Effect of Temperature and Prey on Biology and Life Table Parameters of Predatory Mite *Phytoseius finitimus* Reared on *Aceria melongena* and *Tetranychus urticae* Under Laboratory Conditions

Eman H. Walash[1], Samah Z. Elkholy[1] and Masoud R. El-Aassar[2*]
(1) Plant Mites Department, Plant Protection Research Institute, Agricultural Research Centre, Dokii, Giza, Egypt;
(2) Vegetable, Medicinal, Aromatic and Ornamental Pests Research Department, Plant Protection Research Institute (PPRI), Agricultural Research Center (ARC), 12618 Dokki, Giza, Egypt.
[*]Email of the corresponding author: abuelfadelmohamed400@gmail.com

Abstract

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The developmental time, fecundity and life table parameters of the phytoseiid predatory mite *Phytoseius finitimus* Ribaga fed on immature stages of *Aceria melongena* (Zaher & Abou-Awad) and *Tetranychus urticae* Koch were studied in the laboratory at three different temperatures (22, 27 and 32°C), to find out the possibility of using the predator as a biological control component of eggplant phytophagous mites. Total developmental time of *P. finitimus* female and male was shortest and reached 5.56 and 5.33 days, respectively, on *A. melongena* at 32°C, whereas the longest period was 12.05 and 10.96 days, respectively, on *T. urticae* at 22°C. The oviposition period was longest 33.35 days on *T. urticae* at 22°C. The total egg production rates were the highest on *A. melongena (*40.37 eggs/female) with daily rate of 2.05 eggs/♀/day at 32°C. A diet of *A. melongena* showed a higher value of the intrinsic rate of increase (r_m) which was 0.230 ♀/♀/day at 32°C. The net reproductive rate was highly affected by temperatures where (R_0) values were 23.45 and 19.19; 19.79 and 16.99; 16.98 and 12.72 ♀/♀ at 32, 27 and 22°C for *A. melongena* and *T. urticae*, respectively. The predation rates of *P. finitimus* increased with temperature increase. A significant difference between the three temperatures and two prey diets on the feeding capacity of adult female and male. The lowest life cycle thermal threshold (t_0) ranged between 8.55 and 12.41°C. The lower temperature threshold (t_0) and thermal constant (K) for the total immature stages of this predator was calculated to be 11.72 and 115.22°C degree-days for *A. melongena*, and 7.94 and 171.63°C degree-days for *T. urticae*, respectively. These values suggested that the optimal temperature for the population growth of *P. finitimus* ranged between 27 and 32°C. Our findings suggest that *P. finitimus* can successfully complete its life cycle on *A. melongena* and *T. urticae* and have excellent potential as a biological control agent for two pests on eggplant under field conditions. Temperatures 22 and 27°C seem to be more suitable for mass rearing of this predator mite fed on two prey diets. The eriophyid mite *A. melongena* was more favored to the predator mite than *T. urticae*.

Keywords: Phytoseiidae, Eriophyidae, Tetranychidae, biological control, predation.

Introduction

In Egypt, the eggplant, *Solanum melongena* L. is an economically important vegetable crop. Its fruits are consumed after being grilled, boiled, or cooked (Zayed *et al.* 2017). The total cultivated area of eggplant is 52,790 acres with an annual production of 608,795 tons of fruits with an average of 11,532 ton/acre (Ministry of Agriculture and Land Reclamation Statistic, 2019).

The eggplant rust mite, *Aceria melongena* was recorded on *Solanum melongena* L. (Solanaceae) all over the governorates of Egypt. The mites prefer the lower leaf surface, but during times of heavy infestation, it was noted that they were present on both surfaces and in the area around the leaf petiole, resulting in yellowish color of deformed leaves and reduced growth. (Abou-Awad *et al.*, 2021; Farahat, 2020).

The two-spotted spider mite, *Tetranychus urticae* Koch is one of the most serious pests in various agricultural systems all over the globe. Vegetables, fruits, field crops, and a variety of ornamentals are among its host plants (Migeon & Dorkeld, 2022). *Tetranychus urticae* feeds on tender tissues on the lower leaf surface, resulting in brownish or yellow-brown stippling and mite webbing on the lower leaf surface (Saito, 1985). In the study area, *T. urticae* caused leaves to become yellow, and then finally die and drop off the plant. In severely affected fields, entire plants may get defoliated.

Phytoseiid mites are predators of plant feeding mites and small insects of many crops. The predators of the genus *Phytoseius* have been recorded worldwide on several crops of economic importance. They are reported as Type III predators that feed on insect and mite pests (El-Laithy, 1998; McMurtry *et al.*, 2013; Rasmy & Elbanhawy, 1974). The generalist predatory mite *Phytoseius finitimus* fed on tetranychids, eriophyoids, and pollen (Momen & El-Borolossy 2010), and was found on several kinds of cultivated and non-cultivated plants, including grapevine, hazelnut, citrus, elm, walnut, mulberry, peach, plum, pomegranate, cotton, fig, eggplant, and lantana (Faraji *et al.*, 2011). Few studies investigated biological aspects of *P. finitimus* worldwide (Abou-Awad *et al*., 2018; Ahmad *et al.*, 2015; El-Laithy, 1998). Thus, the main objective of the present study was to evaluate the two prey diets *A. melongena* and *T. urticae* and temperature on efficiency of

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the predator through the study of the life table and predation rate of *P. finitimus* under laboratory conditions. The results obtained can be useful in the biological control of eggplant phytophagous mites.

Materials and Methods

Prey mite culture

Eggplant rust mite, *A. melongena* Zaher & Abou-Awad and *T. urticae* Koch was collected from eggplant leaves in Shebeen El-Kom (30°33'39"N, 31°00'31"E), Menoufia Governorate, Egypt, during the summer season of 2021. The site has an annual rainfall during December to February. Eggplant received standard cultural practices of fertilization and irrigation and without pesticide application. Stock colonies of two prey diets were reared on eggplant leaves at 25±1°C, 60±5% RH and 16:8 h (L:D) photoperiod for several generations before starting to use them in the experiments.

Mass rearing of the predatory mite *Phytoseius finitimus*

The predatory mite *P. finitimus* was collected from fig trees, *Ficus carica* L. and conyza, *Pluchea dioscoridis* (L.) DC. at Shebeen El-Kom, Menoufia Governorate associated with spider mite and eriophyid mite. The colonies were kept in big plastic boxes (70×30×40 cm) in the Lab at room temperature. Water was added when needed. Excised bean leaves highly infested with *T. urticae* were provided every day as prey source for the predatory mite (Elhalawany *et al.*, 2019).

Experimental units

Experiments were conducted on arenas consisting of discs of freshly-excised Magd eggplant cultivar leaves (3 cm in diameter), placed upside down on water saturated cotton, inside plastic Petri dishes (6 cm in diameter). Leaves were well washed with running water to remove any mite individuals. Petri dishes were covered with fine mesh for ventilation. The predatory mites were transferred into new arenas when needed. The experiments were conducted at three constant temperatures (22, 27 and 32°C, 60±5% R.H. and 16:8 (L:D) photoperiod). The two prey species *A. melongena* and *T. urticae* were used to feed the *P. finitimus* predator.

Biological aspects of *Phytoseius finitimus*

To study the effect of prey species on biology and life table parameters of *P. finitimus*, three groups of 60 newly deposited eggs were singly transferred with a fine brush to leaf disk and subjected to different temperatures. The experiment included six treatments (two prey diets and three temperatures), and each treatment was replicated 60 times. After egg hatching, 15 immature stages of the two prey diets were added daily to each *P. finitimus* until reaching adult stage and the predation rate was determined. The developmental stages were checked at 24 h intervals until all individuals had reached adulthood. A male was introduced to each leaf disk for mating and removed from the plate after the deposition of the first egg. Every plastic plate was examined daily to record the number of eggs laid until the female died.

Life-table parameters

Life table parameters were estimated according to Birch (1948) using the Life 48, BASIC Computer programme (Abou-Setta *et al.*, 1986). The sex ratio for each experiment was determined by visual observation and life tables were constructed from the data obtained for the developmental time of immature stages and adult characteristics. Whereas: The net reproductive rate is the mean number of female offspring produced per female

$$R_0 = \Sigma\ (lx \times mx)$$

where "m*x*" is female progeny per female; "l*x*" is the rate of females survival.

The mean length of generation period, expressed in days:

$$T=\Sigma\ (x \times lx \times mx)/\Sigma(lx \times mx)$$

intrinsic rate of natural increase is a natural logarithm of the intrinsic rate of increase and indicates the number of times of population multiplication in a time unit:

$$r_m = \ln\ (R_0)/T$$

mean time of population to double (DT) = ln (2)/r_m and the finite rate of increase is the multiplication per female in unit time of a population with a stable age distribution (λ) = exp (r_m).

Statistical analysis

The influence of prey species developmental time, duration of adult stages and fecundity were analyzed using One Way ANOVA and means comparison was conducted using Student's LSD at P=0.05. Analysis was conducted using SAS program (Anonymous, 2003). For the relation between the effect of different constant temperatures and developmental rates (1/developmental times within the tested range), linear regression (Y = a±bX) was used. Whereas, rate of development (Y) and temperature (X) (at a specific range), a (intercept), b (slope of temperature) and X is the tested temperature (°C). Data obtained was analyzed using Proc Reg in SAS (Anonymous. 2003). This approach led to calculating degree-day's constants of developmental threshold (t_0) and K value in degree-days (DDs) as physiological time. Effect of prey and temperature using Two-way analysis of variance ANOVA and mean separation was conducted using Duncan's multiple range test ($P \leq 0.05$).

Results and Discussion

Developmental time and longevity of *Phytoseius finitimus* reared on different prey species at three constant temperatures

The predatory mite *P. finitimus* completed its development on the eggplant rust mite *A. melongena* and *T. urticae*. The results indicated that all of the deposited eggs did hatch (100%). Development times of immature stages of males and females were significantly affected by prey species and temperature (Table 1). Temperature had a significant influence on incubation period of larva, protonymph and dutonymph of male and females of the predatory mite. The shortest incubation period of *P. finitimus* was 1.62 days at 32°C on *A. melongena*, whereas the longest period was 3.70 days at 22°C on *T. urticae*. The *A. melongena* shortened the duration of female and male immature stages to 5.56 and 5.33 days at 32°C, but the longer immature stages were 12.05 and 10.96 days, respectively, when fed on *T. urticae* at 22°C.

The males developed faster than females at the three temperatures. Feeding on the eriophyid *A. melongena* prey led to the shortest developmental period of predatory immatures compared to feeding on *T. urticae*.

Results obtained showed that temperature and prey diets had a highly significant effect on pre-oviposition, oviposition, post-oviposition and longevity periods (Table 1). The shortest periods were 2.21, 19.74, 3.03 and 24.97 days, respectively, on *A. melongena* at 32°C, whereas the longest periods were 4.80, 33.35, 4.73 and 42.87 days, respectively, on *T. urticae* at 22°C. In addition, the shortest female and male life span averaged 32.14 and 30.32 days, respectively, on *A. melongena* at 32°C, whereas the longest period was 58.62 and 53.04 days, respectively.

Mean fecundity and daily rates increased as long as temperature increased. The maximum fecundity rate was 40.37 eggs/female and the daily rate was 2.05 eggs/female/day on *A. melongena* at 32°C, whereas the minimum fecundity rate were 22.73 eggs/female and 0.68 eggs/female/day on *T. urticae* at 22°C (Table 1).

The above mentioned results are in agreement with the findings of El-Laithy (1998) who showed that the developmental time of the predatory mite *P. finitimus* was 7.9 days when fed on *Eriophyes olive*, and the total female fecundity was 23.5 eggs/female during an oviposition period of 16.0 days. Pappas *et al.* (2013) indicated that *P. finitimus* can feed and reproduce on larvae of *T. urticae*. The life cycle lasted 8.8 and 7.5 days for female and male at 25°C, respectively. Gorji *et al.* (2009) showed that *P. plumifer* can develop and reproduce on *T. urticae* over a wide range of temperatures (15–35°C). Shakarami & Bazgir (2017) indicated that developmental time of *P. plumifer* female fed on nymphal stages of *Eotetranychus hirsti* was 17.13, 10.0, 7.75 and 6.55 days at 20, 25, 30 and 35°C, respectively. Abou-Awad *et al.*, (2018) showed that when predatory mite *P. finitimus* fed on the fig bud mite *Aceria ficus* led to the shortest developmental period.

Life table parameters

Life table parameters of *P. finitimus* at three constant temperatures and two prey diets are presented in Table 2. The gross reproductive rate (GRR) increased from 17.03 on *T. urticae* at 22°C to 24.18 offspring/individuals on *T. urticae* at 32°C. The life table parameters, T, r_m, λ and R_0 differed between the three constant temperatures and two prey diets. The shortest mean generation time (T) at 32°C was 13.69 and 17.35 days, and the longest at 20°C was 24.44 and 28.0 days on *A. melongena* and *T. urticae*, respectively. The highest intrinsic rate of increase (r_m) value was 0.230 ♀/♀/day on *A. melongena* at 32°C. The highest net reproductive rate (R_0) value was 23.45 ♀/♀ on *A. melongena* at 32°C. The shortest doubling time (DT) was found 3.01 days on *A. melongena* at 32°C and the longest on *T. urticae* at 22°C was 7.70 days. The survival rate ranged between 80.0 to 85.0%.

The above-mentioned values were much lower than the findings of Shakarami and Bazgir (2017) when *P. plumifer* females were reared on *Eotetranychus hirsti*, the (r_m) increased as temperature increased from 20°C (0.064 day^{-1}) to 30°C (0.180 day^{-1}). The highest mean generation time was 32.75 days at 20°C and the lowest was 14.181 days at 35°C. Abou-Awad *et al.*, (2018) showed that the r_m value for *P. finitimus* was 0.24 females/female/day when fed on *A. ficus* at density of 20 preys, which is in agreement with the present study at 32°C.

Table 1. Mean developmental time and fecundity (eggs/female) and longevity (days±SD) of *Phytoseius finitimus* reared on *Aceria melongena* and motile stages of *Tetranychus urticae* at three constant temperatures.

		Aceria melongena			***Tetranychus urticae***		
Stages	**Sex**	**22°C**	**27°C**	**32°C**	**22°C**	**27°C**	**32°C**
Incubation period	♀	3.51 b	2.69 c	1.62 e	3.70 a	2.75 c	2.01 d
	♂	2.98 b	2.27 c	2.01 d	3.39 a	2.37 c	2.09 d
larva	♀	3.19 b	2.04 d	1.55 e	3.78 a	2.22 c	2.05 d
	♂	2.98 b	1.90 d	1.70 e	3.37 a	2.09 c	1.93 cd
Protonymph	♀	3.88 b	3.05 d	2.04 f	4.05 a	3.45 c	2.53 e
	♂	3.50 b	2.92 c	1.78 e	3.80 a	3.41 b	2.11 d
Deutonymph	♀	3.67 b	2.93 d	1.97 f	4.22 a	3.50 c	2.49 e
	♂	3.46 b	2.78 c	1.85 e	3.79 a	3.32 b	2.19 d
Immature stages	♀	10.74 b	8.02 d	5.56 f	12.05 a	9.18 c	7.08 e
	♂	10.13 b	7.44 d	5.33 f	10.96 a	8.82 c	6.23 e
Life cycle	♀	14.25 b	10.72 d	7.17 f	15.75 a	11.93 c	9.09 e
	♂	13.08 b	9.75 d	7.35 f	14.35 a	11.19 c	8.33 e
Pre-ovipostion	♀	3.97 b	3.63 c	2.21 e	4.80 a	3.92 b	2.83 d
Ovipostion	♀	30.21 b	25.53 d	19.74 f	33.35 a	26.77 c	22.58 e
Post-oviposition	♀	4.05 b	3.68 c	3.03 d	4.73 a	4.04 b	3.51 c
Longevity	♀	38.24 b	32.84 d	24.97 f	42.87 a	34.73 c	28.92 e
	♂	36.23 b	31.69 d	22.46 f	38.69 a	33.19 c	27.13 e
Fecundity	♀	28.68 d	34.37 b	40.37 a	22.73 f	26.85 e	30.85 c
Daily rate (egg/♀)	♀	0.95 c	1.35 b	2.05 a	0.68 d	1.00 c	1.37 b
Life span	♀	52.48 b	43.56 d	32.14 f	58.62 a	46.66 c	38.01 e
	♂	49.31 b	41.54 d	30.32 f	53.04 a	44.38 c	35.45 e

Means followed by the same letters in the same row are not significantly different at P=0.05.

Table 2. Life table parameters of *Phytoseius finitimus* reared on *Aceria melongena* and motile stages of *Tetranychus urticae* at three constant temperatures.

	Aceria melongena			*Tetranychus urticae*		
Parameter	**22°C**	**27°C**	**32°C**	**22°C**	**27°C**	**32°C**
Gross reproductive rate (GRR)	22.51 d	26.59 b	28.55 a	17.03 e	23.77 c	24.18 c
Sex ratio (female/total)	0.75 a	0.72 a	0.70 a	0.70 a	0.75 a	0.75 a
Net reproductive rate (R_0)	16.98 c	19.79 b	23.45 a	12.72 d	16.99 c	19.19 b
Survival rate %	80.0 b	80.0 b	85.0 a	80.0 b	85.0 a	85.0 a
50% mortality[a]	43.0 b	36.0 c	25.0 e	49.0 a	38.0 c	31.0 d
Mean generation time (T)[a]	24.44 b	18.81 d	13.69 e	28.0 a	21.35 c	17.35 d
Intrinsic rate of increase (r_m)[c]	0.115 b	0.158 ab	0.230 a	0.090 b	0.132 ab	0.170 ab
Finite rate of increase (λ)[c]	1.12 a	1.17 a	1.25 a	1.09 a	1.14 a	1.18 a
Doubling time (DT)[a]	6.03 b	4.38 d	3.01 e	7.70 a	5.25 c	4.07 d

[a] Days, [b] ♀/♀,[c]♀/♀/day, [d] offspring/individual, $R_0 = \Sigma(lx \times m_x)$; $T_c = \Sigma(x \times l_x \times m_x)/\Sigma(l_x \times m_x)$; $r_m = \text{Ln}(R_0)/T$; $DT = \text{Ln}(2)/r_m$, $\lambda = \exp(r_m)$ and GRR= Σmx. Means followed by the same letters in the same row are not significantly different at P=0.05.

The predation rates of *P. finitimus*

Results obtained clearly showed that the predator larvae developed to proto-nymphal stage without feeding on immature stages of two prey diets (Table 4). Generally, immature females of *P. finitimus* significantly consumed a higher number of prey diet than male immature stages. In addition, the females consumed more total prey than the immature stages. The consumption rate increased as temperature increased. However, *P. finitimus* significantly consumed more prey (190.68) on *A. melongena* at 32°C than on *T. urticae* at 22°C (17.50) during the oviposition period. The higher number of preys consumed during the adult stage was reported for *P. finitimus* females and males on *A. melongena* at 32°C (271.37 and 264.62 prey), whereas the lowest was 34.54 and 32.69 prey when fed on *T. urticae* at 22°C, respectively (Table 3).

The same results were obtained by Gorji *et al.* (2009) indicated that the daily prey consumption of the females increased with temperature from 8.85 preys/day at 15ºC to 31.81 prey/day at 35ºC. The consumption rate of female increased with temperature from 218.30 preys at 15 ºC to 426.98 prey diets at 25ºC. Fouly *et al.* (2011) found that the predatory mite *Typhlodromips swirskii* was fed on three different levels of whitefly eggs. The number of prey eggs significantly impacted the development of *T. swirskii*. Adult females consumed 41.6, 128.4, and 140.1 prey eggs daily, and laid 10.5, 12.8, and 15.7 eggs daily.

Thermal requirements of *P. finitimus*

Correlation coefficient associated with the developments of egg, larva, nymphal stages (R^2) ranged from 87.0 to 1.0 on *A. melongena* and *T. urticae*, respectively (Table 4). The linear model described the influence of temperature on the developmental rate of *P. finitimus*. The lowest thermal threshold (t_0) for egg, larva, proto-nymph, deuto-nymph and life cycle were 14.28, 12.48, 11.54, 11.12 and 12.41°C on *A. melongena,* respectively. The thermal constant (K) for completion of the fore-mentioned stages were 29.94, 30.05, 43.12, 42.48 and 144.49 degree-days, respectively. Similar trends were observed for *T. urticae*. The results indicated that a threshold of 8.55°C and 215.10 accumulated degree-days were required for *P. finitimus* to complete one generation on *T. urticae*. Similar results were obtained by Shakarami and Bazgir (2017) who showed that the lower temperature threshold and thermal constant for the total immature stages of this predator *P. finitimus* was estimated at 10.33°C and 166.67 degree-days when fed on *Eotetranychus hirsti.*

Table 3. The predation rates of *Phytoseius finitimus* reared on *Aceria melongena* and motile stages of *Tetranychus urticae* at three constant temperatures.

		Aceria melongena			*Tetranychus urticae*		
Stages	**Sex**	**22°C**	**27°C**	**32°C**	**22°C**	**27°C**	**32°C**
Protonymph	♀	9.74 c	11.47 b	16.53 a	3.42 e	6.96 d	11.85 b
	♂	8.38 c	9.08 c	15.08 a	2.50 e	5.81 d	10.44 b
Deutonymph	♀	9.68 c	15.37 b	23.26 a	5.50 e	8.69 d	15.12 b
	♂	8.92 d	12.23 c	18.46 a	5.06 f	7.56 e	14.00 b
Immature	♀	19.42 d	26.84 b	39.79 a	8.92 e	20.62 c	26.96 b
	♂	17.31 d	21.31 c	33.54 a	7.56 f	13.38 e	24.44 b
Preoviposition	♀	23.05 e	44.53 b	47.47 a	9.62 f	26.73 d	34.35 c
Oviposition	♀	36.47 e	73.84 c	190.68a	17.50 f	38.69 d	92.15 b
Postoviposition	♀	26.53 b	16.95 d	33.21 a	7.42 e	22.04 c	27.19 b
Longevity	♀	86.05 d	135.32 c	271.37 a	34.54 f	74.31 e	153.69 b
	♂	76.31 d	96.54 c	264.62 a	32.69 f	69.38 e	142.31 b
Life span	♀	105.47 d	162.16 c	311.16 a	43.46 f	94.92 e	180.65 b
	♂	93.62 d	117.85 c	298.15 a	40.25 f	82.75 e	166.75 b

Means followed by the same letters in the same row are not significantly different at P=0.05.

Effect of prey diet and temperature of *P. finitimus*

The results obtained (Table 5) showed that the mean duration of all developmental stages were longer on *A. melongena* and the shortest on *T. urticae* with significant differences were found between adult female longevity, oviposition period and life span. The *A. melongena* individuals were more favored to *P. finitimus* than *T. urticae*. Moreover, significant differences occurred between the two prey diets fecundity which was the highest on *A. melongena* and the lowest on *T. urticae*. Significant differences occurred between all stages at the three temperatures levels, at 32°C, being faster than 22 or 27°C. The highest fecundity at 22°C was 34.86 eggs/female, whereas the lowest was at 32°C and reached 25.24 eggs/female (Table 6). These results are in agreement with earlier findings (Gorji *et al.*, 2009) which indicated that the total developmental time of immature stages of *Phytoseius plumifer* decreased with increasing temperature from 20 to 35°C.

It can be concluded from this study that *P. finitimus* showed a fast growth rate and short generation time at higher than at lower temperature. The optimal temperature for the population growth of *P. finitimus* ranged between 27 and 32°C. Our findings suggest that *P. finitimus* can successfully complete its life cycle on *A. melongena* and *T. urticae* and have excellent potential as a biological control agent of two pests on eggplant under field conditions. The temperatures 22 and 27°C seem to be more suitable for mass rearing of this predator mite fed on the two prey diets. The eriophyid mite *A. melongena* was more favored to the predator mite than *T. urticae*.

Table 4. linear regression model for temperature-dependent developmental rates of immature stages of *Phytoseius finitimus* females reared on different prey species.

Stages	Prey	A	b	T_0	K	R^2
Incubation period	*A. melongena*	-0.48	0.03	14.28	29.94	0.93
	T. urticae	-0.23	0.02	10.36	44.13	0.99
larva	*A. melongena*	-0.42	0.03	12.48	30.05	1.00
	T. urticae	-0.20	0.02	9.00	44.97	0.87
Protonymph	*A. melongena*	-0.27	0.02	11.54	43.12	0.95
	T. urticae	-0.09	0.01	6.02	67.63	0.94
Deutonymph	*A. melongena*	-0.26	0.02	11.12	42.48	0.94
	T. urticae	-0.14	0.02	8.25	60.89	0.95
Immature stages	*A. melongena*	-0.10	0.01	11.72	115.22	0.98
	T. urticae	-0.05	0.01	7.94	171.63	1.00
Life cycle	*A. melongena*	-0.09	0.01	12.41	144.49	0.96
	T. urticae	-0.04	0.00	8.55	215.10	0.99

Table 5. Factorial analysis of obtained biological aspects of *Phytoseius finitimus* female as affected by temperature and prey diet.

				Temperature (°C)			
Parameters	***A. melongena***	***T. urticae***	**LSD**	**22**	**27**	**32**	**LSD**
Egg	2.60 b	2.82 a	0.09	3.61 a	2.72 b	1.84 c	0.11
larval	2.25 b	2.68 a	0.19	3.53 a	2.14 b	1.84 c	0.11
Protonymph	2.98 b	3.34 a	0.08	3.98 a	3.28 b	2.32 c	0.10
Deutonymph	2.85 b	3.40 a	0.18	3.98 a	3.26 b	2.27 c	0.10
Immature stages	8.10 b	9.39 a	0.18	11.49 a	8.60 b	6.43 c	0.21
Life cycle	10.71 b	12.21 a	0.22	15.11 a	11.33 b	8.28 c	0.26
Generation	13.98 b	16.06 a	0.24	19.56 a	15.13 b	10.85 c	0.29
Pre-oviposition	3.27 b	3.85 a	0.10	4.45 a	3.79 b	2.56 c	0.12
Oviposition	25.15 b	27.56 a	0.54	32.02 a	26.24 b	21.37c	0.66
Post-oviposition	3.58 b	4.09 a	0.10	4.44 a	3.89 b	3.30 c	0.12
Longevity	32.01 b	35.50 a	0.57	40.91 a	33.93 b	27.25 c	0.69
Fecundity	34.47 a	26.80 b	0.92	34.86 a	30.02 b	25.24 c	1.13
Daily rate	1.45 a	1.01 b	0.05	1.65 a	1.15 b	0.79 c	0.06
Life span	42.72 b	47.71 a	0.64	56.03 a	45.26 b	35.53 c	0.77

The means are followed by different letters in the same rows are significantly divergent ($P < 0.05$, Duncan)

الملخص

ولاش، ايمان حسني، سماح زكريا الخولي ومسعود رشاد عبد الباقي الاعصر. 2024. تأثير درجة الحرارة ونوع الفريسة على بيولوجيا وجدول حياة المفترس الأكاروسي *Phytoseius finitimus* عند تربيته على حَلَم الباذنجان (*Aceria melongena*) والعنكبوت الأحمر العادي تحت ظروف المختبر. مجلة وقاية النبات العربية، 42(3): 361–367. https://doi.org/10.22268/AJPP-001247

تمت دراسة مدّة التطور والكفاءة التناسلية وجدول حياة المفترس الأكاروسي *Phytoseius finitimus* عند تربيته على الأطوار المتحركة لحَلَم الباذنجان الأريوفيدي والعنكبوت الأحمر العادي تحت ظروف المختبر تحت ثلاثة مستويات من الحرارة (22، 27 و 32°س)، وذلك لمعرفة إمكانية استخدام هذا المفترس في مجال المكافحة الحيوية للحَلَم النباتي على الباذنجان. سجلت أقصر مدّة لتطور الإناث والذكور (5.56 و 5.33 يوماً، على التوالي) لدى الحلم الاريوفيدي عند حرارة 32°س. وكانت أطول مدة لوضع البيض 33.75 يوماً لدى العنكبوت الأحمر عند حرارة 22°س. وكانت أعلى كفاءة تناسلية 40.37 بيضة لكل أنثى، ومعدل وضع البيض اليومي 2.05 بيضة/أنثى/يوم عند حرارة 32°س. عند التغذية على الحَلَم الأريوفيدي، سجل أعلى معدل للزيادة الذاتية 0.230 أنثى/أنثى/يوم عند حرارة 32°س. كان لدرجة الحرارة تأثير كبير على صافي معدل التكاثر (R_0) الذي بلغ 23.45 و 16.16؛ 19.79 و 16.99؛ 16.98 و 12.72 أنثى/أنثى عند حرارة 32، 27 و 32°س للحَلَم الاريوفيدي والعنكبوت الأحمر، على التوالي. زاد معدل الافتراس بزيادة درجة الحرارة. سجلت الكفاءة الافتراسية للإناث والذكور اختلافاً معنوياً بين درجات الحرارة الثلاث ونوع الفرائس. تراوحت درجة صفر النمو بين 8.55 إلى 12.41°س خلال مدّة دورة الحياة. تم حساب عتبة النمو (t_0) والثابت الحراري للأطوار غير الكاملة للمفترس فكانت 11.72 و 115.22°س يومية للحلم الاريوفيدي، 7.94 و 171.63°س للعنكبوت الأحمر، على التوالي. أشارت النتائج المتحصل عليها إلى أن أفضل درجة حرارة لزيادة التعداد كانت بين 23 و 27°س. كما نجح المفترس الأكاروسي في استكمال دورة حياته على نوعي الفرائس، وبذلك فهو مفترس واعد للمكافحة الحيوية على الباذنجان. أظهرت النتائج أنّ درجتي الحرارة 22 و 27°س كانت أكثر ملائمة للتربية الكمية للمفترس الأكاروسي عند التغذية على نوعي الفرائس، وكان الحَلَم الأريوفيدي أكثر تفضيلاً للمفترس من العنكبوت الأحمر.

كلمات مفتاحية: Phytoseiidae، Eriophyidae، العناكب الحمراء، المكافحة الحيوية، الإفتراس.

عنوان الباحثين: ايمان حسني ولاش، سماح زكريا الخولي ومسعود رشاد عبد الباقي الاعصر*، معهد بحوث وقاية النباتات، مركز البحوث الزراعية، الدقي، جيزة، مصر. *البريد الإلكتروني للباحث المراسل: abuelfadelmohamed400@gmail.com

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