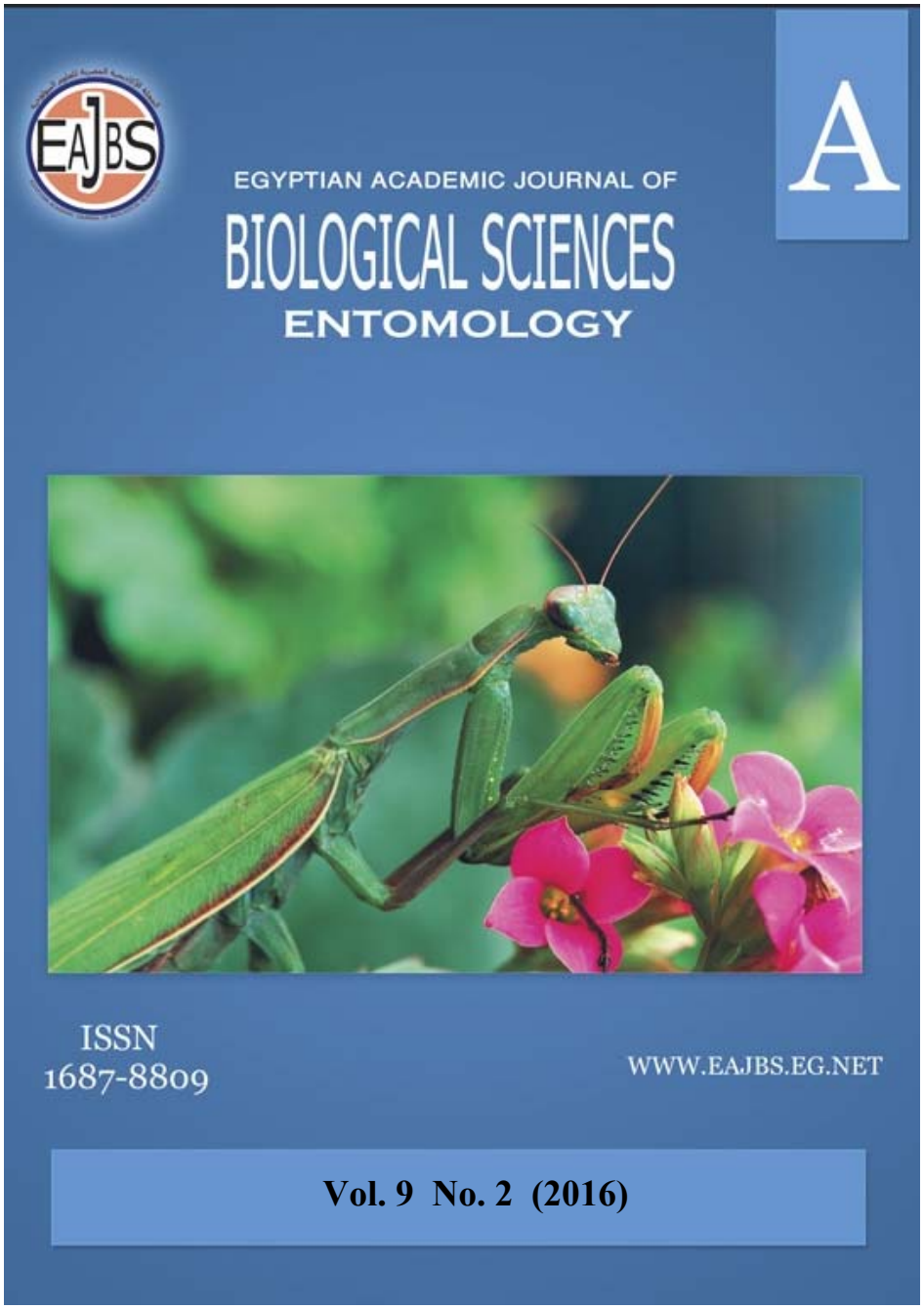

Egyptian Academic Journal of Biological Sciences is the official English language journal of the Egyptian Society for Biological Sciences, Department of Entomology, Faculty of Sciences Ain Shams University.

Entomology Journal publishes original research papers and reviews from any entomological discipline or from directly allied fields in ecology, behavioral biology, physiology, biochemistry, development, genetics, systematics, morphology, evolution, control of insects, arachnids, and general entomology.

www.eajbs.eg.net

Citation: *Egypt. Acad. J. Biolog. Sci. (A. Entomology) Vol.9 (2)pp. 1-6(2016)*

Egypt. Acad. J. Biolog. Sci., 9(2): 1– 6 (2016)

Egyptian Academic Journal of Biological Sciences
A. Entomology

ISSN 1687- 8809
www.eajbs.eg.net

Life History of the Predaceous Mite *Cunaxa capreolus* (Berlese) (Acari: Prostigmata: Cunaxidae) When Fed on Different Diets at Different Temperatures

Mostafa, A.M.[1]; Amina M. Abdel-Rahman[2], A. A. Younis[2], E.M.A. Yassin[1] and Rania H. Saber[1]

1- Plant Protection Research Institute, A.R.C. Dokki, Giza, Egypt
2- Entomology Dept., Fac. Sci., Cairo Univ., Giza, Egypt

ARTICLE INFO

Article History
Received: 1/4/2016
Accepted: 2/5/2016

Keywords:Life history, *Cunaxa capreolus* (Berlese)

ABSTRACT

This work aimed to study different biological aspects of the predatory mite, *Cunaxa capreolus* (Berlese) when fed on different diets mainly free living nematode, *Rhabditis 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 25 ºC, but the free living nematodes as diet was the lowest favorable one, where the predator female deposited 33.05 eggs at 35 ºC**.** Generally, Collembola proved to be the more suitable prey as resulted in more deposited eggs and longer life span.

INTRODUCTION

Mites belonging to the family Cunaxidae are well known predators of other harmful mites and small soft bodied insects and include many species which known their wide distribution inhabiting leaves, litter, dry or damp humus and straw, Baker and Wharton (1952) and Smiley (1992). Walter and Kaplan (1991) found that *Coleoscirus simplex* (Cunaxidae) colonizes greenhouse pot cultures of root knot nematodes (*Meloidogyne* spp.) in Florida where it feeds on vermiform nematodes and other soil arthropods. The life cycles of a few mites of the nearly 260 described Cunaxid species have been studied (Schruft 1971; Zaher *et al*., 1975; Taha *et al*., 1988; Walter and Kaplan 1991; Sathiamma 1995; Arbabi and Singh 2000; Tatiane *et al*., 2010; and Khalil *et al*., 2012. These studies have shown the ability of cunaxids to prey upon mites of the Tetranychoidea and Eriophyoidea, as well as other small arthropods and nematodes.

Therefore, the present work was undertaken to introduce a detail study on the biological aspects of the cunaxid mite, *C.capreolus* Berlese when fed on different diets,

free living nematode, *R. scanica* and *E. musatica* (Collembola) at different laboratory conditions.

MATERIAL AND METHODS

The cunaxid mite, *C. capreolus* was extracted from soil under broad bean *Ficia faba* L. and maize *Zea mayz* L. plants in Qaluobia Governorate (Qaha region). Three adults females and males of the 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±2ºC and about 75±5% R.H. 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, *R. scanica* and *E.musatica* (Collembola) and consumed food was replaced every 2 days interval with another new one till reaching maturity stage.

Collembola: Individuals of the spring tail insect, *E. musatica* were extracted from soil of clover samples by Tullgeren funnel and reared in cages similar to those of acarid mites, but small pieces of potatoes were added daily to collembola as a food source.

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 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 % R.H. All obtained data were presented as means ±S.D. of ten 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).

RESULT AND DISCUSSION

Behavior: Field observations showed that the predatory mite, *C. capreolus* 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 *C. capreolus* 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. Active immature individuals enters a resting or quiescent stage before entering the following stage.

Mating: Laboratory observations showed that the mating process is necessary for *C. capreolus* 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, then it manipulated itself underneath the female, bending its opithosomal region upward and forward to meet that of female. Copulation usually lasted about 5 minutes.

Oviposition: Females of *C. capreolus* usually deposited its eggs singly. The

newly laid eggs were creamy in colour; its colour is changed by egg development to just before hatching.

Hatching: As incubation proceeds, the embryo grows and limits itself to any of the egg sides, then a longitudinal slit occurs medially and hatching larvae crawls outside the egg shell.

Moulting: During this study, it was noticed that before moulting, each immature stage of the cunaxid mite, *C. capreolus* enters into a quiescent stage during which, the mite stop feeding and moving. The individuals stretch their chelicerae, palps backwardly along the sides of the body. Immediately before moulting a dorsal transverse rupture occurs between the propodosoma and hysterosoma. The mite tries to disengage itself from the old skin by twisting movements and subsequently withdraws the forelegs and the anterior part of the body outside. Afterwards, the mite crawl forwardly trying to get rid of the posterior part of the exuvia. Colour of the newly emerged larva is usually orange, then changes gradually darker after feeding.

Incubation period: The tabulated data in Table (1) indicated that the different temperatures and diets had significantly affected on the incubation period of the cunaxid mite, *C. capreolus*. It was found that this period lasted 4.5 and 3.79 days when the mite female fed on collembola at 25 and 35ºC, respectively, changed to recorded 4.31 and 3.49 days when the mite fed on free living nematodes, respectively. On the other hand the males of *C. capreolus* averaged 3.67 & 2.98 days on collembola and 3.92 & 3.01 days on free nematodes at 25 and 35ºC, respectively. The statistical analysis of data showed that L.S.D. at 0.05 for incubation period = 0.0745.

Table 1: Duration of the developmental periods of the predacous mite, *Cunaxa capreolus* when fed on different diets

Biological aspect		25 ºC		35 ºC	
		Collembola	Free nematodes	Collembola	Free nematodes
Incubation period	♀	4.5±0.08 (4.4-4.6)	4.31±0.13 (4.1-4.6)	3.79±0.1 (3.6-3.9)	3.49±0.08 (3.3-3.6)
	♂	3.67±0.38 (2.6-3.9)	3.92±0.11 (3.7-4.1)	2.98±0.11 (2.8-3.1	3.01±0.09 (2.9-3.2)
Life cycle	♀	22.4±0.35 (21.9-23)	20.45±0.39 (20-21)	19.02±0.24 (18.7-19.6)	17.35±0.42 (16.5-17.8)
	♂	19.16±0.46 (18.5-20.2)	17.12±0.40 (16.5-18)	16.01±0.18 (15.8-16.4)	15.0±0.28 (14.5-15.6)
Longevity	♀	27.89±0.63 (27-29)	26.39±0.28 (25.8-26.8)	21.96±0.23 (21.6-22.4)	20.18±0.47 (19.5-20.9)
	♂	24.93±0.55 (23.9-26)	17.95±0.50 (16.9-18.9)	17.87±0.67 (16.5-18.7)	16.45±0.37 (16-17)
Life span	♀	50.29±0.83 (48.9-51.5)	46.72±0.45 (46-47.5)	41.1±0.46 (40.4-41.9)	37.65±0.65 (36.5-38.4)
	♂	43.99±0.85 (42.9-46.2)	35.07±0.61 (34.1-36.4)	33.98±0.86 (32.3-35.7)	31.45±0.28 (31-31.8)

L.S.D. at 0.05 level
Incubation period = 0.0745
Life cycle = 0.1576
Longevity = 0.2176
Life span = 0.2929

Life cycle: The influence of different diets on *C. capreolus* life cycle can be summarized in Table (1) which revealed that the mean duration periods were shorter in case of male individuals than those of females and recorded 22.4 , 20.45 and 19.02, 17.35 days when the mites reared on collembola and free nematodes at 25 and 35ºC, respectively. However, the *C.capreolus* males took 19.16, 17.12 and 16.01, 15.0 days

at the same conditions, respectively (Table 1). The statistical analysis of current data indicated that L.S.D. at 0.05 level for life cycle = 0.1576.

Longevity: As shown in Table (1), females and males of *C. capreolus* longevity was maximal at 25ºC and reduced at higher temperature. During this period, female lived 27.89, 26.39 & 21.96, 20.18 days when fed on collembola and free living nematodes at 25 and 35ºC, respectively**.**

The male individuals of this predacous mite lasted about 24.93 and 17.87 days when the individuals reared on collembola at 25 and 35ºC, respectively, shorted to recorded 17.95 and 16.45 days when the mite fed on living nematodes at the same conditions, respectively. The statistical analysis of current data indicated that L.S.D. at 0.05 level for mite adult longevity = 0.2176.

Life span: Accordingly, the total life span of the predacous mite, *C. capreolus* was highly significantly affected by rearing on different diets at different temperatures. The longest period of this mite as shown in Table (1) was 50.29 days when the female individuals fed on collembola at 25ºC, changed to 31.45 days (the shortest period) when the male fed on the free living nematode at 35 C. L.S.D. at 0.05 = 0.2929.

Pre-oviposition, oviposition and postoviposition periods: Mated females of *C. capreolus* were randomly collected from stock cultures. Ten *C. capreolus* females were introduced into the rearing cages and preys each were introduced into rearing cages, all of which were maintained under the same laboratory conditions mentioned before and recording the periods before egg laying (preoviposition), oviposition and postoviposition. From tabulated data. In Table (2), it was noticed that these periods were longer when the predator fed on collembola in comparison with those reared on free living nematodes at 25 and 35ºC.

Table 2: Effect of different diets on the longevity and fecundity of Cunaxa capreolus female at 25 and 35 ºC

Biological aspect	25 ºC		35 ºC	
	Collembola	Free nematodes	Collembola	Free nematodes
Pre-ovip. Period	3.02±0.15 (2.8-3.3)	2.72±0.1 (2.6-2.8)	2.58±0.08 (2.4-2.7)	2.08±0.12 (2-2.30
Ovip. Period	23.02±1.12 (21.7-24.9)	21.2±0.19 (20.7-21.4)	16.99±0.27 (16.5-17.3)	16.1±0.38 (15.6-16.80
Post-ovip. Peiod	2.76±0.11 (2.5-2.9)	2.49±0.07 (2.4-2.6)	2.21±0.06 (2.1-2.3)	2.01±0.14 (1.8-2.3)
Fecundity	39.11±1.38 (37.6-42)	34.08±0.89 (32-35)	41.94±0.4 (41-42.5)	33.05±0.45 (32.5-34)

Fecundity: Females of *C. capreolus* usually deposited its eggs singly in protected places. The number of eggs laid by the predacous mite differed significantly between the mites fed on tested diets, Table (2). The average number of eggs were 39.11 and 34.08 eggs at 25ºC when the females fed on collembola and free nematodes, respectively, changed to 41.94 and 33.05 eggs on the two diets at 35ºC, respectively. Generally, in this study Collembola proved to be the more suitable prey as resulted in more deposited eggs and longer life span.

The food preference and capacity of *C. capreolus* and the effect of food type on its development were studied using two animal diets: booklice (Psocoptera) and the citrus brown mite *Eutetranychus orientalis* (Klein) and three plant diets: date palm pollen, and slices of potato, alone or in diluted yeast solution (Zaher *et al.,* 1975). The authors found that *C. capreolus* failed to develop on diets of plant material but developed equally well on diets of booklice (Psocoptera) or of the citrus brown mite, *E. orientalis*, which were eaten in their active stages and not as eggs. Cannibalism

occurred during shortage of food. Although the growth of the immature stages of *C. capreolus* was accompanied by an increasing consumption of prey, yet their total consumption was less than 30 of that of the female adult. The number of prey individuals consumed by *C. capreolus* was inversely related to temperature but consumption rate increased slightly with increasing temperature. This result demonstrated that 25ºC. was the most favorable temperature for rearing the cunaxid mite, *P. martina*. The obtained results in this study are similar to those of El-Khateeb (1998), where she mentioned that low temperature decreased female fecundity of the cunaxid mite, *Cunaxa setirostris* (Hermann). Yassin (2006) investigated the effect of three diets mainly Collembola (*Neanurodes* sp.), free living nematode, *Rhabditella muscicola* Chitwood and acarid mite, *Tyrophagus putrescentiae* (Schrank) on the biological aspects of the cunaxid mite, *Cunaxa capreolus* Berlese. He reported that Collembola proved to be the suitable prey where as female deposited high number of eggs and longer life span and this might be due to the collembolan contained the highest total sugar and higher relative concentration of glucose contents. Khalil *et al*. (2009) reared the cunaxid mite, *Coleoscirus baptos* on different fungi and mentioned that 25ºC was the most favorable temperature for rearing this mite where 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 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 27±1ºC 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. The coleoscirine cunaxid mite *C. simplex* colonizes greenhouse pot cultures of rootknot nematodes (*Meloidogyne* spp.) in Orlando, Florida, where it preyed on vermiform nematodes and soil arthropods (Walter and Kaplan, 1991). This was the first report of nematophagy in a cunaxid mite. The authors added that the cunaxid mite *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.

REFERENCES

Abou-El-Sood, A. B. (1992): Ecological and taxonomical studies on nematodes in certain Governorates of Egypt. Ph.D. Thesis, Fac. Agric. Al-Azhar Univ., 252 pp.

Arbabi, M. and J. Singh (2000): Studies on biological aspects of predacious mite *Cunaxa setirostris* on *Tetranychus ludeni* at laboratory condition in Varanasi, India. J. Agric. Rural Dev., 2: 13–23.

Baker, E.W. and G.W. Wharton (1952): An introduction to Acarology. Macmillan Company, New York, pp. 465-466.

Duncan, D.B. (1955): Multiple range and multiple F-test. Biometrics,11: 1-42.

El-Khateeb, Hanaa M.A. (1998): Life tables of some predacious mites and their importance in biological control. Ph.D. Thesis, Fac. Agric. Cairo Univ., 119 pp.

Ghallab, Mona M. (2002): Ecological and morphological studies on some predacous mites (Suborder Actinedida). Ph.D. Thesis, Fac. Sci., Cairo Univ., 244 pp

Khalil, A.M.; E.M.A. Yassin, M.A.M. Abou Tayesh and S.A. Allam (2009): Effect of different diets on the development and fecundity of the cunaxid mite, *Coleoscirus baptos* (Chaudhri) (Acari: Cunaxidae). Minufia J. Agric. Res., 34

(3): 1295-1303.
Khalil, A.M.; E.M.A. Yassin and M.M. El-Sebaay (2012): Life history of predatory mite *Pulaeus martini* (Den Heyer), (Acari: Prostigmata: Cunaxidae) fed on different diets. Egypt. J. Agric. Res., 90(3): 1147-1156.
Sathiamma, B. (1995): Biological supression of the white spider mite *Oligonychus iseilemae* (Hirst) on coconut foliage. Entom., 20: 237–243
Schruft, G. (1971): *Haleupalus oliveri* new species, A "Thorn-palped" mite on grape vines (*Vitis* spp.) Acari: Cunaxidae. Dutsch. Entomol. Z., 18(4-5): 379-382.
Smiley, R.L. (1992): The Predatory Mite Family Cunaxidae (Acari) of the World with a New Classification. Indira Publishing House, Michigan USA 356 pp.
Taha H.A.; M.E. El-Naggar; M.M. Abou-El-Nagga and S.M. Soliman (1988): Effect of different prey species on the development and fecundity of the predaceous mite, *Neocunaxoides andrei* Baker & Hovmann. (Acari: Cunaxidae). Agric. Res. Rev., 66: 129–135.
Tatiane M.M.; G. de Castro and G.J. de Moraes (2010): Life cycle and behaviour of the predaceous mite *Cunaxatricha tarsospinosa* (Acari: Prostigmata: Cunaxidae). Exp.Appl. Acarol., 50: 133–139.
Walter, D.E. and D.T. Kaplan (1991): Observations on *Coleoscirus simplex* (Acarina: Prostigmata), a predatory mite that colonizes greenhouse cultures of root knot nematode (*Meloidogyne* spp.), and a review of feeding behavior in Cunaxidae. Exp. Appl. Acarol., 12(1-2): 47-59.
Yassin, E.M.A. (2006): Notes on the biological behavior of the predacous mite *Cunaxa capreolus* Berlese (Acari: Prostigmata: Cunaxidae). Ann. Of Agric. Sci., Moshtohor, 44(4-5): 1843-1853.
Zaher, M.A.; Z.R. Soliman and S.M. El-Bishlawy (1975): Feeding habits of the predaceous mite, *Cunaxa capreolus* (Acarina: Cunaxidae). Entomophaga, 20(2), 209-212.

ARABIC SUMMERY

تاريخ حياة الأكاروس المفترس: *Cunaxa capreolus* (Berlese) (Acari: Prostigmata: Cunaxidae) عند تغذيته على أغذية مختلفة عند درجات حرارة مختلفة

عادل محمود مصطفى[1] – أمينة محمد عبدالرحمن[2] – على أحمد يونس[2] – عصام محمد عبدالسلام ياسين[1] – رانيا حمدى صابر[1]

1- معهد بحوث وقاية النباتات- مركز البحوث الزراعية – الدقى – الجيزة – مصر
2- قسم علم الحشرات – كلية العلوم – جامعة القاهرة – الجيزة - مصر

تهدف هذه الدراسة إلى معرفة تأثير كلا من النيماتودا الحرة المعيشة *Rhabditis scanica* Allgen وحشرة الكولمبولا (Collembola) *Entomobrya musatica* على المظاهر البيولوجية للأكاروس المفترس *Cunaxa capreolus* وذلك عند درجتى الحرارة 25 و 35 م° ورطوبة نسبية 75 % ولقد اتضح من الدراسة أن المظاهر البيولوجية للأكاروس المفترس قد تأثرت عند التغذية على نوعى الغذاء المقدم وأن حشرة الكولمبولا كانت أفضل من النيماتودا الحرة المعيشة حيث أن التغذية على هذه الحشرة زادت طول فترات حضانة البيض Incubation period و دورة الحياة Life cycle و فترة حياة الأفراد البالغة Longevity والفترة الكلية لحياة الأكاروس Life span أكثر منها على النيماتودا الحرة المعيشة وأيضا أعطت الإناث عدداً أكبر من البيض عند التغذية على حشرة الكلمبولا (39.11) بيضة عند 25 م° وأقلها كان (33.05) بيضة عند التغذية على النيماتودا الحرة المعيشة عند درجة الحرارة 35 م°.