

Biological Attributes of *Chrysoperla Carnea* (Stephens) (Neuroptera-Chrysopidae) as a Natural Enemy of the Green Peach Aphid as Preys Reared on different Leguminous Host Plants

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ABSTRACT

The present experiments was carried out in both experimental farm and laboratory of Plant Protection Research Institute, Sakha, Kafr El-Sheikh governorate for study the impact of *Myzus persicae*(Sulzer) which educated on different host plants on biological attributes of *Chrysoperla carnea* (Stephens) influence of the green peach aphid, *M. persicae* as a prey. There was no significant different in the incubation periods for *C.carnea* when the predator fed on *M. persicae* preys reared on different host plants (faba bean, kidney bean and cowpea). The shortest developmental time of the three larval instars for *C.carnea* recorded on *M. persicae* which reared on faba bean were 3.3, 4.6 and 4.9 days, respectively. Meanwhile, the longest developmental time of the three larval instars for *C.carnea* recorded on *M. persicae* which reared on Cowpea were 4.0, 5.4 and 5.7days, respectively. The total developmental time of immature stages was 23.1, 25.4and 26.3 days on the three tested host plants with significant differences. Male Longevity was 26.09, 21. 63 and 20.18 days with significant differences among *C.carnea* which fed on *M. persicae* was reared on the three leguminous plants. Fecundity of females was 109.20, 97.42 and 94.42 eggs/ female with significant differences among *C.carnea* which fed on *M. persicae* was reared on the three leguminous plants.

Keywords: *Chrysoperla carnea*, biological attributes, *Myzus persicae*, leguminous plants

INTRODUCTION

Insect predators are of the major groups of biological control agents used for aphid control. Family Coccinellidae and Chrysopidae these feed on the larval and adult stages on several insect pests such as aphids, white flies, jassids and mites (Shalabyet al., 2008).*Chrysoperla carnea* (Stephens) is one of the important insect predators use against many insect pests especially against soft body adult and immature insect pests such as leafhopper, aphids, mealy bug, and thrips. (Gautam and Tesfaye 2002). *Chrysoperla carnea* is widely spread throughout agricultural systems. It has been observed as an effective generalist predator of aphids, whit flay and mealy bugs.(Singh and Manoj, 2000; Zaki and Gesraha, 2001). *Chrysoperla carnea* is a major predator of some white fly, aphid and thrips. It has been successfully used for aphid in many crops (Venkatesan et al., 2000 and Saleh et al. 2017). The wide spread of this predator may be due to ease of breeding on polyphagous habits, and agree with microbial agents and IPM programs (Obryckiet al., 1989; Uddin et al., 2005).

Therefore,the objective of this study was to assess some biological properties of *Chrysoperla carnea* as a natural enemy of the green peach aphid, *Myzus persicae* breeding on several leguminous host plants.

MATERIALS AND METHODS

1. Rearing of immature stages:

Adults of *Chrysoperla carnae* were collected from faba bean, *vicia faba* L. in farm of Sakha Agriculture Research Station, Kafr El-Sheikh governrate and reared on the first larvae instar of *Myzus persicae*. The egg of *C. carnae* were collected daily, observed until hatching and newly hatched larvae . To avoid were transferred to petri dishes (9 cm in diameter) under laboratory conditions (23±3.2°c and 60± 5.0% R.H.). Twenty larvae from the predator were fed on *Myzus persicae* (faba bean, kidney bean and cowpea). Each larva was considered a replicate. The developmental time and rate (1/ developmental time)

(Omar, 2004) of larval stages, survival from eggs to adult and sex ratio were recorded.

Rearing of adult stage:

When larvae became full grown, 10 females and males of the predators booked in plastic containers (5 liters)blocked with a piece of cloth that was fastened with a rubber band and supplied with food and water on a daily.The nutritional medium consisted of sugar, yeast and distilled water in percentage (4: 7: 10), respectively. The longevity of females was divided to three periods according to (Phoofolo and Obrycki, 1995 andLanzoniet al. (2004). The pre-oviposition period was measured as the number of days from female eclosion to initiation of egg laying, while inter-oviposition one as the number of days between two successive oviposition occurred. The fecundity of female, fecundity rate (number of progeny produced per female per day) and the longevity of males recorded.

Statistical analysis:-

The analysis of Duncan's Multiple Range Tests (DMRT) in all experiments were used the`spss statistics 16.0`program.

RESULTS AND DISCUSSION

Results arranged in Table (1) show influence of,*M.persicae* breeding on different host plants on the immature stages of the green lacewing, *C.carnea* under laboratory conditions(23±3.2°c and 60 ± 5.0% R.H.).These results revealed that, there was no significant different in the incubation periods for *C.carnea* when the predator fed on *M. persicae* preys reared on different host plants (faba bean, kidney bean and cowpea). The developmental time of the three larval instars when *C.carnea* fed on *M. persicae* was reared on faba bean were3.3. 4.6 and 4.9 days, respectively. While,the developmental time of the three larval instars when *C.carnea* fed on *M. persicae* was reared on kidney bean were 5.3, 5.2 and 5.6days, respectively. Meanwhile, the longest developmental time of the three larval instars for *C.carnea* recorded on *M.persicae* which reared on Cowpea and represented by 4.0, 5.4 and 5.7days, respectively. The pupal stage

averaged 6.3, 6.3 and 7.0 days when *C. carnea* fed on *M. persicae* was reared on three host plants (faba bean- kidney bean- cowpea) with significant differences. The total developmental time of first stages was 23.1, 25.4 and 26.3 days on the three tested host plants with significant differences. This results agreement with (Giles et al., 2000 and Liu and Chen 2001) who observed that *C. carnea* predator larvae growth and developed is faster when breeding on pea aphid than breeding on faba bean.

Table 1. Influence of, *M. persicae* breeding on different host plants on the immature stages of the green lacewing *C. carnea* under laboratory conditions (23±3.2°C and 60± 5.0% R.H.).

| Biological aspects | leguminous plants | | | |
|-----------------------|------------------------|---------------|--------------|--------------|
| | faba bean | Kidney bean | Cowpea | |
| Incubation period | 4.0 ± 0.2 a | 4.4 ± 0.2 a | 4.2 ± 0.2 a | |
| Larval stage | 1 st instar | 3.3 ± 0.1 b | 3.5 ± 0.1 b | 4.0 ± 0.2 a |
| | 2 nd instar | 4.6 ± 0.1 b | 5.2 ± 0.3 a | 5.4 ± 0.1 a |
| | 3 rd instar | 4.9 ± 0.2 a | 5.6 ± 0.2 a | 5.7 ± 0.2 a |
| | Total | 12.8 ± 0.5 b | 14.3 ± 0.6 a | 15.1 ± 0.5 a |
| Pupal stage | 6.3 ± 0.2 b | 6.7 ± 0.1 ab | 7.0 ± 0.3 a | |
| Total immature stages | 23.1 ± 0.5 b | 25.4 ± 0.5 ab | 26.3 ± 0.5 a | |

There are no significant differences between the means with the same letters in the same row, according to Dauncan's Multiple Rang Test at 0.05 probability level.

Data in Table (2) indicated the influence of *M. persicae* which breeding on different host plants on the survival percentages of the green lacewing *C. carnea* under laboratory conditions (23±3.2°C and 60± 5.0% R.H.). It can be noticed that the survival percentages of larval stage were the highest (98.2%) when *C. carnea* fed on *M. persicae* which reared on faba bean followed by kidney bean (96.0%) and the lowest survival percentages were recorded when *C. carnea* fed on *M. persicae* which reared on Cowpea and represented by (90.9%). On the other hand, the survival percentages of pupal stage were the highest (96.5%) when *C. carnea* fed on *M. persicae* which reared on faba bean followed by kidney bean (94.7%) and the lowest survival percentages were recorded when *C. carnea* fed on *M. persicae* which reared on Cowpea and represented by (91.0%).

Table 2. Influence of, *M. persicae* as preys breeding on different host plants on the survival percentages of the green lacewing *C. carnea* under laboratory conditions (23±3.2°C and 60± 5.0% R.H.).

| Biological aspects | leguminous plants | | | |
|--------------------|------------------------|-------------|--------|------|
| | Faba bean | Kidney bean | Cowpea | |
| Larval stage | 1 st instar | 96.1 | 95.5 | 85.1 |
| | 2 nd instar | 98.6 | 95.4 | 93.4 |
| | 3 rd instar | 100 | 97.3 | 94.3 |
| | Total | 98.2 | 96.0 | 90.9 |
| Pupal stage | 96.5 | 94.7 | 91.0 | |

Generally, these results indicated that the survival percentages of immature stages when *C. carnea* fed on *M. persicae* which reared on faba bean and kidney bean were higher than when *C. carnea* fed on *M. persicae* which reared on Cowpea. The obtained results agree with Liu and Chen (2001) who found that when breeding of *C. carnea* on aphid species such as, *A. gossypii*, *M. persicae* and *Lipaphis erysimi*. Observed the larvae of *C. carnea* were

breeding on *M. persicae* and *A. gossypii*, 87.6% and 94.4 indiv. developed to mature stage, respectively. Duration of development was short with significantly (19.8 d) when fed *A. gossypii* followed by *M. persicae* (22.8 d).

As shown in Table (3) Influence of *M. persicae* which breeding on different host plants on the adult longevity, ovipositional periods and fecundity of *C. carnea* under laboratory conditions (23±3.2°C and 60± 5.0% R.H.). It can be observed that, on *M. persicae* which reared on faba bean, pre-oviposition, oviposition, inter-oviposition and total longevity periods lasted 7.33, 6.08, 26.2 and 39.6 days, respectively. While, these periods lasted 6.75, 5.00, 23.66 and 35.42 days, respectively on *M. persicae* which reared on Kidney bean and 5.83, 4.92, 21.58 and 32.33 days on *M. persicae* which reared on cowpea, respectively. Male longevity was 26.09, 21.63 and 20.18 days with significant differences among *C. carnea* which fed on *M. persicae* which reared on the three leguminous plants.

As for the fecundity of females, the number of egg per female was 109.20, 97.42 and 94.42 eggs/ female with significant differences among *C. carnea* which fed on *M. persicae* which reared on the three leguminous plants. In addition, the fecundity rate was 4.16, 4.12 and 3.98 on *C. carnea* which fed on *M. persicae* which reared on the three tested leguminous plants. This results are agreement with Saleh et al. (2017) reported that the oviposition period reared on *A. gossypii* was 28.3 ± 2.23 days. As for the post-oviposition period, the shortest period (3.7 ± 1.05 days) was on *sitotroga cerealella* and the longest period (6.6 ± 2.3 days) was on *A. gossypii*. On the other hand, Sattar (2010) found that the pre-oviposition period on *C. carnea* of *A. gossypii* was 3.37 ± 0.18 days.

Table 3. Influence of *M. persicae* preys breeding on different host plants on the ovipositional periods, adult and fecundity of the green lacewing, *C. carnea* under laboratory conditions (23±3.2°C and 60± 5.0% R.H.).

| Parameters | leguminous plants | | | |
|-------------------|-------------------|----------------|----------------|----------------|
| | faba bean | Kidney bean | Cowpea | |
| Pre-oviposition | 7.33 ± 0.45 a | 6.75 ± 0.42 ab | 5.83 ± 0.55 b | |
| Oviposition | 6.08 ± 0.35 a | 5.00 ± 0.25 a | 4.92 ± 0.61 a | |
| Inter-oviposition | 26.20 ± 1.69 a | 23.66 ± 1.77 b | 21.58 ± 1.31 b | |
| Longevity | ♀ | 39.60 ± 1.59 a | 35.42 ± 1.27 b | 32.33 ± 1.16 b |
| | ♂ | 26.09 ± 1.30 a | 21.63 ± 0.76 b | 20.18 ± 0.92 b |
| Fecundity | 109.20 ± 3.26 a | 97.42 ± 2.08 b | 94.42 ± 1.54 b | |
| Fecundity rate | 4.16 ± 0.31 a | 4.12 ± 0.34 b | 3.98 ± 0.32 b | |

There are no significant differences between the means with the same letters in the same row, according to Dauncan's Multiple Rang Test at 0.05 probability level.

As shown Fig.(1) Simple linear regression between female age (independent variable X) and fecundity rate (dependent variable Y) of *C. carnea* fed on *M. persicae* which reared on faba bean yielded R² = 0.7547. The regression equation was derived: female fecundity rate (Y) = 6.1218 - 0.1432X female age (x). This equation indicated that there was a negative relationship between female age and female fecundity rate which means that fecundity rate gradually decreased as the age of female increased. Considering rearing *C. carnea* which fed on *M. persicae* which reared on kidney bean, the value of R² was 0.7238 and the regression equation was Y = 5.3783 -

0.0804X. This equation indicated that there was a negative relationship between female age and female fecundity rate. While, Simple linear regression between female age and fecundity rate of *C.carnea* fed on *M.persicae* which reared on Cowpea yielded $R^2= 0.4482$ and the regression equation was derived: female fecundity rate(Y) = 5.2433 -0.071X. This equation indicated that there was a negative relationship between female age and female fecundity rate. 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.

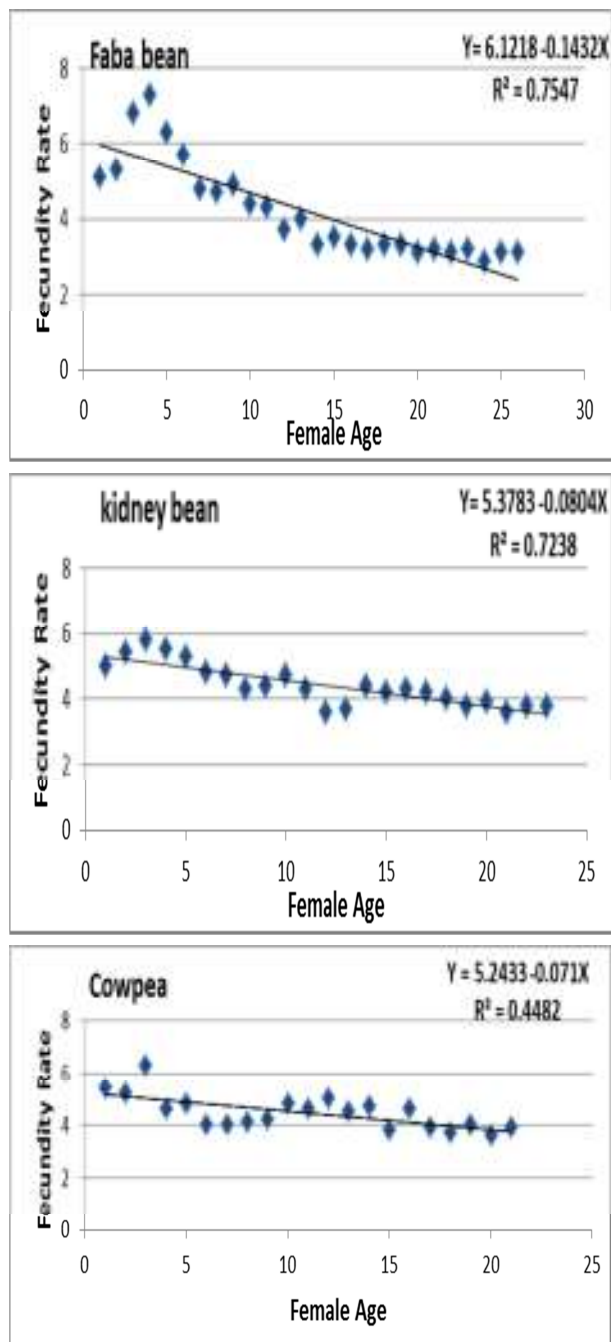


Fig. 1. Simple linear regression between female age (X) and fecundity rate (Y) of *C.carnea* fed on *M.persicae* which reared on host plants under Laboratory conditions ($23 \pm 3.2^\circ\text{C}$ and $60 \pm 5.0\%$ R.H.).

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الصفات البيولوجية لمفترس أسد المن كعدو طبيعي لحشرة من الخوخ الأخضر المرباه علي عوائل نباتية بقولية مختلفة.
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أجريت هذه التجارب في مختبر معهد بحوث وقاية النباتات بسخا محافظة كفر الشيخ بهدف دراسة الصفات البيولوجية لمفترس أسد المن الأخضر كعدو طبيعي لحشرة من الخوخ الأخضر. أوضحت النتائج عدم وجود إختلافات معنوية في فترات حضانة البيض عند تربية المفترس علي حشرة من الخوخ الأخضر التي تغذت علي العوائل البقولية الثلاثة وهي الفول البلدي، الفاصوليا، اللوبيا. أظهرت النتائج أيضا أن أقصر فترة نمو للأطوار اليرقية الثلاثة كانت لأسد المن الذي تربى علي نبات الفول البلدي وهي 3,3 ، 4,6 ، 4,9 يوما علي التوالي. وكانت فترة نمو الأطوار الغير كاملة 23,1 ، 25,4 ، 26,3 يوما علي العوائل النباتية الثلاثة المختبرة بفروق معنوية. وأشارت نتائج التحليل الأحصائي وجود إختلافات معنوية في فترة ما قبل وضع البيض وفترة وضع البيض ما بين وضع البيض periodinter-oviposition وكذلك فترة الحياة الكلية للفريسة علي العوائل النباتية الثلاثة المختبرة. وكانت فترة حياة الذكور 21,63 ، 20,18 ، 20,18 يوما مع وجود إختلافات معنوية علي العوائل الثلاثة. وكانت نسبة وضع البيض اليومي للإناث هي 109,20 ، 97,42 ، 94,42 بفروق معنوية لمفترس أسد المن بين العوائل الثلاثة.