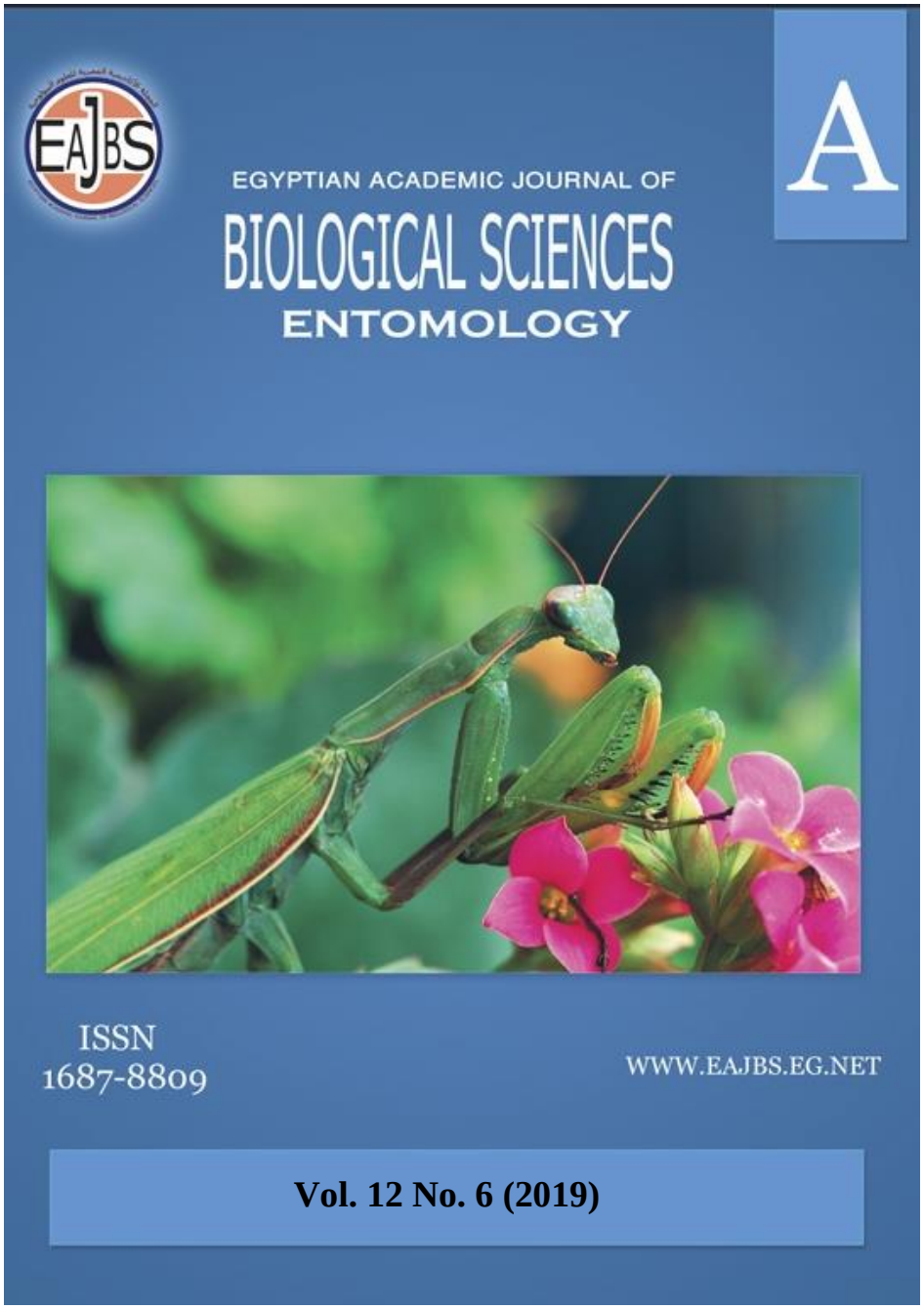

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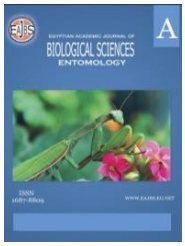

Effect of Host Plant on the Biological Aspects and Life Table Parameters for *Tetranychus urticae* (Acari: Tetranychidae)

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ABSTRACT

The biological aspects and life table parameters of the spider mite, *Tetranychus urticae* Koch were studied under laboratory conditions on two kinds of host plants, tomato leaves and cucumber leaves. The study showed that the incubation period, the total immature stages, life cycle and generation of *T. urticae* on tomato leaves were higher than them on cucumber leaves. The life cycle was 13.58 and 9.52 days on tomato leaves and cucumber leaves, respectively. The generation period was 15.91 and 11.19 days on tomato leaves and cucumber leaves, respectively. On the other hand, longevity and life span of *T. urticae* were higher on cucumber than on tomato. Longevity was 15.33 and 19.97 days on tomato leaves and cucumber leaves, respectively. The life span was 28.91 and 29.49 days on tomato leaves and cucumber leaves, respectively. Also, the daily main number of laid eggs was higher on cucumber, 5.36, than on tomato, 4.71. Also, the results demonstrated that the population of *T. urticae* had the ability to multiply about 1.91 and 2.53 on tomato and cucumber leaves, respectively.

INTRODUCTION

Red spider mites, *Tetranychus* spp. (Acari: Tetranychidae) are associated with more than 120 host plants of economic importance worldwide, including cotton, tomato, eggplant, cucumber and other vegetables (Çakmak and Demiral, 2007). Red spider mites are one of the most important pests of cucumbers and tomato in greenhouse and in open fields especially, under hot and dry conditions.

This species is adapted to various environmental conditions they capable of completing their life cycle from egg to larva, nymph, and adult in one to two weeks under optimal conditions (Biswas *et al*., 2004).

Tomato plants, (*Lycopersicon esculentum* Mill) is grown in protected houses and in open fields for direct consumption and processing. In the world, tomato is cultivated over an area of 3.989 million hectares with a total production of 108.499 million tons and a prodigality of 27202kg/ha. In India, it is cultivated on 0.52 million hectares with production of 7.42 million tons (productivity 14269 kg/ha) (Anonymous, 2004). In Sri Lanka, tomato is grown over an area of 5300 ha with total production of 40400 tons and productivity of 7574 kg/ha (Anonymous, 2003). On protected as well as field grown tomato, one of the predominant pest species is the two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) (Lange and Bronson, 1981).

Cucumber plants, *Cucumis sativus* L. are more susceptible to pest feeding during the vegetative stage (Rural Development Administration (RDA) 2001] and the level of *T. urticae* infestation early in the growing season determines the size of populations that could impact cucumber yield (Park and Lee 2005).

Both crops were affected by many pests that cause extensive yield losses. As *T., urticae* is one of the most important pests of cucumbers and tomatoes.

Manufacturers use chemical pesticides to control it, and this process threatens the health of consumers, particularly because these crops are consumed as raw and fresh.

The present work was aimed to evaluate the biological aspects and life table parameters of *T. urticae* on tomato leaves and cucumber leaves.

MATERIALS AND METHODS

Rearing Mites:

T. urticae were collected from unsprayed tomato and cucumber leaves of unsprayed fields and reared, in the laboratory, at 25± 2° C and 60± 5%RH.

Application Method:

The experiment was conducted as follow:

Leaf discs of tomato and cucumber (4 cm in diameter each) were placed singly with the upper surface down on cotton wool pads saturated with water, in Petri dishes as for the stock cultures. Sexed females from each culture were individually isolated and placed singly on replicated leaves for each host plant. Immediately after the egg deposition, females were transferred to stock culture. Hatched larvae were reared during their life span. Rearing individuals were examined daily and the developmental stages: The durations of egg, larval, protonymphal and deutonymphal stages were calculated, in addition to the time periods of total immatures, life cycle, generation, and life span. Moreover, the preoviposition, oviposition, postoviposition and longevity periods were measured. The number of eggs laid per female was counted. The individuals were transferred to new leaf discs upon the first sign of deterioration.

Results were analyzed by the life table program (Abou- Setta *et al.*, 1986) and L.S.D. values were calculated by costat program (costat software, 1990).

RESULTS AND DISCUSSION

Biological Aspects:

Data in Table (1) showed that the incubation period, total immature stages, and total life cycle of *T. urticae* increased with a tomato host plant than cucumber plant. The incubation period was 4.33 and 3.08 days on tomato and cucumber plants, respectively, but the increase was not significant. The total immature stages on tomato and cucumber plants were 9.25 and 6.44 days, respectively, but this increase was significant with tomato than cucumber plants. Also, the total life cycle of *T. urticae* on tomato host plant was significant than cucumber plant, respectively, the life cycle was 13.58 and 9.52 days for tomato and cucumber, respectively.

Table 1: Effect of different plant hosts on the life cycle of *T. urticae*

Host plant	Incubation period	The average period of different developmental instars (in days)			Total immature stages	Life cycle
		larvae	protonymph	dutonymph		
Tomato	4.33± 0.14 a	2.52± 0.08 a	2.91± 0.06 a	3.82± 0.04 a	9.25± 1.09 a	13.58± 1.5 a
Cucumber	3.08± 0.04 a	2.13± 0.03 a	2.22± 0.04 a	2.09± 0.08 a	6.44± 0.12 b	9.52± 0.05 b
L. S.D at 0.05	0.35	0.33	0.29	0.31	0.78	0.74

Marie *et al.* (2012) proved that *T. urticae* infest cucumber plants heavily and complete the life cycle quickly, so these results were in agreement with the obtained results.

Also, the data in Table (2) demonstrated that female generation and female longevity decreased significantly with tomato than cucumber host plants. The female generation was 15.91 and 11.9 days with tomato and cucumber host plant, respectively, while the female longevity was 15.33 and 19.97 days for tomato and cucumber, respectively.

The life span of *T. urticae* decreased with tomato host plant than cucumber plant but this decrease was not significant which was 28.91 days with tomato and 29.49 days with cucumber host plant. These results agreed with Park and Lee (2007) who demonstrated that *T. urticae* generation took short time on cucumber but longevity and life span took long time on cucumber plants. While Ghais *et al.* (2013**)** proved that *T. urticae* had long time generation on tomato plants but longevity and life span had short time on tomato plants.

The results revealed that cucumber plants were more suitable host than tomato plants.

Table (2): Effect of different host plants on longevity and life span of females of *T. urticae*

Host plant	Duration of different female adult stages (in days)				
	Pre-oviposition	Generation	Post-oviposition	Longevity	Life span
Tomato	2.33 ± 0.55 a	15.91± 0.46 a	2.67± 0.26 a	15.33± 1.22 a	28.91± 1.48 a
Cucumber	1.67 ± 0.24 a	11.19± 1.35 b	5.33± 0.49 b	19.97± 1.31 b	29.49± 1.38 a
L. S.D at 0.05	1.16	0.67	0.41	0.82	2.18

Data in Table (3) showed that the oviposition period decreased significantly with tomato host plant than cucumber plant which was 10 and 13.33 days for tomato and cucumber plants, respectively. The total average of eggs was low with tomato than cucumber host plants, so, the daily mean of deposited eggs was low with tomato than cucumber plants they was, 4.71 eggs on tomato plants and 5.36 eggs on cucumber plants. Although the oviposition period was lower on tomato than on cucumber, the daily mean number of deposited eggs was higher on cucumber than on tomato plants. These results were in agreement with Ghais *et al.* (2013).

Table 3: Effect of different host plants on the oviposition period and fecundity of female of *T. urticae*

Host plant	oviposition period (in days)	Number of deposited eggs	
		Total average	Daily mean
Tomato	10.33± 1.06 a	48.67± 3.78 a	4.71
Cucumber	13± 0.01 b	69.67± 4.83 b	5.36
L. S.D at 0.05	4.24	5.80	- - - - -

Life Table Parameters:

The calculated life table parameters which have been taken into consideration in the present study were generation (T), net reproduction rate (R_o), intrinsic (r_m), finite rate of increase **(ƛ)** and generation doubling time (G.D.T.) all these data present in table 4.

Data in Table (4) show that the net reproduction rate (R_o) was 21.9 and 31.35 days within a single generation on leaves of tomato and cucumber, respectively.The duration of

one generation of *T. urticae* as shown in the same table lasted about 18.99 and 13.66 days on leaves of tomato and cucumber, respectively.

Table 4: Effect of host plant on life table parameters of *T. urticae* on days*:*

Parameters	Hosts	
	Tomato	Cucumber
Net reproduction (R_O)	21.9	31.35
Mean generation time(T)	18.99	13.66
Intrinsic rate of increase(r_m)	0.65	0.93
Finite rate of increase (λ)	1.91	2.53
*Generation doppling time (G.D.T.)	2.18	1.52

***G.D.T. = $\ln_2 / r_m$**

The value of the intrinsic rate of increase (r_m) which expresses the relationship between fecundity, generation time and survival differed from host plant to other.

Cucumber leaves have a maximal value of r_m than tomato leaves. A highest value of (r_m) is attributed to greater rate of fecundity per female (R_o) and shorter generation time ($r_m = \log R_o /T$) at the favorable host than the other. furthermore, when the values of the r_m were converted to the finite rate of increase **(λ)** by the procedure outlined it is clear that the population of *T. urticae* had a capacity to multiply about 1.91 and 2.53 on tomato and cucumber leaves, respectively. The generation doppling time (G.D.T.) have values 2.18 and 1.52 which the tomato leaves have higher result than cucumber leaves. Uddin *et al.* (2015) proved similar results on life table of *T. urticae* on bean varieties.

Tomato is less suitable for the development and reproduction of *T. urticae* compared to cucumber. In future, it is necessary to test host suitability of many cucumber cultivars hoping to find resistant cultivars that can be used in safe way in the integrated pest management against this pest. This study is very important when designing integrated management programs against this pest on the tested crops to choose the most effective host plant in mass production in biological control studies.

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ARABIC SUMMARY

تأثير العائل النباتي على العمليات البيولوجية ومقاييس جداول الحياة على أكاروس العنكبوت الأحمر ذو البقعتين *Tetranychus urticae*

هبه محمد نصر، وفاء محمد جابر، وسام ظريف عزيز، ايمان عوض شحاتة
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تم دراسة كلا من العمليات البيولوجية وجداول الحياة للأكاروس الأحمر ذو البقعتين *Tetranychus urticae* على نوعين من الغذاء وهما أوراق نبات الطماطم وأوراق نبات الخيار. وقد بينت الدراسة أن كلا من فترة حضانة البيض ، المراحل الكلية الغير كاملة ، دورة الحياة وفترة الجيل على أوراق الطماطم أكبر منها على أوراق الخيار. حيث سجلت دورة الحياة 13.58 و 9.52 يوم على أوراق الطماطم وأوراق الخيار على التوالى. بينما سجلت فترة الجيل 15.91 و 11.19 يوم على أوراق الطماطم وأوراق الخيار على التوالى. بينما طول فترة حياة الأنثى البالغة وطول فترة الحياة كاملة كانت أكبر على أوراق الخيار عنها على أوراق الطماطم. حيث سجلت فترة حياة الأنثى البالغة 15.33 و 19.97 يوم على كلا من أوراق الطماطم وأوراق الخيار على التوالى. بينما طول فترة الحياة كاملة كانت 28.91 و 29.49 يوم على كلا من أوراق الطماطم وأوراق الخيار على التوالى. كذلك فان التعداد اليومى للبيض الذى تضعه الأنثى على ورق الخيار، 5.36 أكثر من الذى تضعه على ورق الطماطم ، 4.71. كذلك فقد أوضحت النتائج أن تعداد أنثى الأكاروس له المقدرة على التضاعف حوالى 1.91 ، 2.53 على كلا من أوراق الطماطم وأوراق الخيار على التوالى.