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# CERTAIN ASPECTS ON REPRODUCTIVE POTENTIAL AND FEEDING CAPACITY OF TWO PREDATORS, *Coccinella undecimpunctata* L. AND *Chrysoperla carnea* (STEPH.)

BY

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## ABSTRACT

Studies were carried out in the laboratory of Vegetable Pests Department (PPRI), Dokki, Giza, during the period from July 2001, till July 2003 to evaluate three species of Aphids, *Aphis gossypii* Glover, *Aphis craccivora* Koch and *Myzus persicae* Sulzer for rearing the two predators *Coccinella undecimpunctata* L. (Coccinellidae : Coleoptera) and *Chrysoperla carnea* (Steph.) (Chrysopidae Neuroptera) under laboratory conditions 26±1°C and 65-70% R.H.

The results of these experiments assured *A. gossypii* was the bests for rearing by two predacious species, because the fecundity of two predacious was higher on this pest (596.3±34.3 and 212.1±14.5 eggs/ female of *C. undecimpunctata* and *Ch. carnea*, respectively) than the other pests tested, while the total consumption by the larval stage of the two previous predators was 795.4±6.8 and 791.0±8.6 aphid nymphs of *A. Gossypii*/larva, respectively, and the averages in number of deposited eggs per female of *C. undecimpunctata* and *Ch. carnea* were 11.5±0.7 and 6.4±0.6 eggs/day, respectively when reared on *A. gossypii*

## INTRODUCTION

*Coccinella undecimpunctata* L. and *Chrysoperla carnea* (Steph.) are the important predacious insects in Egypt (Hendawy 1999; Ghanim and El-Adl, 1988; Mohammed 1996 and Mousa, 1998). Many investigators indicated that *C. undecimpunctata* has highly feeding capacity and fecundity (Klingen *et al.*, 1996 and Ahmed, 2000). Larvae of *Ch. Carnea* are active and effective predator, attacking aphids (Kharaizanov and Dimitrov, 1972 & Kassem 2002).

The aim of this work is to study certain biological aspects of *C. undecimpunctata* and *Ch. carnea* reared on three aphid species.

## MATERIALS AND METHODS

Studies were carried out in the laboratory of Vegetable Pests Department at Plant Protection Research Institute, Dokki, Giza, during the period from July 2001, till July 2003 to study certain biological characters of *Coccinella*

*undecimpunctata* L. when reared on three aphid species, *Aphis gossypii* Glover, *Aphis craccivora* Koch and *Myzus persicae* Sulzer. Forty newly hatched larvae of this predator were put singly into glass tubes (4 X12 cm). A known number of aphid nymphs of *A. gossypii*, *A. craccivora* and *M. persicae* were introduced daily at 150 nymphs placed on a soybean plan leaf for feeding the larvae.

The soybean plant leaf was replaced daily in glass tube as food for the aphid nymphs. The numbers of devoured aphids were recorded. The rest of aphid nymphs and their parts were removed from each glass tube before introducing the new nymphs, the numbers of aphids (*A. gossypii*, *A. craccivora* and *M. persicae* nymphs) consumed per larva of *C. undecimpunctata* was recorded. The mean numbers of aphids (*A. gossypii*, *A. craccivora* and *M. persicae* nymphs) consumed by the predator larval instars were also counted.

After emergence, adults from the predator received the same prey, which was used for feeding the larval stage. The technique of rearing the adult stage was the same for rearing of the larval stage. After three days of emergence, copulation was done and then two sexes were separated and oviposition period was estimated. The total number of eggs laid per each predator female was estimated. The daily averages of food consumption during the longevity of male and female were calculated.

The technique of rearing the larval stage of *Ch. carnea* was the same as that used for rearing the larvae of *C. undecimpunctata.*

Just after adult emergence, numbers of females and males were confined into a glass chimney with a cage, placed on the bottom, of a Petri-dish provided with moistened filter paper for spreading humidity. A piece of cotton saturated with 10% sugar solution was put in the chimney glass as a food supply for adults; 3 days later, females and males were transferred singly into a chimney glass. The male was provided with sugar solution for nutrition. The female was introduced into a chimney glass with a black cap. The black ribbons were hanging to act as oviposition sites. Number of deposited eggs, pre-oviposition, oviposition and post-oviposition periods were recorded. Longevities of both sexes were also estimated.

Statistical analysis using computer program of Costat, a product of Cohort- Soft ware Inc., Berkeley, California, USA, was carried out.

## RESULTS AND DISCUSSION

*Coccinella undecimpunctata* and *Chrysoperla carnea* are of the important predators found during the course of this investigation. They attacked different insect pests infesting soybean plants.

The results in Table (1) show the larval duration and feeding capacity of *C. undecimpunctata* when fed on the three aphid species. It can be seen from this table that the duration of the larval stage lasted 12.1±0.1, 11.3±0.15 and 11.6±0.16 days as averages when fed on *A. gossypii*, *A. craccivora* and *M. persicae*, respectively. The mortality rates reached 15, 20 and 22.5% when this predator fed on the three aphid species, respectively.

**Table (1): Larval duration and feeding capacity of *Coccinella undecimpunctata* L. reared on three different aphid species under constant conditions of temp and R. H. (26±1°c and 65-70%).**

| Insect sp. as prey for predator | Predator data | | | | |
|---|---|---|---|---|---|
| | Larval instar | Duration in days | Total consumption | Feeding capacity/day | Mortality% |
| *A. gossypii* | 1st | 2.6±0.1 | 60±2.2 | 20±0.73 | 2.5 |
| | 2nd | 2.7±0.08 | 118±2.5 | 39.3±0.8 | 5 |
| | 3rd | 2.9±0.05 | 214±2.8 | 71.3±0.9 | 5 |
| | 4th | 3.9±0.006 | 403.3±5 | 100.8±1.2 | 2.5 |
| | Σ | 12.1±0.1* | 795.4±6.8* | 231.4±3.6 | 15 |
| *A. craccivora* | 1st | 2.6±0.1 | 54.2±1.3 | 18.0±0.43 | 5 |
| | 2nd | 2.5±0.1 | 92.6±2.4 | 30.8±0.8 | 7.5 |
| | 3rd | 2.6±0.1 | 172.7±3 | 57.6±1.0 | 5 |
| | 4th | 3.6±0.1 | 335.3±5.9 | 83.8±1.4 | 2.5 |
| | Σ | 11.3±0.15 | 654.8±6.1* | 190.2±3.6 | 20 |
| *M. persicae* | 1st | 2.6±0.1 | 40.3±1.0 | 13.4±0.3 | 5 |
| | 2nd | 2.7±0.08 | 82±1.9 | 27.3±0.6 | 7.5 |
| | 3rd | 2.7±0.1 | 143.6±3.0 | 47.8±1.0 | 7.5 |
| | 4th | 3.6±0.1 | 279.9±3.7 | 67±0.9 | 2.5 |
| | Σ | 11.6±0.16 | 545.8±5.7* | 155.5±2.8 | 22.5 |

"F" value for larval duration = 11.4 $P_{0.05}$
L.S.D. value for larval duration 5% = 0.38
"F" value for averages of total consumption = 338 $P_{0.05}$
L.S.D. value for averages of total consumption 5% = 19.3

The feeding capacity per day by each of the four larval instars of this predator, when fed on three aphid species *A. gossypii*, *A. craccivora* and *M. persicae*, were (20.0±0.7, 39.3±0.8, 71.3±0.9 and 100.8±1.8), (18.0±0.33, 30.8±0.8, 57.6±1.0 and 83.8±1.4) and (13.4±0.3, 27.3±0.6, 47.8±1.0 and 67±0.9 nymphs/day), respectively.

The averages of total consumption by each instar of *C. undecimpunctata*-larvae during the four larval instars for each of the three aphid species of this predator were (60±2.2, 118±2.5, 214±2.8 and 403.3±5), (54.2±1.3, 92.6±2.4, 172.7±3 and 335.3±5.9) and (40.3±1.0, 82±1.9, 143.6±3.0 and 279.9±3.7 aphid nymphs), respectively

The results in Table (1) revealed that the consumption rate increased with the progressive of the larval age, respectively. On the other hand, the fourth larval instar of this predator (age from 3.6-3.9 days) consumed from 50.7-51.2% of the total consumption of the three tested aphids *A. gossypii*, *A. craccivora* and *M. persicae* (recalculated from Table 1)

The results in Table (2) show the larval duration and feeding capacity of *Ch. carnea* when fed on the three aphid species. It can be seen from this table that the duration of the larval stage averaged 9.3±0.12, 8.8±0.13 and 8.9±0.12 days

when fed on *A. gossypii* *A craccivora* and *M persicae* respectively The mortality rates reached 10. 15 and 17 5% when this predator fed on the three aphid species, respectively

**Table (2): Larval duration and feeding capacity of *Chrysoperla carnea* (Steph) reared on three different aphid species under constant conditions of temp. and R. H. (26±1°c and 65-70%).**

| Insect sp. as prey for predator | Predator data | | | | |
|---|---|---|---|---|---|
| | Larval instar | Duration in days | Total consumption | Feeding capacity/day | Mortality% |
| *A. gossypii* | 1st | 2.7±0.08 | 90±1.6 | 30±0.53 | 2.5 |
| | 2nd | 2.8±0.08 | 212.8±3.1 | 70.1±1.0 | 5 |
| | 3rd | 3.8±0.08 | 489±6.8 | 122.3±1.7 | 2.5 |
| | Σ | 9.3±0.12* | 791±8.6* | 223.2±3.2 | 10 |
| *A. craccivora* | 1st | 2.6±0 1 | 68.2±1.9 | 22.4±0.6 | 5 |
| | 2nd | 2.6±0.1 | 142.2±3.1 | 47.4±1.0 | 7.5 |
| | 3rd | 3.6±0.1 | 314.3±5.7 | 78.6±1.4 | 2.5 |
| | Σ | 8.8±0.13 | 524.7±6.1* | 148.4±3.0 | 15 |
| *M. persicae* | 1st | 2.7±0.08 | 46.7±1.26 | 15.6±0.4 | 5 |
| | 2nd | 2.6±0.1 | 74.1±1.8 | 24.7±0.6 | 7.5 |
| | 3rd | 3.6±0.1 | 158.7±3.3 | 39.7±0.8 | 5 |
| | Σ | 8.9±0.12 | 279.6±3.3* | 80±1.8 | 17.5 |

"F" value for larval duration = 3 6 $P_{0.05}$
L.S.D. value for larval duration 5% = 0.35
"F" value for averages of total consumption = 587 $P_{0.05}$
L.S.D. value for averages of total consumption 5% = 17.8

The feeding capacity per day for each of the three larval instars of this predator when fed on three aphid species *A gossypii*, *A craccivora* and *M persicae* were (30±0.53, 70.9±1 0 and 122.3±1 7), (22.4±0.6, 47 4±1.0, and 78.6±1.4) and (15.6±0.4, 24 7±0.6 and 39 7±0.8 aphid nymphs), respectively

The averages of total consumption for the tested predator, *Ch carnea* during its three larval instars fed on each of the three aphid species *A. gossypii*, *A craccivora* and *M. persicae* were (90±1.6, 212.8±3.1 and 489±6.8), (68.2±1 9, 142.2±3 1 and 314.3±5 7) and (46 7±1 2, 74 1±1 8 and 158 7±3 3 aphid nymphs), respectively

The results in Table (2) revealed that the consumption rate increased with the progressive of the larval ages, respectively On the other hand, the third larval instar of this predator (age from 3.6-3 8 days) consumed from 56.8-61.8% of the total consumption of the three tested aphids, *A gossypii* *A craccivora* and *M. persicae* (recalculated from Table 2)

From the above discussed data about the consumption of the both tested predators, *C undecimpunctata* and *Ch carnea*, it could be concluded that there is an effect of the kind of food (prey) on the larval durations of the for mentioned

predators (see Tables. 1 & 2) The differences between the three averages of larval durations of the two above predators were statistically assured (L.S.D. 0.38 and 0.35 days under $P_{0.05}$ respectively)

These periods for *C. undecimpunctata* were 12.1±0.1, 11.3±0.15 and 11.6±0.16 and for *Ch. carnea* were 9.3±0.12, 8.8±0.13 and 8.9±0.12 days when the two predators were reared on *A. gossypii* and *A. craccivora*, respectively (Tables. 1 &2).

Same effect could be seen also by the differences between the averages of total consumed aphids form the three species by larvae of the two predators. The results summarized in Tables (1 & 2) shows that *A. gossypii* as prey was preferred (795.4 & 791 nymphs) for the two tested predators *C. undecimpunctata* and *Ch. carnea*, followed by *A. craccivora* (654.8 & 524.7 nymphs). The least averages of total consumption was recorded when larvae of the two predators were feed on *M. precise* aphids as prey (545.8 & 279.6 nymphs/larvae).

Similar results were obtained by (Scopes, 1969; Singh and Mathotra 1979; Abdel-Fattah *et al.*, 1987 El-Khawalka *et al.* 1991 and El-Hag and Zaitoon, 1996).

The obtained data on the pre-oviposition, oviposition, post-oviposition periods, deposited eggs per female and the longevity of the female and male of the two tested predators, when reared on three different species of aphids, could be seen in Table (3)

The predator *C. undecimpunctata* showed the longest period for egg laying (oviposition period was 46.1±0.8 days), when reared on *A. gossypii* as prey than *A. craccivora* (30.3±0.9 days) or *M. persicae* (28.4±1.0 days). The differences in oviposition period were statistically significant (L.S.D. 2.45 days). As shown in Table (3), the shortest pre oviposition period (5.0±0.4 days) and shortest post oviposition period (2.8±0.5 days) were recorded by feeding on *A. gossypii* nymphs These results showed that *A. gossypii* nymphs may be considered as the preferred food (as prey) or the suitable one for feeding the Coccinellid within the tested aphid species. The differences between the averages of pre oviposition and post oviposition period were insignificant. The same trend could be observed also for results of the predator longevity and fecundity (as deposited eggs) for predator females and the longevity for males also (Table 3). The highest average of deposited eggs (596.3±34.4 eggs per female) by the *A. gossypii*-prey and the least deposited eggs per female was recorded by *M. persicae*-nymphs (as prey for the same predator) it was 367±13.6 eggs per female The statistical analysis showed significant differences between the averages of deposited eggs (L.S.D. = 69.6 eggs/female) Also, the differences between the averages of predators longevity either by females or males reared on the three different preys (L.S.D. values 0.05 for female and male was 2.7 & 2.8 days, respectively) were statistically significant with exception between the two averages of *A. craccivora* and *M. persicae* in case of predator longevity (Table. 3)

Table (3): Certain aspects of reproductive potential of *C. undecimpunctata and Ch. carnea* reared on three different aphid species under constant condition of temp. and R. H. (26±1°c and 65-70%).

| Predator species | Insect pray | Female–predator data | | | | | | Male predator data |
|---|---|---|---|---|---|---|---|---|
| | | Pre-oviposition period | Oviposition period | Post-oviposition period | Longevity in day | Mean number of deposited eggs/ | Daily mean of deposited eggs | Longevity in days |
| *C. undecimpunctata* | *A. gossypii* | 5.0±0.4 | 46.1±0.8* | 2.8±0.5 | 53.9±1.0* | 596.3±34.4* | 11.5±0.7 | 43.5±1.0* |
| | *A. craccivora* | 5.8±0.3 | 30.3±0.9 | 3.3±0.5 | 39.4±1.1 | 442.6±7.8* | 11.7±0.8 | 32.9±0.97* |
| | *M. persicae* | 5.5±0.3 | 28.4±1.0 | 3.8±0.3 | 37.7±1.6 | 367±13.6* | 10.8±0.7 | 27.4±1.0* |
| "F" value 0.05 | | ins | 122 | ins | 93 | 28 | ins | 63 |
| LSD 0.05 | | - | 2.45 | - | 2.7 | 69.6 | - | 2.8 |
| *C. carnea* | *A. gossypii* | 3.5±0.3* | 28.2±0.6* | 3.3±0.3 | 35±0.7* | 212.1±14.5* | 6.4±0.6* | 26.5±1.0* |
| | *A. craccivora* | 5.0±0.4 | 22.8±0.8* | 2.5±0.3 | 30.3±0.8 | 15 78±6.0* | 5.5±0.6* | 21.9±1.0 |
| | *M. persicae* | 5.5±0.3 | 19.6±0.6* | 3.3±0.3 | 28.4±1.0 | 126.9±5.8* | 4.9±0.5* | 19.9±0.9 |
| "F" value 0.05 | | 9 | 51 | ins | 14 | 20 | 26 | 12 |
| LSD 0.05 | | 1.1 | 1.7 | - | 2.2 | 30.6 | 0.5 | 2.7 |

The results obtained above the same biological data of the 2nd tested predator, *Ch. carnea,* when reared on the three aphid spp., showed the similar trend (Table 3) and the statistical analysis showed the significance between the averages of different biological aspects as of the predator *C. undecimpunctata* with the reference to the L.S.D. values under 0.05 probability seen in Table (3). It could be also there concluded that, *A. gossypii* nymphs as food for the predator *Ch. carnea* was the suitable or pest prey among the three tested spp. of aphids (Table, 3). These results agree with those of Abdel-Azez (1991); Klingen *et al.*, (1996); Ahmed (2000) and Kassem (2002).

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## بعض مظاهر معدل التكاثر والكفاءة الأفتراسية لنوعين من المفترسات (أبوالعيد ذي الأحدي عشر نقطة وأسد المن)

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أجريت الدراسة في معمل بحوث آفات الخضر بمعمل بحوث وقاية النباتات – الدقي – الجيزة خلال الفترة من يوليو ٢٠٠١ الي يوليو ٢٠٠٣ لدراسة نوعين من المفترسات هما أبو العيد ذي الأحدي عشر نقطة وأسد المن حيث تم تغذيتهم عي ثلاث أنواع من المن (من القطن – من البقوليات – من الخوخ( تحت الظروف المعملية علي درجة حرارة ٢٦±١°م و ٦٥-٧٠% رطوبة نسبية) وأظهرت النتائج أن أفضل تغذية للمفترسين كانت علي من القطن حيث أعطت أعلي نتائج بالنسبة لمعدل البيض للأنثي (٣٤,٤±٥٩٦,٣ و ١٤,٥±٢١٢,١بيضة/أنثي لكل من مفترس أبو العيد ذي الحدي عشر نقطة وأسد المن علي التوالي) بينما معدل الأفتراس للطور اليرقي كان أعلي معدل علي حوريات من القطن (٦,٨±٧٩٥,٤ و ٨,٦±٧٩١ لكل من المفترسين علي التوالي) وكان متوسط المعدل اليومي لوضع البيض لكل أنثي ٠,٧±١١,٥ و ٠,٦±٦,٤ بيضة/يوم لكل من المفترسين علي التوالي وذلك في حالة التغذية علي حوريات من القطن.