Menoufia J. Plant Prot., Vol. 1 October (2016): 121 - 128

EFFECT OF DIETS AND TEMPERATURE DEGREES ON THE BIOLOGICAL ASPECTS OF THE LAELAPID MITE, *OLOLAELAPS USSURIENSIS* BREGETOVA & KOROLEVA, 1964

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Received: Apr. 14, 2016 **Accepted: Sep. 20 , 2016**

ABSTRACT: *The biological aspects of the laelapid mite, Ololaelaps ussuriensis (Laelapidae: Mesostigmata) was investigated at laboratory conditions under different diets and two temperature degrees. The obtained results showed that the diets as acarid mite , Tyrophagus putrescentiae (Schrank) and free living nematodes, Rhabditella muscicola (Andrassy) and temperature degrees (15 and 25 ºC) were significantly influenced the periods of incubation period, longevity and life span of the predatory mite, O. ussuriensis, but there was no significant differences in the case of combination or interaction between these factors .Data , also, indicated that the adult female of O. ussuriensis laid more eggs (41.8 eggs) when fed on the free living nematode at 25 ºC compared with the acarid mite diet . The lowest number of laid eggs (33 eggs) was observed when the females fed on T. putrescentiae at 15 ºC.*

Key words: *Ololaelaps ussuriensis, diets, free live nematodes, biological aspects.*

INTRODUCTION

Mites represent the majority of the soil and organic manure arthropods fauna, and playing different important roles in nature which vary from harmful and beneficial. Soil mites play an important role in increasing soil fertility by its effect on organic matter decomposition. Owing to their numerical importance, the soil mites have received more attention than other soil Acari. Actinedida and Gamasida represent the major groups of soil mites which found in many soil habitats (Usher, 1971; Wallwork, 1976; Mostafa, 1980 and Convey *et al*., 2000). Although the Acarina communities of Egyptian soil have not been widely studied, some information is available on the prostigmatid and mesostigmatid mites' fauna. The majority of these species appear to predators associated with small and immature stages of insects, mites, and nematodes in the soil surface (Karg 1961; Sardar and Murphy 1987; Bilgrami (1994). Some of them feed on fungi and helps in control soil born fungi diseases (Ragusa and Zedan 1985 and Ahmed 1998). Smaller deep-litter and soil forms are predominantly nematophagous and are the most important predators of nematodes in many habitats. Interaction within a community and therefore predator mites have the ability to keep free living nematodes and mite pests under the threshold level. In Egypt, Ibrahim 1982, Metwally *et al*., 1983, Ahmed 1998, Kaid1998 and Ezz El-Dein 2003 investigated the behaviour of the different ground mites. The mite family Laelapidae (Mesostigmata) is ecologically diverse, including obligate and facultative parasites of vertebrates, insect paraphages, and free-living predators that inhabit soil litter habitats and the nests of vertebrates and arthropods (Evans and Till 1966; Strong and Halliday 1994; Lindquist *et al*., 2009).

The present work aims to study the effect of different diets and temperatures on the biological aspects of the laelapid mite, *O. ussuriensis* at laboratory conditions.

MATERIALS AND METHODS

Collection and preparation of the commonest predacous soil mite:-Individuals belonging to the laelapid mite, *Ololaelaps bregetova* (Laelapidae: Mesostigmata) Shereef and Soliman used in biological studies were collected from normal untreated soil of maize, wheat and soybean at Qaha region, Qaluobia Governorate. For individual rearing, newly deposited eggs were transferred individually to a new rearing plastic cell. Each newly hatched larva was supplied with prey. Devoured prey was replaced daily until maturity. Emerged females were allowed to mate with males and monitored for oviposition. All biological aspects were recorded twice daily during the mite development. Other necessary data dealing with the predator's biology, fecundity and other biological aspects were recorded.

Rearing procedures:

To rear the predacious mite, *O. bregetova*, there are two types of cages were used. The first for culturing mites (large glass Petri dishes filled up to 0.5 cm with a mixture of plaster of Paris and Charcoal (9:1) and the second for individual rearing (plastic ring 2.5 cm in diameter and 1.5 cm in depth) filled with 0.7 cm with a mixture of plaster of Paris and Charcoal (7: 3) according to Metwally *et al.,* (1983). For culturing of mites, several adult females and males of *O. bregetova* were placed in Petri-dishes. The bottom was kept moist, thus the relative humidity was suitable by adding one or two drops of water every two days. A camel hair brush was used to transfer newly deposited eggs to the plastic rings. After hatching, each larva was supplied with free living nematodes and acarid mite as preys. Observations were made twice daily using stereomicroscope to determine different biological aspects. Copulated female were kept for determining pre-oviposition, oviposition and postoviposition periods. Observation was taken at 15 and 25±2 ºC. and relative humidity 75±5 %.

Source of food:

a. Free-living nematode:

Soybean and wheat soil samples were put in Baermann funnel for 24 hours for extracting free living nematodes *R. muscicola*, Abou-El-Sood (1992). The extraction of free living nematode was conducted in Petri-dishes contains slides of Potatoes. Petri-dishes were kept at 25 ºC. Camel hair brushes were used to add drops of food in rearing cells of the predatory mites as the main source of food.

b. Acarid mite:

The culture of acarid mite, *T. putrescentiae* was maintained and already obtained form Acarology Dep., Plant Prot. Res. Inst.,. The collected individuals of both predators and prey species were transferred to a covered glass Petri-dishes which covered with a layer of Plaster of Paris and charcoal mixture. Moisture is kept by adding drops of water every two days.

Statistical analysis:

Suitable statistical analysis was used to clearify the results of the work. All biological studies data were subjected to one way analysis of variance (ANOVA) and means were separated by Duncan's multiple range tests, Duncan (1955).

RESULTS AND DISCUSSION

Incubation period:

It was clearly obvious from Tables (1&2) that there were highly significant differences between the incubation period which give rise to_males of *O. bregetova* when fed on different diets. This period was 6.5, 5.5 & 3.1 and 2.4 days at 15 and 25 ºC, when feeding of females and males, respectively on acarid mites. However, these periods changed to 7.9, 7.3 days at 15 ºC and 2.85 and 2.3 days at 25 ºC for females and males, respectively when fed on nematode.

However, statistical analysis of obtained data indicated that there were highly significant differences between the individuals fed on different diets at different temperatures. Generally, the effect of interaction between the temperature and food type on the incubation period of *O.*

bregetova male individuals was observed not affected, Table (4).

Larval stage:

The obtained results in Tables (1&2) indicates that the highest recorded larval stage of *O. bregetova* was noticed when females fed on the acarid mite, *T. putrescentiae* at 15 ºC (6.0 days) and the lowest larval stage was noticed when the male individuals reared on the free nematodes at 25 ºC (1. 3 days). On the other hand, the quiescent larval stage of *O. bregetova* durated the highest period 1.6 days when the female fed on the acarid mite at 15 ºC, decreased to recorded 0.33 days on the free nematodes at 25 ºC

Table (1): Biological aspects of the laelapid mite, *Ololaelaps ussuriensis* when fed on acarid mite, *Tyrophagus putrescentiae* at different temperatures

Biological aspect		15 ºC		25 ºC	
		♀	♂	♀	♂
Incubation period		6.5±0.53 (6-7)	5.5±0.53 (5-6)	3.1±0.74 (2-4)	2.4±0.52 (2-3)
Larva	a	6.0±0.67 (5-7)	5.0±0.82 (4-6)	2.43±0.5 (2-3)	1.73±0.52 (1.25-2.25)
	q	1.6±0.52 (1-2)	0.93±0.37 (0.25-1.25)	1.25±0.4 (1-2)	0.7±0.39 (0.25-1)
Protonymph	a	6.2±0.79 (5-7)	5.2±0.79 (4-6)	2.7±0.52 (2-3.25)	2.28±0.4 (2-3)
	q	1.95±0.4 (1-2.25)	1.34±0.54 (0.25-2)	0.98±0.23 (0.25-1.25)	0.8±0.56 (0.25-2)
Deutonymph	a	7.68±0.43 (7-8)	6.88±0.47 (6-7.25)	3.58±0.51 (3-4.25)	2.83±0.41 (2.25-3.25)
	q	1.63±0.39 1-2.25)	1.23±0.32 (1-2)	1.0±0.29 (0.25-1.25)	0.63±0.39 (0.25-1)
Immature stages		25.06±1.25 (24.5-25.6)	20.58±1.27 (20-21.1)	11.94±0.68 (11.3-12.6)	8.97±0.59 (8.6-9.3)
Life cycle		31.55±1.39 (29.25-33.25)	25.78±1.78 (23.5-28.5)	14.93±1.18 (13.5-16.75)	11.25±1.23 (9-12.5)
Longevity		18.5±0.85 (17-20)	16.83±1.04 (15-18)	12.5±1.33 (11-15)	10.93±1.0 (10-13)
Life span		50.25±1.24 (48.25-51.5)	42.58±1.74 (39.5-44.5)	(27.43±1.92 (24.5-30.75)	22.18±1.19 (20.75-23.75)

± Standard deviation a = active q = quiescent

Table (2): Biological aspects of the laelapid mite, *Ololaelaps ussuriensis* when fed on free living nematodes, *Rhabditella muscicola* at different temperatures

Biological aspect		15 ºC		25 ºC	
		♀	♂	♀	♂
Incubation period		7.9±0.88 (7-9)	7.3±0.67 (6-8)	2.85±0.61 (2-4)	2.3±0.56 (1.25-3)
Larva	a	7.3±0.82 (6-8)	6.4±0.7 (6-8)	1.53±0.56 (1-2.25)	1.3±0.39 (1-2)
	q	1.5±0.53 (1-2)	0.75±0.44 (0.25-1.25)	0.7±0.39 (0.25-1)	0.33±0.24 (0.25-1)
Protonymph	a	6.9±0.74 (6-8)	5.8±0.63 (5-7)	2.25±0.42 (2-3)	1.42±0.41 (1-2)
	q	1.35±0.61 (0.25-2)	0.75±0.44 (0.25-1.25)	0.7±0.39 (0.25-1)	0.48±0.36 (0.25-1)
Deutonymph	a	7.5±0.71 (7-9)	6.6±0.7 (6-8)	3.33±0.47 (2-3)	1.78±0.46 (1.25-2.25)
	q	1.08±0.59 (0.25-2)	1.23±0.13 (1-1.25)	0.7±0.39 (0.25-1)	0.48±0.3 (0.25-1)
Immature stages		26.63±2.25 (26.0-17.3)	21.53±1.08 (21.1-22.2)	9.21±1.0 (9-10.3)	5.79±0.45 (5-6.4)
Life cycle		33.53±1.67 (31-36)	28.73±2.09 (24.5-31.25)	11.03±1.85 (7.75-14.5)	8.08±1.54 (5.5-11.5)
Longevity		14.8±1.69 (13-19)	13.93±1.65 (12-18)	9.2±13.2 (7-11)	8.93±1.63 (7-12)
Life span		48.38±1.51 (45.5-50.5)	42.56±1.40 (40.5-45.25)	20.23±2.59 (17.5-24.5)	17.0±2.36 (14.5-20.75)

± Standard deviation a = active q = quiescent

Protonymphal stage:

Results in Tables (1&2) indicated that the protonymphal active stage of the predatory mite, *O. bregetova* took the longest period 6.2 days when fed as female individuals on *T. putrescentiae* at 15 ºC, and took the shortest period 1.42 days when male fed on the free nematodes at 25 ºC. On the other hand, the quiescent protonymphs had the same trend of active stage but the periods differed, 1.95 days for females and 0.48 days for males.

Deutonymphal stage: As shown in Tables (1&2) the deutonymphal stage of *O. bregetova* was high when the active mite females and males fed on *T. putrescentiae* 7.68 and 6.88 days at 15 ºC, respectively, but the quiescent period of male when fed on free nematode was the lowest period 0.48 days at 25 ºC.

Immature stages:

It is clear from the current study that the immature stages of the predatory mite *O. bregetova* took 25.06, 20.58; 11.94 and 8.97 days when the individuals fed on the acarid mite, *T. putrescentiae* at 15 and 25 ºC for females and males, respectively, Tables (1&2). However, this period averaged 26.63, 21.53; 9.21 and 5.79 days when the same individuals fed on the free living nematodes, respectively.

Life cycle:

Concerning the life cycle, Tables (1, 2 &4), statistical analysis using L.S. D. at 0.05 pointed out that the life cycle of *O. bregetova* was highly significantly differed at different temperatures for (different sexes) males and females. The obtained results indicated that the longest duration period of the life cycle was recorded when the females fed at 15 ºC (31.55 days) on the acarid mite, while the shortest period was recorded when the male individuals fed on the free living nematode at 25 ºC (8.08 days).

Longevity:

Statistical analysis of the obtained results in Tables (1, 2 and 4) revealed the occurrence of significances differences of longevity period of *O. bregetova* when fed on the free living nematodes and the acarid mite. Longevity took 18.5, 16.83 & 12.5 and 10.93 days at 15 ºC and 25 ºC for females and males, respectively when the mites fed on the acarid mite, *T. putrescentiae* as a food. However, these periods changed to recorded 14.8, 13.93 & 9.2 and 8.93 days when the mites fed on the nematode at the same conditions of the experiment. Generally, the effect of temperature and food on the longevity of *O. bregetova* individuals was observed highly significant, Table (4).

Pre-oviposition, oviposition and post-oviposition periods:

The respective durations of pre-oviposition, oviposition and post-oviposition of *O. bregetova* on *T.putrescentiae* and free nematodes are summarized in Table (3). The obtained data showed that there were obvious differences between the *O. bregetova* female individuals fed on both the acarid mite and the nematode at different temperature in case of pre-oviposition period. This period lasted 4.5 and 2.4 days when the predatory mite fed on the acarid mite at 15 and 25 ºC, respectively. On the other hand, this period took 3.25 and 1.7 days when the mite fed on nematode. On the other hand, the longest oviposition period of *O. bregetova* was noticed when the female fed on the acarid mite at 15 ºC (8.9 days), but the shortest period was noticed when the mites fed on nematodes at 25 ºC, (5.0 days). However, the longest postoviposition period was 5.1 days when the mites fed on the acarid mite at 15 ºC, while the shortest period took 2.5 days at 25 ºC on the nematode, Table (3).

Fecundity:

The eggs of *O. bregetova* females laid individually and the number of deposited eggs are represented in Table (3). The study shows the influence of different temperatures and hosts on the fecundity of the predatory adult females of *O. bregetova*. Data clearly indicated that the feeding at 25 ºC on nematode gave the highest level of egg (41.8 eggs) while the lowest number was 33.0 eggs, when the mites fed at 15 ºC on the acarid mite.

Life span:

Accordingly, the life span of *O. bregetova* differed at different temperatures, Tables (1&2). However, this period lasted the highest level (50.25 days) when the females fed on the acarid mite at 15 ºC, changed to the lowest level when the males reared on nematodes at 25 ºC (17.0 days).

The statistical analysis of data, Table (4) showed that the sex (male and female), diets (acarid mites and nematode) and temperature (15 and 25 ºC) had affected on the incubation period, longevity and life span of *O.bregetova* with highly significant effect, but there was no any significant difference in the case of combination or interaction between these factors collectively on these periods. On the other hand, there was no any obviously effect for interaction of these factors on the mite life cycle.

Table (3): Longevity (in days) and fecundity (No. of eggs) of the laelapid mite adult female, *Ololaelaps bregetova* fed on different diets at different temperatures

Biological aspect	Diet	15 ºC	25 ºC
Preoviposition period	Acarid mite	4.5±0.53 (4-5)	2.4±0.46 (2-3)
	Nematode	3.25±0.72 (2.5-5)	1.7±0.67 (1-3)
Oviposition period	Acarid mite	8.9±0.88 (8-10)	7.5±0.97 (6-9)
	Nematode	7.1±0.99 (6-9)	5.0±0.82 (4-6)
Postoviposition period	Acarid mite	5.1±0.88 (4-6)	2.6±0.7 (2-4)
	Nematode	4.45±0.50 (4-5)	2.5±0.53 (2-3)
Fecundity	Acarid mite	33.0±1.83 (30.36	39.6±1.43 (37-42)
	Nematode	38.8±1.23 (37-41)	41.8±1.87 (40-5)

± Standard deviation

Table (4): Effect of different diets and temperatures on the biological aspects of the laelapid mite, *Ololaelaps ussuriensis*

Biological aspect	Source	F.	P.	L.S.D. at 0.05 level
Incubation period	Sex	24.74	0.000***	0.2856
	Diet	24.74	0.000***	
	Temp.	834.22	0.000***	
	Int. sex x diet x temp.	0.1903	0.6639 ns	
Life cycle	Sex	141.18	0.000***	0.7214
	Diet	2.206	0.1418 ns	
	Temp.	2634.55	0.000***	
	Int. sex x diet x temp	0.0298	0.6847 ns	
Longevity	Sex	13.30	0.000***	0.6012
	Diet	97.307	0.000***	
	Temp.	347.871	0.000***	
	Int. sex x diet x temp	0.1717	0.6798 ns	
Life span	Sex	182.77	0.000***	0.8064
	Diet	76.74	0.000***	
	Temp.	3595.65	0.000***	
	Int. sex x diet x temp	0.0021	0.9632 ns	

*** highly significant ns = non-significant

Imbriani and Mankau (1983) observed voracious feeding by *Lasioseius sculpatus* on *Aphelenchus avenae* and *Cephalobous* sp. increased population of mite resulted in a significant decline of *A. avenae.* The most definite association between mites and nematodes came from the work of Rodriguez *et al.,* (1972) who cultured *Macrocheles muscaedomesticae* on *Rhabditis* sp., and found it to prefer house fly eggs over nematodes. Its prot-and deutero-nymphs under same conditions, however, preferred nematodes.

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تاثير الغذاء ودرجات الحرارة على المظاهر البيولوجية للاكاروس الليلابيدى *Ololaelaps ussuriensis*

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الملخص العربى

أجريت هذه الدراسة لمعرفة تاثير نوعين من الغذاء ودرجتى حرارة على المظاهر البيولوجية للاكاروس *Ololaelaps ussuriensis* وذلك تحت الظروف المعملية . اظهرت النتائج المتحصل عليها ان الاكاروس الاكاريدى *Tyrophagus putrescentiae* والنيماتودا الحرة المعيشة *Rhabditella muscicola* ودرجات الحرارة ١٥ ، ٢٥ م° كان لهم تاثير واضح ومعنوى على كل من فترة حضانة البيض Incubation period وطول فترة حياة الفرد البالغ Longevity والفترة الكلية لحياة الاكاروس Life span ، بينما لم يكن هناك أى تاثير معنوى لهذه العوامل (التغذية ودرجات الحرارة) مجتمعة على فترة حضانة البيض والفترة الكلية لحياة الاكاروس ، ولكن ظهر لها تاثير على فترة دورة الحياة فقط. ومن الدراسة اتضح انه كانت لدرجات الحرارة ونوع الغذاء المستخدم تأثيرا واضحا ومعنويا في تغذية الاكاروس *O. ussuriensis* حيث قامت إناث هذا الاكاروس بوضع عددا من البيض مقداره ٤١,٨ بيضة وذلك عند تغذية الأفراد على النيماتودا الحرة المعيشة عند ٢٥ م° بينما كان اقل عدد من البيض (٣٣ بيضة) قد تم تسجيله عند تغذية أفراد المفترس على الاكاروس الاكاريدى على درجة الحرارة ١٥م°.

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