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EFFECT OF DIFFERENT CONSTANT TEMPERATURE AND PHOTOPERIODS ON SOME BIOLOGICAL ASPECTS OF *Chrysoperla carnea* (STEPHENS) (NEUROPTERA: CHRYSOPIDAE) REARED ON COWPEA APHID, *Aphis craccivora* KOCH

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ABSTRACT

Two experiments were carried out to evaluate the effect of three constant temperatures (20, 25 and 30°C) and the influence of three photoperiods (14/10, 12/12 and 10/14 h. L/D) on the larval, pupal duration period and predation capacity of *Chrysoperla carnea* reared on *Aphis carccivora.*

In the 1st experiment the obtained results showed that increasing of temperature resulted in decreasing in both larval and pupal durations period and reducing in the total numbers of consumed preys (*A. carccivora*).

Results obtained in the 2nd experiment proved that the long larval duration was at long photoperiod 14/10 h. L/D). To the contrary, the highest numberd of consumed prey by *C. carneu* was achieved under short day (10/14 h. L/D).

INTRODUCTION

Green lacewing, *Chrysoperla carnea* (Stephens) is one of the most beneficial and prolific predator, (Family Chrysopidae, Order Neuroptera), also known as aphid lion. It is found in different agricultural habitats with high relative frequency of occurrence. Larvae feed on several hurmful agricultural insect pests, however, it prey on thrips, aphids and eggs of *Spodoptera littoralis*, (Awadallah *et al.*, 1975) while adults feed only on nectar, pollen and honey dew. Chrysopids show high resistance towards many widely used pesticides (Bigler, 1984). The predator efficiency as a biocontrol agent is affected by diet and prevailing weather factors such as temperature (Canard and Principi, 1984; Venzon and Carvalho, 1993) and is influenced by also, photoperiods. Therefore, the objective of the current investigation was to study the effect of constant temperatures, photoperiods and diet (aphid species as a prey) on some biological aspects of *C. carnea* individuals which known mass rearing, which can be utilized during field release of this chrysopid for the management of aphid population.

MATERIALS AND METHODS

Lacewings *Chrysoperla carnea* eggs were obtained from Biological Control Laboratory El-Arnaouty, S.A., Faculty of Agric. Cairo Univ., Egypt. Two experiments were carried out, in the first one, larvae were reared at three different constant temperatures 20, 25 and 30°C. while in the second experiment, larvae were reared at three levels of phoptoperiods (light/dark hours, 10/14, 12/12 and 14/10) under constant temperature (25°C). Newly hatched larvae were used in the experiments. Duration of each larval instars, total larval period as well as the pupal period were recorded. Percentages of larval and pupal mortalities were also estimated. These experiments were carried out with the help of constant temperature rooms and photo boxes in the laboratory of El-Arnaouty, S.A., Faculty of Agric. Cairo Univ., Egypt.

To study the consumption capacity, newly hatched larvae of *C. carnea* were transferred with the help of soft and moist camel hair brush, singly, in 15 plastic jars (20x10 cm) having 90 prey aphids, *A. craccivora* covered by muslin kept in position by rubber bands. Jars were kept under laboratory conditions of at constant temperatures (20, 25 and 30^{o}C) and under three phoptoperiods light/Dark hours (10/14, 12/12 and 14/10) at 25^{o}C separately as per requirement. The consumed number of aphids was counted daily and recorded and the prey food *A. craccivora* of each plastic jars was changed daily, so that there was always plenty of food available, until the predator completed their larval development. The consumption capacity for each larval instars of *C. carnea* was recorded under the constant temperatures (20, 25 and 30^{o}C) and under the three phoptoperiods.

Each experiment was adequately replicated and data were evaluated statistically to determine the significant difference by using Duncan (1955) and by using proc. Anova in SAS (SAS Institute 1996).

RESULTS AND DISCUSSION

Effects of temperatures on larval and pupal duration periods of *C. carnea*:

As shown in Table (1) the mean total durations of the 1st larval instar of *C. carnea* at constant temperatures of 20, 25 and 30^{o}C were 4.09±0.3, 2.38±0.52 and 2.64±0.50 days; while they were 3.36±0.81, 2.88±0.35 and 2.0±0.0 days; in case of 2nd larval instar respectively. However, in 3rd larval instar durations were 7.36±0.67, 5.88±0.64 and 5.27±0.47 days the previously mentioned temperatures, respectively. The averages of the total duration of the larval stage at 20, 25 and 30^{o}C were 14.81±1.78, 11.14±1.51 and 9.91±0.97 days.

Table (1): Duration period (days) of larval and pupal stages of *Crysoperla carnea* fed on *Aphis craccivora* at different constant temperatures.

Constant Temp.	Larval stage				Pupal stage	Total
	1st instar	2nd instar	3rd instar	Larval duration		
20	4.09±0.30a	3.36±0.81a	7.36±0.67a	14.81±1.78a	10.73±3.74a	25.54±7.30a
25	2.38±0.52 b	2.88±0.35b	5.88±0.64b	11.14±1.51b	8.81±3.23a	19.95±4.74b
30	2.64±0.50 b	2.0±0.0 c	5.27±0.47c	9.91±0.97c	4.82±3.10b	14.73±4.07c
$LSD_{0.05}$	0.367	0.433	0.493	2.815	2.796	2.820

Means followed by the same latter between rows are not significantly different (Duncan, 1955).

For the pupal stage, durations were at temperatures of 20, 25 and 30°C respectively, 10.73±3.74, 8.81±3.23 and 4.82±3.10 days when the previous larvae were fed on *A. craccivora* (Table 1).

Statistical analysis of obtained data and revealed that, the duration of larval instars decreased significantly with the increase in temperatures. The duration of larval stage varied from 14.81±1.78 days at 20°C to 9.91±0.97 days at 30°C. There was a considerable reduction in the total development period of the larvae with the increase in temperature.

The duration of pupal stage decreased as temperature increased and lasted 10.73±3.74, 8.81±3.23 and 4.82±3.10 days at 20, 25 and 30°C respectively. In general increasing in temperature resulted in decreasing in the duration of both larval and pupal stages. The results generally are in agreement with the finding of Patro and Behera (2002), Jagadish *et al.*, (2004), Pooja Khulbe *et al.,* (2005) Lohar *et al*., (2005), Sirimachan *et al.,* (2005) and Kuldeep Sharma *et al.,* (2008).

Effect of temperature on feeding capacity of *C. carnea* larvae:

Data in Table (2) showed that the total consumptions by each of three larval instars of *C. carnea* fed on *A. craccivora* at three different constant temperatures; 20, 25 and 30C. The 1st instar larva consumed 33.55±2.25, 12.88±5.14 and 18.27±5.33 aphids individuals; the 2nd preyed on 78.09±29.94, 40.50±16.82 and 25.0.9±2.47 victims, and the 3rd larval instar consumed 472.27±77.13, 291.63±26.21 and 212.55±45.51 aphids at 20, 25 and 30°C respectively.

Throughout the total larval stage, the mean of total count of consumed aphids by *C. carnea* larva at different constant temperatures at 20, 25 and 30°C was 583.91±101.07, 345.0±30.80 and 256.27±52.08 nymphs when each larval instar was fed on *A. craccivora* at different constant temperatures at 20, 25 and 30°C respectively.

Table (2): Mean number of aphids individuals (*A. craccivora*) consumed by the three larval instars of *C. carnea* at different constant temperatures.

Constant Temp. (°C)	Larval instars			Total
	1st instar	2nd instar	3rd instar	
20	33.55±2.25a	78.09±29.94a	472.27±77.13a	588.91±101.07a
25	12.88±5.14c	40.50±16.82b	291.63±26.21b	345.0±30.80b
30	18.27±5.33b	25.09±2.47b	212.55±45.51c	256.27±52.08c
$LSD_{0.05}$	3.625	16.679	46.61	58.719

Means followed by the same latter between rows are not significantly different (Duncan, 1955).

From data in Table (2) could be stated that, the total consumption of aphids by the larvae of *C. carnea* decreased with increase of the temperature. It is cleared that the 3rd instar larvae of *C. carnea* fed on the highest numbers of aphids compared to other instars. At 20°C the 1st instar larva fed on 33.55±2.25 aphids the 2nd instar fed on 78.09±29.94 aphids and the 3rd larval instar consumed 472.27±77.13 aphids. While the lowest mean number of consumed aphids were recorded at 30°C, this difference is mathematically highly significant. It is obvious that predaceous capacity increases from the first to last instars at different temperatures (Table 2). Similar results were reported by Yuksel and Gocmen (1992), Fonseca *et al.,* (2001), Patro and Behera (2002), Sirimachan *et al.,* (2005) Renu-Yadav and Pathak (2010).

Effects of photoperiods on larval and pupal duration periods of *C. carnea*:

As shown in Table (3) the mean durations of the 1st larval instar under three photoperiods (light/Dark hours, 10/14, 12/12 and 14/10) were 1.38±0.52, 1.80±0.63 and 2.79±0.43; they were 2.0±0.0, 2.50±0.71 and 2.64±1.01; in the 2nd instar while they were 6.38±1.92, 6.25±2.01 and 4.86±0.66 days in case of the 3rd one respectively. The averages of the total duration of the larval stage under the three photoperiods were 9.76±2.44, 9.83±3.35 and 10.29±2.10 days, respectively.

Different photoperiods also affected the pupal duration of *C. carnea* as shown in Table (3). Pupal durations were 9.69±0.26, 7.52±2.63 and 8.75±2.56 days under the three photoperiods, respectively.

Table (3): Duration (days) of larval and pupal stages of *Crysoperla carnea* feeding on *Aphis craccivora* at three different photoperiods.

Photo-periods (L/D)	Larval instars					Total
	1st instar	2nd instar	3rd instar	Larval duration	Pupal duration	
10/14	1.38±0.52 c	2.00±0.0b	6.38±1.92a	9.76±2.44c	9.69±0.26a	19.44±1.66b
12/12	1.80±0.63 b	2.50±0.71 c	6.25±2.01a	9.83±3.35b	7.52±2.63b	18.07±0.93c
14/10	2.79±0.43a	2.64±1.01a	4.86±6.66b	10.29±2.10a	8.75±5.56ab	19.04±2.89a
$LSD_{0.05}$	0.343	0.515	1.015	-	1.497	-

Means followed by the same latter between rows are not significantly different (Duncan, 1955).

Statistical analysis showed that photoperiods had significant effect on the durations of the first, second and third instars. Consequently, the total larval duration was significantly affected. The shortest larval duration of 9.76±2.44 days recorded for larvae reared under short day (10/14), while the longest durations (10.29±2.01 days) occurred under long (14/10 h. L/D). However, photoperiod seems to have no profound effect on the pupal duration since no significant difference was detected between means of larvae pupal duration under different experimental light regimes.

Same type of result was also reported by El-Khawas (1989), Fonseca *et al.,* (2001) and Figueira *et al.,* (2002).

Effect of photoperiods on feeding capacity of *C. carnea* larvae:

Data in Table (4) showed that the total consumptions by each of three instars of *C.carnea* on *A. craccivora* at three photoperiods light/Dark hours (10/14, 12/12 and 14/10). The 1st instar larva fed on 8.75±4.62, 11.80±4.69 and 16.5±4.03 aphids; the 2nd on 23.50±3.07, 29.70±15.90 and the 3rd larval instar on 281.88±165.84, 266.14±129.28 and 226.57±51.57 aphids at the three photoperiods light/Dark hours (10/14, 12/12 and 14/10) respectively.

Throughout the total larval stage, the mean of total consumed preys by *C. carnea* larvae at the three photoperiods light/Dark hours (10/14, 12/12 and 14/10) were 314.13±124.53, 307.64±129.19 and 275.43±72.05 individuals, respectively.

Table (4): Mean number of aphids (*A. craccivora*) consumed by the three larval instars of *C. carnea* at different three photoperiods.

Photoperiods (L/D)	Larval instars			Total
	1st instar	2nd instar	3rd instar	
10/14	8.75±4.62c	23.50±3.07	281.88±165.84	314.13±124.53
12/12	11.80±4.69b	29.70±15.90	266.14±129.28	307.64±129.19
14/10	16.5±4.03a	32.36±28.30	226.57±51.57	275.43±72.05
$LSD_{0.05}$	2.893	-	-	-

Means followed by the same latter between rows are not significantly different (Duncan, 1955).

Through the present data, it appears that the number of aphids consumed by different larval instars of *C. carnea* progressively increases throughout the larval period and the largest amount of consumed aphids was persistently reported for the third larval instar under different photoperiod conditions. The results are in agreement with those previously reported by El-Khawas (1989), Fonseca *et al.,* (2001), Sirimachan *et al.,* (2005) and Gao Feng *et al.,* (2007).

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تأثير كل من درجات الحرارة والاضاءة الثابتتين على بعض النواحى البيولوجية لأسد المنّ المربى على منّ البقوليات

عبدالحكم عبداللطيف الصعيدى ، إبراهيم لبيب إبراهيم ، سعيد عبدالعليم حماد و سيد شحاته عبدالفتاح
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تم إجراء تجربتين منفصلتين لتقدير تأثير ثلاث درجات حرارة ثابته ومختلفة (٢٠، ٢٥، ٣٠°م) وتأثير ثلاث فترات إضاءه مختلفة أيضاً (١٤/١٠ ساعه ، ١٢/١٢ ساعه، ١٠/١٤ ساعه إضاءه/ إظلام) على كل من طول مدة الطور اليرقى وعلى طول مدة طور العذراء والكفاءه الافتراسية للمفترس الحشرى أسد المنّ.

أوضحت نتائج التجربة الأولى أن زيادة درجة الحرارة تؤدى إلى قصر مدة الطور اليرقى وكذلك طور العذراء كما أدت أيضاً إلى إنخفاض فى أعداد حشرة المنّ المستهلكة.

بينما دلت نتائج التجربة الثانية على أن زيادة فترة الاضاءه قد أدت إلى زياده فى طول مدة الطور اليرقى (١٠/١٤ ساعه إضاءه/إظلام) وعلى العكس فإن أكبر الأعداد المستهلكة من المنّ كانت تحت ظروف اليوم القصير (١٤/١٠ ساعة إضاءه/إظلام).

قام بتحكيم البحث

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