

Life-History Parameters of *Eotetranychus uncatus* Garman (Acari: Tetranychidae) on Red Delicious Apple

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Abstract.- *Eotetranychus uncatus* Garman (Acari: Tetranychidae) was found in unsprayed and abandoned orchards in Turkey. It has the capability to become an important pest of deciduous fruit trees. In this study life-history parameters of *E. uncatus* Garman was studied at 25±1°C and 16:8 L:D photoperiod and 65±5% relative humidity on the apple leaf discs under controlled conditions. While the mean generation time of female (from egg to adult stage) was 13.65 days, it was 11.82 days for male. Pre-oviposition period of female was 2.95 days and total number of eggs laid per female was 26.30.

Key words: *Eotetranychus uncatus*, apple, generation time, pre-oviposition

INTRODUCTION

The apple (*Malus communis* L.) is one of the most important fruit crops grown in Turkey. There are several economically important diseases and pests which reduce apple production. One of these pests reducing the apple production is *Eotetranychus uncatus* Garman (Acari: Tetranychidae). *E. uncatus* has been known from the United States, the Netherlands, Northern Kazakhstan, Japan and Poland (Pritchard and Baker, 1955; Jeppson *et al.*, 1975; Gutierrez and Helle, 1981; Gotoh, 1987b). This mite causes damage to apple, pear and plum as well as several other plant species such as *Alnus*, *Betula*, *Juglans*. Damaged apple leaves show light stippled patches and the foliage may have a dusty or lead-coloured appearance. Injuries, early in the growing season, sometimes cause the leaves “to ” cup” ” or to “crinkle” (Pritchard and Baker, 1955; Jeppson *et al.*, 1975; Gotoh, 1987b).

In Turkey, *E. uncatus* was first recorded on apple in Tokat Province, Turkey (Yanar and Ecevit, 2005) and later reported on apple in Bitlis Province (Kasap and Çobanoğlu, 2007). This species is commonly found in unsprayed apple orchards in Tokat (Yanar and Ecevit, 2008). This species might be susceptible to insecticides used in apple orchards

in Turkey therefore it can not develop any population in commercial apple orchards, but may become resistant to these insecticides in the future and cause serious damage in apple orchards.

The present study was conducted to provide data on life-history parameters of *E. uncatus* on red delicious apple leaves under the laboratory conditions.

MATERIALS AND METHODS

Mite samples were collected from unsprayed apple trees (*Malus communis* L.) in Tokat, Turkey. The mites were reared on Red Delicious apple leaf discs (25 mm diam.) in petri dishes (9 cm in diam.) at 25±1°C and 16:8 L:D photoperiod and 65±5 % relative humidity. Leaf discs were placed on double layers of filter paper which saturated with distilled water to keep the filter paper moist. The experiments were carried out by using 40 adult females and 28 adult male. Data on developmental time, longevity and fecundity were analysed using analysis of variance (ANOVA). SPSS 10.00 program was used for analysis (SPSS, 2000). Age-specific survival rates (l_x) and number of female offspring (m_x) for each age interval (x) day were calculated using the formula given by Birch (1948)

$$l = \sum e^{-r^*x} l_x * m_x$$

Net reproductive rate (R_0 , females/females/generation), the intrinsic rate of natural increase (r_m , females/female/day) and the mean generation time [$T_0 = \ln(R_0/r)$, in days], were estimated (Laing, 1968).

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To study the life table of *E. uncatatus* a pair of adult female and male mite from stock culture were introduced onto each leaf disc and allowed to lay eggs for 24 h period. The female and male mites were removed from leaf disc and the eggs laid on the leaf disc were incubated for hatching. Larvae were transferred individually onto leaf disc and observed at 24 h intervals until they grew up to adulthood. The new generation females were transferred onto leaf disc (one female per leaf disc) and one adult male was introduced onto each leaf disc for 24 h period. At the end of 24 h the male mites were removed from each leaf disc and pre-oviposition, oviposition periods of female were recorded daily. Number of eggs laid per day, total number of eggs laid by one female and longevity of the female were also recorded. To determine the sex ratio, the females were placed on leaf discs. Discs with same age eggs were maintained in the same experimental conditions. The sex ratio was determined from the adults which had been developed from the same age eggs. Damaged leaf discs were regularly replaced with freshly cut leaf discs.

RESULTS

The mean hatchling times of the eggs for female and male were 5.33 ± 0.15 and 4.89 ± 0.13 days respectively. The mean durations of larval, protonymph, deutonymph of female and male stages were ♀ 1.10 ± 0.07 , ♂ 1.02 ± 0.09 days; ♀ 1.10 ± 0.05 , ♂ 1.07 ± 0.05 days; ♀ 1.03 ± 0.03 , ♂ 0.96 ± 0.03 days respectively. Mean egg hatchling time and duration of larvae, protonymphs and deutonymphs, didn't differ between female and male mites statistically. But protochrysalis, deutochrysalis and teliochrysalis periods are longer for females than males (protochrysalis ♀ 1.65 ± 0.10 , ♂ 1.27 ± 0.08 days; deutochrysalis ♀ 1.65 ± 0.08 , ♂ 1.25 ± 0.08 days; teliochrysalis ♀ 1.80 ± 0.06 , ♂ 1.36 ± 0.12 days) and the difference is significant. The mean time required to develop from egg to adult was 13.65 ± 0.30 days for females and 11.82 ± 0.30 days for males (Table I). The difference between mean total development time is significant at 0.05 level. The average durations of pre-oviposition, oviposition and postoviposition periods were 2.95 ± 0.13 , 9.60 ± 0.09 ,

and 1.78 ± 0.14 days for female respectively. The average female longevity was 14.33 ± 0.19 days (Table II). The daily mean average egg production per female was 2.75 ± 0.08 eggs per day. The total mean number of eggs laid by one female was 26.30 ± 0.69 (Table III). Sex ratio was estimated by using 100 female and male offspring. Sex ratio was 0.67. Net reproductive rate R_0 was 17.81, r_m in day^{-1} was 0.335, mean generation time, T in days (T_0) was 8.58 (Table IV). The age-specific survival rates (l_x) and age-specific oviposition rates (m_x) in *E. uncatatus* are given in Figure 1.

Table I.- The developmental period (days) of immature stages of *Eotetranychus uncatatus*.

Stages	n	Mean±S.E.
Egg	♀	5.33 ± 0.15 a*
	♂	4.89 ± 0.13 a
Larva	♀	1.10 ± 0.07 a
	♂	1.02 ± 0.09 a
Protochrysalis	♀	1.65 ± 0.10 a
	♂	1.27 ± 0.08 b
Protonymph	♀	1.10 ± 0.05 a
	♂	1.07 ± 0.05 a
Deutochrysalis	♀	1.65 ± 0.08 a
	♂	1.25 ± 0.08 b
Deutonymph	♀	1.03 ± 0.03 a
	♂	0.96 ± 0.03 a
Teliochrysalis	♀	1.80 ± 0.06 a
	♂	1.36 ± 0.12 b
Total developmental time (from egg to adult)	♀	13.65 ± 0.30 a
	♂	11.82 ± 0.30 b

*The mean difference is significant at the 0.05 level (Duncan test)

DISCUSSION

In our study, the time required to develop from egg to adult was 13.65 ± 0.30 days for female and 11.82 ± 0.30 days for male at $25 \pm 1^\circ\text{C}$ and 16:8 L:D photoperiod and $65 \pm 5\%$ relative humidity (Table I). The daily mean average egg production per female was 2.75 ± 0.08 eggs. The total mean number of eggs laid by one female was 26.30 ± 0.69 (Table II). Gotoh (1987a) studied the life parameters of *E. uncatatus* on *Betula platyphylla* Sukat.var. *japonica* (Miq.) Hara (Asian White Birch) at $25 \pm 1^\circ\text{C}$ and 15:9 L:D photoperiod. He reported that the time required to develop from egg to adult was

Table II.- Duration of various periods of adult female of *Eotetranychus uncatatus*.

	n	Mean±S.E.
Preoviposition period	40	2.95±0.13
Oviposition period	40	9.60±0.09
Postoviposition period	40	1.78±0.14
Total adult longevity	40	14.33±0.19

Table III.- Ovipositional rate of adult females of *Eotetranychus uncatatus*.

	n	Mean±S.E.
Mean number of eggs laid per day per female	40	2.75±0.08
Mean total number of eggs per female	40	26.30±0.69

Table IV.- Parameters of population increase of *Eotetranychus uncatatus*.

Parameters	
Net reproductive rate R_0	17.81
r_m in day^{-1}	0.335
Mean generation time, T in days (T_0)	8.58

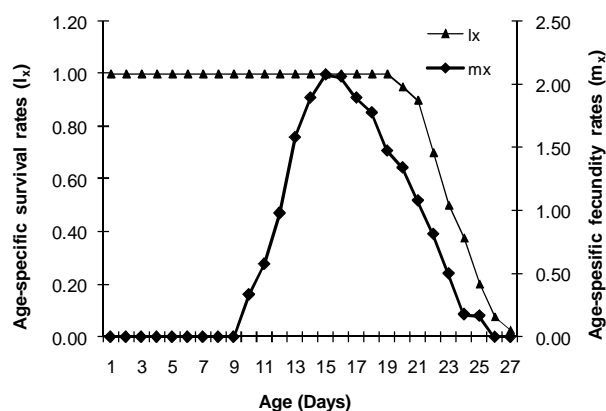


Fig. 1. The age-specific survival rates (l_x) and age-specific fecundity rates (m_x) of *Eotetranychus uncatatus*

11.38±0.13 days for female and 10.30±0.25 days for male. The number of eggs laid by female was 39.53±2.29 and daily eggs production per female was 3.39±0.15. Lal and Mukharji (1978) had studied the life parameters of *E. uncatatus* on *Bauhinia variegata* L. (Orchid tree, Mountain ebony). They

reported the duration of the developmental stages (in days) as follows: egg, 2.7; larva, 2.30; protonymph, 1.68; deutonymph, 1.49; egg to adult, 8.01 at 26.60°C. Fertilized females laid 21.20 eggs at 30.60°C and 12.20 eggs at 22.47°C. Life span of adult female was 9.10 days. There are some differences between results of present study and that of previous studies. The differences in results may be attributed to differences in host plants, temperatures and populations of *E. uncatatus*.

This species is generally found in neglected and unsprayed orchards in Turkey. *E. uncatatus*' net reproductive rate R_0 was 17.81, r_m in day^{-1} was 0.335, mean generation time, T in days (T_0) was 8.58 in this study (Table IV). The results of this study showed that this species needs a short period of time to complete its life cycle and has a high reproductive rate. Therefore, this harmful species has the potential to become an important pest in commercial fruit orchards in future. As this study was conducted under laboratory conditions. The further studies under natural conditions is necessary.

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