

Effect of temperature on the stationary life stages of the eastern citrus moth *Eutetranychus orientalis* (Klein) (Acari: Tetranychida) when fed on leaves of *Albizia lebbek* L.

Murtadha. AD.LRaazzaq¹, Taha M.M Al-Sweedi²

^{1,2} Department of Plant Protection, College of Agriculture, Kerbala University - Kerbala – Iraq.

DOI: 10.47750/pnr.2022.13.S01.118

Abstract

A field trial was conducted in one of the fields of Ibn Al-Bitar Preparatory Vocational- Holy Kerbala Governorate, during spring season at 2021, to know the effect of organic fertilizers (0, 2000 Kg ha⁻¹ Cow, 2000 Kg ha⁻¹ Poultry, 1500 Kg ha⁻¹ cow+ 500 Kg ha⁻¹ Poultry, 1000 Kg ha⁻¹ Poultry). The eastern citrus moth, *Eutetranychus orientalis*, is one of the most important plant pests that affect agricultural crops around the world. This study aims to determine the effect of different temperatures on the growth stages of the eastern citrus moth *E.orientalis* (Klein) on some vegetable crops and to predict the population according to the prevailing temperature. The development times of *E. orientalis* (Klein) were evaluated in vitro on a leaf disc excised from *Albizia* at various temperatures of 20, 25 and 30 ± 2 C° with 60 ± 5% relative humidity (R.H) under laboratory conditions. The total incubation period of eggs at temperatures of 20C°, 25C°, 30C° was (7.9±0.91 5.65±0.82 3.2±0.55) days, respectively, while the number of eggs per female was at the same temperatures. They were (4.16±1.06, 8.33±0.94, 7.16±1.34 eggs/female). It was found that the male hatches before the female. Also, females live longer than males. The results showed that the life cycle of *E.orientalis* was (20.45±1.5 14.7±1.47 9.76±0.93) per day at 20 °, 25 C°, 30C°. The sex ratio and duration of the immature stages of active and dormant *E. exogenous* were studied. The growth time of females and males, the period before laying eggs, is observed.

Keywords: *Albizia lebbek* L; tetranychidae, *Eutetranychus orientalis*;

INTRODUCTION

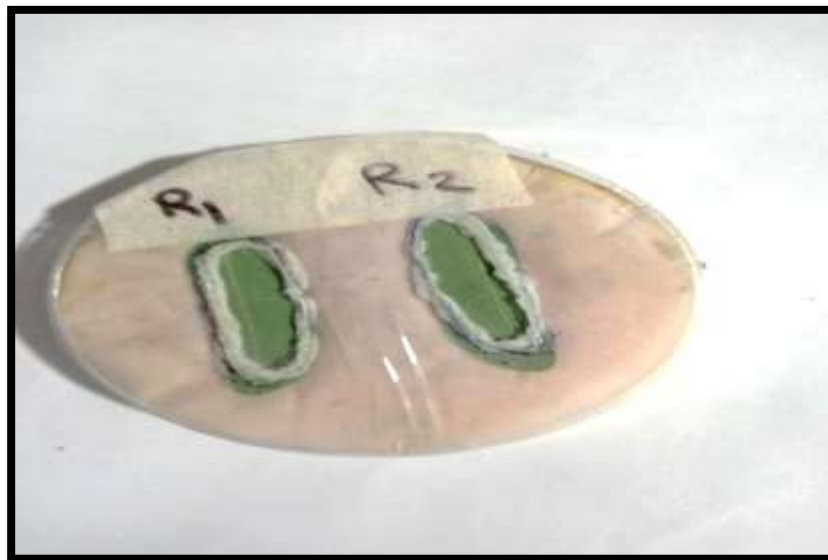
The genus *Eutetranychus* in the Tetranychidae family contains 33 species, about half of which have been reported from just one species of plants (Migeon and Dorkeld, 2012). Most of the species have been reported on plants in the families Fabaceae, Malvaceae, Rutaceae and Moraceae. *E. orientalis* is the most polyphagous species of the genus, as it has been reported from 213 plant species in 60 different families. *E. orientalis* is considered a pest of citrus sp. It is also found on other crops including almonds (*Prunus amygdalus*), avocados (*Persea americana*), bananas (*Musa paradisiaca*), cassava (*Manihot esculenta*), castor oil plant (*Ricinus communis*), cotton (*Gossypium* spp.) Palm (*Phoenix dactylifera*), Fig (*Ficus carica*), Vine (*Vitis vinifera*), Guava (*Psidium guajava*), Corn (*Zea mays*), Mulberry (*Morus* spp.), Olive (*Olea europaea*), Papaya (*Carica papaya*), Peaches (*Prunus persica*), pears (*Pyrus communis*), peaches (*Prunus domestica*), quince (*Cydonia oblonga*), sunflower (*Helianthus annuus*), squash (*Curcubita moshata*), sweet potatoes (*Ipomoea batatas*) and watermelon (*Citrullus PO lanatus*) (Dhooria, 2003; Al-Atawi, 2011; Migeon and Dorkeld, 2012). Ornamental species, such as *Cercis siliquastrum*, *Euonymus japonicus*, *Ficus macrophylla*, *Melia azedarach*, *Plumeria alba*, *Salix* sp., have also been reported. (Zhou et al., 2006; Ben-David, 2008; Migeon and Dorkeld, 2012). *E. orientalis*, is not only a major pest of citrus, but also has been reported to attack a wide variety of other plants including *Albizia* spp. (Walter et al., 1995). The infested leaves turn yellowish-brown, dry up and ultimately fall off. Mite infestation is usually seen on the upper surface of leaves, under heavy webs to which dust particles adhere. The infested leaves also get crumpled. Web formation, adhered dust particles and continuous cell sap sucking badly affect the photosynthesis process, leading to retarded growth and reduced vigour of the host plants (Yousef et al., 2006).

This study aims to evaluate the effect of constant temperatures on the development stages of the compound *Eutetranychus orientalis* (Klein) on *Albizia Albizia lebbbeck L.* leaves in order to predict the population according to the prevailing temperature. Know the different stages of *E. orientalis*. The optimum temperature for development.

MATERIALS AND METHODS

Samples were taken from infected leaves of the eastern Albizia plant from one of the orchards in Karbala governorate, Al-Hussainiya area. With the aim of studying the life cycle of *Eutetranychus orientalis* on Albizia leaves, it was examined under a dissecting microscope and was defined by Assistant Professor Taha Al-Suwaidi in the laboratory at the Plant Protection Department - College of Agriculture - University of Karbala. A plastic Petri dish (1.5 cm x 9 cm) was taken, and two circular holes were made in the cover of the dish cover with a diameter of 2 cm using a cork drill as shown in the photo; Very small holes were made adjacent to the holes using a 5 ml medical syringe, then a 2 cm thick sponge was placed at the base of the plastic Petri dish and filter paper was placed on it. Then the Albizia leaf was taken and made sure that it was not infected by examining the paper with a dissecting microscope, then the paper was placed on the filter paper and the cover of the Petri dish. It is closed with duct tape. The sheets were changed from time to time. Cotton was placed on the edges of the circular opening in petri dish lids to prevent mite instars from escaping. The male and female were then transferred to a petri dish for breeding using a 1 ml insulin syringe needle, and the petri dish was placed in the incubator at three different temperatures (20 C°, 25 C°, 30 C°). ± 2) with a ratio of 65 ± 5% (RH), and the period of light to dark (8:16) (Al Suwaidi, 2003). This laboratory experiment included studying the life cycle of *Eutetranychus orientalis*, female egg productivity, egg laying duration, pre and post egg laying period, and longevity in adults (males and females). As well as determining the sex ratio of *Eutetranychus orientalis* by observing the development of egg laying for each female and at each temperature. sex ratio was estimated as in the method (Shih and Pai, 1995).

$$\text{Percentage\%} = \frac{\text{number of males or females}}{\text{number of (males + females)}} \times 100\%.$$



Method of breeding *E. orientalis* on Albizia leaves

STATISTICAL ANALYSIS

The study data were statistically analyzed using Completely Randomized Design. Significance was tested by using the least significant difference L.S.D (Least Significant Difference) at the level of probability (0.05 ≥ P) to show the significance of the

results (Al-Rawi and Khalaf Allah, 2000).

RESULTS

The life cycle of *E. orientalis* was studied in vitro on Albizia leaves at temperatures (20C°, 25C°, 30C° ± 2), with a relative humidity of 60 ± 5% (R.H). The life of *E. orientalis* was observed on the Albizia leaf in the laboratory. The results showed that the incubation period of eggs (Table 1) The results showed that the incubation period for eggs (Table 1) found statistically significant differences between the temperatures for the incubation period of eggs at temperatures(20C°,25C°and30C°),

Which amounted to(7.9±0.91•5.65±0.82 and 3.2±0.55) days, respectively. The results showed that there was a significant difference between the temperatures on the larva stage (active + quiescent), which reached a temperature of 20C° (4.6 ± 0.78) days, and it reached a temperature of 25C° (3.59 ± 0.85) days, and reached (2.6 ± 0.65) days at a temperature of 30C°,As for the first stage of the nymph (active + quiescent), there was a significant difference between the temperatures (20C°), which averaged (3.59 ± 0.66) days, and there was no significant difference between the temperatures (25C° and 30C°), which amounted to (2.26). ± 0.61 and 1. 71 ± 0.7) days respectively, As for the second nymph (active + quiet) between the statistical analysis, there is a significant difference between the temperatures (20C°, 25C°and 30C°) which amounted to (4.4 ± 1.04, 3.35 ± 0.75and 2.45 ± 0.41)days, respectively. *E. orientalis* was aged at the three temperatures (20.45±1.5, 14.7±1.47 and 9.76±0.93) day, and there was a significant difference between them.

Table (2) showed that the survival of both males and females at different temperatures. Whereas, the highest survival time for *E. orientalis* males was at 20C° (11.38±2.49) days, and the shortest survival time for males at 30C°. . As for the female, the longest period of residence was at a temperature of 20 degrees Celsius and the shortest period at a temperature of 30 degrees Celsius. The results showed that the survival time of females was longer than that of males at all temperatures, while the survival time of females and males was higher at 20 C° and the lowest duration of males and females. at 30C°, Developmental times between the both sexes (females and males) at temperatures (20 C°, 25 C°, 30 C°) was studied The results showed that the development period of females is longer than that of males, with the development period of females being (22.75 ± 2.11) days, at temperature (20) and the lowest development period at temperature (22.75 ± 2.11) days. . (30) where it reached (11.43 ± 1.35) days, which is the lowest development period for males, and the temperature reached (20) (17.07 ± 0.83) days, and the lowest development period at temperature (30) was (8.12). . . ± 0.85) day. The sex ratio was studied in the laboratory. Table (4) showed that the number of males at 25C° was the most abundant with an average of (1.9±0.62). The lowest number of males was at 20C°, and the average presence of males was (0.80±0.41). For females, the number of females present at the temperature of 25 C° was more than the other temperatures, and the average presence of females at the temperature of 25 C° was (3.20±1.23). The lowest number of females was at 30C° (1.70±0.78). For the proportion of the females to males presence at a temperature of 20 C° was (1:2.12). The percentage at a temperature of 25 C° it was (1:1.68). For a temperature of 30 C° was (1:1.67). Table (5). Where the period before laying eggs was higher at a temperature of 20C° (2.31±0.37) day, and there was a significant difference from other temperatures. While the shortest period of lying eggs was (0.85±0.31) days at a temperature of 30C°, which did not differ significantly of a temperature of 25C° (1.42±0.44). The highest rate of the eggs number was at a temperature of 25 C° as the female gave the number of eggs (8.33±0.94eggs/mite). The lowest number of eggs laid by the female was at a temperature of 20 C° (4.16±1.06eggs/mite),

DISCUSSION

The results obtained when studying the life of the Oriental red mite *E. orientalis* on castor leaves in Table (1), where the incubation period of the eggs was consistent with Enas Hamed Al-Ani (2004), When studying the Oriental red mite *E. orientalis* on Citrus aurantium leaves, the incubation period for eggs was (7.41±0.67, 4.46±0.71, 3.22±0.60) days at temperatures of (20C°, 25C°, 30C°), respectively. The results of the active and quiescent larvae, the larvae (active + quiescent) experiments, and the first and second nymph with their active and quiescent stages agree with what was reached by researchers (Angsumarn-Kosol-Charemsom Chandrapatya.1988) when studying the life of the oriental citrus nipple *E. Orientalis* (Angsumarn-Kosol-Charemsom Chandrapatya.1988) when studying the life of the oriental citrus nipple *E. Orientalis* (Imani & Shishehbor, 2009). The results obtained when studying the life cycle of the Oriental red mite *E. orientalis* (Table 1) were similar to (Metwally et al., 2019) when studying the Oriental red mite *E. orientalis* on bean leaves.

Table (2) refers to the results of study the survival duration of females and males, both separately, and the survival duration of females and males staying together at the temperature of (20 C°, 25 C°, 30 C°), where the females were longer than the males at all temperatures and recorded the longest survival duration for females at a temperature of (20C°), where the duration of females' survival was (18.67±1.55) days. The shortest duration was (12±1.09) days at a temperature of 25C°, while the males were the longest survival duration as well at a temperature of 20C°, and the shortest life span for males at a temperature of 30C°. for the duration of the stay of females and males together, the longest time they reached it at a temperature of 20 ° C, and the shortest period at a temperature of 30C° (Childers et al., 2009).

Table (3) shows the period of females and males development and the period of development for both females and males together, where the period of females development was longer than the period of males development at all temperatures used. The longest period of females and males development was at a temperature of 20C°, and the shortest period of development was at a temperature of 30 C°, and these results are consistent with the findings of Tan and Ward (1977). The results indicated that males develop faster than females at all temperatures and agree with Enas Hamed Al-Ani (2004).

Sexual ratio of females and males Table (4) The number of females exceeds the males in all temperatures, and the percentage of females was higher than the males in all temperatures under study, and this agrees with Enas Hamed Al-Ani (2004) when studying the sexual ratio of *Eutetranychus orientalis* on the bitter orange leaves in Baghdad. When studying the period before laying eggs and the number of eggs for each female at a temperature (20C°, 25C° and 30C°).

Table (5), the highest average number of eggs was at a temperature of 25C° and the lowest number of eggs was at 20C°. The results showed the period before laying eggs was the most duration at a temperature of 20C° and the shortest period at a temperature of 30C°. For the period of generation at the temperature of 20 C°, it reached (1.92 ± 28.13), which was the longest period compared to the other temperatures

TABLES

Table (1): The effect of different temperatures degrees on the immature stages of *E. orientalis* Albizia leaves., at 20, 25 and 30±2 C° with % 60±5 % R.H.

Stages		Mean duration in days			LSD(0.05)
		20C°	25C°	30C°	
Incubation period(Eggs)		7.9±0.91	5.65±0.82	3.2±0.55	0.892
Larva	active	3.15±0.63	2.44±0.58	1.75±0.47	0.544
	quiescent	1.45±0.49	1.15±0.52	0.85±0.23	0.405
	Active+ quiescent	4.6±0.78	3.59±0.85	2.6±0.65	0.716
Proto nymph	Active	2.25±0.53	1.36±0.42	0.96±0.31	0.403
	Quiescent	1.34±0.4	0.9±31	0.75±0.35	0.355
	Active+ quiescent	3.59±0.66	2.26±0.61	1.71±0.7	0.640
Deuto nymph	Active	2.65±0.73	2.2±0.51	1.65±0.48	0.551
	Quiescent	1.75±0.67	1.15±0.52	0.8±0.34	0.491
	Active+ quiescent	4.4±1.04	3.35±0.75	2.45±0.41	0.744
(life cycle)	Egg_Adu	20.45±1.5	14.7±1.47	9.76±0.93	1.274

Table (2): Effect of constant temperatures on the survival of females and males and the survival of *E. orientalis* bred on Albizia leaves. At 20, 25 and 30 ± 2 C° with % 60 ± 5.

Temperature	Longevity ± SD		
	Male	female	Male +female

20C°	11.38±2.49	16.42±2.18	14.40±3.29
25C°	9.88±1.93	11.67±1.09	10.95±1.61
30C°	7.47±1.72	9.30±1.64	8.55±1.93
LSD(0.05)	3.329	2.301	2.292

Table (3): Effect of constant temperatures on female and male growth and development (males and females) of eastern red mite *E. orientalis* reared on Albizia leaves, at 20, 25 and 30 ± 2 C° with %60 ± 5.

Temperature	Development time ±SD		
	Male	female	Male +female
20C°	17.07±0.83	22.75±2.11	20.85±2.94
25C°	11.85±0.79	16.67±2.2	13.17±2.71
30C°	8.12±0.85	11.43±1.35	11.32±3.04
LSD(0.05)	1.372	2.376	2.794

Table (4): The effect of constant temperatures on the determination of the sex ratio of *E. orientalis* on Albizia leaves. , at 20, 25 and 30 ± 2 C° at 60% ± 5.

Temperature	Number of Male+ female	Number of female	Number of Male	Sexual percentage		Sexual percentage Female+ Male
				Male%	Female %	
20C°	2.5±1.06	1.70±0.78	0.80±0.41	%32	%68	1:2.12
25C°	5.1±1.45	3.20±1.23	1.9±0.62	%37.25	%62.75	1:1.68
30C°	4.3±1.3	2.7±1.07	1.6±0.68	%37.21	%62.79	1:1.67
(LSD(0.05)	1.329	1.114	0.547			

Table (5): Effect of constant temperatures on the pre-egg-laying period, number of eggs and breeding duration of *E. orientalis* on bee leaves. , at 20, 25 and 30 ± 2 C° with % 60 ± 5.

Temperature	Pre-egg period ±SD	Eggs /Female ±SD	Generation
20C°	2.31±0.37	4.16±1.06	22.07±2.41
25C°	1.42±0.44	8.33±0.94	15.70±1.81
30C°	0.85±0.31	7.16±1.34	10.36±1.01
LSD(0.05)	0.452	1.524	1.714

REFERENCES

- Imani, Z., & Shishebor, P. (2009). Effect of temperature on life history and life tables of *Eutetranychus orientalis* (Klein) (Acari: Tetranychidae). *Systematic and Applied Acarology*, 14(1), 11.
- Tan, F.M. and C.R. Ward. 1977. Laboratory studies on the biology of Banks grass mite. *Ann. Entom. Soc. Amer.* 70:534-536.
- Jeppson, L.R.; Keifer, H.H. and Baker, E. W. (1975): Mites injurious to economic plants. University of California Press. Berkely. pp 614database for the Tetranychidae. In *Trends in Acarology*, Springer Dordrecht, 557-560 pp
- Angsumarn-Chandrapatya and Kosol-charernsom .1988. *Citrus Pests and their Control*. Kasetsart University. Bangkok (Thailand). Faculty of Agricultural. Dept. of Entomology
- The narrator, humbled Mahmoud and Khalaf Allah, Abdul Aziz Muhammad. 2000. *Design and Analysis of Agricultural Experiments*, Ministry of Higher Education and Scientific Research, Dar al-Kutub for Printing and Publishing - Mosul University' 488 pages.
- Migeon A and Dorkeld F, 2012. Spider Mites Web: a comprehensive database for the Tetranychidae 2006-2012. Available online
- Dhooria MS, 2003. Economic status of phytophagous/predaceous mites from different plants in Punjab. *Journal of Insect Science*16, 12–17.
- Al-Atawi FJ, 2011. Phytophagous and predaceous mites associated with vegetable crops from Riyadh, Saudi Arabia. *Saudi Journal of Biological Sciences* 18, 239–246

9. Zhou C, Zhang W, Qiao L, Sun X and Wang Z, 2006. The biological characteristics, effective accumulate temperature and occurrence regulation of *Eutetranychus orientalis*. *Scientia Silvae Sinicae* 42, 89–93.
10. Metwally, A. M., Abdallah, A. A., & El-Hady, A. (2019). Effect of temperature degrees on the duration of the phytophagous mite, *Eutetranychus orientalis* complex (Klein) (Acari: Tetranychidae) when fed on green bean (*Phaseolus vulgaris* L.). *Al-Azhar Journal of Agricultural Research*, 44(2), 172–179.
11. Abdel-Rahman, S., 1996. Studies on Some Tetranychoid Mites. Ph.D. Thesis, Fac. Agric., Cairo Univ., Egypt, p. 118.
12. Rasmay, A. H. (1978): Biology of citrus brown mite, *Eutetranychus orientalis* (Klein) as affected by some citrus species. – *Acarologia* 19: 222-224.
13. Yousef, M., Chouhan, S., Guptan, R. K. (2006): Loss assessment in some important forest tree species, caused by *Eutetranychus orientalis* (Klein) (Acarina: Tetranychidae). – *Bulletin of Pure and Applied Sciences* 25: 25-30
14. Al-Suwaidi, Taha Musa Muhammad. (2003). Thermal Gathering and Building Tables Reproductive Capability and Life Dreaming of Dust on Palms. Master's Thesis, College of Agriculture - University of Baghdad.
15. Shih, C. and K. F. Pai. 1995. Effects of male chastity and female virgining of *Tetranychus urticae* Koch (Tetranychidae) at copulation on insemination and sex ratio. *Acarology*. 1: 401-408pp.
16. Parviz Shishehbor (2009) Shahid Chamran University in Ahvas Systematic and Applied Acarology Publications 873 Citations 89
17. Enas Hamed Al-Ani (2004). Biological study of the teat of oriental citrus *Eutetranychus orientalis* (Klein) on the orange. Master Thesis / College of Agriculture _ University of Baghdad
18. Elhalawany, A.S. (2019): Influence of some host plants and temperature on biological aspects of the citrus brown mite, *Eutetranychus orientalis* (Klein) (Acari: Actinedida: Tetranychidae). *Annals of Agric. Sci., Moshtohor*, 57(3):745-754.