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Biology and Predatory Potential of *CHRYSOPERLA CARNEA* S. (NEUROPTERA: CHRYSOPIDAE) Reared on Different Species of APHID Under Laboratory Condition

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ABSTRACT: The common green lacewing, *Crysoperla carnea* is best known bio-control agent. For the study of its biology and predatory potentiality, study was carried out in the laboratory of Division of Entomology, Nepal Agricultural Research Council, Khumaltar, Nepal in 2015/16. The larvae of green lacewing were reared by feeding five different aphid species namely *Brevenia rehi, Brevicoryne brassicae, Aphis craccivora, Aphis fabae, Eriosoma lanigerum* at constant temperature of 28±0.5ºC and 65±5% Relative Humidity. Highest larval survival and adult emergence rate of *C.carnea* was found on feeding *B. rehi* (57.5% and 100%) followed by *B. brassicae* (52.5% and 90.47%); *A. fabae* (45%% and 100%); *A. craccivora* (47.5% and 84.21%) and *E. lanigerum* (25% and 100%. Feeding on *B. rehi, B. brassicae, A.fabae* and *A. craccivora* doesn't make any significant difference for larval survival and adult emergence whereas *E. lanigerum* shows being statistically inferior. Highest aphid consumption rate by the larvae of *C.carnea* was found by feeding *B. brassicae* (242.25) followed by *A.craccivora* (237.25), *A fabae* (234.00), *B. rehi* (230.25) and *E. lanigerum* (139.00). Aphid consumption rate by *C. Carnea* was not significantly different between *B. rehi, B. brassicae, A. craccivora* and *A. fabae* whereas it consumed statistically less number of *E. lanigerum*. Highest fecundity with 781 number of eggs were obtained by feeding *A. fabae* followed by *B. brassicae* (682), *A. craccivora* (673) and *B. rehi* (667) while lowest (588) eggs were obtained by feeding *E. lanigerum*. The male: female ratio was found to be 0.91, 1.37, 1, 1.25 and 1 for *B. rehi, B. brassicae, A. craccivora, A. fabae* and *E. lanigerum* respectively. Thus we can conclude that for mass rearing of *C. carnea*, we can choose any of the aphids above except *E. lanigerum*.

KEYWORDS : Aphids; Biology; Emergence; Green lacewing; Larvae; Predatory.

I. INTRODUCTION

Aphids are the soft bodied pear shaped insects with long leg and antennae with color variation bearing cornicles. This insect damages the agricultural crops directly by sucking the saps and indirectly by acting as a vector for different disease transmission. Increasing population of aphids with wide range of host plants with poor management system causes huge loss in Agriculture.

The green lacewing, *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae) generally known as the aphid-lion is generalist predator of a wide range of pest species such as aphids, thrips, whiteflies, mealybugs and eggs of different insect pests (Carrillo and Elanov, 2004). Among all the Chrysopids; *C. carnea* is the most intensively studied species due to its wide geographical distribution, broad range of habitat with high frequency of occurrence, good searching ability and easy rearing in laboratory. *C. carnea* is a cosmopolitan polyphagous predator, mostly found in the Agricultural systems.The Larvae of *C. carnea* are voracious feeder and very efficient biological control agents for

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various phytophagous arthropods (McEwen *et al*., 2001). It is very important to identify alternative high quality prey or food for the successful development of insect pest management programs that utilize *C. carnea* as a biocontrol agent.

The aim of the present study was to evaluate five species of aphid (*Brevenia rehi, Brevicoryne brassicae, Aphis craccivora, Aphis fabae* and *Eriosoma lanigerum*) as food for *C. carnea* in terms of survival, development and reproduction of the predator under laboratory conditions. Those information would be helpful for optimizing the mass rearing of *C. carnea* and may also help in designing integrated pest management (IPM) programs involving the use of *C. carnea* as a biocontrol agent of pests on various crops.

II. MATERIAL AND METHODS

The Experiments were conducted in the Bio control laboratory, Entomology Division, Nepal Agricultural Research Council, Khumaltar, Lalitpur, Nepal during the period of 2015/16. Initially, the refrigerated eggs of *C. carnea* were collected from the laboratory of entomology division which are allowed to hatch. The newly hatched larvae are transferred to the plastic jars of which the caps are removed. With five treatments and four replications, in twenty plastic jars, larvae of *C. carnea* were transferred, ten in each and the jars are covered with black muslin cloth to allow better air exchange for respiration.

The larvae of *C. carnea* were reared at the controlled temperature of 28±0.5^{0}C by means of Air temperature controller. The relative humidity of the lab was 65±5% throughout the research. The larvae of green lacewing was reared by feeding five different aphid species namely *Brevenia rehi, Brevicoryne brassicae, Aphis craccivora, Aphis fabae, Eriosoma lanigerum* as T_1, T_2, T_3, T_4 and T_5 respectively. The aphids which are collected from the field excluding those bearing wings are placed in the jars containing Ten *C. carnea* larvae, twenty in numbers in first day. With the view that it would be too little, from the second day thirty aphids are placed and reduced in last few days because most of the larvae are converting towards pupae. The regular supervision was done and the data regarding period of molting and aphids consumption in each molt, larval survival rate, total aphid consumption rate was recorded. The total adult emerged were recorded and the male and female number for each treatment as a whole was recorded. The male and female identification was done through observation of abdomen because when they are allowed to mate, the abdomen of the female can be seen to be swollen. After they are identified, three pairs from each treatment were taken and are allowed to mate. The total eggs laid per day was calculated and comparisons between treatments was done. Those adults are reared by feeding the Semi artificial diet which consist of yeast extract, pollen, clean water and honey water solution soaked in cotton was placed in four small cap. Regular supervision for providing diet and water was done. All the collected data were tabulated according to replication and treatments. Regarding to software programs, Microsoft word 2013 was used for word processing, Microsoft Excel 2013 for tables and SPSS 16.0 with Tukey test was used for statistical analysis. Some parameters like fecundity, male female ratio; simple mean comparisons were done.

III. RESULT AND DISCUSSION

Table 3.1: Effect of Different Aphid Species on Larval survival, Aphid consumption, Adult emergence Rate and Male Female Ratio

Treatments	Larval survival rate	Aphid consumption rate	Adult emergence rate	Male female ratio
Brevenia rehi	5.75^a	230.25^a	100%	0.91
Brevicoryne brassicae	5.25^a	242.25^a	90.47%	1.37
Aphis craccivora	4.75^{ab}	237.25^a	84.21%	1
Aphis fabae	4.50^{ab}	234.00^a	100%	1.25
Eriosoma lanigerum	2.50^b	139.00^b	100%	1
Significance @ 5% level	**(0.005)	**(0.00)	-	-

* refers to significant and ** refers to highly significant

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A. Larval Survival Rate

Analysis of data (Table 3.1) revealed that the larval survival rate of *C. carnea* reared by feeding five different aphid species was found to be highly significant. It is clear from the data that maximum larval survival rate i.e. 57.5% was obtained by feeding *B. rehi* which is statistically at par with the treatments *B. brassicae* (52.5%), *A. craccivora* (47.5%), *A. fabae* (45%) and lowest i.e. 25% is obtained by feeding *E. lanigerum* which is also statistically at par with *A. craccivora*, *A. fabae*.
Maximum of 57.5% of larval survival rate was obtained in this report, while maximum of 87.5% is reported by Satter *et al*. (2007) by feeding the cotton aphid which may be due to low food availability leading cannibalism. Elgar and Crepsi (1992) illustrated that the low availability of food leads to larval cannibalism. The lowest survival rate is found with *E. lanigerum* which might be due to low consumption due presence of waxy covering.

B. Aphid Consumption rate

There is a significant difference in aphid consumption rate by green lacewing larvae when reared by feeding different aphid species (Table 3.1). The maximum aphid consumption rate i.e. 242.25 was obtained by feeding *B. brassicae* which is statistically at par with the treatments *B. rehi* (230.25), *A. craccivora* (237.25), *A. fabae* (234.00) and lowest i.e. 139.00 is obtained by feeding *E. lanigerum* which is found to be statistically inferior among the treatments.

Rana & Srivastava (1998) showed that the larvae of *C. carnea* can consume upto 349.80 aphids which showed relatively high rate of predatism in comparison to present findings which may be due to the lower prey density (only 30 per 10 *C. carnea* larvae) which is also supported by Satpathy *et al*. (2001). Result showed that the significantly lowest consumption of wooly aphid, which might be due to the filamentous waxy white covering in the body of *E. lanigerum* which protects it from insecticide, weather and natural enemies (Alston *et al*., 2010).

C. Adult Emergence rate

From the total larvae survived, the highest of 100% adult emergence was recorded by feeding *B. rehi*, *A. fabae* and *E. lanigerum* whereas 90.47% followed by 84.21% is recorded by feeding *B. brassicae* and *A. craccivora* respectively (Table 3.1)

Liu and Chen (2001) determined 94.4±3.3 % adult emerged feeding on different aphid species. Khan *et al*. (2013) showed 100% adult emergence from the total larva survived of *C. carnea* reared on wheat aphid.

D. Sex ratio

From table 3.1, the highest femaleness was recorded (i.e. 0.91 male: female ratio) in *C. carnea* by feeding *B. rehi* followed by 1 in both *A. craccivora* and *E. lanigerum*, 1.25 in *A. fabae* and highest maleness i.e.1.37 in *B. brassicae*. Geethalakshmi *et al*. (2000) studied the biology and feeding of *C. carnea* on *Corcyra cephalonica* (Stainton) eggs and found the sex ratio of 0.95: 1 (Male: Female). However, El- Serafi *et al*. (2000) found that the rearing of *C. carnea* on different prey species doesn't affect the sex ratio.

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E. Fecundity

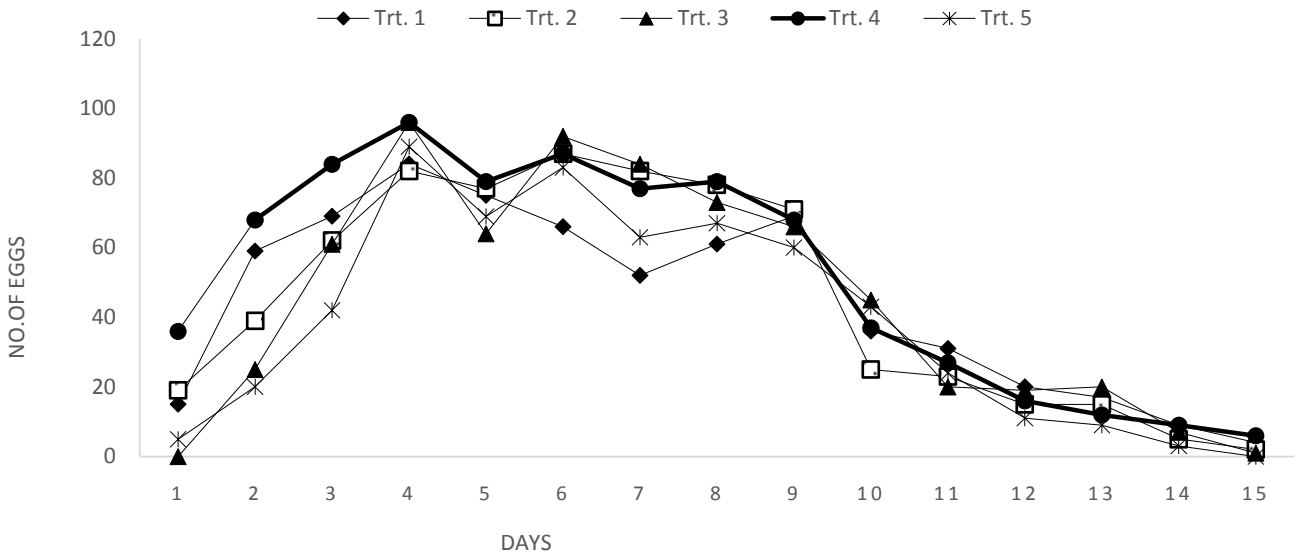

Fig. 3.1 Graph showing the egg laid by *C. carnea* in different days for different treatment

The egg laid by the 3 pairs Adults of *C. carnea* is shown in the figure 3.1 below. In first 10 days, the green lacewing laid the maximum number of eggs in all treatment. The highest number of eggs i.e. 781 is obtained by feeding *A. fabae*, followed by 682, 673, 667 and 588 with *B. brassicae*, *A. craccivora*, *B. rehi* and *E. lanigerum* respectively.

However, Takalloozadeh H. M. (2015) found the maximum fecundity per female of *C. carnea* was 478.50 eggs/female recorded when fed as larvae on *M. persicae*, whereas, the minimum of 242.78 eggs/female was recorded when fed on *A. craccivora* nymphs. While, Tesfaye and Gautam, (2002) observed that *C. carnea* laid 1079, 582 and 172.8 eggs/female when reared on *C. cephalonica*, *D. melanogaster* and *A. cracivora*, respectively. The lowest performance in apple wooly aphid is may be due to the toxicity of waxy covering and poor nutrients availability.

IV. CONCLUSION

This study confirms the wide range of predation and good biological attributes of the green lacewing. From the result, aphids other than wooly aphid may be used for the mass rearing of *C. carnea* because of its poor performance. And also due to its high prey consumption rate it should be given first chance rather than chemical control of the agricultural pests.

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