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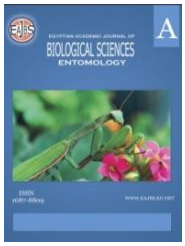

Biological Characteristics of *Chrysoperla carnea* Steph. Fed on Two Prey Hosts Under Laboratory Conditions.

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ABSTRACT

Biological characteristics of the predator *Chrysoperla carnea*, aphid lion were studied in the laboratory at a temperature of. 25±1°C, 70±5% relative humidity, and 16:8 h of daily light / dark periods. two different preys were tested as hosts for *C. carnea* larvae. The predator larvae were fed on newly emerged larvae of pink bollworm, *Pectinophera gossypiella,* and adult members of *Aphis craccivora,* Cowpea aphid (2-3 days old),

The results showed that the duration of larval and pupal period of predator was observed differences which recorded 8.46± 0.82 and 6.92± 0.86 days, respectively, when the predator larvae fed on PBW larvae, while recorded 8.25± 0.96 and 6± 0.15 days, respectively, when the predator larvae fed on adult aphids. The larval survival percentage was 88.1% and 90.2% respectively, while the emergence of the adult was 87.4% and 94.7% respectively, Data showed the incubation period of eggs was similar in two treatments, the duration of *C. carnea* females had higher than the duration of males. The percent of egg hatchability recorded a higher value 95.87% when the predator larvae fed on adult aphids and recorded 91.51% when its fed on PBW larvae.

INTRODUCTION

Natural enemies (predators and parasites) play a very important part in controlling pest populations. *Chrysoperla carnea* Steph., (Order / Neuroptera: Family Chrysopidae), aphid lion, green lacewing,. The adults feed on nectar, pollen, and aphid honeydew and are not predatory, but the larvae are active polyphagous predators, commonly found in agricultural systems. It has been recorded as an effective generalist predator of aphids, coccids, mites, and mealybugs, etc. (Singh and Manoj, 2000; Zaki and Gesraha, 2001). It has been widely used for aphid bio-control and other insect pests because of its ubiquitous nature, polyphagous habits, and compatibility with selected chemical insecticides, microbial agents, and amenability to mass rearing (Uddin *et al*., 2005). It is one of the important natural enemies in suppressing several pests especially soft-bodied insects and Lepidoptera pests (Anon., 1992).

In most cotton-producing countries, *Pectinophora gossypiella* Saunders (Lepidoptera: Gelechiidae), commonly known as the pink bollworm, PBW is considered one of the major cotton pests, larvae burrow into cotton bolls to feed on the cotton seeds. In the process, they

destroy the cotton lint. This feeding damage allows other insects and fungi to enter the boll and cause additional damage (Fernandes, 1988). According to (Ingram 1994), pink bollworm is found in tropical and subtropical regions and causes considerable economic losses, and huge quantities of insecticides or transgenic traits adoption are required in order to control the pest around the world. For a long time, pesticide application was the effective control method of this pest. Many problems have been encountered as a result of the extensive use of synthetic pesticides. Increasing problems concerning the application of such pesticides include pest resistance, residue contamination of human foods, mammalian toxicity, and pollution of the environment.

Aphis craccivora Kock Cowpea aphid (Order / Homoptera: Family Aphididae) or plant lice, is one of the hundreds of different species of aphids. The aphids are small soft-bodied insects, some attack only one host plant species while others attack several species. Aphids cause direct damage by sucking sap and indirect ones by virus transmission and excreting honeydew that favors the proliferation of leaf stomata obstructing fungi (Capnodium spp) (Kitajima *et al*., 2008, Fernandes *et al*., 2013, Malaquias *et al*., 2014). *Aphis craccivora* initially infests cowpea seedlings, but as this plant develops, it may infest flowers and pods (Berberet *et al.* 2009). Its feeding causes leaf shriveling and bud deformation and as the population increases, plant infested becomes weakened due to loss of sap and toxins injected (Silva *et al*., 2005). *Aphis craccivora* is an efficient virus vector, transmitting Cowpea aphidborne mosaic virus (CABMV) (Kitajima *et al.,* 2008), and Blackeye mosaic virus (BICpMV) (Lima *et al.*, 1981).

The aim of the present study was to evaluate two different prey species (*Pectinophora gossypiella* and *Aphis craccivora*) as food for in terms of survival and development under laboratory conditions to determine the potential of this predator. Consequently, the second objective of this study was to evaluate the prey preference. Such information would be helpful for optimizing the mass rearing of *C. carnea*.

MATERIALS AND METHODS

Origin and Maintenance of Insect Culture:

A- The Predator, *Chrysoperla carnea* (Stephens):

The predator was initially collected from the cotton field and reared on Angoumois grain moth, *Sitotroga cerealella* (Olivier) at the same mentioned laboratory conditions. The adults of *C. carnea* were sexed and 10 pairs of adults were placed in plastic boxes (22x13x10 cm) covered with black muslin for deposited eggs and changed daily. Drops of Semi artificial diet solution consist of 2g yeast extract, 1g fructose, and 1cm distilled water were provided on tape stacked on the muslin cover. The deposited eggs were collected daily and kept in glass jars until hatching. The hatched larvae were reared on *S. cerealella* eggs. (Hassan and Ezz 2009).

B- The Insect Pests:

The mass rearing of the PBW larvae occurred on the kidney bean diet that previously described by (Abdel-Hafez *et al.*, 1982), Such an artificial diet consists of 215 gm. dried kidney beans boiled in water, 32 gm. dried active yeast, 3 gm. ascorbic acid, 1.5 gm. methyl-p-hydroxy benzoate, 1.5 gm. sorbic acid and 12 gm. agar, to which 150 ml. water was added. The kidney bean diet was placed in glass tubes (2 x 7.5 cm.) at the rate of 4 gm diet/ tube then about 7 neonate larvae were placed into each tube using a fine hairbrush and capped by cotton wool. All tubes were kept at 27±1°C and 80±5 % R.H. As the larvae completed their development (about 14 days) the full-grown larvae found their way to the cotton wool to pupate. The newly emerged adult moths were sexed and kept in a glass chimney. To avoid the stress effects of crowding, the male and female moths were distributed at the rate of 10-

males: 15-females/ chimney. The upper and lower surface of each chimney was covered with muslin secured by rubber bands. Moths were fed on sucrose solution by providing each cage with soaked cotton wool. The moths normally deposit eggs mostly on the upper muslin cover and lightly on the lower surface. The eggs were incubated in clean glass jars and placed in an incubator at the same conditions suitable for rearing the larvae. The newly hatched larvae were transferred to the kidney bean diet as described above.

A. craccivora adult feed on bean plants (*Vicia faba*) by sucking plant juices. Seeds of beans were planted in rearing pots. When the plants grew above the soil (7 days), the artificial infestation was achieved by transferring heavily infested leaves to the new plants. Aphids were transferred weekly from old to young plants. The colony was maintained under laboratory conditions. Rearing was carried out in a wooden box with two sides were made up of wire netting and the upper part was made up of glass, (Atif A. El- Banna *et al.*, 2003),

The original colony of the predator and its prey were supplied from the Plant Protection Research Institute, Agriculture Research Centre. Mass rearing was carried out in the laboratory of the Economic Entomology Unit, Plant Protection Department, Desert Research Center**.**

The Comparison of Biological Changes of the Predator *Chrysoperla carnea* When Hosted on Two Different Preys:

Fresh aphid lion eggs are less than 24 hours old were collected and divided into two groups, after hatching put in Petri dish (9 cm in diameter), 25 petri dishes for each containing one larvae, For each group, The Petri dishes were placed in incubators set at a temperature of. 25±1°C, 70±5% relative humidity, and 16:8 h of daily light / dark periods. two different preys were tested were submitted to *C. carnea* larvae. (newly emerged larvae of pink bollworm, *pectinophera gossypiella* and adults members of *Aphis craccivora,* Cowpea aphid 2-3 days old),. offer them the appropriate amount of food. Given that the prey numbers were Introduced to predator larvae must be more than the predator larva need. Daily inspections were conducted. After pupation, a newly emerged pair of *Chrysoperla carnea* adults (male and female) was kept with an appropriate quantity of Semi artificial diet solutions, that were renewed every day (Baoying *et al*., 2001), and the biological aspects of the predator were recorded.

Biological aspects investigated:

The following biological aspects were assessed for survived larvae:

- The incubation period of eggs.
- Duration of larval stage.
- Duration of the pupal stage.
- percent of hatchability of the resulted females were calculated according to (Zidan *et al.,* 1998) as follows:

% Hatchability = [No. of hatched eggs / No. of deposited eggs] x 100

Standard deviation was calculated according to Bliss and Stevens (1937).

RESULTS AND DISCUSSION

As shown in Table (1), The data on larval duration of 1st instar *C. carnea* larvae on a different host are recorded 1.97± 0.68 days when the predator larvae fed on pink bollworm larvae, whereas it recorded 2.5± 0.85 days when the predator larvae fed on adult aphids, According to the reported data, duration of 2nd and 3rd instar larvae of *C. carnea* recorded 3.39± 0.50 and 3.10± 0. 64 days, 2.75± 0.50 and 3± 0.82 days respectively, for the two prey species with total larval corresponding periods (8.46± 0.82, and 8.25 ± 0.96 days) for each prey species. Results of the study were in conformity with (Balakrisna *et al*., 2005 and

Mangrule 2002) showing the effectiveness of *Corcyra* eggs in increasing the larval duration of the *Crysoperla carnea* as a laboratory host. The statistical analysis revealed that there was a significant difference between the mean total number of consumed *P. gossypiella* larvae and *Aphis craccivora* adults. Findings of (Syed *et al*., 2005) indicated that *C. carnea* consumed more *Bemisia tabaci* (200.5 nymphs) as compared to *Amrasca devastans* (171.8 nymphs).On the other hand, The duration of the pupal period of predator was observed differences from 6.92± 0.86 when the predator larvae hosted on pink bollworm larvae and 6 ± 0.15 in case the predator larvae hosted on adult aphids. our result was similar ones (Ulhaq *et al.,* 2006), which reported that the larvae and pupae duration on a semi-artificial diet was (12.29± 0.81, 8.14± 0.14). The data recorded showed the percent of adult emergence was 87.4% and 94.7% respectively.

Liu and Chen 2001 determined 94.4±3.3% adult emerged feeding on different aphid species. El-Serafi, H. A. K *et al.*, 2013 showed 100% adult emergence from the total larva survived of *C. carnea* reared on wheat aphid. Data presented in Table (1) showed the duration of *C. carnea* females had higher than the duration of males, the longevity of the adult male showed in case of treatment involving *P. gossypiella* larvae 25.40± 0.43 days while adult females showed 27.80± 0.17 days. Treatment with adult aphids showed male longevity of the *C. carnea* was 32.40± 85 days whereas female longevity was 36.80± 0.15 days. Saminathan *et al*., 1999 and Bansod and Sarode 2000 studied biology and feeding potential of C. *carnea* on different hosts and noted developmental period of *C. carnea* ranged from 18.6 days on *Aphis cracivora* to 22.7 days on *H. armigera* neonate larvae. On feeding upon mixed hosts, it was studied that the male development period was (20 days) and that of female was (31.25 days) (Giles *et al*. 2000) studied nutritional interactions among alfalfa, Medicago sativa and faba bean, *Vicia faba*, as host plants, pea aphid, *Acyrthosipnon pisum* an herbivore and *C. carnea* a predator. It was shortest when larvae were fed *A. gossypii* followed by *M. persicae* and *Lipaphis erysimi*.

Table 1: The effect of the type of prey consumed on the biological characteristics of *chrysoperla. carnea.*

Average predator duration in days		Newly emerged larvae of Pink bollworm	Adults members of Cowpea aphid
1st larval stage		1.97± 0.68	2.5± 0.85
2nd larval stage		3.39± 0.50	2.75± 0.50
3rd larval stage		3.10± 0. 64	3± 0.82
total larval period		8.46± 0.82	8.25 ± 0.96
% larval survival		88.1%	90.2%
total pupal period		6.92± 0.86	6 ± 0.15
% of adult emergence		87.4%	94.7%
adult longevity	male	25.40± 0.43	32.40± 85
	female	27.80± 0.17	36.80± 0.15

The results showed in Table (2), the incubation period of *C. carnea* eggs was similar when the larvae fed on newly emerged larvae of pink bollworm, or fed on adults members of Cowpea aphid and that recorded 4± 0.07 days, (Uddin, J. *et al.,* 2005) noticed that the incubation period of *C. carnea* eggs was 4 days only when predator larvae fed on *M. rotundata* pupae in the laboratory condition. (Qadeer 2012) indicated that the duration of the egg stage was 4.0± 0.00 days at 26± 1 °C.

The average number of deposited eggs/female recorded about 364± 6.4 eggs when the *chrysoperla carnea* larvae fed on pink bollworm larvae, whereas recorded 368.5± 6.7 eggs

when the predator larvae fed on adult aphids, On the other hand, the average number of hatched eggs registered 333.1± 6.4 eggs and 353.3± 7.8 eggs, respectively, The percent of egg hatchability recorded a higher value 95.87% when the predator larvae fed on adult aphids and recorded 91.51% when its fed on PBW larvae. (Liu and Chen, 2001, Ballal and Singh 1999 and Bartlett 1984) studied the host plant-mediated orientational and ovipositional behavior of three species of chrysopids and found that C. *carnea* females had a higher preference for sunflower and cotton, while pigeonpea was less preferred. On cotton, *C. carnea* preferred to lay more eggs on the underside of leaves than on buds. These results are agreement with (Abd-El-Aziz 1991) indicated that the total mean number of eggs laid *C. carnea* was 442.0± 4.85 eggs at a daily rate of 18.42 eggs/ female. (Saleh *et al*. 2017) when fed on *A. gossypii* the fecundity of *C. carnea* was 361 ± 21.88 eggs/ female.

Table 2: Daily deposited and hatched eggs of *C. carnea* females when its larvae were fed on different preys under laboratory conditions.

Prey species	Newly emerged larvae of Pink bollworm	Adults members of Cowpea aphid
incubation period of eggs	4.00± 0.07	4.00± 0.07
average No. of deposited eggs/female	364 ± 6.4	368.5 ± 6.7
average No. of hatched eggs	333.1 ± 6.4	353.3 ± 7.8
% of hatchability	91.51	95.87

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ARABIC SUMMARY

الاختلافات البيولوجيه للمفترس أسد المن عند تغذيته على نوعين من الفرائس تحت ظروف المعمل

ايمان ابراهيم امام
مركز بحوث الصحراء – وحدة الحشرات الاقتصادية

درست الصفات الحياتية للمفترس أسد المن (*Chrysoperla carnea*) تحت ظروف المعمل عند د جة حرارة ٢٥ ±١° س ورطوبة نسبية ±70 ٥٪ واضاءة ١٦ ساعة/اليوم. تم اختبار نوعين من الفرائس، حيث غذيت يرقات المفترس على يرقات دودة اللوز القرنفلية حديثة الفقس (*Pectinophera gossypiella*) وعلى افراد بالغه عمر ٢-٣ أيام من حشرة المن (*Aphis craccivora*).

اوضحت النتائج ان طول فترة العمر اليرقي وطول فترة التعذر فقد اختلف بفروق معنوية بين نوعين التغذيه فقد بلغ متوسط الفترة في التغذيه على يرقات دودة اللوز القرنفلية ٨,٤٦ ±٠,٨٢ و٦,٩٢ ±٠,٨٦ يوما علي التوالي بينما كانت في التغذيه علي افراد المن البالغه ٨,٢٥ ±٠,٩٦ و٦ ±٠,١٥ يوما علي التوالي. وبنسبة بقاء لليرقات ٨٨,١% و٩٠,٢% علي التوالي، وبلغت نسبة خروج الأفراد البالغة ٨٧,٤% و ٩٤,٧% على التوالي. وأظهرت النتائج أن طول فترة حضانة بيض المفترس كان متساوياً في الحالتين وان طول مدة عمر الإناث للمفترس اطول من مدة عمر الذكور. وسجلت النسبة المئوية لفقس البيض أعلى قيمة ٩٥,٨٧ ٪ عندما تتغذى يرقات المفترس على حشرة المن ، وتسجيل ٩١,٥١ ٪ عندما تتغذى على يرقات ديدان اللوز القرنفليه.