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Life history of the flat-mite, *Brevipalpus phoenicis* (Geijskes) (Acari : Prostigmata: Tenuipalpidae) on Navel orange variety (*Citrus sinensis* (L.))

Mamduoh M. EL-Sebaay
Fruit Acarology Department, Plant Protection Research Institute (PPRI), Agricultural Research Center (ARC), Egypt
Corresponding author: Dr.M_elsebaay@yahoo.com

Abstract

Biology of *Brevipalpus phoenicis* (Geijskes, 1936) was studied on leaves of navel orange at two temperature degrees 25 and 30°C and 70 % R.H. The lengths of embryonic and post-embryonic period were affected by due to the temperature degrees, where the mite was showed better development and higher fecundity at 30°C and 70 % R.H .The total immature time was averaged 16.32 & 14.23 day and 12.93 & 12.04 day for females and males at temperature degrees 25 and 30°C, respectively, while the life cycle was averaged 24.32 & 21.73 and 19.03 &17.94 day for females and males at temperature degrees 25 and 30°C, respectively. In addition, the fecundity of *B. phoenicis* was affected by temperature degrees where it averaged 11.66 & 16.23 eggs/ female by daily rate 21.24 & 2.12 egg / female /day at temperature degrees 25 and 30°C, respectively

Keywords: *Brevipalpus phoenicis , Biology, Navel orange.*

Introduction

The flat mite, *B. phoenicis* was first described by **Geiskes in 1939** under name *Tenuipalpus phoenicus* in Netherland. Later **Pritchard and Baker (1958)** placed this species in the genus Brevipalpиs and listed 63 host plants for the mite in their review. It is a cosmopolitan in distribution and has been reported from a number of host plants in different countries **(Attiah, 1956; Milne *et al*, 1962; Prasad, 1968; Lo & Hsia, 1968; Ehara, 1969; Rodrigues, 1970; Nagesh Chandra & Channa Basavanna, 1976).** This mite infests various cultures of economical importance, such as coffee (*Coffea spp*.), citrus (*Citrus spp*.), Indian tea [*Camellia sinensis* (L.) *O. Kuntze*], peach [*Prunus persica* (L.) Batsch], papaya (*Carica papaya* L.), coconut (*Coconuts nucifera* L.), apple (*Malus spp*.), pear (*Pyrus comunis* L.), guava [*Psidium guajava* (L.)], olive (*Olea europaea* L.), fig (*Ficus carica* L.), walnut (*Juglans spp*.) and grapevine (*Vitis spp*.) (**Jeppson *et al*., 1975**). In Brazil, **Reis (1974)** mentioned 37 hosts of the flat-mite found mostly in fruit plantations and **Trindade & Chiavegato (1994)** mentioned 33 hosts found in weeds and ornamental plants.

The flat mite, *B. phoenicis* considered important in citrus, where it known as the citrus leprosis mite for being a vector of the Citrus Leprosis Rhabdovirus - CitLV (**Chiavegato *et al*., 1982; Gravena *et al*., 1994**) but, fortunately the citrus leprosis has not been reported in Egypt yet. The mites are found on leaves, branches and fruit of the citrus (**Martinelli *et al*., 1976 & Halawa and Fawzy, 2014**),. The biological data of *B. phoenicis* have already been obtained in several hosts, such as papaya by **Haramoto (1969)**; Indian tea by **Oomen (1982)** and **Kennedy *et al*. (1996)**; *Oroxylum indicum* Vent. and *Clerodendron siphonanthus* R. Br. by **Lal (1978)**. **Chiavegato (1986)**, demonstrated that the development and reproduction of the mite vary considerably in relation to the species of host plant it feeds on and temperature degrees. The feeding sites become progressively necrotic, darker in color, and eventually develop into irregular scab-like lesions on affected fruit (**Childers et al., 2003**). However, the information oп the biology and life history of this mite is scanty (**Nagesh Chandra and Channa basavanna, 1974 and Halawa, 2017**). A study oп the biology of *B. phoenicis* was therefore, under-taken and presented in this paper.

Materials and Methods

A pure culture of *B. phoenicis* 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°C ± 2°C and 70 ± 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 to 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.

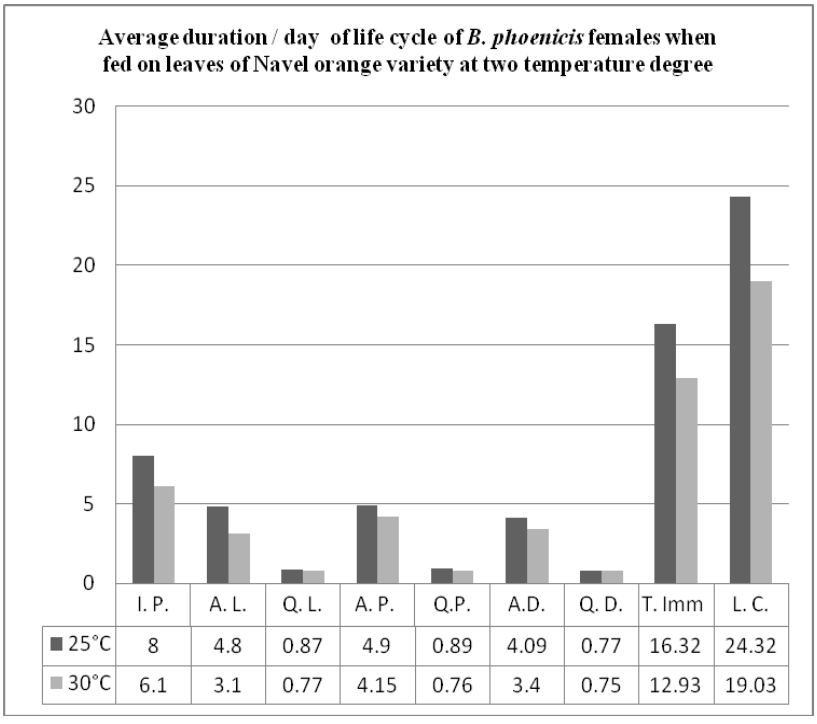
Results and Discussion

The duration of males and females of tenuipalpid mite, *B. phoenicis* 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, 2,3,4). The obtained data in table (1) and figs(1 &2) showed that the incubation period was affected by temperature degrees where it averaged 8 and 7.5 day at temperature 25°C for females and males while it recorded 6.1 and 5.9 day at 30°C for females and males, respectively. The larval stage was spent 4.8 & 4 day and 3.1 & 2.9 days as an active stage for females and males at temperature degrees 25 and 30°C, respectively, while it required 0.87 & 0.8 and 0.77 & 0.69 day for females and males as quisent larval stage without significant differences at the temperature degrees mentioned above.

Significant differences were recorded between the developmental time of protonymphal stage where it needed 4.9 & 4.15 day and 4 & 3.8 day for females and males until reached to quiescent protonymph which required 0.89 & 0.76 and 0.79 & 0.72 day without significant differences at 25 and 30°C, respectively. The third movable stage, deutonymph was spent 4.9 &3.8 day and 3.4 & 3.2 day for females and males at temperature degrees mentioned above respectively.

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

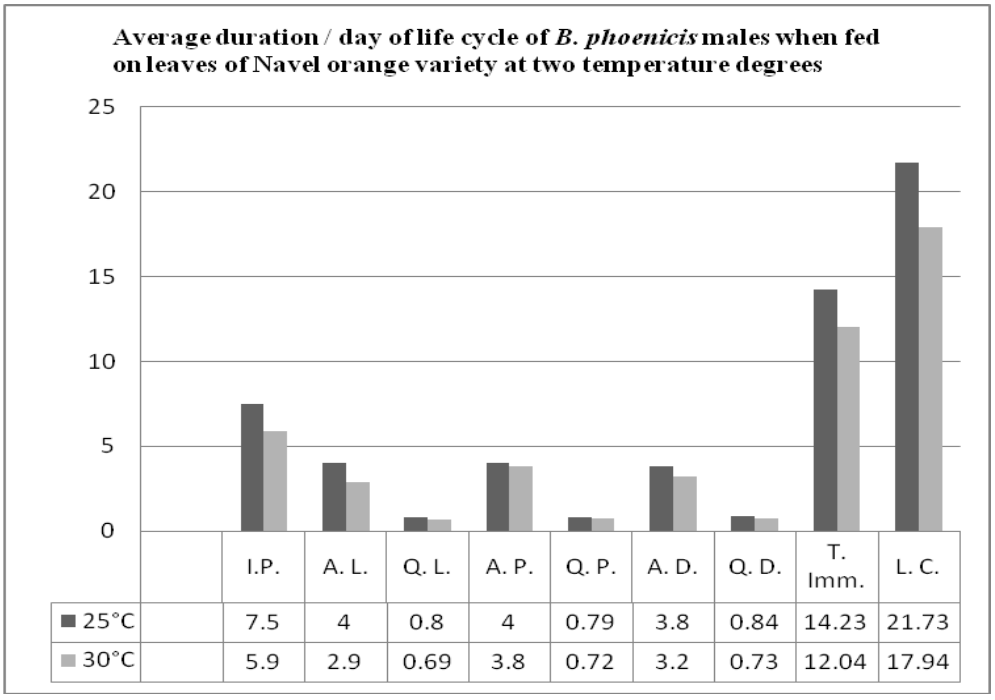
Developmental stage	25°C		30°C	
	Female	Male	Female	Male
Incubation period	8.00±0.26[a]	7.5±0.273[c]	6.1±0.232[b]	5.9±0.233[d]
Active larvae	4.8±0.27 [a]	4.0±0.267[c]	3.1±0.254[b]	2.9±0.261[d]
Quiescent larvae	0.87±0.23[a]	0.8±0.243[c]	0.77±0.22[a]	0.69±0.211[c]
Active protonymph	4.9±0.29[a]	4.00±0.272[c]	4.15±0.27[b]	3.8±0.31[d]
Quiescent protonymph	0.89±0.23[a]	0.79±0.289[c]	0.76±0.22[a]	0.72±0.41[c]
Active deutonymph	4.09±0.26[a]	3.8±0.344[c]	3.4±0.23[b]	3.2±0.39[d]
Quiescent deutonymph	0.77±0.25[a]	0.84±0.28[c]	0.75±0.24[a]	0.73±0.36[c]
Total immature	16.32±0.75[a]	14.23±0.47[c]	12.93±0.63[b]	12.04±0.77[d]
Life cycle	24.32±0.57[a]	21.73±0.43[c]	19.03±0.80[b]	17.94±0.44[d]



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

I.P.= incubation period; A.L.= Active larvae; Q.L.= Quiescent larvae; A.P.= Active protonymph; Q.P.= Quiescent protonymph; A.D.= Active deutonymph; Q.D.= Quiescent deutonymph; T.Imm.= Total immature; L.C.= Life cycle

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



I.P.= incubation period; A.L.= Active larvae; Q.L.= Quiescent larvae; A.P.= Active protonymph; Q.P.= Quiescent protonymph; A.D.= Active deutonymph; Q.D.= Quiescent deutonymph; T.Imm.= Total immature; L.C.= Life cycle

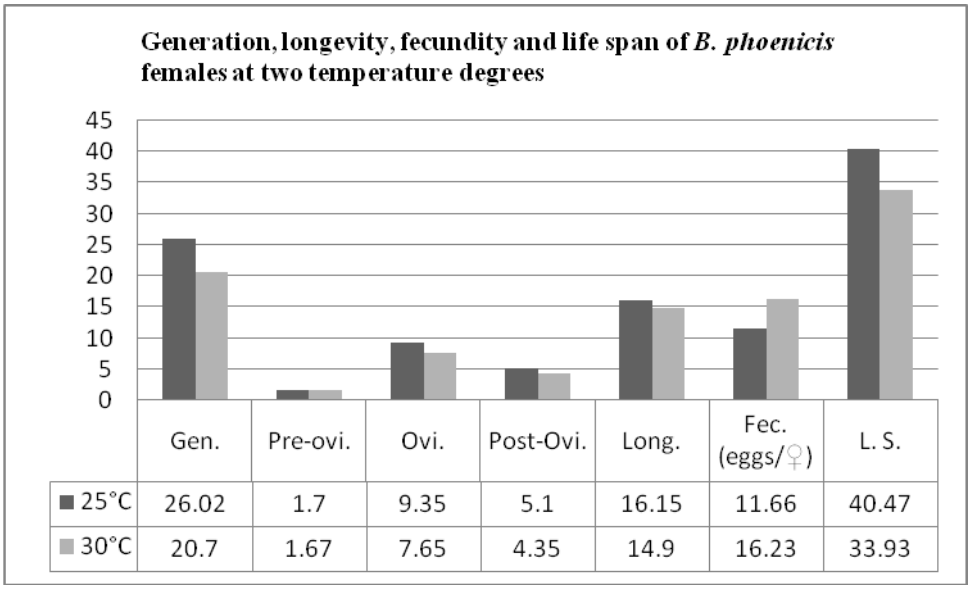
Fig(2): Average duration of life cycle of *B. phoenicis* males on Navel orange variety at two temperatures degrees (25°C and 30°C ± 2°C) and 70 ± 5% R.H.

Data in table (1) and fig(1&2) showed that, the life cycle of flat mite, *B. phoenicis* was recorded high significant differences dependent on temperature degrees, where it averaged 24.32. & 21.73 day and 19.03 & 17.94 day for females and males at temperature degrees 25 and 30°C, respectively. Data in table (2) and figs (2, 3 &4) recorded that females started to deposit eggs after 1.7 & 1.67 day at temperature degrees 25 and 30°C, respectively while, the generation time was 26.02 and 20.7 day at temperature degrees mentioned above. The oviposition period was affected by temperature degrees where it averaged 9.35 and 7.65 day at 25 and 30°C, respectively. The adult females were lived after stopped deposit eggs for 5.1 & 4.35 day depend on temperature degrees. Accordingly, the duration of adults females and males were affected by temperature degrees with values 16.15 & 14.9 and 14.7 & 14.3 day for females and males at temperature degrees day at 25 and 30°C, respectively. The fecundity of females was varied from 11.66 & 16.23 eggs depend on temperature degrees with daily rate 1.24 & 2.12 eggs at 25 and 30°C, respectively. Finally, the life span of citrus flat mite *B. phoenicis* was required 40.47 & 33.93 day and 36.43 and 32.24 day for females and males at 25 and 30°C, respectively.

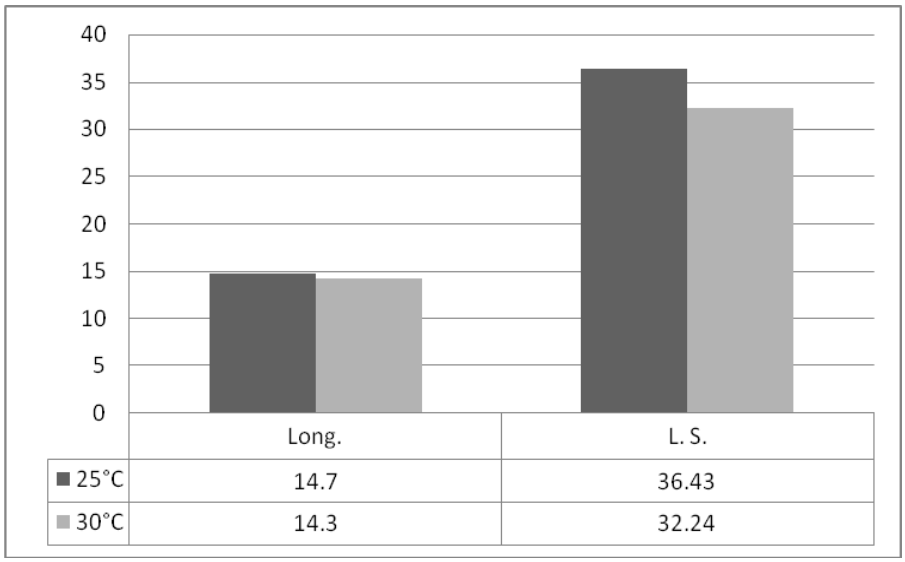
Table 2. Generation, longevity, fecundity and life span of *B. phoenicis* on Navel orange variety at two temperatures degrees (25°C and 30°C ± 2°C) and 70 ± 5% R.H.

Developmental stage	25°C		30°C	
	Female	Male	Female	Male
Generation	26.02±٠.60[a]		20.7±0.781[b]	
Pre-oviposition	1.7±0.079[a]		1.67±0.077[a]	
Oviposition	9.35±0.191[a]		7.65±0.225[b]	
Post-Oviposition	5.1±0.222[a]		4.35±0.272[b]	
Longevity	16.15±0.232[a]	14.7±0.37[c]	14.9±0.291[b]	14.3±0.49[c]
Fecundity (eggs/♀)	11.66±0.251[a]		16.23±0.678[b]	
Daily rate(eggs/♀/day)	1.24±0.122[a]		2.12±0.321[b]	
Life span	40.47±0.430[a]	36.43±0.97[c]	33.93±0.775[b]	32.24±0.99[d]

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



Fig(3): Generation, longevity, fecundity and life span of *B. phoenicis* females on Navel orange variety at two temperatures degrees (25°C and 30°C ± 2°C) and 70 ± 5% R.H.



Fig(4): Longevity and life span of *B. phoenicis* males on Navel orange variety at two temperatures degrees (25°C and 30°C ± 2°C) and 70 ± 5% R.H.

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تاريخ الحياة للاكاروس المبطط (Geijskes) *Brevipalpus phoenicis* على البرتقال ابوسرة عند درجتى حرارة ٢٥ و ٣٠ °م ورطوبة نسبية ٧٠ %

ممدوح محمد السباعى

قسم بحوث اكاروس الفاكهة – معهد بحوث وقاية النباتات – مركز البحوث الزراعية

اجريت الدراسات البيولوجية لاكاروس الموالح المبطط على اوراق البرتقال ابوسرة عند درجات حرارة ٢٥ و ٣٠ م° ورطوبة نسبية ٧٠ % . واوضحت الدراسات ان دورة الحياة ومدة الجيل ومعدل وضع البيض للانثى قد تاثرت بدرجات الحرارة حيث كانت دورة الحياة للانثى24.32 و ١٩.٠٣ يوم على درجتى حرارة ٢٥ و ٣٠ درجة مؤية بينما كانت دورة الحياة للذكور 21.73 و ١٧.٩٤ يوم على درجات الحرارة المذكورة على التوالى كما بلغت مدة الجيل 26.02 و ٢٠.٧ يوم بينما كان معدل وضع البيض 11.66و ١٦.٢٣ بيضة لكل انثى على درجات حرارة ٢٥ و ٣٠ درجة مؤية على التوالى