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Biological aspects of *Brevipalpus californicus* (Banks) (Acari: Prostigmata: Tenuipalpidae) on Navel orange variety *Citrus sinensis* (L.)

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ABSTRACT

Biological aspects of *Brevipalpus californicus* (Banks) were studied on leaves of Navel orange at two temperature degrees 25 and 30°C and 70% R.H. The life cycle, generation time, and fecundity were affected by temperature degrees where the life cycle averaged 21.56 & 20.7 days and 17.11 & 15.6 days for females and males at temperature degrees 25 and 30°C, respectively. The generation time was 22.99 and 18.48 days at temperature degrees mentioned before. The fecundity of females was varied depended on temperature degrees where it was 16.71 eggs/ female at 25°C while it was 19.36 eggs/female at 30°C.

INTRODUCTION

Genus *Brevipalpus* Donnadieu includes most of the economically important species of family Tenuipalpidae Berlese. Many *Brevipalpus* species reproduce by theletokous parthenogenesis while other species reproduce by male fertilization of female eggs. Recently, many researchers have determined that *Brevipalpus californicus* (Banks), females were haploid with two chromosomes while, the longevity of each *Brevipalpus* species is two to three times greater than corresponding longevities of various tetranychid mites (Childers *et al.*, 2003; Childers & Rodrigues, 2011). Citrus flat mite is a cosmopolitan pest of citrus and ornamental plant with a wide range of host and distribution around the world. This mite attacks citrus trees, causing direct and indirect damage such its ability to transmit leprosis virus on citrus species, chlorosis, blistering, bronzing, or necrotic areas on leaves and fruits (Hele *et al.*, 2005; Chigira & Miura, 2005). The feeding sites become progressively necrotic, darker in color, and eventually develop into irregular scab-like lesions on affected fruit (Childers *et al.*, 2003). This mite is slow-moving and developing from egg to first egg requires about 30 days. The females on oranges or lemons produced 15-33 progeny, dependent on the Egyptian climate, and completed 11 annual generations were thus present throughout the year. The populations peak is in mid-summer and favours the eastern parts of the canopy, the lower branches and frequently the fruits, whereon they occur in larger populations on oranges than on mandarins (Prieto and Diaz, 1972; Wahab *et al.*, 1974; Banerjee, 1976; Lal, 1978; Zaher *et al.*, 1984; Gope and Das, 1992; Kennedy, 1995; Kennedy *et al.*, 1996; Childers *et al.*, 2003; Novelli *et al.*, 2008; Childers & Rodrigues, 2011).

Despite the high diversity of the tenuipalpid mites in Egyptian agro-ecosystem, the biological studies on the *Brevipalpus* species are very little. So, the present work aims to study the life span of *B. californicus* on leaves of Navel orange at two temperature degrees.

MATERIALS AND METHODS

A pure culture of *B. californicus* was propagated on leaves of Common Navel orange variety. Leaf discs of about one-inch in diameter were made and washed with running water to remove any possible residuals or mites which may be found on these leaves. The leaf discs were surrounded by tangle foot, which acts as a barrier to prevent mite individuals from escaping and placed on pieces of moisten cotton wool in Petri dishes of 10cm diameter, and then a couple (male and female of mite) was placed on each disc, on the lower surface of the leaf. The Petri dishes were kept at two different temperatures (25 and $30^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $70 \pm 5\%$ R.H.) for 24 hours to allow mating process between male and female. Thereafter, males were removed, while females served as a source for known-age eggs, which in turn produced known-age larvae. The moisture was kept constant by adding few drops of water to the cotton wool. Hatching larvae were transferred and kept singly on leaf discs and left to continue their life span.

Statistic analysis, mean, F-test and correlation between variables of the life span parameters were calculated using SPSS program.

RESULTS AND DISCUSSION

The developmental time for males and females of citrus flat mite, *B. californicus* reared on leaves of Navel orange at temperature degrees 25 and 30°C and 70% R.H were recorded in tables (1 & 2) and figs. (1 & 2). The obtained data in table (1) and figs (1 & 2) showed that the incubation period was affected by temperature degrees where it averaged 7.05 and 6.9 days at temperature 25°C for females and males while it recorded 5.7 and 5.1 day at 30°C for females and males, respectively. The larval stage was active for 4.1 & 4 days and 3 & 2.8 days for females and males at temperature degrees 25 and 30°C , respectively, while the quiescent larva required 0.76 & 0.70 and 0.66 & 0.60 day for females and males without significant differences at the temperature degrees mentioned above. Significant differences were recorded between the developmental time of protonymphal stage where it needed 4 & 3.7 days and 3.25 & 2.7 days for females and males until reached to quiescent protonymph which required 0.80 & 0.82 and 0.65 & 0.70 days without significant differences at 25 and 30°C , respectively. The third movable stage, deutonymph, required 4.05 & 3.8 days and 3.25 & 3 days for females and males at temperature degrees mentioned above respectively.

The life cycle of citrus flat mite, *B. californicus* recorded high significant differences depending on temperature degrees, where it averaged 21.56 & 20.7 days and 17.11 & 15.6 days for females and males at temperature degrees 25 and 30°C , respectively. Data in table (2) and figs. (2 & 4) recorded that the newly emerged female started to deposit eggs after 1.43 & 1.37 day at temperature degrees 25 and 30°C , respectively while, the generation time was 22.99 and 18.48 days at temperature degrees mentioned above. The oviposition period was affected by temperature degrees where it averaged 11.44 and 10.41 days at 25 and 30°C , respectively. The adult females lived after they stopped depositing eggs for 4.15 & 3.25 days depending on temperature degrees. Accordingly, the duration of adult females and males were affected by temperature degrees with values 17.02 & 16.4

and 15.03 & 14.8 days for females and males at temperature degrees day at 25 and 30°C, respectively. The fecundity of females was varied from 16.71 & 19.36 eggs depending on temperature degrees with daily rate 1.46 & 1.86 eggs at 25 and 30°C, respectively. Finally, the life span of citrus flat mite *B. californicus* required 38.58 & 37.1 days and 32.14 and 30.4 days for females and males at 25 and 30°C, respectively.

Table (1): Average duration of life cycle of *B. californicus* female and male on Navel orange variety at two temperature degrees (25°C and 30°C ± 2°C) and 70 ± 5% R.H.

Developmental stage	25°C		30°C	
	Female	Male	Female	Male
Incubation period	7.05±0.37 ^a	6.9±0.394 ^c	5.70±0.261 ^b	5.1±0.342 ^d
Active larva	4.15±0.24 ^a	4.0±0.388 ^c	3.00±0.334 ^b	2.8±0.351 ^d
Quiescent larva	0.76±0.33 ^a	0.7±0.336 ^c	0.66±0.321 ^a	0.6±0.211 ^c
Active protonymph	4.00±0.33 ^a	3.7±0.381 ^c	3.25±0.35 ^b	2.7±0.33 ^d
Quiescent protonymph	0.80±0.26 ^a	0.8±0.366 ^c	0.65±0.24 ^a	0.7±0.39 ^c
Active deutonymph	4.05±0.28 ^a	3.8±0.344 ^c	3.25±0.26 ^b	3.00±0.376 ^d
Quiescent deutonymph	0.75±0.26 ^a	0.8±0.377 ^c	0.60±0.21 ^a	0.7±0.321 ^c
Total immature	14.51±0.86 ^a	13.8±0.57 ^c	11.41±0.76 ^b	10.5±0.861 ^d
Life cycle	21.56±0.53 ^a	20.7±0.55 ^c	17.11±0.89 ^b	15.6±0.521 ^d

Different letters (a and b between females while c and d for males) in horizontal column denote significant difference.

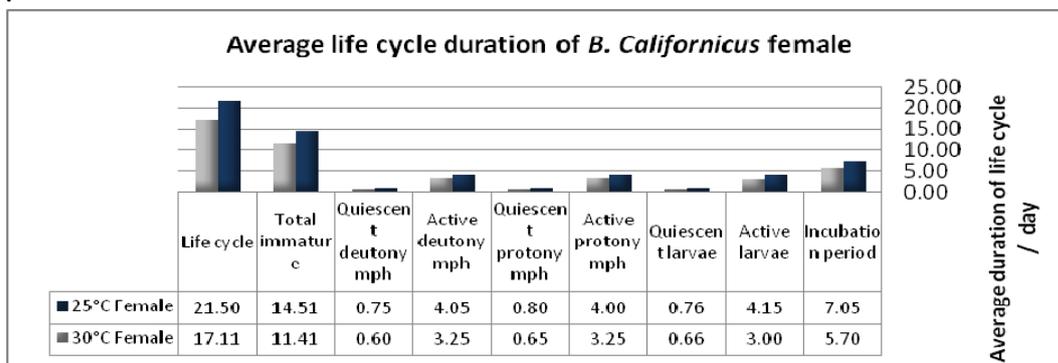


Fig. (1): Average duration of life cycle of *B. californicus* female on Navel orange variety at two temperature degrees (25°C and 30°C ± 2°C) and 70 ± 5% R.H.

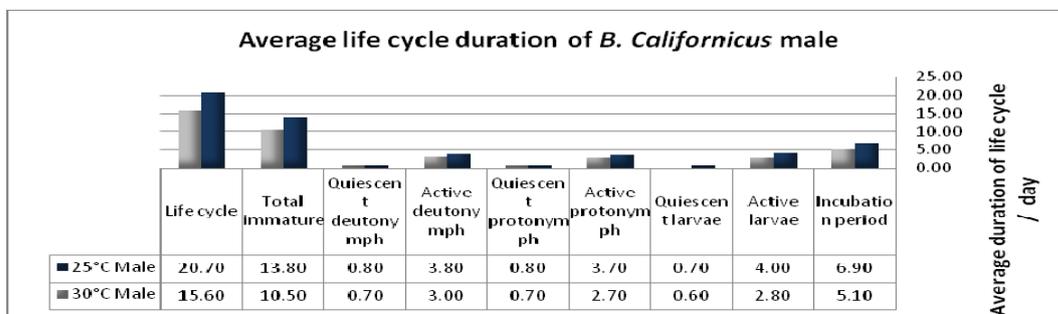


Fig. (2): Average duration of life cycle of *B. californicus* male on Navel orange variety at two temperature degrees (25°C and 30°C ± 2°C) and 70 ± 5% R.H.

Table (2): Mean generation, longevity, fecundity and life span times and longevity and life span of *B. californicus* female and male on Navel orange variety at two temperature degrees (25 and 30°C ± 2°C) and 70 ± 5% R.H.

Developmental stage	25°C		30°C	
	Female	Male	Female	Male
Generation	22.99±0.013 ^a		18.48±0.891 ^b	
Pre-oviposition	1.43±0.081 ^a		1.37±0.059 ^a	
Oviposition	11.44±0.176 ^a		10.41±0.231 ^b	
Post-Oviposition	4.15±0.241 ^a		3.25±0.261 ^b	
Longevity	17.02±0.271 ^a	16.4±0.43 ^c	15.03±0.317 ^b	14.8±0.81 ^c
Fecundity (eggs/♀)	16.71±0.254 ^a		19.36±0.881 ^b	
Daily rate(eggs/♀/day)	1.46±0.039 ^a		1.86±0.119 ^b	
Life span	38.58±0.529 ^a	37.1±0.91 ^c	32.14±0.889 ^b	30.4±1.21 ^d

Different letters (a and b between females while c and d for males) in horizontal column denote significant difference.

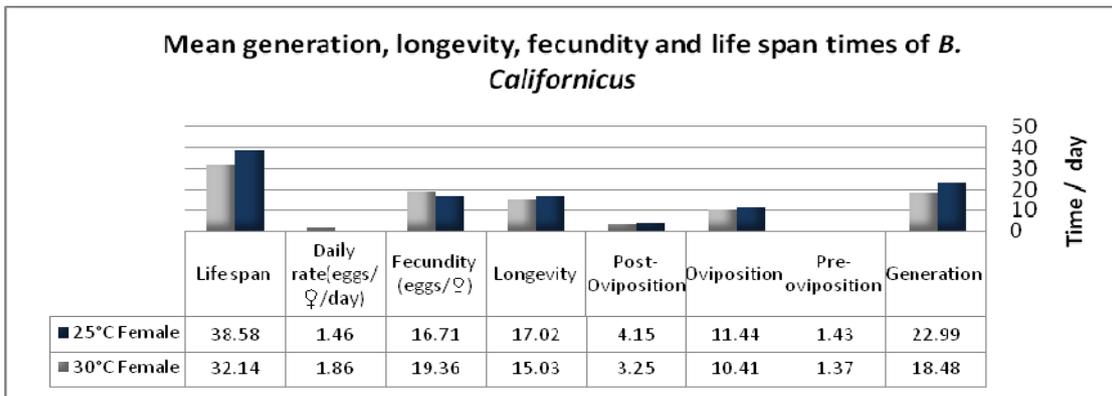


Fig. (3): Mean generation, longevity, fecundity and life span times of *B. californicus* female on Navel orange variety at two temperature degrees (25 and 30°C ± 2°C) and 70 ± 5% R.H.

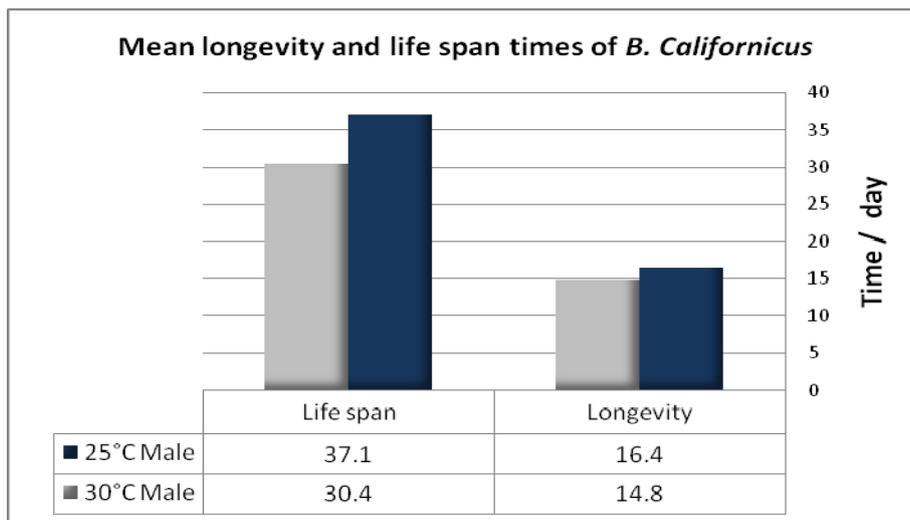


Fig. (4): Mean longevity and life span times of *B. californicus* male on Navel orange variety at two temperature degrees (25 and 30°C ± 2°C) and 70 ± 5% R.H

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ARABIC SUMMARY

الجوانب البيولوجية لأكاروس الموالح (Acari: *Brevipalpus californicus* (Banks) على البرتقال ابوسرة (L.) *Citrus sinensis* Prostigmata: Tenuipalpidae)

علاء محمد حلاوه

قسم بحوث أكاروس الفاكهة - معهد بحوث وقاية النباتات - مركز البحوث الزراعية

تمت دراسة الجوانب البيولوجية لأكاروس الموالح *Brevipalpus californicus* (Banks) على أوراق البرتقال أبوسرة عند درجات حرارة ٢٥ و ٣٠ م° ورطوبة نسبية ٧٠ % .وأوضحت الدراسات أن دورة الحياة ومدة الجيل ومعدل وضع البيض للأنثى قد تأثرت بدرجات الحرارة حيث كانت دورة الحياة 21.56 و 20.7 يوماً و 15.6 & 17.11 يوماً للإناث والذكور على درجات الحرارة ٢٥ و ٣٠ م° على التوالي هذا وقد سجلت فترة الجيل 18.48 & 22.99 يوماً على درجات الحرارة المذكورة كما تنوع معدل وضع البيض بتنوع درجات الحرارة حيث كان معدل وضع البيض للأنثى 16.71 بيضة على حرارة ٢٥ بينما كانت 19.36 بيضة على درجة حرارة ٣٠ م° .