Life Table Parameters of the Predatory Mite, *Phytoseiulus persimilis* Athias-Henriot on Four Tetranychid Prey Species (Phytoseiidae - Tetranychidae)

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ABSTRACT

Developmetal duration, predation rate, reproduction and life table parameters of *Phytoseiulus persimilis* Athias-Henriot on the four tetranychid mites: *Tetranychus urticae* Koch., *Oligonychus sayedi* Zaher, Gomaa & El-Enany, *Eotetranychus zacheri* Zaher, Gomaa & El-Enany, and *Petrobia tritici* Kandeel, El-Naggar & Mohamed, were studied at 25 ± 2°C and 70 ± 5% R.H.. *P. persimilis* was able to feed and complete its development on the four tested preys. The predator exhibit a particularly high capacity for increase when fed on *T. urticae* and *O. sayedi*, feeding on *P. tritici*, enhanced poor predator performance as significant longer life cycle and decrease in adult female longevity and no eggs laying occured. The period of adult female longevity increased to 24.1 days when fed on *T. urticae* comparing to 23.4 & 14.2 days when fed on *O. sayedi* and *E. zacheri*, respectively. The result showed that low capacity of predator population growth suggests poor ability of *P. persimilis* to suppress *E. zacheri* and *P. tritici* populations on commercial crops. The daily multiplication rate (R_0/T) and the intrinsic rate increase (rm) revealed the highest rate of *P. persimilis* fed on *T. urticae* which averaged 2.51 and 0.12, respectively.

Key Words: *Phytoseiulus persimilis*, Development, Reproduction, Life table parameters, Tetranychid preys.

INTRODUCTION

Field observations showed that the four tetranychid species, *Tetranychus urticae* Koch, *Eotetranychus zacheri* Zaher, Gomaa & El-Enany, *Oligonychus sayedi* Zaher, Gomaa & El-Enany and *Petrobia tritici* Kandeel, El-Naggar & Mohamed maintained high populations throughout the year on crops and vegetables in Egypt.

According to Naher & Haque (2007), *P. persimilis* is the commercialized and widely released phytoseiid predator in greenhouses. It has been widely studied for its capacity for the biological control of tetranychid mites in many crops. In Egypt, Rasmy and El-Lathy (1988) have introduced *P. persimilis* to control *T. urticae* in greenhouse.

Cakmak *et al.* (2005) suggested that *P. persimilis* has enormous potential for the biological control of *T. cinnabarinus* in protected strawberry in Aydin (Turkey), where temperatures over 30 °C and relative humidities below 60% are unfavorable condition for the development of predatory acari. Nowadays, *P. persimilis* is used as a biological control agent for tetranychids worldwide, especially in protected crops (Goodwin &Wellham, 1992; Zhang & Sanderson, 1995; Zhang, 2003; Congiz, 2008). On other hand, little is known about the influence of other prey species of tetranychids on the biology of phytoseiids (Escudero & Ferragut, 2005).

The present study was conducted to evaluate life history of *P. persimilis* fed on *T. urticae*, *E. zacheri*, *O. sayedi* and *P. tritici* in the laboratory to assess the potential of *P. persimilis* to suppress population of these four pests.

MATERIALS AND METHODS

1. Predatory mite culture:

A laboratory colony of *P. persimilis* was maintained in Institute of Efficient Productivity, Zagazig University and reared on potato leaves *Ipomoea patatas* infested with *T. urticae* as prey. The experiment was undertaken in laboratory conditions of 25±2°C and 70±5 % R.H.

2. Colonies of tetranychid mites:

The tetranychid mites, *T. urticae* and *E. zacheri* were collected from leaves of faba been, *Faba vulgaris* Moench; *Oligonychus sayedi* was collected from leaves of sugar cane, *S. officinarum* L. and *P. tritici* was collected from leaves of wheat, *Triticum aestivum* L. Those species were reared on detached potato leaves and supplied to the predatory mite, *P. persimilis*.

3. Experimental procedure:

Experimental arenas were prepared as follows: twenty gravid females of *P. persimilis* were taken randomly and transferred to rearing substrates. Females were left 24 hours and their oviposited eggs were used to start biological aspects. Leaf discs of potato leaves (3 cm in diameter) were used as rearing arenas. The discs were placed on cotton wool soaked with water in Petri-dishes. Newly laid eggs of the predator, *P. persimilis* were transferred singly to the rearing discs. Hatched larvae were fed during their life span on one of the aforementioned preys moving stages. This experiment was repeated with other species of the experiment. 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). Differences among means were tested by using Duncan's New Multiple Range test (Duncan, 1955). Life table parameters were calculated according to Birch (1948) using the BASIC computer program of Abou-Setta *et al.* (1986).

RESULTS AND DISCUSSION

1. Effect of preys on development of *P. persimilis*:

The eggs of the predacious mite, *P. persimilis* developed successfully to the adult stage when fed on any of the four prey species (Table 1). Life sycle of *P. persimilis* females was longer than that of males. Durations were 7.13, 7.11, 8.53, 14.33 days for females and 7.06, 6.02, 8.26, 10.32 days for males fed on *T. urticae*, *O. sayedi, E. zacheri* and *P. tritici*, respectively. The shortest life cycly of both sexes were recorded when predatory immatures were fed on *O. sayedi* (7.11 & 6.02 days) for female and male, respectively. Life cycle estimated for female immatures fed on *T. urticae* or *O. sayedi* did not differ significantly (Table 1).

Feeding on *P. tritici* elongated significantly the predatory female life cycle compared with the other preys and distinctly shortered female longevity, and no oviposition occured.

Feeding on *T. urticae* elongated adult female longevity of *P. persimilis* to 24.1 days comparing to 23.4 & 14.2 days on *O. sayedi* and *E. zacheri*, respectively (Table, 1).

2. Effects of preys on reproduction fecundity and life table parameters of *P. persimilis*:

Preys also influenced the total eggs laid per female and the number of consumed prey eggs. The reproductive rate of *P. persimilis* obviously reflected the preference of feeding on *T. urticae* comparing to the other preys (Table, 2).

In addition, data showed that the number of preys consumed and the fecundity were significantly lower when fed on *E. zacheri* compared to *T. urticae* and *O. sayedi*. The life time fecundity was about 3 eggs/female for *P. persimilis* when fed on *E. zacheri*, 40% less than that obtained with *T. urticae*, and 33 eggs/female for predator fed on *O. sayedi* which represents 31% fewer eggs than that when the prey fed on *T. urticae*.

The daily multiplication rate (R_0/T) and the intrinsic rate of increase (rm) revealed the highest rate of *P. persimilis* preying on *T. urticae* of 2.51 and 0.12, respectively. But for the other preys showed the lowest value.

Results demonstrate that local population of *P. persimilis* is able to feed and complete development on the four tetranychid mite species. This predator may exhibt high capacity for population increase when fed on *T. urticae* and *O. sayedi*, and provide effective control in the field. The results support the previous studies that *P. persimilis* was observed to build up in large numbers under field conditions and suppress *T. lintearius* population (Ireson *et al.* 2003 and Jamie *et al.*, 2009).

Pickett & Gilstrap (1986) mentioned that predation by *P. persimilis* and *Amblyseius californicus* had their greatest impact on the eggs and immature stages of Banks grass mite (BGM), *Oligonychus pratensis*, but the predators had little impact on BGM adults. They recorded that *P. persimilis* was a more efficient predator than *A. californicus*, which reduced adult BGM 72% by 6.0 days. Osakabe (2002) recorded that, the predators *P. persimilis* and *A. californicus* attacked *T. urticae* and *Eotetranychus asiaticus*, but produced very few eggs and their offspring rarely reached adulthood when fed on *E. asiaticus*, which considered to be nutritionally poor for *P. persimilis*. This implies that also *E. asiaticus* is not a good food source for *P. persimilis*.

When *P. persimilis* fed on *P. tritici*, the predatory performance was poor as it enhanced a significant increase in developmental duration and reduction occurred in oviposition period and fecundity.

P. tritici is an invasive species recently introduced to Egypt, where it was firstily found on wheat, *Triticum aestivum* L.; barley, *Hordeum vulgare* L.; sorghum, *Sorghum vulgare* Pers.; garlic, *Allium carinatum* L.; clover, *Trifolium alexandrinum* L.; lupin, Table (1): Developmental duration of female and male stages of *Phytoseiulus persimilis* fed on four mite species at 25±2 °C and 70±5 R.H.

	T. urticae	*O. sayedi*	*E. zacheri*	*P. tritici*
		Female		
Egg	2.47±0.13	2.4±0.13	2.53±0.13	2.6±0.13
Larva	1.4±0.13b	1.6±0.13b	1.53±0.13b	4.53±0.13a
Protonymph	1.33±0.13c	1.47±0.13c	2.13±0.09b	4.53±0.13a
Deutonymph	1.67±0.16b	1.91±0.12b	2.33±0.13b	3.27±0.53a
Life cycle	7.13±0.19c	7.11±0.26c	8.53±0.17b	14.33±0.3a
Pre-ovipostion period	1.6±0.13c	1.8±0.2c	2.33±0.28b	5.6±0.13a
Oviposition period	18.87±0.69a	17.4±0.49a	4.87±0.24b	-
Postovipostion period	3.53±0.26b	3.87±0.22b	7.27±0.49a	-
Longevity	24.1±0.51a	23.4±0.53a	14.2±0.55b	5.4±0.64c
Life span	31.13±0.67a	30.2±0.67a	22.87±0.45b	19.3±0.77c
		Male		
Egg	1.8±0.13	1.16±0.13	2.11±0.19	2.3±0.23
Larva	1.9±0.13	1.74±0.13	1.4±0.09	2.36±0.24
Protonymph	1.7±0.15	1.11±0.13	2.25±0.19	2.16±0.13
Deutonymph	2.2±0.14	2.01±0.11	2.5±0.13	3.5±0.41
Life cycle	7.06±0.18	6.02±0.13	8.26±0.17	10.32±0.31

Means in the same raw not followed by the same letter are significantly different (P≤ 0.01).

Table (2): Life table parameters of *P. persimilis* fed on four tetranychid species at 25±2°C and 70±5 % R.H.

Prey	Fecundity	Oviposition rate/day	Total consumption	R_0	T	R_0/T	rm
T. urticae	47.67±1.17a	2.56±0.08a	28.6±0.33a	30.99	12.41	2.51	0.12
O. sayedi	32.53±0.79b	1.89±0.07b	25.33±0.63a	22.24	15.09	1.47	0.09
E. zacheri	2.53±0.27c	0.55±0.07c	6.47±0.24b	5.46	13.05	0.42	0.06
P. tritici	-	-	3.87±0.32b	-	-	-	-

Fecundity (eggs/female); Oviposition rate (eggs/female/day); T (mean generation time in days); R_0 (net reproductive rate female/female); rm (intrinsic rate of increase in day)
Means in the same raw not followed by the same letter are significantly different (P≤ 0.01).

Lupinus angustifolius L. and sugar beet, *Beta vulgare* L. plants (Kandeel *et al*., 2007).

Recet attempts to control the pest through mass releases of predatory mites, mainly *P. persimilis* have been unsuccessful. Poor efficacy of *P. persimilis* in the present study may be due to large body of prey or the secondary plant compounds, while *P. tritici* was reared on potatoes. Chatzivasileiadis & Sabelis (1997); Maluf *et al.* (2001), and Saber & Rasmy (2010) mentioned that host plants may affect the efficiency of predatory mites.

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