



BIOLOGY OF *Tetranychus urticae* KOCH (ACARI: TETRANYCHIDAE) ON APPLE TREES LEAVES IN NORTH SINAI, EGYPT

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ABSTRACT

The two spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) is an important mite pest, which heavily infests apple leaves trees, *Malus domestica* Borkh in North Sinai, Egypt. Life cycle of spider mite was conducted on the leaves of apple at room temperature ranging from 25-30 °C and 60±10% relative humidity. The present study declared that both sexes of the mite passed through four movable stages (larva, protonymph, deutonymph and adult) beside the egg stage. The adult male seemed smaller than the adult female and characterized by its distinctly pointed abdomen. There was a short resting period known as quiescent stage termed as protochrysalis, deutochrysalis and tritochrysalis, respectively. The female pre-oviposition, oviposition and post-oviposition periods were estimated. All developmental stages were mentioned. Mean duration of total immature lasted (5.87±1.37) and (5.91±1.05) day, life cycle was (7.63±1.72) and (7.57±1.29) day, longevity (7.98±2.69) and (2.52±1.22) day, life span was (15.61±1.64) and (10.09±1.08) day for female and male, respectively. The mean number of eggs/female and mean number of eggs/female/day were recorded.

INTRODUCTION

Apple are one of the most popular fruits in the world. Apple trees is widespread in North Sinai Governorate. The two spotted spider mite (TSM) *Tetranychus urticae* Koch is the most serious pest of apple leaves. The spider mites infests most vegetable crops, preferring cucurbits, Solanaceous vegetable crops *i.e.*, egg plants, tomato and pepper (Awad *et al.*, 2018) okra and ornamental plants, preferring roses, violets, and some field crops such as cotton, beans, alfalfa and fruit trees such as plums, guavas, apricots, apples and herbaceous weed (Mostafa and Ali, 2022). The lower surface of the leaf is preferred next to the middle vein and in the concave places, nourished by sucking the plant sap, causing faint spots in the leaf of the plant.

The object of this study aimed to calculate the developmental stages and fecundity of *T. urticae* reared on apple leaves under room conditions.

MATERIALS AND METHODS

A pure culture of the two spotted spider mite, *T. urticae* was maintained on apple cuttings holding 2-3 juicy leaves each, placed in glass jars containing tap water and artificially infested by both sexes of the mite. The water was changed every 48 hours and the apple cuttings were changed twice a week through the period of the study. The jars were placed in a water pan and protected by a rack covered with muslin. The present study was conducted on apple leaves at room temperature ranging from 25-30 °C and 60±10% R.H.

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Leaf discs (one inch in diameter) were cut out from clean juicy leaves of apple using a cork borer. The leaf discs were placed lower side down on wet cotton pads placed in petri-dishes. The method for rearing *T. urticae* by **Saeidi (2014)**, was followed with some modifications. Leaf discs (one inch in diameter) were prepared from apple leaves, placed on wet cotton in a plastic petri dish and infested with 5 adult female individuals of mites (3-5 day in age) as a culture. One newly laid egg was put gently by a camel hair brush (No. zero) on each disc and repeated 50 times on the leaf discs. The edges of the leaf discs were smeared by tangle foot composed of Canada balsam, castor and citronella oils as barrier, that adequately prevent mites from escaping. The newly emerged mites were observed twice daily.

RESULTS AND DISCUSSION

The two spotted spider mite, *T. urticae* passed through a larval and two nymphal stages *viz.*, protonymph and deutonymph. Each of these feeding stages was followed by a short period of quiescent stage termed as protochrysalis, deutochrysalis and tritochrysalis at 25-30 °C and 60±10% R.H.

Developmental Stages of *T. urticae*

Egg stage

The adult female of the spider mites chooses the concave areas of the leaf to lay the egg. The egg is spherical in shape and transparent, the color darkens with maturity, then turns pale yellow and red eye spots appear for the fetus immediately before hatching. The egg hatched after an average of (1.76±0.35) day for female and (1.66±0.24) day for male (Table 1). The present findings are similar to the findings of **Sandeepa *et al.* (2019)** who reported that the incubation period for *T. urticae* at room temperature (27.79 ± 4.4°C) and (79.84 ± 5.75% R.H.) ranged an average of (3.36 ±

0.56) day and (3.21 ± 0.43) day for female and male, respectively.

Immature stages

The immature stages required an average period of 5.87 and 5.91 day for female and male to reach adulthood, respectively (Table 1). Each immature stage passed through (feeding, quiescent and molting) stage. The immature stages include the following stages:

Larval Stage

When the larva emerges from the egg, it is round in shape, the same size as the egg, has three pairs of legs, and was transparent except for the eye spots. With feeding, it turned pale green and distinctive black spots began to form on the back and remained active for a short period of 1.61±0.21 day and 1.58±0.19 day for female and male, respectively. After which it went through the first quiescent period (Table 1). The protochrysalis period lasted for 0.82±0.24 day for female and 0.92±0.19 day for male (Table 1). This report is harmony with **Sandeepa *et al.* (2019)** whom reported the quiescent stage for *T. urticae* lasted 0.59 ± 0.35 day for male and 0.64 ± 0.32 day for female. Thus, the duration of the larval stage was 2.43±0.45 day for female and 2.50±0.38 day for male (Table 1), after which molted to give the protonymph. The present results were similar to those of **Singh and Singh (1993)** who reported that the larval period for *T. cinnabarinus* on lady's finger 2.70 ± 0.83 day at 30 °C, 35 °C and R.H. (75, 55%). Also, **Kasap (2004)** counted the larval period of *T. urticae* which recorded 1.9 ± 0.10 day for male and (2.1 ± 0.09) day for female on apple leaves at 25 °C. **Sandeepa *et al.* (2019)** recorded the larval period for *T. urticae* under room conditions at (27.79 ± 4.4 °C) and (79.84 ± 5.75% R.H.) as (2.79 ± 0.57) day for female and (1.79 ± 0.64) day for male.

Table 1. Duration of developmental stages of *Tetranychus urticae* Koch, reared on leaves of apple at room temperature ranging from 25-30 °C and 60±10%R.H.

Mite stages	Mean ± S.D. day	
	Female	Male
Incubation period	1.76±0.35	1.66±0.24
Active larva	1.61±0.21	1.58±0.19
Protochrysalis	0.82±0.24	0.92±0.19
Larval stage	2.43±0.45	2.50±0.38
Active protonymph	0.82±0.34	1.08±0.19
Deutochrysalis	0.65±0.23	0.66±0.24
Protonymphal stage	1.47±0.57	1.74±0.43
Active deutonymph	1.06±0.16	1.17±0.24
Tritochrysalis	0.91±0.19	0.50±0.00
Deutonymphal stage	1.97±0.35	1.67±0.24
Total immature	5.87±1.37	5.91±1.05
Life cycle	7.63±1.72	7.57±1.29

Protonymphal Stage

The protonymph is larger than the larva, more oval, and had four pairs of legs. The two dorsal spots are more prominent and the color is slightly darker green. It fed for 0.82±0.34 day for female and 1.08±0.19 day for male (Table 1). The current study was somewhat similar to the study of **Kasap (2004)** who found this period of *T. urticae* on apple 2.5 ± 0.11 day for male and 2.7 ± 0.07 day for female at 20°. While **Rajkumar et al. (2005)** found this period for *T. urticae* on jasmine recorded 1.66 ± 0.37 and 2.33 ± 0.24 day for male and female, respectively. The deuto-chrysalis period lasted for 0.65±0.23 day and 0.66±0.24 day for female and male, respectively (Table 1). Thus, the duration period of the female and male protonymph lasted 1.47 and 1.74 day, respectively, after which it molted to give the deutonymph (Table 1).

Deutonymphal Stage

The deutonymph is slightly larger than protonymph, and males can be distinguished from females at this stage by the smaller size and more pointed abdomen. The duration of the active deutonymph lasted 1.06±0.16 day for female and 1.17±0.24 day for male deutonymph (Table 1). It lasted 0.91±0.19 and 0.50±0.00 day for tritochrysalis period for female and male, respectively. Thus, the duration of the deutonymphal stage lasted 1.97±0.35 day for female and 1.67±0.24 day for male (Table 1). **Kasap (2004)** reported that the deutonymphal period of *T. urticae* lasted 2.8 ± 0.10 day for female and 2.5 ± 0.11 day for male on apple leaves.

Life cycle

The total developmental period recorded was 7.63±1.72 day for female and 7.57 ± 1.29 day for male, (Table 1). **Kasap (2004)**

reported that the life cycle of *T. urticae* reared on apple leaves lasted 10.00 ± 0.11 and 8.3 ± 0.18 day for female and 9.3 ± 0.15 and 8.1 ± 0.22 day for male at 25 and 30 °C respectively.

Adult stage

The adult female is oval in shape and red in color. The male is triangular in shape, smaller than the female and more active.

Pre-oviposition period

The adult female started to oviposit eggs after an average of 1.48 ± 0.52 day (Table 2). It was more or less similar to the obtained data by Sandeepa *et al.* (2019) who reported that the pre-oviposition period lasted 2.69 ± 0.68 day.

Oviposition period

The adult female continued to deposit eggs for an average of 5.32 ± 0.96 day (Table 2). It was more or less similar with the obtained data by Sandeepa *et al.* (2019) who reported that the oviposition period lasted 7.79 ± 1.68 day.

Post-oviposition period

The adult female stopped laying eggs for an average of 1.18 ± 0.48 day before death (Table 2). This study was more or less similar with results of Sejalina *et al.* (1993) who reported that 2.73 ± 1.19 day and 2.33 ± 0.68 day for unmated and mated female of *T. macfarlanei* in July- August which was less in accordance with the current results.

Fecundity

The present study indicated that the female laid eggs per day with an average of 2.85 ± 0.93 eggs (Table 2). Which is more or less similar with the findings of Sandeepa *et al.* (2019) who reported that the female laid eggs per day with an average of 5.62 ± 1.36 eggs/day. Also, Rai *et al.* (1989) reported that the rate of egg laying by the mated female was an average of 4.06 ± 2.57 eggs for *Oligonychus indicus*.

The fecundity per female varied with an average of 13.26 ± 8.15 egg (Table 2).

The average longevity was 7.98 ± 2.69 day for female and 2.52 ± 1.22 day for male (Table 2).

The life span duration lasted 15.61 ± 1.64 day for female and 10.09 ± 1.08 for male (Table 2).

Shih *et al.* (1976) mentioned that the life cycle of *T. urticae* in the laboratory lasted 7.5 day at 27 ± 1 °C and $95 \pm 5\%$ R.H. Mean generation time was 16.0 day and the tritochrysalis for females lasted 2.4 day. The oviposition rate was 7.97 egg/ female / day.

Chandra *et al.* (2008) indicated that the developmental stages of *T. urticae* on Thompson Seedless grapevine lasted (3.68, 2.06, 0.74, 1.89, 0.79, 2.02 and 0.84) day for (egg, larvae, protochrysalis, protonymph, deutochrysalis, deutonymph and tritochrysalis) stages, respectively. The fecundity was 73.20 egg/female, while pre-oviposition, oviposition and post-oviposition periods lasted for 1.96, 10.53 and 2.48 day, respectively. The total developmental period from egg to adult (life cycle) lasted 12.03 day and adult longevity lasted 8.60 and 14.60 days for male and female, respectively.

Mondal and Ara (2006) reported the duration of developmental stages of *T. urticae* on excised leaf disc of fresh bean in the laboratory for 5 generations. The egg to larva took 4.66 ± 0.19 day, larva to protonymph took 1.75 ± 0.14 day, protonymph to deutonymph took 1.92 ± 0.12 day and deutonymph to adult stages took 1.72 ± 0.08 day. The total duration from egg to adult stage was 10.15 ± 0.16 day. The total number of eggs laid per female in her lifetime averaged 108.3 ± 3.23 up to 16 days.

Table 2. Longevity, life span and fecundity of *Tetranychus urticae* Koch, reared on leaves of apple at room temperature ranging from 25-30 °C and 60 ± 10% R.H.

Mite stages and fecundity	Mean ± S.D. day	
	Female	Male
Pre-oviposition	1.48±0.52	-
Oviposition	5.32±0.96	-
Post- oviposition	1.18±0.48	-
Longevity	7.98±2.69	2.52±1.22
Life span	15.61±1.64	10.09±1.08
No. of eggs/female	13.26±8.15	-
No. of eggs/female/day	2.85±0.93	-

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المخلص العربي

Tetranychus urticae Koch. بيولوجيا حلم
(Acari: Tetranychidae) على أوراق أشجار التفاح في شمال سيناء، مصرإيمان عبد الله إبراهيم علي¹، محمد محمد حسن قنديل²، صلاح محمد عبدالكريم¹، محمد نجيب البسيوني³

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يعتبر الحلم العنكبوتي ذو البقعتين، (*Tetranychus urticae* Koch. (Acari: Tetranychidae) آفة مهمة، وقد لوحظ أنه يصيب أوراق أشجار التفاح بشده *Malus domestica* Borkh في شمال سيناء، مصر. ولذلك تم دراسة دورة حياة ذلك الحلم على أوراق التفاح على درجة حرارة الغرفة التي تتراوح ما بين (25-30) درجة مئوية ورطوبة نسبية $60 \pm 10\%$. وأوضحت النتائج أن كلا الجنسين للحلم يمر بأربع مراحل متحركة هي (اليرقة، الحورية الأولى، الحورية الثانية ثم الحيوان الكامل) بجانب طور البيضة. ولقد بدأ الذكر البالغ أصغر من الأنثى البالغة وكان يتميز ببطنه المدببة بوضوح. توجد فترات سكون بين كل مرحلة وأخرى (سكون أولي، سكون ثاني وسكون ثالثي) على التوالي. وتم حساب فترة حضانة البيض و فترة ما بعد وضع البيضة. كما تم وصف جميع مراحل النمو للحلم. وكان متوسط فترات الأطوار غير الناضجة (5.87±1.37) و(5.91±1.05) يوم، وكانت دورة الحياة (7.63±1.72) و(7.63±1.72) يوم، طول العمر (7.98±2.69) و(2.52±1.22) يوم، مدة البقاء (15.61±1.64) و(10.09±1.08) يوم للإناث والذكور على التوالي، تم تسجيل عدد البيض/أنثى وعدد البيض/أنثى/اليوم.

الكلمات الاسترشادية: *Tetranychus urticae*، أوراق التفاح، بيولوجيا.

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