

## BIOLOGICAL CHARACTERS OF PREDACEOUS MITE, *Typhlodromus pyri* SCHEUTEN (ACARI:PHYTOSEIIDAE) AT DIFFERENT TEMPERATURES

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(Manuscript received 15 May 2017)

### Abstract

**B**iological characters and life table parameters of *Typhlodromus pyri* was determined at three different temperatures degree. Developmental time of *T. pyri* differed according to temperature degree. Life cycle was 7.31 days at 30°C while, it elongated to 11.36 days at 20°C. Female survival immature% affected with different temperature these values were 79.72, 88.46 and 91.58% at 20, 25 and 30°C, respectively. Our results indicated that the predator consumed significantly more prey at 30°C than other degree of temperature. The highest fecundity (36.82 eggs / ♀) at 30°C while, it decreased to (19.28 eggs / ♀) at 20°C. The effect of temperature on life table parameters was determined. The mean generation time (T) was decreased when the temperature increased, the net reproductive rate ( $R_0$ ) value were 9.48, 14.12 and 24.36 times for 20, 25 and 30°C. The intrinsic rate of increase ( $r_m$ ) was 0.10, 0.17 and 0.21 individual/♀/day for the above same order.

**Keywords:** Biological aspects, *Typhlodromus pyri*, temperatures.

### INTRODUCTION

Predaceous mites play an important role in the biological control of associated pests, such as phytophagous mites, scale insects and whiteflies. The most important natural enemies of tetranychids are phytoseiid mites (McMurtry and Croft 1997, McMurtry *et al.* 2013). Phytoseiid mites are important biological control agents because of their well-known capacity to suppress pest mite populations, mainly tetranychids in diverse cropping system (Easterbrook *et al.* 2001; Colfer *et al.* 2004). Members of the family phytoseiidae proved to be the most important due to their high predaceous efficiency, worldwide distribution and large number of species which exceeds 1700 species (Walter 1992). The predatory mite of genus, *Typhlodromus* attacks mites, including the two-spotted spider mite. *Typhlodromus* is well adapted to hot and dry conditions, and it is resistant to or tolerant of many organophosphate insecticides. Some are important in controlling phytophagous mites. *Typhlodromus pyri* is considered one of the species belonging to family phytoseiidae. Yousef (1981) studied the morphology and the biology of *Typhlodromus africanus*. The aim of the present study was to evaluate the effects of different temperature on some biological aspects and life table parameters of *Typhlodromus pyri*.

## MATERIALS AND METHODS

### **Stock culture of *Tetranychus urticae***

The stock culture started with females collected from eggplant from a farm at Sharkia Governorate. The eggplant leaves (*Solanum melongena*) infested with the two-spotted spider mites, *T. urticae* were collected and placed in paper bags. Samples were transferred immediately to the laboratory. The mass culture was initiated by transferred individuals of females and males using a camel's hair brush placed in petri-dishes about 10 cm diameter, which provided with untreated fresh leaves discs of mulberry (*Morus alba* L.) about 3 cm diameter placed on a pad of cotton wool, fully saturated with water as a source of moisture and to prevent mite escaping. Newly laid eggs were obtained by releasing the adult females on fresh and clean mulberry leaf discs overnight and removing all the adult females at the next day. After eggs hatching, the newly larvae were placed on fresh leaf discs in prepared petri-dishes as mentioned above. The old leaf discs were removed after one day and mites were fed on fresh leaf discs. The colony was kept in an incubator at  $27 \pm 2^\circ\text{C}$  and  $65 \pm 5\%$  R.H

### **Rearing of the predatory mite; *Typhlodromus pyri***

A stock culture of the predatory mite; *T. pyri* was collected from Soybean crops at Sharkia Governorate. Leaf discs 3 cm diameter of mulberry (*Morus alba* L.) were used as a substrate for rearing the predator and putted in Petri-dishes on piece of cotton wool, each disc was lined with a wet cotton barrier. Drops of water were added daily to maintain suitable moisture for the predator. Whenever, leaf substrate began to deteriorate, it was changed by fresh one and sufficient numbers of *T. urticae* at different stages were offered as prey. The experiments were carried out under constant conditions  $27 \pm 2^\circ\text{C}$  and  $65 \pm 5\%$  R.H.

### **Effect of temperature on predaceous mite**

To determine the effect of temperature on survival, development and fecundity of predaceous mite, *Typhlodromus pyri*. The mated females were transferred from the established culture to leaf mulberry discs to lay eggs. The newly deposited eggs were transferred singly to another leaf mulberry disc of one inch in diameter as rearing arenas in Petri-dishes on water saturated cotton and kept on 30, 25 and  $20^\circ\text{C}$  until hatched and incubation period was recorded. Each newly hatched larva (25 replicates) each replicate contain one larva which supplied with sufficient known number of the prey (immature of *T. urticae*). All larvae were reared individually under different temperatures, 30, 25 and  $20^\circ\text{C}$  till reached adulthood, duration of larvae and nymphal stages were calculated. Before the final molt of the female, one adult male was introduced into the replicate for mating. After a day, the male was removed and the female was observed at 6-12h intervals (egg laying periods) to record the first oviposition date to measure longevity and fecundity, three different temperatures (20, 25 and  $30^\circ\text{C}$ ) were examined. The number of eggs laid was

counted daily and consumption rate until female died. Longevity and consumption of adult male was recorded.

### Life table parameters

Life table parameters were collected using a BASIC computer program Abou-Setta *et al.*, (1986) for females reared on various tested temperature degrees. The following population growth parameters were determined: the mean generation time (T), the net reproductive increase ( $R_0$ ), the intrinsic rate of increase ( $r_m$ ) and the expected rate of increase ( $\lambda$ ). During developmental period, eggs of resultant females were collected daily from each female and sex ratio of the progeny was determined.

### Statistical analysis

Data were subjected to statistical analysis using one way analysis of variance, ANOVA Duncan (1955).

## RESULTS AND DISCUSSION

### Effect of temperature on duration of the development

The presented data in table (1) showed the incubation period of *T. pyri* were 2.36, 2.62 and 3.66 days at 30, 25 and 20°C for females, respectively.

The average periods of female total immatures were 4.95, 5.49 and 7.70 days at 30, 25 and 20°C, respectively. The male followed similar trend, but having shorter periods. Rising temperature had an obvious effect on the development of immature stages where increasing temperature significantly shortened the developmental periods. These findings were previously mentioned by Yousef (1981) reported the total period of *Typhlodromus africanus* female immature stages averaged 5.2 days while, the male emerged earlier than the female for a period of 0.6 days. Kasap and Sekeroglu (2004) who reported that total developmental times of *Euseius scutalis* were 6.7, 4.9 and 4.2 days at 20, 25 and 30°C, respectively.

Table 1. Duration in days of developmental stages and survival % of *Typhlodromus pyri* at different temperatures

Temp. (°C)	Sex	Development duration in days (mean ±S.E)					Life cycle	Survival %	Development %
		Egg	Larva	Protonymph	Deutonymph	Total immature			
30	♀	2.36±0.02	0.98±0.01	1.92±0.05	2.05±0.04	4.95±0.03	7.31±0.08	91.58±3.62	79.00±2.78
	♂	2.14±0.01	0.92±0.00	2.00±0.03	1.51±0.02	4.43±0.07	6.57±0.09	78.17±2.41	73.42±1.44
25	♀	2.62±0.03	1.41±0.01	2.36±0.06	1.72±0.09	5.49±0.05	8.11±0.04	88.46±2.12	71.53±1.16
	♂	2.33±0.04	1.11±0.02	2.30±0.04	1.95±0.11	5.36±0.04	7.69±0.03	75.52±1.83	69.60±1.39
20	♀	3.66±0.17	2.20±0.03	2.98±0.09	2.52±0.38	7.70±0.05	11.36±1.69	79.72±1.44	63.48±1.43
	♂	3.09±0.25	1.93±0.05	2.72±0.57	2.37±0.13	7.02±0.13	10.11±1.46	71.48±1.57	66.51±1.72

± Standard Error

**Food consumption of predatory mite, *T. pyri***

The results in table (2) showed that food consumption of *T. pyri* female and male from *T. urticae* affected by temperature degree difference. The total devoured prey individuals were increased as temperature increased from 20 to 30 °C. The total average number of *T. urticae* fed by predator immatures were 27.42, 21.63 and 14.92 prey at 30, 25 and 20°C. During adulthood, female consumed greater number of preys at high degree of temperature 136.23 prey at 30°C and 112.41 prey at 25 °C but the rate of consumption was less at low temperature 85.37 prey at 20 °C. Male followed similar trend as that of female, but in smaller numbers. Also, Dahiah (2015) the mean consumption of female predator, *Typhlodromus athiasae* during oviposition period was significantly higher than in pre- or post-oviposition. Sengonca *et al.*, (2004) determined the effect of feeding predatory mite *Typhlodromus pyri* on phytophagous mite *Panonychus ulmi*. The predators consumed significantly more *P. ulmi* nymphs at 25 °C.

Table 2. Predation rate of *Typhlodromus pyri* fed on *T. urticae* at different temperatures

Temperature (°C)	Sex	Total immatures	Oviposition period	Adult longevity	Life span
30	♀	27.42±1.89	102.35±1.43 <sup>a</sup>	136.23±4.86 <sup>a</sup>	163.65±3.01
	♂	25.16±1.64	-	93.27±3.34	118.43±3.68
25	♀	21.63±1.41	78.95±1.52 <sup>b</sup>	112.41±3.61 <sup>b</sup>	134.04±3.32
	♂	15.51±1.26	-	80.21±2.53	95.72±2.87
20	♀	14.92±1.13	69.74±1.20 <sup>c</sup>	85.37±2.20 <sup>c</sup>	100.29±2.64
	♂	16.27±1.22	-	65.19±2.07	81.46±2.69

Means in columns followed by the same letter are not significantly different at p≤5%

± Standard Error

**Adult stage and life table parameters**

Data in table (3) showed that female of *T. pyri* lived longer than male and significantly affected by different temperatures. Female and male longevity were shorter on low temperature than high temperature 15.44, 19.68 and 26.57 days at 20, 25 and 30°C, respectively. Feeding of female predator on high temperature resulted greater number of eggs (36.82 eggs) at 30°C. Adult male followed similar trend as that of female longevity but having shorter periods. Concerning life table parameters of *T. pyri* indicated that thermal factor has a great influence. Net reproductive rate ( $R_0$ ) differed according to temperature as this values increased with temperature increased. Thus, these values averaged 9.48, 14.12 and 24.63 times for 20, 25 and 30

°C. The intrinsic rate of increase ( $r_m$ ) was 0.10, 0.17 and 0.21 individual/♀/day for the above same order. The mean generation time (T) was decreased when the temperature increased. Similar results were also obtained by Puchalska and Kozak (2016) noticed that *Typhlodromus pyri* when fed on *Tetranychus urticae*, the net reproductive rate ( $R_0$ ) value (11.50). Mean generation time (T) was (22.20). The intrinsic rate of population increase ( $r_m$ ) was (0.11).

Table 3. Effect of different temperatures on the life table parameters of *Typhlodromus pyri*

Temperature (°C)	Sex	Longevity (days)	Fecundity	Sex ratio ♀%	$R_0$	T	$r_m$	$\lambda$
30	♀	26.57±1.84 <sup>a</sup>	36.82±2.41 <sup>a</sup>	64.35±1.87 <sup>a</sup>	24.63	11.73	0.21	1.30
	♂	20.39±1.72	-	-	-	-	-	-
25	♀	19.68±1.19 <sup>b</sup>	29.72±1.84 <sup>b</sup>	62.17±1.43 <sup>a</sup>	14.12	17.83	0.17	1.25
	♂	14.12±1.11	-	-	-	-	-	-
20	♀	15.44±1.08 <sup>c</sup>	19.28±1.45 <sup>c</sup>	61.92±1.15 <sup>a</sup>	9.48	22.09	0.10	1.13
	♂	11.82±1.12	-	-	-	-	-	-

Means in columns followed by the same letter are not significantly different at  $p \leq 5\%$

± Standard Error

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**الصفات البيولوجية للحلم المفترس *Typhlodromus pyri* Scheuten**  
**(Acari:Phytoseiidae) عند درجات حرارة مختلفة**

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تهدف هذه الدراسة لمعرفة تأثير درجات الحرارة المختلفة على الصفات البيولوجية للحلم المفترس. - إختلفت مدة دورة حياة أنثى المفترس *Typhlodromus pyri* تبعاً لإختلاف درجة الحرارة حيث قصرت مدة دورة الحياه عند درجة الحرارة العالية ٣٠ م° مقارنة بدرجات الحرارة الأقل حيث بلغت ٧,٣١ يوم بينما زادت هذه المدة حتى وصلت إلى ١١,٣٦ يوم عند درجة حرارة ٢٠ م° كما تراوح معدل التطور للأنثى ما بين ٦٣,٤٨ - ٧٩ % عند درجات حرارة ما بين ٢٠- ٣٠ م° على التوالي.

- تأثرت نسبة معيشة الأطوار الناقصة للحلم المفترس حيث زادت بإرتفاع درجة الحرارة.  
 - كان متوسط الإستهلاك الكلى للأطوار الناقصة لأنثى المفترس ٢٧,٤٢ ، ٢١,٦٣ و ١٤,٢٩ فريسة (أطوار ناقصة من *T. urticae*) وذلك على درجات حرارة ٣٠، ٢٥، و ٢٠ م° على التوالي. كما أستهلكت الانثى كمية اكبر من الذكر اثناء مدة معيشتها حيث وصلت كمية الاستهلاك الى ١٣٦,٢٣ فريسة عند درجة حرارة ٣٠ م° وكانت ١١٢,٤١ فريسة عند ٢٥ م° ولكن قلت الكمية المستهلكة بإنخفاض درجة الحرارة فكانت ٨٥,٣٧ فريسة عند درجة حرارة ٢٠ م°.  
 - زادت خصوبة الاناث بإرتفاع درجة الحرارة حيث بلغت ٣٦,٨٢ بيضة /الانثى عند درجة حرار ٣٠ م° بينما قلت الى ١٩,٢٨ بيضة / الأنثى عند درجة حرارة ٢٠ م°.