Egypt. J. Agric. Res., 80 (4), 2002.

BIOLOGICAL AND ECOLOGICAL STUDIES ON THE SOIL PREDATORY MITE *HOLOSTASPELLA SOLIMANI* AFIFI, HASSAN AND NAWAR (Macrochelidae: Gamasida)

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(Manuscript received March, 2002)

Abstract

A laboratory work was conducted to investigate some biological aspects of the predatory mite *Holostaspella solimani* Afifi, Hassan and Nawar (Macrochelidae: Gamasida). Eight different diets were used. *H. solimani* did not develop beyond the deutonymphal stage when served with the acarid mites, *Rhizoglyphus robini* or *Tyrophagus putrescentiae*. Female life cycle ranged between 7.7 and 11.1 days and slightly shorter for the male (7.1 and 10.6 days). The free living nematode *Rhizoglyphus scanica* and the soil fungi *Aspergillus niger* were the most suitable diet. Female fecundity averaged 56.7 and 22.0 eggs with daily rate of 3.5 and 0.7 when fed on *Rhizoglyphus scanica* and *Aspergillus niger*, respectively. Food consumption increased as stages developed regardless of food type. The highest multiplication rates were 77.71 and 85.57 at 25°C when fed on *Rhabditis scanica* alone and mixture of diets, respectively.

Female life span averaged 10.3, 7.7 and 4.8 days at 20, 25 and 30°C. Fecundity and ovipostion were higher at 25°C than at 20 or 30°C. Life cycle increased by 122% and 95% when 10/20 and 15/20°C regimes were applied, respectively. Life span prolonged to 125% and 92% under the two regims. Egg hatchability decreased from 93.3% to 20.3%. Absence of males led to lowest fecundity, 26.3 eggs / female, while increased to 53.6 and 56.7 eggs/female with male presence for one day every five days or with complete companionship all over female longevity.

INTRODUCTION

Macrochelid mites commonly occur in domestic animal manure, predating on eggs and larvae of the house fly *Musca domestica* L. (Axtell 1961 and Rodriguez & Wade 1961). Many species of the genus *Holostaspella* were figured and described by Karg (1971), Krantz (1972) and Bregetova *et al.* (1977).

In Egypt, it was the first time to record this genus by the two new species *Holostaspella sherefi* and *H. solimani*. These two species were figured and described by Afifi, *et al.* (1986a).

Shereef *et al.* (1990) reared *Macrocheles glaber* (Muller) on eggs and larvae of housefly *M. domestica* and vinegarfly, *Dorosophila melanogaster* and free living nematode *R. scanica* at 20, 25 and 30°C. The life table parameters showed that 30°C was

the most suitable temperature for its highest rate of increase (rm,) and housefly eggs were the most suitable prey for its highest rm. Therefore, this work aimed to investigate the biology, reproduction of *H. solimani* Afifi, Hassan and Nawar (1986), as affected by different diets, temperatures and presence of male.

MATERIALS AND METHODS

Individuals of *H. solimani* were extracted from soil and debris under ficus trees in Orman garden, Giza using modified Tullgren funnel. Some adult specimens were cleared in Nesbittis solution, mounted in Hoyer's medium then microscopically examined.

Seven sources of food as prey were used for *H. solimani* : immatures of the acarid bulb mite, *Rhizoglyphus robini* Claparede, the acarid stored product mite, *Tyrophagus putrescentiae* Schrank, eggs and larvae of housefly, *M. domestica*. L., free living nematodes *R. scanica* Allgen, the soil fungi, *Aspergillus niger* Roper and the collembola, *Lepeidocyrtinus incertus* (Hand), and mixture of diets.

Rate of reproduction for the tested predacious mite was studied at 20, 25 and 30°C ± 1°C by keeping 5 newly emerged adult females together with two males in a rearing plastic cage for 8 weeks, then number of offspring was counted. The seven prementioned foods were used. Experiments were carried out at 70 ± 5% R.H. using NaCl salt solution as R.H. modifier, and replicated 5 times.

An experiment was designed to study the effect of low temperature. Thirty newly deposited eggs of *H. solimani* were collected from the laboratory cultures and kept singly each in a cylindrical plastic cup (2.8 x 2cm) with a filter paper at its bottom. Relative humidity was maintained by adding few drops of water on the filter paper when needed. A group of eggs was exposed to an alternating temperature of 10 and 20°C (12 hours each, through life span). The same technique was repeated for another group of eggs except using 15, and 20°C, alternatively.

Another experiment was designed to determine the female ability of multiple mating and its effect on female longevity, fecundity and progeny sex ratio. Four groups were used. Five newly emerged females for every group were confined singly to rearing cells. The 5 newly emerged unmated females of the first group were kept to complete their longevity and deposit eggs. For the second group, a young male was introduced to each female until first copulation occurred, then removed. For the third group a young male was introduced to each female for 24 hours every five days during her longevity. Females of the fourth group was accompanied with males throughout their longevity.

RESULTS AND DISCUSSION

I. Ecological Aspects: Samples of *H. solimani* were collected from soil and debris under ficus trees located in the farm of Faculty of Agriculture, Cairo University, Giza. It was associated with the free-living nematodes, R. *scanica*, the acarid bulb mite, R. robini, larvae and eggs of the housefly, *M. domestica*, the collembola, *L. incertus* and the two soil fungi, *A. niger* and *Penicillium viride*.

II. Biological Aspects

Hatching and Moulting: Egg is oval whitish when deposited, then changes to creamy. Hatching occurs by longitudinal slit from which larva crawls outside leaving the egg shell. Immature individual undergoes some twisting movements to loosen its body from the exuvia, then newly emerged individual crawls outside and keeps quiet near its old skin for a short period before starting to move actively searching for prey. Moulting process lasted for about 1.5 to 2 hours.

Mating: Both male and female accepts copulation immediately after emergence. Male carefully approaches female from front and touches her with leg I, then quickly climbs over her dorsum. The female can move carrying the male on her back. This process lasts for 4 – 5 minutes. Afterwards, the male crawls underneath the female and clasps his body using the III and IV legs and their ventral surfaces are facing each other. After copulation, both sexes separate and female shows some body movements. Copulation process lasts 4 – 8 minutes. Female accepts copulation more than once.

Rate of reproduction was presented in Table 1 indicates that temperature of 25°C was better than 30°C. Prey *R. scanica* alone or mixed with other tested foods gave highest rates of *H. solimani* increase. Multiplication rate was 77.71 and 85.57 at 25°C and 55.29 and 57.71 at 30°C with intrinsic rate of increase (rm) of 0.078 and 0.079 at 25°C and 0.072 and 0.072 at 30°C, respectively. Feeding on the fungus *A. niger* resulted in lower values than *R. scanica*. Multiplication rate of 22.71 at 25°C and 12.29 at 30°C, with intrinsic rate of increase of 0.056 and 0.045 at 25 and 30°C, respectively. Feeding on *R. robini* or *P. viridi* resulted in population decrease. No cannibalism was observed.

Table 2 shows that *H. solimani*, at 25°C and 70% R. H., developed and female oviposited successfully when fed on the free living nematode, *R. scanica*, the larvae or eggs of housefly *M. domestica*; the collembola, *L. incretus* or the fungus, *A. niger*. The fungus *P. viride* was an accepted diet for development only, while no development occurred following the deutonymphal stage with the acarid mites, *R. robini* and *T. putrescentiae*. Developmental duration of immature stages of *H. solimani* ranged between 4.7

and 8.0 days for female and 4.0 and 7.5 days for male. The life cycle (egg – adult) followed similar trend as it ranged between 7.7 and 11.1 days for female and 7.1 and 10.6 days for male. *R. scanica* and *A. niger* were the most favourite diets resulting in the shortest developmental duration as life cycle for both sexes was 7.7 days for female and 7.1 days for male, respectively. The rest of tested diets gave longer life cycle durations; 9.5 to 11.1 for the female and 9.1 to 10.6 days for the male.

Effect of different diets on longevity and fecundity of tested mite at 25°C and 70% R.H., was presented in Table 3. The shortest duration was obtained when fed on *R. scanica*; while the longest was on *A. niger*. Female longevity was 21.5, 37.7, 35.2, 45.3 and 61.5 days when the mite fed on *R. scania*, *M. domestica*, larvae *M. domestica* eggs, *L. incretus* and *A. niger*, respectively. Pre-oviposition period ranged between 2.0 and 5.9 days on the tested diets except for *L. incretus* where it prolonged to 11.8 days. Mean of female fecundity was 56.7 and 22.0 eggs with a daily rate of 3.5 and 0.7 when fed on *R. scanica* and *A. niger*, respectively. Feeding on *M. domestica* larvae, and eggs of *L. incretus* resulted in much lower fecundity 3.5, 2.6 and 1.6 eggs/female, respectively. Post-oviposition period average was 3.3 days when fed on *R. scanica*. Feeding on the rest of diets resulted in post-oviposition period ranging between 18.8 to 32.0 days, and the life span followed the same trend.

Table 4 indicates food consumption of *H. solimani* during different stages when fed on *M. domestica* larvae or eggs. Food consumption increased as stages developed regardless of food type and that of female was generally higher than that of male.

Table 5 indicates that raising temperature from 20 to 25 and 30°C reduced *H. solimani* female life cycle duration and adult longevity, averaging 10.3, 7.7 and 4.8 days; and 34.5, 21.5 and 18.5 days, respectively at 20, 25 and 30°C and 70% R.H. when fed on the suitable diet *R. scanica*. Data also show that fecundity and oviposition daily rate were higher at 25°C than at 20 or 30°C. At 25°C, fecundity was 56.7 eggs/female with 3.5 eggs/female/day as compared with 38.2 and 34.2 eggs/female with 2.1 and 2.6 eggs/female/day at 20 and 30°C, respectively. In the mean time, oviposition period, post-oviposition period, longevity and life span were shorter at 30 °C than at 25 or 20°C, Table 5. These results are generally in agreement with the findings of Mowafi (1993) when rearing the macrochelid mite, *M. muscaedomestica* on *R. scanica* at 20, 25, 30 and 32°C. He found that female life cycle averaged 8.2, 9.7, 7.9 and 4.1 days, respectively. Female fecundity also increased but decreased at 32°C averaging 18.5, 25.8, 37.5 and 22.7 eggs, respectively.

Table 6 shows that exposure to alternating temperature reduced development of all stages as well as female fecundity. Life cycle increased by 122% and 95% when 10/20 & 15/20°C regimes were used, respectively (22.6 and 19.7 days compared with 10.3 days, at constant 20°C). Life span prolonged by 125% and 92% under the same

regime compared with constant temperature 65.6 & 56.1 days compared with 44.8 days, respectively. Oviposition period was similar, but fecundity per female was reduced to 60 and 79%.

Table 7 indicates that exposing *H. solimani* eggs to alternating 10/20°C, gradually increased the incubation period from 4.3 to 7.3 days as exposure time increased from one to seven days and hatchability decreased from 93.3% to 20.3%. All other stages showed similar pattern, as life cycle duration increased from 10.8 to 21.3 days. Exposing eggs of the mite to alternating 15/20°C resulted in similar trend. These results are confirmed by those of Abou-Elella (1998) who found that, the percentage of egg hatchability of *Amblyseius deleoni* decreased as cold storage increased. The total hatchability percentage decreased from 100 to 0% after one week of cold storage at 10 and 5°C, respectively. On the other hand, female percentage survivability decreased as time increased with greater rate at low temperature. Number of female survivors decreased from 100 to 0.04% and from 100 to 18% when females were stored for 1 week at 5 and 10°C, respectively.

Male presence of *H. solimani* affects female longevity, fecundity and progeny sex ratio, Table 8. Female longevity averaged 17.4, 22.8 and 21.5 days when male was presented for one day only or when repeated every 5 days or full companionship. Absence of male resulted in lowest female fecundity (26.3 eggs / female) and production of males only. Female fecundity as well as progeny female percentage increased with increasing presence of male. Female deposited an average of 31.4, 53.6 and 56.7 eggs when associated with male for only one day or repeated every five days or full companionship, respectively. Progeny female sex ratio increased from 51% to 71% and 73% with increasing male association, respectively. This may be due to that increasing companionship time increases possibility of mating which consequently increases egg fertilization. Ali (1994), studied the effect of single and multiple mating on oviposition period and fecundity of *Amblyseius swirskii* Athias-Henriot and *Typhlodromus talbii* Athias-Henriot females, and found that females of the two species accepted copulation more than once. Multiple mating by male presence over female whole longevity or periodically for 24 hours every 5 days increased female fecundity and longevity.

Table 1. Effect of different diets on population increase of 5 females and 2 males of *H. solimani* over 8 weeks period, under two different degrees of temperature.

Diet type	25 °C			30 °C		
	Population	Multiplication rate	Daily rate of increase (rm)	Population	Multuplication rate	Daily rate of increase (rm)
Rhabditis scanica	544	77.71	0.078	387	55.29	0.072
Rhizoglyphus robini	4	0.57	-0.01	4	0.57	-0.01
Tyrophagus putrescentiae	8	1.14	0.002	6	0.86	-0.003
Musca domestica larvae	60	8.57	0.038	42	6	0.032
Musca domestica eggs	64	9.14	0.039	39	5.57	0.031
Lepeidocyrtinus incertus	9	1.29	0.005	7	1	0
Aspergillus niger	159	22.71	0.056	89	12.29	0.045
Penicillium viride	4	0.57	-0.01	3	0.43	-0.015
Mixture of diets	599	85.57	0.079	404	57.71	0.072

Table 2. Effect of different diets on developmental duration (days) of *H. solimani* at 25°C and 70% R.H.

Diet	Duration in days						
	Sex	Egg	Larva	Protonymph	Deutonymph	Immatures	Life cycle
Rhabditis scanica	F	3.0± 0.00	1.4±0.52	1.3±0.48	2.0 ± 0.82	4.7 ± 0.82	7.7 ± 0.78
	M	3.1± 0.32	1.1±0.32	1.3 ± 0.48	1.6 ± 0.69	4.0 ± 0.67	7.1 ± 0.83
Musca domestica larvae	F	3.1 ± 0.30	1.0 ± 0.00	1.4 ± 0.48	5.6 ± 0.92	8.0 ± 0.77	11.1 ± 0.83
	M	3.1 ± 0.30	1.1 ± 0.30	1.3 ± 0.45	5.1 ± 0.70	7.5 ± 0.67	10.6 ± 0.48
Musca domestica eggs	F	3.1 ± 0.30	1.1 ± 0.30	1.3 ± 0.45	4.6 ± 0.05	7.0 ± 0.63	10.1 ± 0.70
	M	3.0 ± 0.00	1.0 ± 0.00	1.0 ± 0.00	4.5 ± 0.50	6.5 ± 0.50	9.5 ± 0.50
Lepeidocyrtinus incretus	F	3.1 ± 0.30	1.0 ± 0.00	1.6 ± 0.66	4.1 ± 1.64	6.7 ± 1.73	9.8 ± 1.66
	M	3.2 ± 0.40	1.0 ± 0.00	1.5 ± 0.50	3.8 ± 0.60	6.3 ± 1.00	9.5 ± 1.20
Aspergillus niger	F	3.2 ± 0.40	1.0 ± 0.00	1.0 ± 0.00	2.5 ± 0.67	4.5 ± 0.67	7.7 ± 0.64
	M	3.1 ± 0.30	1.1 ± 0.30	1.2 ± 0.40	2.3 ± 0.45	4.6 ± 0.80	7.7 ± 0.78
Penicillium viride	F	3.0 ± 0.00	1.3 ± 0.45	1.9 ± 0.53	3.3 ± 0.64	5.6 ± 1.28	9.5 ± 1.28
	M	3.0 ± 0.00	1.3 ± 0.45	1.6 ± 0.48	3.2 ± 0.60	6.1 ± 0.94	9.1 ± 0.94

(F: female, M: male)

Table 3. Effect of different diets on *H. solimani* female longevity and fecundity at 25°C and 70% R.H.

Diet	Pre-oviposition	Oviposition	Post-oviposition	Longevity	Life span	No. of eggs	
						Total	Daily rate
Rhabditis scanica	2.0±0.63	16.2±2.40	3.3±1.00	21.5±2.62	29.2±2.99	56.7±9.58	3.5±0.38
Musca domestica larvae	5.9±0.94	12.4±1.28	19.4±2.1	37.7±2.50	48.8±2.69	3.5±0.67	0.3±0.05
Musca domestica eggs	5.4±1.02	11.0±1.95	18.8±2.18	35.2±3.25	45.3±3.41	2.6±0.66	0.2±0.04
Lepeidocyrtinus incretus	11.8±1.56	1.5±0.5	32.0±8.32	45.3±7.18	55.1±6.78	1.6±0.69	0.7±0.34
Aspergillus niger	3.4±0.66	33.2±4.17	24.9±5.34	61.5±4.94	69.2±4.87	22.0±4.02	0.7±0.18

Table 4. Food consumption of *H. solimani* different stages when fed on *M. domestica* larvae and eggs at 25°C and 70% R.H.

Diet		Female		Male	
		Consumption	Daily rate	Consumption	Daily rate
Protonymph	*L.*	1.2±0.4	0.62	1.1±0.3	0.79
	E.	3.6±0.3	2.77	2.7±0.5	2.7
Deutonymph	*L.*	4.7±0.6	0.77	3.9±0.5	0.76
	E.	17.0±2.8	3.69	12.4±0.8	2.76
Total immatures	*L.*	5.9±0.8	0.68	5.0±0.8	0.68
	E.	20.6±3.2	2.94	15.1±0.7	2.32
Oviposition	*L.*	13.8±2.9	1.11	-	-
	E.	47.4±9.7	4.31	-	-
Longevity	*L.*	35.0±2.8	0.93	16.2±2.3	0.84
	E.	129.6±14.7	3.68	52.2±7.56	2.9
Life span	*L.*	40.9±2.9	0.83	21.2±2.2	0.71
	E.	150.2±14.5	3.32	67.3±5.9	2.41

* L: larvae * E: eggs

Table 5. Effect of temperature on developmental duration and female longevity (days) and fecundity of *H. solimani* when fed on *Rhabditis scanica*

Stage and / or Parameter	20°C		25°C		30°C	
	F	M	F	M	F	M
Eggs	3.9 ± 0.54	3.9 ± 0.30	3.0 ± 0.32	3.0 ± 0.00	1.4 ± 0.02	1.4 ± 0.04
Larvae	1.4 ± 0.52	1.2 ± 0.40	1.4 ± 0.40	1.1 ± 0.32	0.9 ± 0.04	0.8 ± 0.03
Protonymph	2.1 ± 0.54	2.1 ± 0.70	1.3 ± 0.48	1.3 ± 0.48	0.9 ± 0.03	0.9 ± 0.04
Deutonymph	2.9 ± 0.70	2.7 ± 0.64	2.0 ± 0.82	1.6 ± 0.69	1.6 ± 0.66	1.3 ± 0.45
Total immature	6.4 ± 0.60	6.0 ± 0.70	4.7 ± 0.82	4.0 ± 0.67	3.4 ± 0.67	3.0 ± 0.44
Life cycle	10.3 ± 0.54	9.9 ± 0.75	7.7 ± 0.78	7.0 ± 0.83	4.8 ± 0.67	4.4 ± 0.43
Preoviposition	3.1 ± 0.70	-	2.0 ± 0.63	-	0.9 ± 0.14	-
Oviposition	18.8 ± 0.99	-	16.2 ± 2.40	-	13.3 ± 1.62	-
Post oviposition	12.3 ± 2.54	-	3.30 ± 1.00	-	4.3 ± 0.92	-
Longevity	34.5 ± 3.50	-	21.5 ± 2.62	-	18.5 ± 1.97	-
Life span	44.8 ± 3.50	-	29.2 ± 2.99	-	23.3 ± 2.49	-
No. of eggs	38.2 ± 5.99	-	56.7 ± 9.58	-	34.2 ± 5.95	-
Daily rate	2.1 ± 0.39	-	3.5 ± 0.38	-	2.6 ± 0.32	-

Table 6. Effect of alternating temperature on *H. solimani* different stages duration when fed on *Rhabditis scanica*

Alternating temp. regime / Parameter	10 / 20°C	15 / 20°C
Egg	7.7±0.69	7.6±049
Hatchability%	20.30%	23.30%
Larva	4.1±0.64	3.9±0.64
Protonymph	4.9±0.35	3.9±0.44
Deutonymph	5.9±0.64	4.3±0.45
Life Cycle	22.6±1.39	19.7±1.16
Pre-oviposition	11.2±0.75	8.2±1.07
Oviposition	13.2±2.48	16.0±1.29
Post-oviposition	18.6±2.42	12.2±1.07
Longevity	43.0±2.68	36.4±2.05
Life span	65.6±3.38	56.1±2.61
No. of eggs	13.6±1.85	20.0±2.71

Table 7. Effect of exposing *H. solimani* eggs to alternating 10/20°C and 15 / 20°C for 12 hours each for different durations then kept at 20°C on life cycle when fed on *Rhabditis scanica*

Exposure time	Alternating temperature regime	Incubation period	Hatchability %	Larvae	Portonyoph	Deutonymph	Life cycle
One day	10 / 20°C	4.3 ± 0.51	93.3	2.2 ± 0.41	2.1 ± 0.35	2.2 ± 0.35	10.8 ± 1.03
	15 / 20°C	4.1 ± 0.63	100	1.3 ± 0.47	1.9 ± 0.59	2.8 ± 0.60	10.1 ± 1.15
Two days	10 / 20°C	4.4 ± 0.49	70	2.2 ± 0.49	2.5 ± 0.59	2.8 ± 0.73	11.9 ± 1.27
	15 / 20°C	4.1 ± 0.34	93.3	1.5 ± 0.49	2.1 ± 0.70	3.0 ± 0.63	10.7 ± 0.67
Three days	10 / 20°C	5.4 ± 0.62	43.3	2.9 ± 0.53	2.8 ± 0.58	3.5 ± 0.63	14.6 ± 1.15
	15 / 20°C	4.5 ± 0.57	83.3	1.8 ± 0.65	2.2 ± 0.43	3.1 ± 0.65	11.6 ± 1.09
Four days	10 / 20°C	5.1 ± 0.78	26.7	2.8 ± 0.43	2.9 ± 0.59	3.5 ± 0.50	14.3 ± 1.19
	15 / 20°C	4.6 ± 0.64	80	2.0 ± 0.29	2.7 ± 0.54	3.2 ± 0.47	12.5 ± 0.87
Five days	10 / 20°C	5.8 ± 0.42	26.7	3.1 ± 0.33	2.8 ± 0.66	3.7 ± 0.48	15.4 ± 0.97
	15 / 20°C	5.3 ± 0.63	70	2.5 ± 0.66	2.2 ± 0.53	3.4 ± 0.49	13.4 ± 0.95
Six days	10 / 20°C	6.9 ± 0.35	23.3	3.4 ± 0.49	3.1 ± 0.35	3.9 ± 0.64	17.3 ± 0.88
	15 / 20°C	6.4 ± 0.74	43.3	2.7 ± 0.61	3.2 ± 0.42	3.5 ± 0.49	15.8 ± 0.89
Seven days	10 / 20°C	7.3 ± 0.45	20.3	3.6 ± 0.49	3.7 ± 0.94	6.7 ± 0.94	21.3 ± 96
	15 / 20°C	7.7 ± 0.88	23.3	3.4 ± 0.49	3.4 ± 0.49	3.6 ± 0.49	18.1 ± 0.64

Table 8. Effect of male presence on *H. solimani* female fecundity, longevity and sex ratio when fed on the nematode *R. scanica* at 25°C and 70% R.H.

Male presence	No. of eggs	Longevity	Sex ratio[1]
No male	26.3±6.2	27.4±2.5	0
One day	31.4±4.4	17.4±2.1	0.51
Every five days	53.6±7.0	22.8±1.7	0.71
All over longevity	56.7±9.58	21.5±2.62	0.73

[1] Females / total

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دراسات بيولوجية وبيئية على أكاروس التربة المفترس هولوستاسبيلا سوليماني. من ذوات الثغر المتوسط

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أوضحت الدراسات البيئية تواجد المفترس الأكاروسى ***Holostaspella solimani*** فى التربة والأوراق المتساقطة ومصاحباً للعديد من حشرات التربة، وكذلك النيماتودا حرة المعيشة وبعض الفطريات بمزرعة كلية الزراعة بالجيزة، كماأوضحت الدراسات البيولوجية أنه باختبار ثمانية أنواع من الغذاء تراوحت فترة دورة حياة الإناث ٧,٧ - ١١,١ يوما، بينما كانت ٧,١ - ١٠,٦ يوماللذكور. وكانت التغذية على النيماتودا حرة المعيشة ***R. scanica*** هى الأفضل يليها التغذية على فقر التربة ***A. niger*** وعلى هذه الأغذية المفضلة فإن خصوبة الأنثى تراوحت بين ٢٢ - ٥٦.٧ بيضة بمعدل يومى للتبويض ٠,٧ - ٣.٥ بيضة وعموماً فإن استهلاك الغذاء زاد بزيادة تطور أفراد الأكاروس ، وكان أعلى معدل للتكاثر ٧٧.٧ و ٨٥,٦ مرة عند التغذية على النيماتودا ***R.scania*** وخليط الأغذية المختبرة على التوالى.

وباختبار تأثير الحرارة فقد سجل متوسط دورة حياة الإناث ١٠,٣ و ٧.٧ و ٤.٨ يوما على درجات حرارة ٢٠ ، ٢٥ ، ٣٠ م على التوالى وكانت خصوبة الإناث على درجة ٢٥ م أفضل منها عند ٢٠ م، ٣٠ م. كما أنه عند تعريض الأفراد لنظامين (تبادل حرارى: لمدة ١٢ ساعة على ١٠ م ثم ٢٠ م لمدة الـ١٢ ساعة الأخرى من اليوم) وتكرار ذلك مع التبادل بين ١٥ م و٢٠ م فإن مدة دورة الحياة طالت بنسبة ١٢٢٪ و٩٥٪ وطالت مدة الجيل بنسبة ١٢٥٪ و٩٢٪ وقلت النسبة المئوية لفقس البيض من ٩٣,٣٪ إلى ٢٠,٣٪ فى النظامين السابقين على التوالى.

كما درست مدة مصاحبة الذكور للإناث وتأثير ذلك على الخصوبة واتضح أن غياب الذكر تماماً يؤدى لأقل نسبة خصوبة ٢٦,٣ بيضة / أنثى بينما تزيد إلى ٥٣,٦ بيضة / أنثى عند تواجد الذكر مع الأنثى يوم واحد كل خمسة أيام وتصل إلى ٥٦,٧ بيضة / أنثى عند مصاحبة الذكر للأنثى طوال حياتها.