FEEDING RESPONSE OF *Chrysoperla carnea* (Steph.) LARVAE TO PISTACHIO PSYLLA NYMPHS

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ABSTRACT

This study was carried out under laboratory conditions at 25±2°C and 65±5% R. H.. The *Chrysoperla carnea* (Steph.)larvae in that experiments was fed on pistachio psylla nymphs (*Agonoscena pistaciae* Licht.) and compared with Mediterranean moth eggs (*Ephestia kuehniella* Zeller; Lepidoptera: Pyralidae) as standard host. The results showed with significant difference, a mean predatism of predator larvae of two hosts were tested was 561.44±37.82 and 433.78±26.51 respectively. The greatest predation efficiency of *C. carnea* larvae was on pistachio psylla nymphs then on *E. kuehniella* eggs.

keywords: *Chrysoperla carnea* (Steph.)*, Ephestia kuehniella* zeller*, Agonoscena targionii* Licht*,* Predation Efficiency, biology.

INTRODUCTION

Pistachio psylla is one of the most important and dangerous pests on the pistachio tree (Burckhardt and Lauterer, 1993), because of the difficulty of controlling on it, and pesticide damages on environment and on the population of the beneficial insects, besides the developing of new generations that resist the most used insecticides.

There are several natural enemies for this pest which control its population such as green lacewing (*Chrysoperla carnea* Stephens). This species because of having desired character has been more attracted as a natural biological control agent (Hassan, 1978). *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. (Singh and Manoj, 2000; Zaki and Gesraha, 2001; Duelli, 2001; Carrillo *et al.*, 2004). 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*., 2000, 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 for population management of many insect pests (Liu and Chen, 2001; Balasubramani and Swamiappan, 1994; Tauber *et al*., 2000).

At low densities, polyphagous predators may eat common prey such aphids, lepidopteran eggs and larvae, but when prey and predator densities increase, the predators may also show negative actions such as cannibalism (Burgio *et al*., 2005). When beneficial insects are released as bio-control agents into agro-ecosystems and habitats such as protected crops, it is important to evaluate the possible interactions between polyphagous predators. Inoculative or augmentative releases and the side effects of introducing exotic generalist predators are other issues that require accurate analyses (van Lenteren *et al*., 2003).

This study was conducted to determine feeding potential of *C. carnea* larvae on pistachio psylla nymphs (*A. targionii* Licht.) comparing with alternative host (*E. kuehniella* Zeller) in laboratory conditions.

MATERIALS AND METHODS

- **Prey and predator insects:** Pistachio psylla and *C. carnea* insects were obtained from pistachio orchards. Adult of *C. carnea* were kept in glass jars (8 x 20 cm), that covered with black cloth screen and fed on artificial diet: 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* Zeller were obtained from laboratory mass rearing then the eggs were killed by freezing at 2º for 20 days.
- **Predation Efficiency of *C. carnea*:** Newly hatched larvae (< 24 h) of *C. carnea* were used in the experiments. To avoid cannibalism, newly hatched larvae was kept singly in glass Petri dish. Predation efficiency of the predator was tested by providing pistachio psylla in 4^{th} nymphal instar which we identified the most preferred stage of psylla in previous experiments, and this result agree with (Hadji Mohammad, 2008) who founds that there positive preference for 4^{th} nymphal instars by *C. carnea* larvae, and *E. kuehniella* eggs for each larvae. larvae were transferred to the new glass Petri dish contains new number of preys with the help of soft and moist camel hair brush and kept for 24 h. To calculate amount of preys that fed on theire by predator's larvae, the consumed number of preys was counted after every day until the predators completed its larval development.
- **Analyzes**: Experiments were designed in Randomized Complete Block Design (RCBD) with five replications each having five *C. carnea* larvae. Data analyzed by the Least Significant Difference (LSD) analysis. Data recorded was analyzed by a computer software SPSS.

RESULTS AND DISCUSSION

Foods consumption for 1st larval instar of *C. carnea*:

The results showed that the mean number of preys which consumed by 1st larval instar of *C. carnea* was less compared with 2nd and 3rd larval instars when predator fed on three testing preys. Obtained results in (Fig. 1) indicated to significantly differences (P< 0.001) existence between preys number which consumed by 1st larval instar of *C. carnea*. maximum number of preys consumed by predator larvae was on pistachio psylla nymphs comparing with *E. kuehniella* eggs.

Foods consumption for 2nd larval instar of *C. carnea*:

The results showed that the mean of preys number which consumed by 2nd larval instar of *C. carnea* was equal between tow preys, (Fig. 1).

Foods consumption for 3rd larval instar of *C. carnea*:

Obtained results in (Fig. 1) indicated increasing in preys number consumed by 3rd larval instar of *C. carnea* was significantly highly than 1st and 2nd larval instars. The 3rd larval instar predation rate was (81.11, 79.89, 79.06) when fed on tow testing preys, respectively.

Same type of results was also reported by (Hadji Mohammad, 2008) that 80% of total preys was consumed by 3rd larval instar. Quantity of preys that consumed by *C. carnea* larvae depends up on prey species size and on stage offered for feeding. The increasing of predation rate because increasing of size and age of larvae and its food requirements.

The results showed that number of tow testing preys which consumed by 3rd larval instar was significantly different (P< 0.05). Maximum number of preys consumed by 3rd larval instar was on pistachio psylla nymphs (455.39±39.15), and minimum number on *E. kuehniella* eggs (342.94±24.21).

Foods consumption for *C. carnea* larvae:

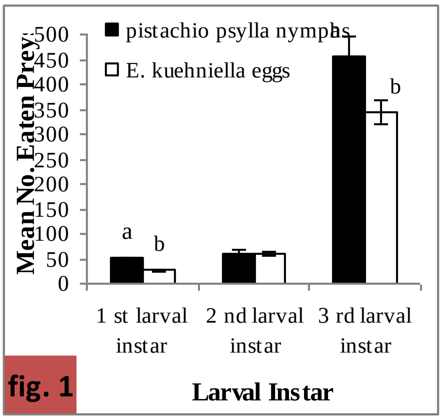
The consumption increases from the first to last larval instars at different preys (Fig. 1). It's apparent that on average 7-10% food was consumed by the 1st larval instar, 10-15% by the 2nd larval instar and 79-81% food was consumed by the 3rd larval instar. The results showed that preys number which consumed by 3rd larval instar of *C. carnea* was significantly different (P=0.001) from each other. Maximum number of preys consumed by 3rd larval instar was on pistachio psylla nymphs (561.44±37.82), minimum number was on eggs of *E. kuehniella* (433.78±26.51), (Fig. 1).

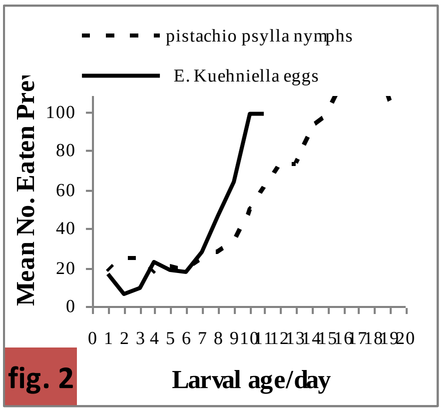
Mean of daily consumption of *C. carnea* larvae:

In (Fig. 2), there is a significant difference between the daily consumption of *C. carnea* larvae on different preys, depend on larval instar. Mean of different preys consumption in first day was 17.92 and 16.46 on pistachio psylla nymphs and *E. kuehniella* eggs, respectively. Then the consumption gradually increasing until its maximum value, which was 125.67 on pistachio psylla nymphs in 18th day of *C. carnea* larvae age, while it was 98.89 on *E. kuehniella* eggs in 10th day of larvae age. It is obvious from the (Fig. 2) that consumption was decreasing in several points of daily consumption diagram because of stopping larvae of feeding before metamorphosis process. Relationship between larvae age "X" and number of daily consumption preys "Y" formulated as:

Y= 6.587X - 7.102 (when fed on pistachio psylla nymphs)

Y= 9.085X -15.70 (when fed on *E. kuehniella* eggs)





(Fig. 1): Number of preys fed by *C. carnea* larvae under laboratory conditions.

(Fig. 2): Mean of daily consumption of *C. carnea* larvae on different preys under laboratory conditions.

Pistachio psylla *A. targionii* Licht. 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. The results showed that the mean of preys number which consumed by 1st and 2nd larval instars of *C. carnea* was less compared with 3rd larval instar when predator fed on pistachio psylla nymphs and eggs of *E. kuehniella*. Whereas the consumption preys average by 1st and 2nd larval instars was about 20% from total larval consumption, while 3rd larval instar consumed in average 80% from total larval consumption that was 561.44 and 433.78 preys respectively, from pistachio psylla nymphs and eggs of *E. kuehniella*. Whereas 1st larval instar consumed 51.00 and 26.88 while that of 2nd instar was 60.52 and 58.57 and that 3rd instar was 455.39 and 342.94 preys respectively, from tow testing preys. This result agreements whith (Jaafari et al., 2003) who found that the most predatism of *C. carnea* insect is at the 3rd larval stage. Laboratory rearing for *C. carnea* larvae can be successfully on eggs of *E. kuehniella*, The 3rd larval instar consumption of *C. carnea* about 80% of total sum from consumed preys, this founded by (Hadji Mohammad, 2008). Our result help us to defined successfully release time for *C. carnea* larvae which was in last of 2nd larval instar to saving of food and execution the maximum consumption rate in field. Mean of daily consumption of *C. carnea* larvae calculated for three tested preys, and this help us to evaluate preys quantity that we need to *C. carnea* mass rearing.

Food consumption varied in *C. carnea* depending upon the host species. *C. carnea* larvae are voracious predators of *A. gossypii*, *H. virescens*, *H. zea*, *H. armigera*, *P. gossypiella*, and *Leptinotarsa decemlineata* (Rafiq, 1974; Balasubramani and Swamiappan, 1994) and other soft body insects. *C. carnea* larvae killed a mean total of 567.3 eggs of *Tetranychus urticae*, consuming 7.5 in first, 20.9 in second and 71.6% in third instar (Sengonca and Coeppicus, 1985). Sengonca and Grooterhorst (1985) studied feeding activity of *C. carnea* on eggs of *Barathra brassicae* and *S. littoralis* and found that during larval development a single larvae consumed 426.2 eggs of *B. brassicae* and 982.9 eggs of *S. littoralis*. *C. carnea* larva consumed on an average 377 and 641 egg of *O. nubilalis* and *A. ipsilon*, respectively and 2056 of *A. ipsilon* neonates during larval development (Obrycki *et al*., 1989). Balasubramani and Swamiappan (1994) worked on feeding potential of *C. carnea* on insect pests of cotton under laboratory conditions, during development each larvae of *C. carnea* consumed an average 732.3, 662.5 eggs of *C. cephalonica* and *H. armigera*, respectively, 419.2 *A. gossypii*, 409.6 neonates of *H. armigera*, 329.7 nymphs of *B. tabacci* and 288.5 nymphs of *A. biguttula*. *C. carnea* preyed on a mean of total of 312 eggs and 232 larvae of *M. brassicae* during larval development. Comparatively, less consumption of cotton bollworms eggs by the predator may be attributed to the size of the eggs as the eggs of cotton bollworms are larger than the Angoumois grain moth eggs (Sarwar *et al*., 2011).

Based on the studies, *E. kuehniella* eggs appeared to be the most promising host for mass rearing of the predator. Additionally, successful predation on the pistachio psylla nymphs evidenced the potential of *C. carnea* for the management of pistachio psylla in the field which is an instrumental for biological pest control strategy.

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الاستجابة الغذائية ليرقات المفترس أسد المن تجاه حوريات بسيلا الفستق الحلبي

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تم إجراء هذا البحث ضمن الظروف المخبرية (حرارة 25±2°س ورطوبة 65±5%), وغذيت يرقات المفترس أسد المن فيها على حوريات بسيلا الفستق الحلبي (*Agonoscena pistaciae* Licht.) ومقارنتها مع التغذية على العائل البديل بيض فراشة طحين البحر المتوسط (*Ephestia kuehniella* Zeller). بينت النتائج المتحصل عليها وجود فروق معنوية في معدل الافتراس ليرقات المفترس أسد المن من الفرائس المختبرة حيث بلغ معدل الافتراس لليرقة الواحدة من حوريات البسيلا وبيض فراشة الطحين 561.44±37.82 و433.78±26.51 على الترتيب. وكانت الكفاءة الافتراسية الأعلى ليرقة المفترس أسد المن عند التغذية على حوريات بسيلا الفستق الحلبي.

الكلمات المفتاحية: أسد المن, فراشة طحين البحر المتوسط, بسيلا الفستق الحلبي, الكفاءة الافتراسية, الحياتية.

قام بتحكيم البحث

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