immatures	20.9±0.18	22.22±0.11	17.34±0.15	0.041	0.045	
Life cycle	27.74±0.50	29.01±0.13	24.09±0.16	0.024	0.31	
Longevity	28.96±0.71	26.48±0.6	31.81±1.28	0.265	0.312	
Life span	55.61±0.83	55.5±0.62	55.9±1.24	0.295	0.321	

a= active q= quiescent L.S.D. = least significant difference
 A= Free living nematode B= Acarid mite C= *Aspergillus flavus*

2. Effect of different types of food on the biological aspects of *Neocunaxoides arboreus* male at 25 °C:

The tabulated data in Table (2) showed that the incubation period of *N. arboreus* male lasted 5.05, 5.34 and 5.27 days when the cunaxid mite fed on free lining

nematode, *M. javanica* acarid mite, *T. putrescentiae* and the fungus, *A. flavus* respectively at 25 °C. On the other hand, the same mentioned table indicated that the male individuals took 21.96, 23.13 and 28.19 days and 47.21, 45.43 and 47.3 days for both life cycle and life span at 25 °C.

Table (2): Effect of food types on the biological aspects of *Neocunaxoides arboreus* male at 25 °C.

Biological aspects	Hosts			L.S.D. at 0.05 level		
	A	B	C	Temp.	Diet	
Incubation period	5.05±0.02	5.34±0.04	5.27±0.05	0.013	0.012	
Larva	a	3.87±0.05	3.94±0.03	3.13±0.23	0.040	0.038
	q	0.45±0.02	0.53±0.02	0.44±0.01	0.007	0.004
Protonymph	a	3.69±0.06	3.94±0.02	3.05±0.02	0.029	0.042
	q	0.44±0.02	0.50±0.02	0.48±0.02	0.004	0.003
Deutonymph	a	3.72±0.07	3.94±0.02	3.60±0.22	0.019	0.018
	q	0.45±0.02	0.49±0.01	0.43±0.02	0.004	0.005
Tritonymph	a	3.64±0.02	3.94±0.03	3.05±0.04	0.006	0.012
	q	0.43±0.01	0.50±0.02	0.43±0.01	0.004	0.003
Total immature	16.69±0.12	17.79±0.06	13.94±0.17	0.411	0.26	
Life cycle	21.96±0.23	23.13±0.14	19.21±0.18	0.439	0.544	
Longevity	25.27±0.60	22.31±0.73	28.19±0.64	0.398	0.841	
Life span	47.21±0.69	45.43±0.73	47.3±0.68	0.247	0.267	

a= active q= quiescent L.S.D. = least significant difference
 A= Free living nematode B= Acarid mite C= *Aspergillus flavus*

3. Effect of different types of food on the biological aspects of *Neocunaxoides arboreus* male at 30 °C:

3.1. Incubation period:

As shown in Table (3), the incubation period of different *A. arboreus* male individuals did not affected by the kind of food as it recorded about 4.0 days at 30 °C.

3.2. Life cycle:

The current study indicated that the life cycle of *N. arboreus* males members did not significantly affect when fed at 30 °C. on free living nematodes (17.87 days) and on acarid mite (17.85 days), but the difference was recorded when the mites reared on the fungus *A. flavus* (15.39 days) (Table, 3).

3.3. Longevity:

The mite *N. arboreus* males durated in its adult stage period about 21.01, 18.76 and 23.12 days when the individuals fed at 30 °C on free living nematodes, acarid mite, and the fungus, respectively. The analysis of obtained data showed that L.S. D. at 0.05 = 0.782 and 0.843 for the effect of temperature and introduced food, respectively (Table, 3).

3.4. Life span:

Table (3): Effect of different types of food on the biological aspects of *Neocunaxoides arboreus* male at 30 °C.

Biological aspects		Hosts			L.S.D. at 0.05 level	
Incubation period		A	B	C	Temp.	Diet
		4.04±0.07	4.08±0.03	4.05±0.02	0.018	0.016
Larva	a	3.12±0.03	3.04±0.02	2.50±0.03	0.057	0.214
	q	0.37±0.01	0.42±0.03	0.38±0.02	0.011	0.009
Protonymph	a	3.13±0.01	3.04±0.01	2.46±0.04	0.014	0.024
	q	0.33±0.01	0.40±0.02	0.38±0.02	0.008	0.009
Deutonymph	a	3.13±0.02	3.06±0.02	2.51±0.04	0.0064	0.067
	q	0.33±0.01	0.40±0.04	0.37±0.01	0.004	0.009
Tritonymph	a	3.07±0.01	3.03±0.01	2.39±0.03	0.027	0.029
	q	0.33±0.01	0.40±0.02	0.37±0.02	0.003	0.018
Total immature		13.82±0.05	13.77±0.12	11.32±0.12	0.354	0.514
Life cycle		17.87±0.05	17.85±0.013	15.39±0.18	0.654	0.847
Longevity		21.01±0.06	18.76±0.6	23.12±0.96	0.782	0.843
Life span		38.73±0.79	36.61±0.62	38.22±0.67	1.26	1.068

a= Active Q= quiescent L.S.D. = Least significant difference

A= Free living nematode B= Acarid mite C= *Aspergillus flavus*

4. Effect of different types of food on the biological aspects of *Neocunaxoides arboreus* male at 35 °C:

4.1. Incubation period:

The obtained data in Table (4) showed that the incubation period of the cunaxid mite *N. arboreus* male individuals averaged 3.06, 3.15 and 3.07 days when the mite fed on free living nematodes, acarid mite, and the fungus at 35 °C, respectively with L.S.D. at 0.05 level = 0.051 and 0.061 for effect of temperature and food types on this period, respectively.

4.2. Life cycle:

The study indicated that the life cycle of *N. arboreus* males members significantly affected when fed on the different introduced diets at 35 °C, as it recorded 13.7 days on free living nematodes, 12.81 days on acarid

The tabulated data in Table (3) obviously showed that the life span of the tested mite. *N. arboreus* male individuals significantly affected when different food kinds were introduced at 30 °C. The male took 38.73, 36.61 and 38.22 days when reared on free living nematodes, acarid mite, and *A. flavus*, respectively with L.S.D. at 0.05 for effect of temperature and food as 1.26 and 1.068, respectively (Table, 3).

mite and 11.01 days when the mites reared on the fungus *A. flavus* at 35 °C, respectively with L.S.D. at 0.05 level = 0.624 and 0.711 for effect of temperature and food types on this period, respectively (Table,4).

4.3. Longevity:

As shown in Table (4), the longevity period of the cunaxid mite *N. arboreus* male individuals lasted 16.94, 14.68 and 19.76 days, when the mite members fed on free living nematodes, acarid mite, and the fungus, respectively (Table,4). The statistical analysis of obtained data showed that L.S.D. at 0.05 level for effect of both temperature and food types effect on this period was 0.698 and 0.785, respectively.

4.4. Life span:

The obtained data in Table (4) showed that the life span of *N. arboreus*

females at 35 °C. took 30.64, 27.45 and 30.80 days when the mite individuals fed on free living nematodes, acarid mite and the fungus,

respectively, with L.S.D. at 0.05 level = 1.25 and 1.30 for effect of temperature and food types on this period.

Table (4): Effect of food types on the biological aspects of *Neocunaxoides arboreus* male at 35 °C.

Biological aspects		Hosts			L.S.D. at 0.05 level	
Incubation period		A	B	C	Temp.	Diet
		3.06±0.02	3.15±0.014	3.07±0.03	0.051	0.061
Larva	A	2.33±0.13	2.10±0.12	1.73±0.04	0.042	0.061
	Q	0.32±0.02	0.40±0.02	0.34±0.02	0.003	0.002
Protonymph	A	2.33±0.09	2.04±0.01	1.73±0.04	0.011	0.007
	Q	0.28±0.02	0.35±0.01	0.34±0.02	0.004	0.002
Deutonymph	A	2.34±0.07	2.06±0.02	1.65±0.03	0.013	0.009
	Q	0.27±0.01	0.35±0.01	0.34±0.01	0.0017	0.031
Tritonymph	A	2.29±0.09	2.03±0.01	1.60±0.04	0.032	0.009
	Q	0.27±0.01	0.35±0.02	0.34±0.02	0.016	0.004
Total immature		10.66±0.24	9.64±0.08	7.96±0.29	0.412	0.521
Life cycle		13.7±0.27	12.81±0.19	11.01±0.31	0.624	0.711
Longevity		16.94±0.89	14.68±0.56	19.76±0.62	0.698	0.785
Life span		30.64±0.097	27.45±0.07	30.80±0.71	1.25	1.30

a= active q= quiescent L.S.D. = least significant difference
A= Free living nematode B= Acarid mite C= *Aspergillus flavus*

5. Effect of food types on the biological aspects of *Neocunaxoides arboreus* female at 20 °C:

5.1. Incubation period:

The effect of different kinds of food on the incubation period of the cunaxid mite, *N. arboreus* did not highly affected foe female individuals at 20 °C, with L.S.D. at 0.05 level = 0.023 and 0.025 for effect of temperature and food types on this period. The incubation period lasted 6.82, 6.94 and 6.83 when the females food on free nematodes, acarid mite and *A. flavus*, respectively (Table , 5).

5.2. Life cycle:

The period of *N. arboreus* female obviously affected and took from egg stage to adult sate 30.87, 29.95 and 26.45 days when mite individuals fed on the same trend of different diets mentioned before at 20 °C, with L.S.D. at 0.05 level = 0.034 and 0.041 for temperature and food effect, respectively.

5.3. Longevity:

The adult female of *N. arboreus* averaged 40.26, 36.79 and 40.87 days on the same order of mentioned diets and at 20 °C, respectively/ The statistical analysis of obtained data showed that L.S.D. at 0.05 level for effect of temperature and food types, respectively (Table, 5).

5.4. Fecundity:

The current study clearly indicated that the number of deposited eggs by female of the tested cunaxid mite *N. arboreus* highly significantly affected by the kind of employed food, as, it laid 54.85, 47.45 and 64.25 eggs when the individuals fed on the free living nematodes, *T. putrescentiae* and *A. flavus*, respectively at 20 °C, with L.S.D. at 0.05 = 0.647 and 0.717 for effect of temperature and food types, respectively (Table, 5).

Table (5): Effect of food types on the biological aspects of *Neocunaxoides arboreus* female at 20 °C .

Biological aspects	Hosts			L.S.D. at 0.05 level		
	A	B	C	Temp.	Diet	
Incubation period	6.82±0.24	6.94±0.02	6.83±0.07	0.023	0.0252	
Larva	a	5.30±0.11	5.12±0.07	4.48±0.08	0.051	0.057
	q	0.50±0.02	0.70±0.04	0.50±0.02	0.004	0.004
Protonymph	a	5.12±0.05	5.02±0.29	4.30±0.67	0.044	0.003
	q	0.05±0.02	0.66±0.03	0.47±0.02	0.003	0.005
Deutonymph	a	5.14±0.04	5.08±0.14	4.47±0.02	0.023	0.025
	q	0.49±0.03	0.66±0.02	0.46±0.02	0.006	0.007
Tritonymph	a	5.47±0.34	5.20±0.26	4.45±0.02	0.015	0.016
	q	0.49±0.02	0.64±0.02	0.44±0.02	0.005	0.017
Total immatures	23.58±0.59	23.02±0.32	19.63±0.013	0.035	0.027	
Life cycle	30.87±2.16	29.95±0.31	26.45±0.23	0.034	0.041	
Preoviposition	5.29±0.3	5.82±0.33	4.47±0.04	0.018	0.021	
Oviposition	29.27±1.0	25.98±0.68	31.80±1.03	0.075	0.068	
Postoviposition	6.30±2.16	5.01±0.46	4.43±0.38	0.066	0.042	
Longevity	40.26±1.16	36.79±0.91	40.87±0.98	0.287	0.331	
Life span	70.57±1.41	66.60±1.38	67.29±1.14	0.313	0.351	
Sex ratio	0.33±0.1	0.33±0.01	0.33±0.01	0.002	0.002	
Fecundity	54.85±2.01	47.45±0.82	64.25±1.37	0.647	0.717	
Daily rate	1.91±0.24	1.81±0.06	2.16±0.067	0.543	0.514	

a= Active q= Quiescent L.S.D. = Least significant difference A= Free living nematode B= Acarid mite
C= *Aspergillus flavus*

6. Effect of food types on the biological aspects of *Neocunaxoides arboreus* female at 25 °C:

6.1. Incubation period:

The tabulated data in Table (6) showed that the incubation period of *N. arboreus* females did not affected by the kind of introduced food at 25 °C with L.S.D. at 0.05 = 0.012 and 0.024 for effect of temperature and food types, respectively.

6.2. Life cycle:

Data in Table (6) showed the effect of different diets on the life cycle of *N. arboreus* females at 25 °C. It was longer when the individuals fed free living nematodes and recorded 24.69 days, but the lowest period was noticed when the mites reared on *T. putrescentiae* (23.76 days), with L. S.D. at 0.05 level = 0.029 and 0.043, respectively.

6.3. Pre-oviposition, oviposition and post-oviposition periods :

The duration of pre-oviposition period of *N. arboreus* on different diets represented in Table (6), averaged 5.04, 4.78 and 3.84 days, but the oviposition period took 23.97, 21.38 and 25.59 days when fed on free living nematodes, acarid mite and the fungus, respectively at 25 °C. The statistical analysis of obtained data indicated that L.S.D. at 0.05 = 0.014 and 0.02 and 0.065 and 0.071 for effect of temperature and diets, respectively in case of pre-oviposition and oviposition periods, respectively. However, there were highly significant differences between the individuals in case of post-oviposition period, as, it recorded 5.17, 4.47 and 3.83 days on free nematodes, acarid mite and the fungus, respectively.

6.4. Longevity:

Results in Table (6) indicated that the mean longevity of *N. arboreus* females when fed on different diets averaged 34.12, 30.48

and 33.26 days at 25 °C, respectively, with effect of temperature and diets = 0.264 and 0.334, respectively.

6.5. Fecundity:

The fecundity (number of laid eggs) of *N. arboreus* female was not highly affected by diets as shown in Table (6). It was 71.75, 71.35 and 72.45 eggs when the females fed on the free living nematodes, the acarid mite and the fungus at 25 °C, respectively. The statistical analysis of obtained data showed

Table (6): Effect of food types on the biological aspects of *Neocunaxoides arboreus* female at 25 °C.

Biological aspects		Hosts			L.S.D. at 0.05 level	
		A	B	C	Temp.	Diet
Incubation period		5.41±0.015	5.44±0.07	5.44±0.04	0.012	0.024
Larva	a	4.35±0.30	4.06±0.04	3.47±0.04	0.05	0.06
	q	0.51±0.03	0.54±0.04	0.46±0.07	0.006	0.007
Protonymph	a	4.22±0.12	4.04±0.02	3.50±0.03	0.041	0.004
	q	0.21±0.02	0.52±0.03	0.43±0.02	0.005	0.003
Deutonymph	a	3.72±0.07	3.94±0.02	3.05±0.02	0.017	0.024
	q	0.50±0.02	0.45±0.03	0.43±0.02	0.008	0.011
Tritonymph	a	4.16±0.05	4.07±0.02	3.39±0.03	0.011	0.014
	q	0.50±0.02	0.51±0.02	0.42±0.02	0.009	0.015
Total immatures		19.22±0.39	18.33±0.28	15.51±0.09	0.025	0.025
Life cycle		24.69±0.49	23.76±0.29	20.94±0.09	0.029	0.043
Preoviposition		5.04±0.31	4.78±0.19	3.84±0.30	0.014	0.02
Oviposition		23.97±0.79	21.38±0.72	25.59±0.78	0.065	0.071
Postoviposition		5.17±0.06	4.47±0.18	3.83±0.41	0.069	0.043
Longevity		34.12±0.68	30.48±0.29	33.26±0.84	0.264	0.334
Life span		58.93±0.80	54.24±0.92	54.20±0.86	0.322	0.356
Sex ratio		0.33±0.01	0.32±0.01	0.33±0.01	0.004	0.003
Fecundity		71.75±2.79	71.35±1.46	72.45±1.19	0.587	0.624
Daily rate		2.96±0.22	3.29±0.29	2.84±0.09	0.511	0.705

A= active Q= quiescent L.S.D. = Least significant difference

A= Free living nematode B= Acarid mite C= *Aspergillus flavus*

7. Effect of different types of food on the biological aspects of *Neocunaxoides arboreus* female at 30 °C:

7.1. Incubation period:

As shown in Table (7), the incubation period of *N. arboreus* female was not obviously affected when fed on preys at 30 °C. The statistical analysis of obtained data showed that L.S.D. at 0.05 level= 0.12 and 0.13 for effect of temperature and food types, respectively.

7.2. Life cycle:

From the tabulated data in Table (7), it could be observed that the duration of life

that L.S.D. at 0.05 = 0.587 and 0.624 for effect of temperature and food types, respectively.

6.6. Life span:

Accordingly, the life span of *N. arboreus* females significantly differed on different diets, at 25 °C ,as prolonged on free living nematodes (58.93 days) and shorted on the fungus and acarid mite (54.20 and 54.24, respectively (Table,6).

cycle for female individuals of *N. arboreus* was obviously affected by the type of food employed at 30 °C. This period averaged 20.15, 21.83 and 17.64 days when the mite individuals fed on free living nematodes, acarid mite and the fungus. The statistical analysis of obtained data showed that L.S.D. at 0.05 level = 1.21 and 1.06 for effect of temperature and diets, respectively.

7.3. Longevity:

The maximum longevity was 31.03 days when the predatory mite fed on the fungus *A. flavus*, and the minimum corresponding figures was 26.84 days for

female individuals reared on the acarid mite at 30 °C. However, when the mite females fed on the free living nematode, they lasted about 30.23 days. The analysis of data indicated that L.S.D. at 0.05 level =12.3 and 1.64 for effect of temperature and food types, respectively (Table,7).

7.4. Life span:

The females of *N. arboreus* took 50.35, 48.68 and 74.45 days when reared on nematodes, mite, and the fungus, respectively during life span at 30 °C, with L.S. D. at 0.05 level = 3.25 and 3.15 for

Table (7): Effect of food types on the biological aspects of *Neocunaxoides arboreus* female at 30 °C.

Biological aspects	Hosts			L.S.D. at 0.05 level		
	A	B	C	Temp.	Diet	
Incubation period	4.22±0.04	4.26±0.05	4.27±0.04	0.012	0.013	
Larva	a	3.72±0.02	3.93±0.03	2.94±0.03	0.024	0.024
	q	0.43±0.03	0.57±0.02	0.46±0.02	0.003	0.003
Protonymph	a	3.76±0.07	3.81±0.11	2.79±0.01	0.027	0.068
	q	0.41±0.06	0.52±0.05	0.43±0.02	0.004	0.005
Deutonymph	a	3.23±0.08	3.80±0.04	2.92±0.05	0.034	0.11
	q	0.42±0.02	0.55±0.04	0.43±0.02	0.009	0.11
Tritonymph	a	3.53±0.03	3.87±0.05	3.91±0.06	0.032	0.034
	q	0.43±0.02	0.55±0.03	0.43±0.02	0.002	0.008
Total immatures	15.92±0.09	17.57±0.16	13.41±0.09	0.687	0.789	
Life cycle	20.15±0.10	21.83±0.13	17.64±0.10	1.21	1.06	
Preoviposition	4.86±0.08	3.90±0.03	4.28±0.27	0.021	0.111	
Oviposition	20.94±0.82	18.9±0.49	22.52±0.65	0.958	0.849	
Postoviposition	4.24±0.39	4.07±0.31	4.14±0.5	0.121	0.119	
Longevity	30.23±1.0	26.84±0.64	31.03±0.91	1.23	1.64	
Life span	50.35±1.1	48.68±0.62	48.67±0.88	3.25	3.15	
Sex ratio	0.33±0.01	0.33±0.01	0.33±0.01	0.0003	0.003	
Fecundity	70.6±2.33	64.25±1.52	74.45±0.09	4.26	5.333	
Daily rate	3.35±0.18	3.93±0.13	3.32±0.15	0.024	0.019	

A= active Q= quiescent

A= Free living nematode

L.S.D. = Least significant difference

B= Acarid mite

C= *Aspergillus flavus*

8. Effect of different types of food on the biological aspects of *Neocunaxoides arboreus* female at 35 °C:

8.1. Incubation period:

As can be seen in Table (8) the incubation period slightly similar for the predator *N. arboreus* fed on different introduced diets, 3.13, 3.14 and 3.11 days when fed on free living nematode, acarid mite and *A. flavus*, respectively at 35 °C.

8.2. Life cycle:

effect of temperature and food types, respectively (Table ,7).

7.5. Fecundity:

The adult female of *N. arboreus* as shown in Table (7) laid the high number of eggs (74.45 eggs) when fed on *A. flavus* at 30 °C., while the lowest number was observed when fed on the acarid mite, *T. putrescentiae* (64.25 eggs) at the same experiment conditions. L.S.D. at 0.05 level =4.26 and 5.33 for temperature and diets effect, respectively.

From Table (8), it was observed that at 35 °C, the life cycle of *N. arboreus* females lasted 14.69, 14.89 and 11.85 on nematode, acarid mite and *A. flavus*, respectively.

8.3. Longevity:

The adult female of *N. arboreus* changed according to the kind of food and this clearly at 35 °C observed in Table (8). The longest longevity period of female was observed when the individuals fed on *A. flavus* and recorded 25.4 days

8.4. Life span:

Accordingly, the life span of the cunaxid mite, *N. arboreus* female was highly significantly affected by rearing on different diets at 35 °C. The longest period lasted

39.49 days when the mites fed on free nematode changed to 36.95 and 37.05 days when the female fed on *T. putrescentiae* and *A. flavus*, respectively (Table,8).

Table (8): Effect of food types on the biological aspects of *Neocunaxoides arboreus* female at 35 °C.

Biological aspects		Hosts			L.S.D. at 0.05 level	
		A	B	C	Temp.	Diet
Incubation period		3.13±0.04	3.14±0.03	3.11±0.03	0.032	0.034
Larva	a	2.41±0.05	2.52±0.03	1.81±0.06	0.047	.016
	q	0.45±0.03	0.40±0.02	0.37±0.02	0.003	0.004
Protonymph	a	2.46±0.05	2.42±0.09	1.82±0.05	0.154	0.161
	q	0.45±0.03	0.39±0.01	0.37±0.02	0.003	0.008
Deutonymph	a	2.46±0.05	2.53±0.06	1.82±0.04	0.129	0.147
	q	0.47±0.04	0.38±0.02	0.36±0.02	0.001	0.002
Tritonymph	a	2.46±0.05	2.77±0.03	1.97±0.63	0.101	0.103
	q	0.47±0.04	0.38±0.02	0.36±0.02	0.003	0.004
Total immatures		11.49±0.28	12.31±0.43	8.75±0.09	0.652	0.584
Life cycle		14.69±0.25	14.89±0.12	11.85±0.09	0.346	0.289
Preoviposition		3.19±0.17	2.82±0.16	2.75±0.42	0.024	0.014
Oviposition		18.26±0.83	15.97±0.67	19.40±0.62	0.624	0.852
Postoviposition		3.62±0.79	3.25±0.39	3.37±0.40	0.003	0.002
Longevity		24.82±1.15	22.09±0.84	25.4±0.90	1.125	1.33
Life span		39.49±1.21	36.95±0.77	37.05±0.95	2.245	2.213
Sex ratio		0.33±0.01	0.33±0.01	0.33±0.01	0.002	0.004
Fecundity		54.1±2.38	64.7±1.84	59.25±2.57	2.98	3.511
Daily rate		2.95±0.14	4.04±0.21	3.05±0.17	0.005	0.009

A= active Q= quiescent

L.S.D. = Least significant difference

A= Free living nematode

B= Acarid mite

C= *Aspergillus flavus*

The current study demonstrated that the temperature 25°C. was the most favorable temperature for rearing the cunaxid mite *N. arboreus* when fed on different introduced diets and these results were coincident with those obtained by Khalil *et al.* (2012) where they studied the life history of the cunaxid mite, *P. martini* when fed on the different diets where they found that the best diet for rearing *P. martini* was *F. oxysporum* at 25°C where it recorded the highest number of eggs (73.79) but the least favorable one for feeding was the fungus *P. spinosum* at 35°C (48.71 eggs). Also, El-Khateeb (1998) mentioned that low temperature decreased female fecundity of the cunaxid mite, *Cunaxa setirostris* (Hermann). Also, Khalil *et al.* (2009) reared the cunaxid mite, *Coleoscirus bapto*s on different fungi and mentioned that 25°C was the most favorable temperature for

rearing this mite, as, it deposited 95.6 eggs when fed on *Aspergillus niger*. The same results were observed but on different cunaxid species by Ghallab (2002) where she studied the biological aspects on three cunaxid species, *Coleoscirus simplex* (Ewing), *C. tuberculatus* Den Heyer and *Pulaeus subterraneus* Berlese when reared on the free nematode, *Rhabditella muscicola* under laboratory conditions at 27±1°C and 75-80% RH. The author mentioned that the average life cycle of female was more longer than that of male being 12.8, 13.1 and 15.6 days, while those of male were 12, 11.7 and 13.4 days, respectively. The coleoscirine cunaxid mite *C. simplex* colonizes greenhouse pot cultures of root knot nematodes (*Meloidogyne* spp.) in Orlando, Florida, where it preyed on nematodes and soil arthropods, Walter and Kaplan (1991).

This was the first report of nematophagy in a cunaxid mite. The authors added that the cunaxoidine *Pulaeus* sp. also fed on both arthropods and nematodes, but three species in the Cunaxidinae, *Dactyloscirus inermis*, *Dactyloscirus* sp. and *Cunaxa* sp. fed only on arthropods. Also, Yassin (2006) investigated the effect of three diets mainly Collembola (*Neanurodes* sp.), free living nematode, *R. muscicola* and acarid mite, *T. putrescentiae* on the biological aspects of the cunaxid mite, *C. capreolus* Collembola proved to be the suitable prey as results in more deposited eggs and longer life span and this might be due to the collembolan was the best prey where it contained the highest total 54 sugar and higher relative concentration of glucose contents

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