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EFFECT OF TEMPERATURE ON BIOLOGICAL ASPECTS AND FECUNDITY OF CITRUS RED MITE *PANONYCHUS CITRI* (MCGREGOR) (ACARI:TETRANYCHIDAE)

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ABSTRACT: *This work was carried out to study some biological aspects of Panonychus citri (McGregor) (Acari: Tetranychidae) on mandarin leaves. Experiment was determined at 20 & 25 and 30°C ± 2°C and 65 ±5 % R.H. at laboratory of Plant Protection Research Institute. Total developmental time of P. citri females was 15.36 & 11.79 and 9.45 days at 20 & 25 and 30°C respectively, while male was 13.69 & 11.4 and 9.22 days at the same temperature. Total and daily egg production levels of P. citri was the highest at 25 °C (22.6 / female and 2.1 eggs / day) followed by 20°C (18 and 1.7 eggs). The lowest total and daily egg production levels were at 30°C (15 and 1.6 eggs). Female longevity was longer than male. The average life span of female and male of P. citri were (29.5 & 23.94) , (24.71 & 19.9) and (21.12 & 18.5) days at 20 & 25 and 30 oC. Female life span was longer than male.*

***Key words**: Citrus Red Mite, development, fecundity, Panonychus citri*

INTRODUCTION

In Egypt, citrus is considered one of the great economic important crops for local consumption and exportation which helps to increase the national and growers income.

The citrus red mite *Panonychus citri* (McGregor) is an important phytophagous mite species present in the citrus growing regions of the world (Munger 1963, McMurtry 1969, Dlrio 1985, Takafuji and Fujimoto 1985, Emmanouel and Papadoulis 1987, Gotoh *et al.* 2003 and Lei *et al.* 2004. This mite species was recorded also in Egypt on mandarin, orange and Lemon. It has became serious mite pest and dangerous to citrus in Egypt. It feeds on fruits, foliage and sometimes young branches. It is found on both surface of leaves but appears mostly to feed on the upper surface Duzgunes 1977, McMurtry 1977, Karaca 1994, Kasap *et al.* 1998, Uygun *et al.* 2000 and Abd El-Wahed 2007.

The present study was designed primarily to provide data on the development time and fecundity of *P. citri* at some constant temperature in the laboratory. This knowledge may prove useful to our understanding of the population dynamical *P. citri* and as well as reduce the risk of this mite.

MATERIALS AND METHODS

Mite culture:

The initial population of the citrus red mite *Panonychus citri* was collected from mandarin trees. The stock culture was maintained on leaves and fruits of mandarin in a rearing Chamber (25 ± 2°C and 65 ± 5% R.H.). This culture was the source of all mites used in this study.

Development and biology of *P. citri* at different temperature:

Experiment was conducted on mandarin leaf discs at 20& 25 and 30°C ± 2°C and 65 ± 5% R.H. The constant temperature used in the experiments were chosen according to the average summer temperature. Leaves were taken and well washed with running water to remove any possible residuals or mites which may be found on these leaves. Leaf discs of about (one-inch in diameter) were made and were placed (60 discs) on cotton wool in Petri dishes of 12.5 cm diameter-suitable moisture was maintained by adding daily few drops of water, and surrounded by tangle foot (citronella oil+ faseline), which acts as a barrier to prevent mite individuals from escaping.

Approximately 20 adult females from the stock culture were introduced onto each leaf

disc and allowed to lay eggs for a 24-h. period. About 60 newly hatched larvae were observed as replicates and transferred singly and reared on a fresh leaf discs and left to continue their life span. Newely emerged females were copulated by introduce male for each female and left to deposit their eggs until dead. Examination was made every 12-h. and biological aspects were recorded.

Results

Biological developmental stages (incubation period, Immature stages, life cycle, fecundity, generation, longevity and life span) for the acarine mite pest *Panonychus citri* (McGregor) under laboratory conditions at different temperatures were studied.

As shown in Table (1) data cleared that the incubation period lasted (7.1 ± 0.92 & 7.4 ± 0.69) , (6.2 ± 0.34 & 6.1 ± 0.39) and (4.6 ± 0.43 & 4.5 ± 0.53) days for the both sexes female and male of *P. citri* at 20 & 25 and 30°C and 65±5% R.H respectively.

Female larvae stayed 2.2 ± 0.34 & 1.8 ± 0.26 and 1.3 ± 0.39 days, while the male larvae durated 2.1 ± 0.44 & 1.7 ± 0.35 and 1.2 ± 0.44 days at 20 & 25 and 30°C respectively. The protonymphal stage lasted 2.5 ± 0.39 & 1.7 ± 0.26 and 1.6 ± 0.38 days and 2.3 ± 0.26, 1.6 ± 0.39 and 1.5 ± 0.45 days for female and male at the previous temperature, respectively, while the deutonymphal stage durated 3.1 ± 0.30 & 2.1 ± 0.36 and 1.9 ± 0.47 days and 2.9 ± 0.35 & 2.00 ± 0.41 and 1.9 ± 0.30 days for female and male at the same trend, respectively.

Also data in Table (1) demonstrated that, the female total immature stages lasted 8.27 ± 0.75 & 5.54 ± 0.41 and 4.8 ± 0.38 days while male lasted 7 .31 ± 0.46 & 5.3 ± 0.59 and 4.67 ± 0.75 days at 20 & 25 and 30°C respectively. The life cycle of female and male durated (15.36 & 13.69) , (11.79 & 11.4) and (9.45 & 9.22) days at the previous temperature.

Male adulthood was shorter than female longevity this period averaged (10.2 & 14.13) , (8.5 & 12.9) and (9.3 & 11.67) days for male and female at the same pattern. The average generation period of female were 17.9 ± 1.26 & 12.87 ± 0.57 and 11.37 ± 0.83 days at 20 & 25 and 30°C respectively. The female and male life span averaged 29.5 ± 1.56 and 23.94 ± 1.08 days at 20°C while at 25°C averaged 24.71±1.01 and 19.9 ± 1.07 days, but lasted 21.12 ± 1.37 and 18.5 ± 1.67 days at 30°C.

Table (1): Duration (in days) of developmental stages of *Panonychus citri* at different temperatures

Developmental stages	Duration in days					
	Means ± SD at 20°C		Means ± SD at 25°C		Means ± SD at 30°C	
	Female	Male	Female	Male	Female	Male
Incubation period	7.1±0.92	7.4±0.69	6.2±0.34	6.1±0.39	4.6±0.43	4.50.53
Larva	2.2±0.34	2.1±0.44	1.8±0.26	1.7±0.35	1.3±0.39	1.2±0.44
Protonymph	2.5±0.39	2.3±0.26	1.7±0.26	1.6±0.39	1.6±0.38	1.5±0.45
Deutonymph	3.1±0.30	2.9±0.35	2.1±0.36	2.00±0.41	1.9±0.47	1.9±0.30
Total immature stages	8.27±0.75	7.31±0.46	5.54±0.41	5.3±0.59	4.8±0.38	4.67±0.75
8Life cycle	15.36± 1.17	13.69±0.96	11.79± 0.54	11.4±0.81	9.45±0.81	9.22±0.91
Generation period	17.06±1.26	-	12.89±0.57	-	11.37±0.83	-
Longevity	14.13±0.84	10.2±0.89	12.9±0.67	8.5±0.53	11.67±0.91	9.3±0.87
Life span	29.5±1.56	23.94±1.08	24.71±1.01	19.9±1.07	21.12±1.37	18.5±1.67

The data cleared that the *P. citri* life span period at 20°C was longer than 25 and 30°C.

Data in Table (2) showed that the pre-oviposition period lasted 1.7 ± 0.41 & 1.1 ± 0.19 and 1.9 ± 0.28 days at 20 & 25 and 30°C, respectively, the oviposition period of female averaged 10.3 ± 0.68 & 9.5 ± 0.56 and 8.5 ± 1.00 days at the previous temperature, respectively, while the post-oviposition period durated 2.1 ± 0.20 & 2.3 ± 0.33 and 1.2 ± 0.34 days at the same trend.

Female deposited an average of 18.00 & 22.6 and 15.00 eggs with a daily rate of 1.7 & 2.1 and 1.6 eggs at 20 & 25 and 30°C respectively when female of *P. citri* fed on leaves of mandarin trees.

Discussion

The effect of different temperature on the biology of *Panonychus citri* was investigated at 20 & 25 and 30°C and relative humidity 65 ± 5%, obtained results demonstrated that, the maximum number of eggs was produced at 25°C followed by 20 and 30°C. *P. citri* performed best at 25°C, Yasuda (1982) reported that 24°C was the most favorable temperature for the reproduction and development of *P. citri.*

This mite female was due mainly to a short development time (11.79 days) high daily and total egg production (2.1 and 22.6 eggs, respectively) at 25 °C. Ragusa *et al.* (1983) reported that the development stages and total egg productions of *P. citri* were 10.12 days and 72.8 eggs respectively. 67.2 eggs for *P. citri* on bitter orange (Citrus aurantium L.), respectively at 25 °C. In present study total fecundity (22.6 eggs) at 25 °C were lower than those reported in previous studies . The obtained results in this study may be attributed to difference according host plant. Lei *et al.* (2004), reported that, egg productions of *P. citri* was the highest on Taiwan and the lowest on Ponkan NL . Kasap (2009) stated that, the total and daily mean of egg productions levels of *P. citri* were highest at 25 °C (25.6 and 2.1 eggs) followed by 20 °C (22.1 and 1.8 eggs) and 30 °C (16.6 and 1.7 eggs). The continued examination is recommended of the citrus trees to determine the onset of the citrus red mite in order to determine the time optimal control.

Table (2): Longevity and fecundity of citrus red mite *Panonychus citri* at different temperatures

Temperature	Average period in days				Fecundity	
	Pre-oviposition	Oviposition	Post-oviposition	Longevity	No. of eggs/female	Daily rate
20°C	1.7±0.41	10.3±0.68	2.1±0.20	14.13±0.84	18.00±1.18	1.7±0.26
25°C	1.1±0.19	9.5±0.56	2.3±0.33	12.9±0.67	22.6±1.82	2.1±0.31
30°C	1.9±0.28	8.5±1.00	1.2±0.34	11.67±0.91	15.00±1.13	1.6±0.31

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تأثير الحرارة على المظاهر البيولوجية و الخصوبة لأكاروس الموالح الأحمر *Panonychus citri* (McGregor) (Acari: Tetranychidae)

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الملخص العربي

يعتبر أكاروس الموالح الأحمر من الأكاروسات المسجلة حديثاً في مصر وانتشر في جميع المحافظات وأصبح آفة خطيرة على الموالح ويؤثر سلبياً على إنتاج الموالح كماً ونوعاً ويعيق عملية التصدير.

لذلك كان لابد من دراسة المظاهر البيولوجية على درجات حرارة مختلفة هي ٢٠، ٢٥، ٣٠°م ورطوبة نسبية ٦٥ ± ٥%.

استهدفت الدراسة تأثير درجات الحرارة المختلفة على المظاهر البيولوجية والخصوبة لأكاروس الموالح الأحمر تحت الظروف المعملية عند تغذيته على أوراق اليوسفي أوضحت النتائج المتحصل عليها بأن درجة الحرارة لها تأثير على دورة الحياة حيث أن دورة الحياة تقل بإرتفاع درجة الحرارة حيث بلغت دورة الحياة ١٥,٣٦، ١١,٧٩، ٩,٤٥ يوما للأنثى و ١٣,٦٩، ١١,٤، ٩,٢٢ يوماً للذكر عند درجات حرارة ٢٠، ٢٥، ٣٠°م علي الترتيب. واستطاعت الأنثى أن تضع ١٨، ٢٢,٦، ١٥ بيضة بمتوسط يومي ١,٧، ٢,١، ١,٦ بيضة على نفس درجات الحرارة على التوالي. وكانت درجة حرارة ٢٥°م هي الأنسب حيث أعطت أعلي خصوبة للإناث.

تفيد هذه الدراسة في التنبؤ بمستوى الإصابة بالأكاروس الأحمر علي أشجار الموالح