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Effect Of Photoperiod On The Development And Fecundity Of *Carpoglyphus lactis* L. (Acari: Carpoglyphidae)

Wafaa L. F. Ibrahim
Zoology Department, Faculty of Science (for girls), Al-Azhar University.

Abstract

Introduction:
The effect of four different photoperiods (darkness, 0 ; 8 ; 16 and continuous light, 24 hours per day) on the developmental stages and fecundity of *Carpoglyphus lactis* L. fed on wheat was studied under laboratory conditions of 25±2ºC and 65±5% RH.

Results and conclusion:
The obtained results revealed no clear effect of photoperiod on the incubation period. It was 2.9 and 3.4 for male ; 2.7 and 3.2 for female at darkness and continuous light respectively. The duration of each immature instar as well as the combined immature stages increased with increasing hours of light in both male and female. Different patterns were observed for longevity data for male and female. Male longevity was the longest (9.3 days) at continuous light (24 h.) whereas the greatest female longevity (15.4 days) was at complete darkness. The oviposition period as well as total average and mean daily deposited eggs decreased as the photoperiod increased.

Key words: Photoperiod, Development, Fecundity, *Carpoglyphus lactis* L., Carpoglyphidae, Acari.

Introduction

The mites associated with stored-products are considered of a great economic importance. They cause a great damage not only by consuming a large amount of stored food but also by contaminating materials with their excretions and dead bodies (Taha *et al.*, 2004). Stored-product mites can also be a cause of occupational disease in staff working in the grain and food-processing industries (Wright *et al.*, 2003). *Carpoglyphus lactis* L. was found in dried fruits, milk products, wine, caramel and flour (Hughes, 1976 and Hurbert *et al.*, 2005). It also has been recorded in bee hives in central Europe and is considered as an important contaminant of honey (Chmielewski, 1971).

Pegler and Wall (2004) studied the tactic responses of the astigmatid parasitic mite, *Psoroptes ovis*, to light and temperature. They found that the movement of these mites is strongly directed towards areas of high temperature but away from higher light intensity.

The present work aimed to study the effect of different photoperiods on the development and fecundity of the stored-product mite, *Carpoglyphus lactis* L.

Materials And Methods

Carpoglyphus lactis mites were obtained from Plant Protection Research Institute, Dokki, Giza, Egypt.

Plastic cells of 2.5 cm. in diameter and 2 cm. in depth with perforated covers and filled up with a plaster layer of paris and charcoal (9:1) on its bottom to a depth of 0.5 cm. were used for rearing mites in all experiments. Drops of water were added

daily to maintain suitable relative humidity (El-Wahab, 1992).

In order to provide the different experimental photoperiods, a metal chamber of 320 x 100 x 50 cm. was used. It was divided into 4 horizontal parts, each with 80 cm. in length. Three parts were provided with fluorescent tubes of 250 LUX light intensity while the fourth one was without illumination. The tubes were connected to switched timers to adjust the different photoperiods.

Experimental design: Sexed females were allowed to deposit for 12 hours and the females were then removed. Four different photoperiods namely 0 (darkness), 8, 16 and 24 (continuous light) hours per day were tested on 30 eggs for each photoperiod. The eggs of each group were placed individually in plastic cells and put inside the corresponding part in the metal chamber.

Observations were made every 12 hours until all mites reached adulthood. The number of stages and the duration for each developmental stage was recorded. The newly emerged females were paired with males. Adults were observed every 12 hours until the start of oviposition, and daily observations were then made to determine fecundity, oviposition and postoviposition periods. The observations were continued until all individuals of the original cohort had died.

Exprimental conditions: All experiments were conducted at 25±2ºC and 65±5% RH.

Statistical analysis was done according to Snedecor (1980).

Results

Data of the life history of *C. lactis* is presented in table (1). The incubation periods were slightly affected with the different photoperiods. It recorded 2.9 and 3.4 days for male; 2.7 and 3.2 days for female at complete darkness and continuous light respectively. The immature stages were significantly affected by the different photoperiods. The durations of immature stages were prolonged with the increase of photoperiod. However, the male emerged earlier than the female of a period of 1.6, 2.1, 2.2 and 2 days at 0 (complete darkness), 8, 16 and 24(continuous light) hours of light respectively. The female life cycle was 12.7 and 19.2 days at complete darkness and continuous light respectively.

As shown in table (2) and fig. (1) the male and female longevity followed different patterns. Thus while female longevity decreased as photoperiod increased, the greatest longevity for males was at 24 hours of continuous light. The mite life span was directly proportional to the photoperiod where continuous light (24 h.) introduced the longest life span. Generally, the male life span was shorter than that of the female (table 2).

The photoperiod had a highly negative effect on the oviposition period. It decreased as the photoperiod increased. The same trend was noticed with the mite fecundity where photoperiod had a significant negative effect on both the total average and the daily mean of the deposited eggs (table 3), 55.9 and 4.6 at complete darkness; 5.3 and 0.9 at continuous light.

Table(1): Duration in days (Mean±SD) of the developmental stages of *Carpoglyphus lactis* L. fed on wheat at four different photoperiods under 25±2ºC and 65±5% RH.

Photoperiod*	Sex**	Incubation period	Immature stages***								Total immature stages	Life cycle
			Larva		Protonymph		Deutonymph		Tritonymph			
			A	Q	A	Q	A	Q	A	Q		
0 (darkness)	F	2.9 ± 0.2	1 ± 0.0	0.5 ± 0.1	2.3± 0.22	0.7± 0.1	1.1±0.11	0.5±0.09	3.2± 0.6	0.5±0.05	9.8 ± 0.92	12.7± 0.67
	M	2.7 ± 0.38	1.1± 0.2	0.5± 0.12	2.1± 0.3	0.5± 0.09	1± 0.0	0.5±0.1	2± 0.5	0.5± 0.1	8.2 ± 0.06	10.9± 0.91
8	F	3.1 ± 0.4	1± 0.0	0.8 ± 0.2	2.8± 0.5	0.9± 0.1	1.2±0.6	1± 0.0	3.8±0.3	0.8± 0.1	12.3± 0.89	15.4± 0.95
	M	2.9 ± 0.2	1 ± 0.6	0.5 ± 0.1	2.5± 0.3	0.8± 0.2	1.2±0.2	1± 0.0	2.2±0.6	1± 0.0	10.2± 0.99	13.1± 0.88
16	F	3.3 ± o.1	1.6± 0.46	1 ± 0.0	3.1± 0.5	1± 0.0	1.8±0.19	1± 0.0	4± 0.5	1± 0.0	14.5± 0.68	17.8± 0.79
	M	3 ± 0.36	1.5 ± 0.6	1 ± 0.0	2.7± 0.38	1± 0.0	1.6±0.41	1± 0.0	2.5± 0.3	1± 0.0	12.3± 0.65	15.3± 0.54
24 (continuous light)	F	3.4 ± 0.22	2.1± 0.22	1 ± 0.0	3.3± 0.22	1± 0.0	2.2±0.3	1± 0.0	4.2± 0.7	1± 0.0	15.8± 0.95	19.2± 0.63
	M	3.2 ± 0.25	2 ± 0.5	1 ± 0.0	3.2± 0.23	1± 0.0	2.1±0.29	1± 0.0	2.7± 0.3	1± 0.0	14± 0.81	17.2± 0.52

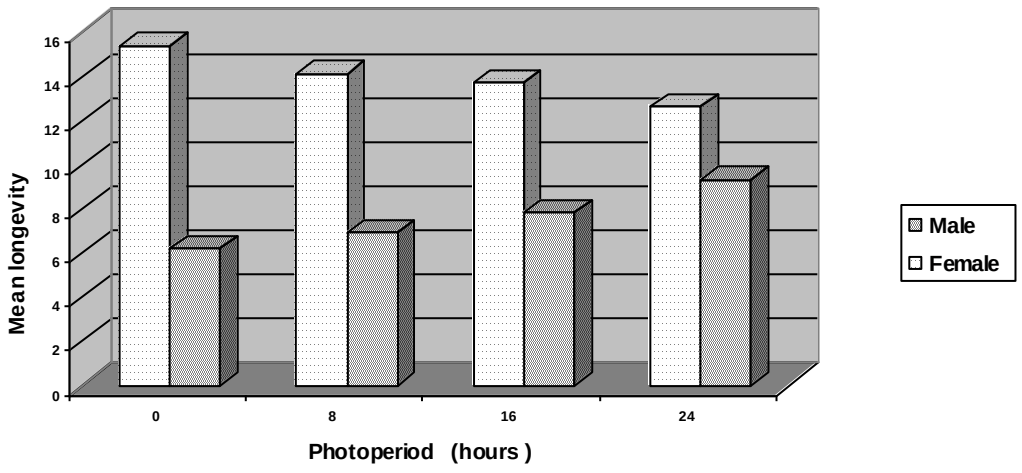
* Photoperiod expressed as hours of light per day .
** F=Female. M= Male.
*** A= Active period.
Q= Quiescence period.

Table(2): Duration in days (Mean±SD) of oviposition phases, longevity, generation and life span of *Carpoglyphus lactis* L. fed on wheat at four different photoperiods under 25±2ºC and 65±5%RH.

Photoperiod*	Sex**	Parameters					
		Pre-oviposition	Oviposition	Post-oviposition	Longevity	Life span	Generation
0 (darkness)	F	2.3 ± 0.51	12.1± 0.9	1 ± 0.0	15.4 ± 0.81	28.1± 0.97	15 ± 0.9
	M				6.2 ± 0.93	17.1± 0.75	
8	F	2.7 ± 0.45	10.2 ± 0.96	1.2 ± 0.9	14.1± 0.78	29.5± 0.92	18.1 ± 0.45
	M				6.9 ± 0.91	20.5± 0.56	
16	F	3.1 ± 0.73	8.3 ± 0.93	2.3 ± 0.7	13.7 ± 0.66	31.5± 0.77	20.9 ± 0.33
	M				7.8 ± 0.88	23.1± 0.98	
24 (continuous light)	F	3.5 ± 0.42	5.5 ± 0.8	3.6 ± 0.5	12.6 ± 0.83	31.8± 0.95	22.7 ± 0.61
	M				9.3 ± 0.72	26.5± 0.32	

* Photoperiod expressed as hours of light per day .
* * F=Female. M= Male.

Fig.(1): Mean longevity duration of *Carpoglyphus lactis* L. at different photoperiods



Table(3): Fecundity of *Carpoglyphus lactis* L. fed on wheat at four different photoperiods under 25±2ºC and 65± 5% RH. (Mean±SD)

Photoperiod*	mean of oviposition period (days)	Number of deposited eggs	
		Total average	Daily mean
0 (Darkness)	12.1 ± 0.9	55.9 ± 6.2	4.6 ± 0.32
8	10.2 ± 0.96	37.2 ± 3.1	3.6 ± 0.48
16	8.3 ± 0.93	12.7 ± 1.2	1.5 ± 0.55
24 (continuous light)	5.5 ± 0.8	5.3 ± 0.8	0.9 ± 0.21

* Photoperiod expressed as hours of light per day .

Discussion

The present work revealed that the tested photoperiods had no effect on the incubation period of *Carpoglyphus lactis* . However, it prolonged the time needed for the development of immature stages. There was a negative relation between the adult female longevity and the tested photoperiods. In addition, life span and female generation were highly affected. Similar results were obtained by El-Banhawy (1976) and El-Wahab (1992). They reported a negative effect of light on the immature stages of *Amblyseius brazilli, A. swirskii* and *Sancassina berlesei* (Ond) whereas no effect was detected on the incubation period.

Maeda *et al.* (2000) found that the oviposition rate of *Tetranychus urtica* did not differ throughout the day. This report disagrees with the present results which revealed a significant reduction in the deposited eggs at 24 h. of continuous light.

Pegler and wall (2004) in their studies on astigmatid mite found that the movement of this mite is strongly directed away from higher light intensity. However, Causer and shorter (2004) reported that the exposure to light is not an important determinant of house-dust mite behavior.

The present study provided information on the effect of photoperiod on the biological parameters of *Carpoglyphus lactis* L. which will be useful in planning control strategies for the stored-product mite in the future.

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تأثير فترة الإضاءة علي تطور وخصوبة حلم *Carpoglyphus lactis* L.

وفاء لبيب فكري ابراهيم.
قسم علم الحيوان – كلية العلوم (بنات) – جامعة الازهر.

تضمنت هذه الدراسة اختبار تأثير فترات إضاءة مختلفة (0, 8, 16و24ساعة إضاءة في اليوم) علي مراحل التطور وخصوبة حلم ***Carpoglyphus lactis* L.** عند درجة حرارة 25± 2º م ورطوبة نسبية 65± 5 % .

وقد أوضحت النتائج عدم حدوث تأثير ملحوظ بالنسبة لفترة حضانة البيض, حيث كانت 2.9و 3.4 يوما للأنثي , 2.7و 3.2 للذكر تحت الاظلام التام والاضاءة الكاملة علي التوالي. كما لوحظ وجود علاقة موجبة بين فترات الاضاءة والاطوار الغير كاملة, فكلما زادت مدة الاضاءة زادت فترة الاطوار الغير كاملة في كل من الذكر والأنثي. وبالنسبة لمدة طول العمر فقد زادت مع زيادة فترة الاضاءة في الذكر و نقصت بزيادة مدة الاضاءة في حالة الانثي.

لوحظ وجود علاقة سلبية بين مدة وضع البيض وفترات الاضاءة المختلفة, فقد زادت المدة في فترة الاظلام التام ونقصت في حالة الاضاءة الكاملة , كما أن المتوسط الكلي والمتوسط اليومي لعدد البيض زاد في فترة الاظلام ونقص في فترة الاضاءة الكاملة.