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EFFICACY OF PISTACHIO PSYLLA NYMPHS *Agonoscena targionii* LICHT.(HOMPTERA : PSYLLIDAE) ON THE DEVELOPMENT OF *Chrysoperla carnea* (STEPH.) (NEUROPTERA : CHRYSOPIDAE) UNDER LABORATORY CONDITIONS.

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ABSTRACT

This study was carried out under laboratory conditions at 25±2°C and 65±5% R. H. *Chrysoperla carnea* (Steph.) larvae in the experiments was fed on pistachio psylla nymphs (*Agonoscena pistaciae* Licht.) and Mediterranean moth eggs (*Ephestia kuehniella* Zeller; Lepi.: Pyralidae). Results showed that the incubation period was equal in all treatments, without significant differences. Significant differences were found among tow treatments in larvae development period. It was 13.69±0.49 and 10.89±0.18 days when fed on pistachio psylla nymphs and *E. kuehniella* eggs respectively. The results indicated significant differences in the predator`s pupae development period. It was 7.90±0.23 and 8.28±0.11 days, respectively. Total development period from egg to adult showed significant differences among tow treatments, it lasted 26.10±0.43 and 24.17±0.15 days, respectively. Fecundity of *C. carnea* females was differ dependence on prey type. It was 151.97±12.24 eggs, when the predator larvae were fed on pistachio psylla nymphs, while it was higher (194.40±12.43 eggs) with a significant difference when the larvae were fed on *E. kuehniella* eggs.

Keywords: *Chrysoperla carnea, Ephestia kuehniella, Agonoscena targionii*, biology.

INTRODUCTION

Pistachio psylla *Agonoscena targionii* Licht. is one of the most important pests of pistachio orchards in Syria [Lababidi 1996]. This pest that is known as jumping psylla has 1.2 to 1.7 mm length and 5 nymphal instars. The nymphs and adults sucking plant sap immediately after opening the pistachio buds and causes interruption of forming the Kernels [Burckhardt and Lauterer, 1993]. There are difference natural enemies for this pest which control its population such as green lacewing *Chrysoperla carnea* (Steph.), which is cosmopolitan species [Chesson, 1984]. This species have received much attention from researchers as well as farmers as a potential biological pest control agent [Gautam and Tesfay, 2002]. *C. carnea* is a cosmopolitan polyphagous predator, commonly found in agricultural systems. It has been recorded as an effective generalist predator of aphids, coccids, mites and mealy bugs etc. [Zaki and Gesraha, 2001; Duelli, 2001]. The main factors

may affect the feeding and function of a predator as a biological control agent are edacity, functional response, numerical response, host preference and ability of a predator to hunt its prey and environmental conditions [Messina and Sorenon, 2000]. It has been widely used for aphid bio-control [Venkatesan *et al*., 2000and 2002) and other insect pests because of its ubiquitous nature, polyphagous habits, and compatibility with selected chemical insecticides, microbial agents and amenability to mass rearing [Ashfaq *et al*., 2002; Uddin *et al*., 2005; Syed *et al*., 2008]. It has been mass-reared and marketed commercially in North America and Europe [Liu and Chen, 2001; Balasubramani and Swamiappan, 1994 and Tauber *et al*., 2000] for population management of many insect pests [Sengonca *et al*., 1995; Daane *et al*., 1996; Legaspi *et al*., 1996 and Atakan, 2000]. The biology of *C. carnea* was studied on *Aphis gossypii* (Glover) and *Myzus persicae* (Sulzer) (Mannan *et al*., 1997), and on eggs of *Corcyra cephalonica* (Stainton), *Earias vitella* (Fabricius) and *Helicoverpa armigera* (Hubner), Neonate larvae of *E. vitella* , *H. armigera* and *A. gossypii* collected from cotton , okra and guava and *Aphis carccivora* (Coch.) collected from cowpea and groundnut (Saminathan *et al*., 1999), and on *Corcyra cephalonica* (Stainton) eggs (Geethalakshmi *et al*., 2000), and on *A. gossypii* ; *M. persicae* and *Lipaphis erysimi* (Kaltenbach) (Liu and Chen, 2001), and on pistachio psylla nymphs (*A. pistaciae*) [Jloud *et al*., 2013].

The aim of this study was to determine biological characteristics of *C. carnea* on pistachio psylla nymphs (*A. targionii*) comparing with alternative host (*Ephstia kuehniella* Zeller) under laboratory conditions.

MATERIALS AND METHODS

The experiments was conducted at the Hama Center for Rearing Natural Enemies (HCRNE), Hama, Syria. Experiments were designed in Randomized Complete Block Design (RCBD) with five replications each having five *C. carnea* larvae.

Prey and predator insects:

Pistachio psylla insects used in the experiments were obtained from pistachio orchards. Then nymphs reared on pistachio seedling which planted in Hama Center for Rearing Natural Enemies greenhouses. Colony of *C. carnea* was established using adults that collected from pistachio orchards. Before the experiments about 5-7 generations of *C. carnea* were reared in the laboratory. Adult insects were kept in glass jars (8 x 20 cm). Jars were covered with black cloth screen and fed on artificial diet consisted of yeast, honey and water 1:1:1 ratio. Eggs deposited on the walls of rearing jars and the cloth screens were daily removed by soft hair brush. Eggs of *E. kuehniella* were obtained from laboratory mass rearing then the eggs were killed by freezing at 2º for 20 days.

Biology of *C. carnea*:

All biological parameters including incubation period, larval and pupal stages, sexual percentage, longevity of male and female and fecundity per female with percent fertility were recorded when reared on both tow preys. To

study the percent hatchability, eggs were harvested with razor and separated along with black muslin cloth, counted and kept for hatching. *C. carnea* larval instars were studied one by one, whereas the separating action between three larval instaers was metamorphosis. *C. carnea* Adults were sorted by insects size and sexual organs in the last of insect body. Two days old virgin adults were paired in the rearing glass jars (8 x 20 cm), provided with standardized adult's diet on hard paper card and wet cotton was placed in glass vials in jars. Also the adult male and female longevity were recorded. To evaluated fecundity per female, total number of eggs laid by each female during their oviposition period was recorded.

Analyzes: Each experiment was adequately replicated and data analyzed by the Least Significant Difference (LSD) analysis. Data recorded was analyzed by a computer software SPSS.

RESULTS

Incubation period:

The results in Table I showed that the incubation period of *C. carnea* was equal when reared on different hosts, it was 5 days in tow treatments.

Larval stage:

The results indicated that larval stage of *C. carnea* when fed on tow preys nymphs of *A. targionii* or eggs of *E. kuehniella* was significantly different (P= 0.006). Duration of 1st larval instar was 3±0.00 and 3±0.00 days, while duration of 2nd larval instar was recorded as 3.04±0.24 and 2.94±0.17 days and that of 3rd larval instar was 7.69±0.43 and 4.94±0.13 days, on pistachio psylla nymphs and eggs of *E. kuehniella*,respectively. The complete larval developmental period was 13.69±0.49 and 10.89±0.18 days on pistachio psylla nymphs and *E. kuehniella* eggs, respectively. (Table 1).

Pupal stage:

As shown in (Table 1) pupal stage of *C. carnea* was significantly different on tow preys (P=0.027), it was 7.90 and 8.28 days on pistachio psylla nymphs and eggs of *E. kuehniella*, respectively.

Adult longevity:

There was significant in adult male longevity (P<0.001) and non-significant in adult female longevity (P=0.906) when fed on testing preys. The adult longevity for male lasted on average of 22.33 and 63.25 days while for male lasted an average of 62.67±4.67 and 63.57±2.78 days on pistachio psylla nymphs and eggs of *E. kuehniella*, respectively. (Table 1).

fecundity and fertility:

When *C. carnea* larvae Fed on tow testing preys, significant effect observed on adult female fecundity (t.probability= 0.026), the number of deposited eggs/female was the lowest on pistachio psylla nymphs with an average of 151.97±12.24 eggs/female. Meanwhile ,the numbers of deposited eggs was the highest on *E. kuehniella* eggs reaching an average of 194.40±12.43 eggs/female. While significant effect not observed on eggs fertility, it was 56.72% and 61.67% on tow preys ,respectively. (Table 1).

Rate of delay deposited eggs:

The relationship between fecundity and female longevity of *C. carnea* is presented in (Fig. 1). The number of eggs laid by the females increased up to a certain period and thereafter it decreased. Maximum number of eggs laid was in the 6th day of females age, whereas 12.46 and 14.25 eggs/female/day. Then eggs laid decreased gradually with increasing of females age until females death. Fecundity of females when *C. carnea* larvae fed on pistachio psylla nymphs and eggs of *E. kuehniella* was 70% and 76% respectively, from total female fecundity through the first 30th days of their live. The relationship between rate of delay deposited eggs (Y) and females age per day (X) recorded as:

Y= -0.060X + 4.316 (when fed on pistachio psylla nymphs)

Y= -0.095X + 6.169 (when fed on *E. kuehniella* eggs)

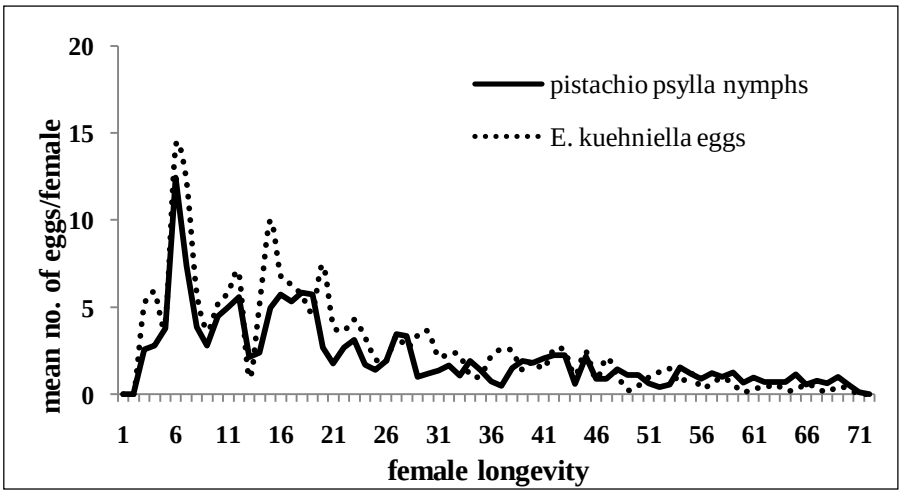
Sexual percentage:

The results showed that no significant differences in adults sex on pistachio psylla nymphs and eggs of *E. kuehniella*. Sexual percentage of *C. carnea* adults was 50.57% and 50.42% on tow preys ,respectively.

Table 1: Effect of feeding of *C. carnea* on different hosts on the developmental parameters under laboratory conditions (Mean±S.E.).

Developmental parameters	pistachio psylla nymphs	eggs of *E. kuehniella*
Incubation period (days)	5.00±0.00	5.00±0.00
1st larval instar (days)	3±0.00	3±0.00
2nd larval instar (days)	3.04±0.24	2.94±0.17
3rd larval instar (days)	7.69±0.43a	4.94±0.13b
Larval stage (days)	13.69±0.49a	10.89±0.18b
Pupal stage (days)	7.90±0.23a	8.28±0.11b
From eggs to adult (days)	26.10±0.43a	24.17±0.15b
Male longevity (days)	22.33±4.01a	63.25±2.59b
female longevity (days)	62.67±4.67	63.57±2.78
Fecundity/ female	151.97±12.24a	194.40±12.43b
Fertility (%)	56.72	61.57

Figures followed by same letter with in a row are not significantly different from each other at 5% DMRT.



(Fig. 1): Daily deposited eggs of the females of *C. carnea* when its larvae were fed on pistachio psylla nymphs and eggs of *E. kuehniella* under laboratory conditions.

DISSCUSION

Pistachio psylla *A. targionii* . is one of the most important pests of pistachio orchards. All of *C. carnea* larval instars had ability to predation pistachio psylla nymphs and complete its natural development on its. In this study larval food significantly affected the length of larval stage. The shorter larval stage was recorded on *E. kuehniella* eggs recording 10.89 days than on pistachio psylla nymphs that was 13.69 days. Balasubramani and Swamiappan (1994) studied development of *C. carnea* on different hosts in laboratory and found that larval development was rapid on eggs of *Corcyra cephalonica* (8.20 days) and longest on neonates of *H. armigera* (11.10 days). Mannan *et al.*, (1997) studied biology of *C. carnea* on *A. gossypii* and *M. persicae* and observed that larval duration was long when fed on *M. Persicae*. Saminathan *et al*. (1999) and Bansod and Sarode (2000) studied biology and feeding potential of *C. carnea* on different hosts and noted that developmental period of *C. carnea* ranged from 18.6 days on *Aphis cracivora* to 22.7 days on *H. armigera* neonate larvae. 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. *C. carnea* larvae developed faster on pea aphid reared on alfalfa than on pea aphid raised on faba bean.

In present study, significantly differences appeared in pupal period of *C. carnea* that was 7.90 and 8.28 days, respectively on pistachio psylla nymphs and eggs of *E. kuehniella*. Ulhaq *et al*. (2006) found that mean pupal period was 6.33±0.40, 7.11±0.34 and 7.22±0.38 days when adults were fed on diet containing egg yolk, mixed egg and egg white respectively, as

compared to standard diet where pupal period was 6.97±0.34 days. The shorter pupal period of *C. carnea* in the due to the rich nutritive value of egg yolk (Norioka *et al.*, 1984), which promoted the quick growth, and complateion of pupal period. Mannan *et al.*, (1997), Cohen and Smith, (1998), Sarode and Sonakar, (1998), Saminathan *et al.*, (1999) and Choi *et al.*, (2000) have also reported the same results when larvae and adults of *C. carnea* were fed on different types of diets. The studies showed that different adult diets have significant effects on the longevity of the both male and female *C. carnea*. McEwen and Kidd (1995) reported that adult life of *C. carnea* is affected directly by the adult diet and found that the adults receiving only sugar as adult diet lived longer than those receiving sugar and yeast (yeast was added to the adult diet for more eggs production). Ulhaq *et al*. (2006) found that adults who were fed on diet containing egg yolk lived significantly longer compared to the adults that were fed on egg white, mixed egg and Standard diet, The adult diet containing egg yolk in addition to milk and honey used in this experiment prolonged adult life probably because of good nutritive value, as egg yolk contains plenty of essential and non-essential amino acids, carbohydrates, oils, vitamins, and minerals. Adult nutrition is a very important factor for egg production and longevity in the case of insects (Morales *et al.*, 1996). Sarwar *et al*. (2011) indicated that larval and pupal durations of the predator *C. carnea* were significantly affected due to feeding upon different hosts and the total developmental period was significantly shorter when the predator was offered with aphids as host. The fecundity, fertility pupation, hatchability and longevity of the predator were also higher on aphids followed by pink and spotted bollworms, and Angoumois grain moth eggs. However, sex ratios were not affected due to the feeding upon different hosts.

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تـأثير التغذيـة علـى حوريـات بسـيلا الفسـتق الحلبـي فـي تطـور المفتـرس أسـد المـن ضمن الظروف المخبرية

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نفذت هذه الدراسة ضمن ظروف حرارة 25±2ºس ورطوبـة 65±5%, وغذيت يرقات المفتـرس أسـد المـن فيهـا علـى حوريـات بسـيلا الفسـتق الحلبـي (*Agonoscena pistaciae* Licht.) وعلـى بيض فراشـة طحين البحر المتوسط (*Ephestia kuehniella* Zellerdae). أظهرت النتائج تساوي فترة حضانة بيض المفترس في جميع المعاملات. ظهرت هناك فروق معنوية في فترة تطـور اليرقـات بـين كـلا المعـاملتين, وكانـت 13.69±0.49 و 10.89±0.18 يومـاً علـى الترتيب. ومن خلال النتائج أيضاً وجد هناك اختلاف معنوي في فترة تطور العذارى للمفترس وبلغت 7.90±0.23 و8.28±0.11 يومـاً علـى الترتيـب. اختلفت فتـرة التطـور مـن البيضـة حتـى الطـور البالغ معنوياً بين المعاملتين وكانـت 26.10±0.43 و 24.17±0.15 يومـاً علـى الترتيـب. اختلفت خصـوبة إنـاث المفتـرس أسـد المـن تبعـاً لنـوع الفريسـة, حيـث بلغـت 151.97±12.24 بيضـة عنـد التغذية على حوريات بسيلا الفستق الحلبي بينما كانت الخصوبة الأعلى (194.40±12.43 بيضة) عند التغذية على بيض فراشة الطحين.

الكلمات المفتاحية: أسد المن, فراشة طحين البحر المتوسط, بسيلا الفستق الحلبي, حياتية.

قام بتحكيم البحث

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