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LIFE HISTORY OF THE PREDATORY MITE, *PHYTOSEIULUS MACROPILIS* (BANKS) FED ON TWO TETRANYCHID MITE SPECIES (ACARI: PHYTOSEIIDAE: TETRANYCHIDAE)

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ABSTRACT:

Developmental duration, consumption rate and reproduction of Phytoseiulus macropilis (Banks) on two tetranychid mites, Tetranychus cucurbitacearum (Sayed) and Eotetranychus zacheri Zaher, Gomaa and El-Enany were studied under laboratory conditions of 25±2ºC and 55±5% R.H.. Females of P. macropilis fed and complete its development on the previous prey. Life cycle was completed in sub equal times, 7.15 and 7.40 days when it fed on both prey, respectively.

Life span of the predatory female lasted 23.96 and 22.84 days when fed on T. cucurbitacearum and E. zacheri, respectively. The female longevity elongated when fed on T. cucurbitacearum compared with E. zacheri whereas, lasted 16.81 and 15.44 days, respectively.

The predatory female consumed during its life span about 95.25 and 87.06 individuals of E. zacheri and T. cucurbitacearum, respectively.

***Conclusively,** after rearing the predatory mite Phytosiulus macropilis on two tetranychid mites, Tetranychus cucurbitacearum and Eotetranychus zacheri the obtained results showed that the predatory mite P. macropilis able to reproduce rapidly and succeed in the control of both tetranychid mite species T. cucurbitacearum and E. zacheri and it can be used in biological control programs.*

Key words: *Phytoseiulus macropilis*, Tetranychid mites, Life history.

INTRODUCTION

Family Tetranychidae Donnadieu is one of the most important families of the Acari including many species can be serious pests of agricultural crops. This family comprises a large numbers of about 1250 phytophagous species (Faith *et al.*, 2009 and Dameda *et al*., 2016). Plant crops are liable to be infested by several phytophagous mites belonging to both genera, *Tetranychus* and *Eotetranychus* that cause severe damage to the plants by feeding on the plant sap in addition to plant viruses transmission (Huffaker *et al*., 1970; Abou Attia *et al*., 2004 and Magouz *et al*., 2011).

Predatory mites of the family phytoseiidae have an economic importance, because they efficiently control pest mites in many crops around the world (Sabelis, 1985; Fouly, 1997; Moraes, 2002; Shrewsbury & Hardin, 2003 and Mostafa, 2012). Nine species belonging to genus *Phytoseiulus* were known worldwide (Moraes *et al*., 2004). The predatory mite, *P. macropilis* was a specialized predator of *Tetranychus* spp., and restricted to warm climates, found in Florida (Coombs &Bale 2014). Several factors affecting predation, fecundity and life history in phytoseiid species had been of interest to many researchers. Among the factors which had been studied are temperature, humidity, quality and quantity of food, repeated mating, starvation and age of male and female (Amano & Chant 1978; Momen, 1997).

Life cycle studies of *P. macropilis*, was to be importance for evaluating the effectiveness and biological control potential of this predatory mite, have been published by a few authors (Oliveira *et al*., 2007 and Gigon *et al*., 2015).

Therefore, the present study throws light on the life history of the predator mite, *P. macropilis* (Bank) feed on *Tetranychus cucurbitacearum* and *Eotetranychus zacheri* under laboratory conditions to assess the potential of the predator to suppress population of different phytophagous mites.

MATERIALS AND METHODS

1. *Predatory mite culture:*

A laboratory colony of *P. macropilis* was maintained in Plant Protection Research Institute, Sharkia Branch, and reared on mulberry

leaves, *Morus alba* L. infested with *T. urticae* as prey, under laboratory conditions of 25±2ºC and 55±5% R.H..

2. *Colonies of tetranychid mites:*

The tetranychid mites, *T. cucurbitacearum* and *E. zacheri* were collected from leaves of mulberry, *M. alba* and wheat, *Triticum aestivum* L., respectively. Those species were reared on mulberry leaves under laboratory conditions.

3. *Experimental procedures:*

Experimental arenas were prepared as follows: twenty gravid females of *P. macropilis* were taken randomly and transferred to rearing substrates. Females were left 24 h and their oviposited eggs were used to start biological aspects. Leaf discs (3cm. in diameters) were made and placed on cotton wool soaked with water in Petri dishes. Newly laid eggs of *P. macropilis* were transferred singly to the rearing discs. Newly larvae were fed during life span on one of the prey mentioned above. This experiment was repeated with the second species. Observations were carried out twice daily and different biological aspects were recorded.

Data were statistically analyzed by using the analysis of variance according to Sendecor and Cochron (1982) using the computer program SPSs (1997). The fecundity of the predator was determined at 25±2ºC and 55±5% RH.

RESULTS AND DISCUSSION

1. *Effect of the tetranychid mites on development of P. macropilis:*

The biology of the predator mite, *P. macropilis* was studied when fed on adult stages of *T. cucurbitacearum* and *E. zacheri* under laboratory conditions 25±2ºC and 55±5 % RH., (Tables 1).

The incubation period was slightly longer on *T. cucurbitacearum* than *E. zacheri* averaged 3.06 and 2.97days, respectively. Whereas, total immatures duration of the predator when fed on *T. cucurbitacearum* was shorter than on *E. zacheri* lasted 4.09 and 4.44 days, respectively. The adult female longevity of the predator was longer when it fed on *T. cucurbitacearum* than *E. zacheri*. Feeding on *T. cucurbitacearum* elongated adult female longevity and life span of *P. macropilis* recorded 16.8 and 23.96 days comparing to 15.44 and 22.84 days fed on *E. zacheri*, respectively.

Table (1): Biological parameters of the predatory mite, *P. macropilis* fed on two tetranychid mite species at 25±2 ºC and 55±5 RH.

Mite stages	Type of food		F. test	L.S.D.$_{0.05}$
	T. cucurbitacearum	*E. zacheri*		
Egg	3.06 ±0.18	2.97 ±0.17	0.451 $_{ns}$	0.285
Larva	1.09 ±0.19	1.22 ±0.11	2.716 $_{ns}$	0.162
Protonymph	1.31 ±0.18	1.34 ±0.19	0.044 $_{ns}$	0.303
Deutonymph	1.69 ±0.19	1.88 ±0.1	2.288 $_{ns}$	0.253
Total immatures	4.09 ±0.16	4.44 ±0.18	6.569*	0.2788
Life cycle	7.15 ±0.26	7.40 ±0.27	1.485 $_{ns}$	0.429
Pre-oviposition	2.63 ±0.28	2.38 ±0.31	1.111 $_{ns}$	0.484
Oviposition	11.69 ±0.63	10.88 ±0.54	3.095 $_{ns}$	0.943
Post-oviposition	2.5 ±0.23	2.19 ±0.35	1.811 $_{ns}$	0.474
Longevity	16.81 ±0.78	15.44 ±0.72	5.284*	1.221
Life span	23.96 ±0.9	22.84 ±0.82	2.847 $_{ns}$	1.354
Fecundity	36.56 ±0.92	29 ±0.97	104.03***	1.514
Eggs/♀/day	3.15 ±0.16	2.68 ±0.12	18.13***	0.226

T= Tetranychus E=Eotetranychus
ns = Non significant * =Significant *** = High significant.

geographical origin of these predator populations and used methods.

Life cycle of the predator was completed in 7.15 and 7.40 days when fed on both preys, respectively. Prasad (1967) found that the female predator *P. macropilis* has a very short life cycle an average of about four

days to reach adult stage. Ragusa (1965) observed that adult lived 22-30 days and laid about 60-100 eggs for an average of about 4 eggs /♀/day at 77-82 º F.

The fecundity of *P.macropilis* female was lower when fed on *E. zacheri* comparing with *T. cucurbitacearum*. These results compatible with that of Ali *et al*., (2005) showed that *P. macropilis* female laid the highest number of eggs and daily rate (35.2 & 2.4) when fed on *T. urticae* eggs.

2.*The efficiency of the predatory mite P. macropilis when fed on phytophagous mites:*

The consumption rate of prey increased through the developmental stages of the predatory mite *P. macropilis.* (Table 2).

Data showed that the preys number consumed by the predator mite *P. macropilis* was lower when fed on *T. cucurbitacearum* compared to *E. zacheri* through all developmental stages of the predator with total average consumption 95.25 and 87.06 preys through its life span when fed on *T. zacheri* and *T. cucurbitacearum*, respectively. Results obtained are in agreement with that of Hassan *et al*. (2007), they studied the biological control of *T. urticae* in different stages with *P. macropilis*. These results nearly similar to Neoli *et al.*, (2011) they tested the functional response of *P. macropilis* and found positive correlation between increased preys number and daily prey consumption. The mite, *P. macropilis* completed its development when fed on three tetranychid mites, *T. cucurbitacearum*, *Eutetranychus orientalis* (Klein) and *Oligonychus mangiferus* (Rahman & Sapra) recorded 5.97, 6.68 and 6.78 days for life cycle, respectively (El-Sharabasy and El-Kawas, 2015). On the contrast, Marcos *et al*. (2010) found that the predator *P. macropilis* was not able to complete its life cycle when fed on eggs and adults of *Oligonychus ilicis*. Larvae survived for 3.0 days, but then died. However, when fed eggs and adults of *T. urticae*, the predator completed its life cycle. Osakabe (2002) recorded that *P. persimilis* attacked *T. urticae* and *Eotetranychus asiaticus* but produced very few eggs and he declared that *E. asiaticus* is not a good food source for *P. persimilis*.

The female fecundity averaged 36.56 eggs / female with a daily rate 3.15 eggs/day for *P. macropilis* when fed on *T. cucurbitacearum*, which more than that obtained with *E. zacheri* recorded 29.0 eggs/female with

Table (2): Consumption rate of *P. macropilis* fed on two tetranychid mites at 25±2 ºC and 55±5 RH.

Mite stages	Type of food		F	L.S.D.$_{0.05}$
	T. cucurbitacearum	***E. zacheri***		
Larva	0.875 ±0.2	0.937 ±0.3	0.074 ns	0.469
Protonymph	2.06 ±0.26	2.38 ±0.28	2.19ns	0.430
Deutonymph	4.75 ±0.55	6.06 ±0.38	12.18**	0.768
Total immatures	7.69 ±0.65	9.38 ±0.5	12.84**	0.961
Pre-oviposition	11.25 ±1.5	14.25 ±1.7	5.596*	2.59
Ovi-position	63.88 ±3.9	71.37 ±4.3	5.34*	6.62
Post-oviposition	4.31 ±0.48	6.56 ±1.4	7.43*	1.68
Longevity	79.43 ±4.04	85.87 ±4.2	3.89ns	6.65
Life span	87.06 ±3.7	95.25 ±4.04	7.13*	6.26

daily rate 2.68 eggs/day. The obtained results showed that the reproductive success of *Phytoseiulus* species depends on the presence of tetranychid mite, and it more efficient when they belong to the genus *Tetranychus*. The species of *Phytoseiulus* have a strong potential to reach high population densities, they showed that high prey consumption rate when compared

with species of other genera (McMurtry&Croft, 1997).

Ragusa (1965) found that the adult female *P. persimilis* consumed 150-200 individuals of *T. urticae*. In contrast, Pickett & Gilstrap (1986) mentioned that predation by *P. persimilis* had greatest impact on eggs and immature of *Oligonychus pratensis*, but it had little impact on adults of the prey.

Conclusively, after rearing the predatory mite *Phytosiulus macropilis* on two tetranychid mites, *Tetranychus cucurbitacearum* and *Eotetranychus zacheri* the obtained results showed that the predatory mite *P. macropilis* able to reproduce rapidly and succeed in the control of both tetranychid mite species *T. cucurbitacearum* and *E. zacheri* and it can be used in biological control programs.

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تاريخ حياة الحلم المفترس *Phytoseiulus macropilis* (Banks) المتغذى على نوعين من الحلم التترانيكيدى (Acari: Phytoseiidae: (Tetranychidae

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تمت دراسة معدل التطور الافتراس وكذلك الخصوبة للمفترس الاكاروسى *Phytoseiulus macropilis* عند تغذيته على نوعين من الاكروسات النباتية التغذية من عائلة الحلم العنكبوتى الاحمر *Tetranychidae* وهما *Tetranychus cucurbitacearum* & *Eotetranychus zacheri* عند درجة حرارة 25±2 º م ورطوبة نسبية 55±5٪ .

ولقد أثبتت النتائج ان:

الحلم المفترس *P. macropilis* قادر على التغذية و إتمام دورة حياته عند تغذيته على كلا النوعين *T. cucurbitacearum* و *E. zacheri* . ولقد كانت النتائج متقاربة حيث كانت (7.15 & 7.40) يوما عند التغذية على كلا النوعين على التوالي.

وقد كان عمر انثى المفترس أطول عند تغذيتها على الحلم النباتى *T. cucurbitacearum*بالنسبة لعمرها عند تغذيتها على النوع *E. zacheri* حيث كانت النتائج (22.84 & 23.96) على التوالى، و لوحظ كذلك زيادة فترة خصوبةالانثى و عمر الأفراد بشكل عام عند التغذية على الحلم النباتى *T. cucurbitacearum*.

و أخيرا فقد وجد أن معدل الكفاءة الافتراسية إناث المفترس *P. macropilis* للحلم النباتى *E. zacheri* اعلى بمقارنته بتغذيته على *T. cucurbitacearum*.

التوصية: من النتائج السابقة فان المفترس الاكاروسى *P. macropilis* يلعب دورا حيويا كأحد العناصر الحيوية الهامة فى المقاومة الطبيعية للاكاروسات نباتية االتغذية *T. Cucurbitacearum*و *E. zacheri* بدون استخدام المبيدات الكميائية التى لها تاثير ضار على البيئة و الاعداء الحيوية.