FEEDING POTENTIAL AND LARVAL DEVELOPMENT OF 
CHRYSOPERA CARNEA (STEPHEN) ON DIFFERENT PREY
SPECIES UNDER LABORATORY CONDITION

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ABSTRACT: - A laboratory study was carried out to examine feeding potential and larval development of Chrysoperla carnea (Stephen) on Banana aphid, (Coquerel), Safflower aphid, Uroleucon carthami (Theo) and Jassid, Emposca devastans (Distant) at temperature 27 ± 2 and relative humidity 65 ± 5 during 2011. The result showed that 1st instar C. carnea larvae consumed 8.6±0.35 nymphs/day of P. nigronervosa, whereas the 2nd and 3rd instar devoured 16.3±0.54 and 20.3±0.56 nymphs/day respectively. Similarly, feeding on U. carthami revealed that 1st instar larvae of C. carnea consumed 6.26±0.31 nymphs/day followed by 2nd and 3rd instar 12.5±0.37 and 18.6±0.40 nymphs/day respectively. The consumption rate of 1st instar larva on jassid was recorded as (6.06±0.49 nymphs/day), whereas the 2nd and 3rd instars consumed 11.9±0.50 and 18.3±0.49 nymphs, respectively. Significant difference (P<0.05) in prey preference and feeding potential of the instars were recorded. The larvae of C. carnea consumed99.4±2.58 nymphs of banana aphids in its entire life followed by safflower Aphid (81.00) and jassids (36.6±0.92). The 1st instar larvae spent 3 days to be transformed in to subsequent instar. Whereas 2nd and 3rd instars non- significantly spent 2 days to transform in to subsequent stages, respectively. Furthermore, no significant (P<0.05) difference was observed in rate of development (0.33 day) of the 1st instar larvae fed on P.nigronervosa, U. carthami and E. devastans and so as the 2nd (0.22 day) and 3rd instar larvae (0.22 day) on all above mentioned preys. However, LSD further revealed the larvae of C. carnea developed non-significantly on Safflower aphid and Jassid.

Key words: Feeding potential, larval development, C. carnea, P. nigronervosa, U. carthami and E. devastans.

INTRODUCTION
The green lacewing, Chrysoperla carnea (Neuroptera: Chrysopidae) is naturally found as a single species with a Holarctic distribution [1]. Each female lacewing lays several hundred small eggs at the rate of two to five per day, choosing concealed spots underneath leaves or on shoots near potential prey [2]. The eggs are normally laid during the hours of darkness [3]. It is known to be an important aphid predator in cotton growing areas in Russia and Egypt, sugar beet crop in Germany and vine crops in Europe. It is also found as an effective predator in cotton crops in Pakistan [4,5]. The adults visiting flowers to feed on nectar and pollen besides that it also nourishes on aphid honey dew. The larvae are active predator that feed on soft bodied insects. It can be used in suppression of insect pest’s populations on crops [2]. Lacewing larvae are generiferous predator and are voracious on the eggs and the immature and mature stages of soft-bodied insects pests like mealy bugs, spider mites, whitefly, thrip, aphids, leaffoppers and caterpillars, and being released as efficient biological control agents for various phytophagous arthropods [6]. One larva may devour as many as five hundred aphids in its life and there is no doubt that they play an important part in the natural control of many small homopterous pests [7,8] and [9] reported that C. canea fed non-significantly of mustard and wheat aphid. Its larvae may produce a volatile semiochemical that inhibits visitation and oviposition by B. tabaci [3]; however, in an instigation by [10] mentioned that larvae fed more whiteflies than aphid. [11] used Chrysoperla carnea against the thrips and aphids, the population of both the insects was reduced by more than 95%. [12] observed Chrysoperla carnea feeding on the eggs and larvae of the Heliothis armigera (Hübner). Combine release of lacewing and Trichogramma wasps was effective against herbivore moths, only thier egg stage was parasitised by Trichogramma, however, lacewing found feeding eggs and young caterpillars as well [13]. Green lacewing egg cards were used to suppress the pest population in cotton and horticultural crops [14]. C. carnea has a wide range of prey, therefore, it is very important to mass rear this beneficial insect on different insect host species by adapting new techniques for augmentation [15]. In view of the importance of Chrysoperla carnea (Stephen) in agroecosystem and the need of its mass rearing, the experiment was conducted to determine the feeding potential and larval development on different prey species under laboratory condition.

MATERIALS AND METHODS
Thes studies were carried out in the laboratory of Plant Protection Department, Faculty of Crop Protection, Sindh Agriculture University Tandojam during the year 2011. The purpose of the studies was to examine the comparative feeding potential of Green Lacewing, Chrysoperla carnea (Stephen) on Banana aphid, Petalonia nigronervosa, Safflower aphid, Uroleucon carthami and Jassid, Emposca devastans. The eggs of Chrysoperla carnea were collected from culture of Bio-control Laboratory Nuclear Institute of Agriculture (NIA) Tandojam. Nymphs of Aphids, jassids were collected

1465
RESULTS

The data depicted in Table 1 shows the feeding rate per day of different larval instars of *Chrysoperla carnea* on banana aphids, safflower aphids and jassids. The 3rd instars larvae consumed maximum 20.30 ± 0.35 nymphs per day of banana aphid followed by 2nd and 1st instars 16.30 ± 0.51 and 8.60 ± 0.28 nymphs, respectively. Similarly, 3rd instar consumed maximum 18.51 ± 0.33 nymphs per day of safflower aphid followed by the 2nd (2.50 ± 0.61) and 1st instars (6.33 ± 0.31). In case of jassids, 3rd instar devoured highest number (18.30 ± 0.46 nymphs per day) as compare to 2nd and 1st instars who consumed (11.80 ± 0.46) and (6.06 ± 0.48) nymphs per day respectively. It was observed that the 3rd instar larvae of efficiently consumed the nymphs of preys provided to them. It could be concluded from the result that the 3rd instar can efficiently reduce the number of each prey in field conditions. The statistical analysis shows that there is significant difference (P<0.05) in feeding potential of *C. carnea* larvae per on the prey species.

Table. 1 Feeding potential per day of green lacewing *Chrysoperla carnea* on different prey species under laboratory conditions (Temperature 27±2, relative humidity 65±5%).

<table>
<thead>
<tr>
<th>Predator development</th>
<th>Host density</th>
<th>Bannan Aphid</th>
<th>Safflower Aphid</th>
<th>Jassid</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st instar</td>
<td>20</td>
<td>8.60±0.28 a</td>
<td>6.33±0.31 b</td>
<td>6.06±0.48 b</td>
<td>F=14.80; n=5; df=2; P=0.006</td>
</tr>
<tr>
<td>2nd instar</td>
<td>30</td>
<td>16.30±0.51 a</td>
<td>12.50±0.61 b</td>
<td>11.80±0.46 b</td>
<td>F=29.70; n=5; df=2; P=0.000</td>
</tr>
<tr>
<td>3rd Instar</td>
<td>40</td>
<td>20.30±0.35 a</td>
<td>18.51±0.33 b</td>
<td>18.30±0.46 b</td>
<td>F=7.93; n=5; df=2; P=0.006</td>
</tr>
</tbody>
</table>

Different latters within a row indicate significant difference (Fisher’s Protected LSD test: P<0.05)

Table. 2 Feeding potential per stage of green lacewing, *Chrysoperla carnea* on different prey species under laboratory conditions (Temperature 27±2, relative humidity 65±5%)

<table>
<thead>
<tr>
<th>Predator development</th>
<th>Host density</th>
<th>Bannan Aphid</th>
<th>Safflower Aphid</th>
<th>Jassid</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st instar</td>
<td>60</td>
<td>25.8±0.86 a</td>
<td>18.8 ± 0.77 b</td>
<td>18.2±1.46 b</td>
<td>F=14.80; n=5; df=2; P=0.0006</td>
</tr>
<tr>
<td>2nd instar</td>
<td>60</td>
<td>32.6±1.02 a</td>
<td>25.0±0.49 b</td>
<td>23.6±0.92 b</td>
<td>F=31.69; n=5; df=2; P=0.000</td>
</tr>
<tr>
<td>3rd Instar</td>
<td>80</td>
<td>41.0±0.70 a</td>
<td>37.2±0.80 b</td>
<td>36.6±0.92 b</td>
<td>F=8.54; n=5; df=2; P=0.0049</td>
</tr>
<tr>
<td>Entire larval</td>
<td>200</td>
<td>99.4±2.58 a</td>
<td>81.00±2.06 b</td>
<td>78.4±3.06 b</td>
<td></td>
</tr>
</tbody>
</table>

Different latters within a row indicate significant difference (Fisher’s Protected LSD test: P<0.05)

Table. 3 Development period (days) of green lacewing, *Chrysoperla carnea* on different prey species under laboratory conditions (Temperature 27±2, relative humidity 65±5%)

<table>
<thead>
<tr>
<th>Predator life stage</th>
<th>Prey</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bannan Aphid</td>
<td>Safflower Aphid</td>
</tr>
<tr>
<td>DP&lt;sup&gt;day*&lt;/sup&gt;</td>
<td>RD&lt;sup&gt;day*&lt;/sup&gt;</td>
<td>DP&lt;sup&gt;day&lt;/sup&gt;</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; instar</td>
<td>3 a</td>
<td>0.33 a</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; instar</td>
<td>2 b</td>
<td>0.55 b</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Instar</td>
<td>2 b</td>
<td>0.55 b</td>
</tr>
</tbody>
</table>

Different latters within a row indicate significant difference (Fisher’s Protected LSD test: P<0.05)

DP<sup>day*</sup> = Developmental period,   RD<sup>day*</sup> = Rate developmental
FEEDING POTENTIAL PER LARVAL INSTAR

The data in the Table 2 revealed the consumption rate of different larval stages of *C. carnea*. The 3rd instar of *C. carnea* consumed maximum an average of 41.0 ± 0.70 nymphs of banana aphid during its life span followed by 2nd and 1st instars, they consumed 32.6 ± 1.02 and 25.8 ± 0.86 nymphs, respectively. Similarly 3rd instar larva consumed an average of 37.2 ± 0.80 nymphs of safflower aphids during its life span followed by 2nd and 1st instar, they 25.0 ± 0.49 and 18.8 ± 0.77 nymphs, respectively. The maximum consumption rate was observed in 3rd instars 36.6 ± 0.92 nymphs /stage followed by 2nd and 1st instars 23.6 ± 0.92 and 18.2 ± 1.46 nymphs/ stage respectively. Therefore 3rd instar larvae were voraciously fed on all prey hosts followed by 2nd and 1st instars of *C. carnea*. Similarly it was also observed that the larva of *C. carnea* consumed Banana aphid highest in number as compared to rest of prey species. The result also reveals that the larvae of *C. carnea* fed 99.4±2.58 nymphs of banana aphids in its entire life followed by safflower Aphid (81.00) and jassids (36.6±0.92). The statistical analysis shows that there is significant difference (P<0.05) in feeding potential per stage on different prey species.

RATE OF DEVELOPMENT

The data prescribed in table 3 indicate that the larval development was observed on *P.nigronervosa, U. carthami* and *E. devastans*. It was evaluated that the larva of *C. carnea* developed non-significantly (P<0.05) on all insect hosts. The 1st instar larvae spent 3 days to be transformed in to subsequent instar. Whereas 2nd and 3rd instars non-significantly spent 2 days to transform in to subsequent stages, respectively. Furthermore, no significant difference was observed in rate of development (0.33-0.39) of the 1st instar larvae fed on *P. nigronervosa, U. carthami* and *E. devastans* and so as the 2nd (0.22-0.29) and 3rd instar larvae (0.22-0.24) on all above mentioned preys.

DISCUSSION

The findings of present study showed that the feeding potential of *C. carnea* larva was high in 3rd instars followed by 2nd and 1st instar per day and per stage. There was significance difference in the consumption rate among different instars at (P<0.05). *C. carnea* larva preferred the Banana aphid, *P. nigronervosa* followed Safflower aphid, *U. carthami* and Jassid, *E. devastans*. The result further revealed that the larval development in 1st instar 3 days, 2nd instar 2 days and 3rd instar 2 days was recorded on *P. nigronervosa, U. carthami* (Theo) and Jassid, *E. devastans*. There was no significance difference in the development period and rate of development per day of *C. carnea* reared on different prey species at (P>0.05). The findings of the present research are partially agreed with Bansod and Sarode (2005) who reported the total larval period of *C. carnea* was 6.52, 6.95, 9.12, 9.87, 10.55 and 12.57 days on sterilized and unsterilized eggs of *Corcyra cephalonica*, nymphs of *Uroleucon compositae* and *Aphis gossypii*, and eggs and neonates of *Helicooverpa armigera*, respectively. Similarly, our result agreed with [17] who observed that less duration of *C. carnea* larvae required on eggs of different hosts as compared to the neonates of different lepidopterans. Our findings not supported by [18] who evaluated the effect of prey density on the larval development of *C. carnea*, which significantly fed more number of *B. tabaci* nymph than *A. devastans*. This difference might be due to the effect of different prey species. Similarly, [19] reported that first instar lasted for 2.20±0.09 days, second instar lasted for 3.40±0.05 days and third instar lasted for 4.70±0.08 days giving a total larval stage of 11.30±0.37 days with viability 97.72, 84.88 and 82.95%, respectively. *C. carnea* is voracious predator of insect eggs and many soft-bodied insect pests such as caterpillars, aphids, jassids and mealy bugs [20]. During present investigation it was observed that the larvae of *C. carnea* fed 99.4±2.58 nymphs of banana aphids in its entire life followed by safflower Aphid (81.00) and jassids (36.6±0.92). The same variation of prey consumption was reported by some workers as [10] who mentioned that that a single larva, consumed 487.2 aphids and 510.8 whitefly pupae in its entire life span. [12] evaluated the effectiveness of *Chrysoperla carnea* against the *Heliothis armigera* (Hübner) and observed that pest infestation was reduced from 1.6 to 0.1%.

REFERENCES


