FEEDING POTENTIAL AND LARVAL DEVELOPMENT OF *CHRYSOPERLA 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. carnae 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 potentioal 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 lavae 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 predaror in cotton crops in Pakistan [4;5]. The adults visiting flowers to feed on nector 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 generlist 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, leafhoppers 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 semio-chemical that inhibits visitation and oviposition by *B. tabaci* [3]; however, in an insetigation 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 patasitised 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 differet 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

from different crops. Upon hatching the 1st instars of *C. carnea* were shifted to a glass vial 3cm dia and 5 cm high. Thereafter, they have been shifted in to the pertridishes (6 inches dia) to provide them a counted number (60 nymphs) of 2nd instar aphids and jassids separately. Similarly 2nd instars were give 70 nympgs and 3rd instars 80 nymphs of each host prey. Experiment was laid down in Completely Randomized Design with 3 treatments and five replications. Feeding efficiency of different larval instars of *C. carnea* on different pery densities was observed after 24 hours. Leaf discs of the same host plants were provided to the aphids/jassids to feed them in the petrishes and the densities the hosts were mantained with live ones.This procedure was repeated daily untill the larvae of *C. carnea* transformed in to pupae. The food consumption rate of each larval instars of *C. carnea* and their development time were ascertained. Similarly rate of development $^{-day}$ was calculated by using the equation [16]. Temperature and relative humidity were maintained as 27 ± 2 ^{0}C and 65 ± 5%, respectively. The data collected were subjected to statistical analysis by using Statitix 0.8 software.

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 follwed 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 dayof 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 pery in field conditions.The statistical anylysis 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%).

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

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%)

Predator development	Host density	Bannan Aphid	Safflower Aphid	Jassid	ANOVA
1st instar	60	25.8±0.86 a	18.8 ± 0.77 b	18.2±1.46 b	F=14.80;n=5; df=2; P=0.0006
2nd instar	60	32.6±1.02 a	25.0±0.49 b	23.6±0.92 b	F=31.69;n=5; df=2; P=0.000
3rd Instar	80	41.0±0.70 a	37.2±0.80 b	36.6±0.92 b	F=8.54;n=5; df=2; P=0.0049
Entire larval	200	99.4±2.58a	81.00±2.06b	78.4±3.30b	

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%)

Predator life stage	Prey						ANOVA
	Bannan Aphid		Safflower Aphid		Jassid		
	DP^{-day*}	RD^{-day*}	DP^{-day}	RD^{-day}	DP^{-day}	RD^{-day}	
1st instar	3 a	0.33a	3 a	0.33a	3 a	0.33a	F=1.0;n=3; df=1; P=0.33
2nd instar	2 b	0.55b	2 b	0.55b	2 b	0.55b	
3rd Instar	2 b	0.55b	2 b	0.55b	2 b	0.55b	

Different latters within a row indicate significant difference (Fisher,s Protected LSD test: P< 0.05)
DP^{-day*} = Developmental period, RD^{-day*} = 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 instras 36.6 ± 0.92 nymphs /stage followed by 2nd and 1st instars 23.6 ± 0.92 and 18.2 ± 1.46
nymphs/ satge respectively. Therefore 3rd instar larvae were voaciuosly fed on all pery hosts followed by 2nd and 1st instars of *C. carnae*. Similarly it was also observed that the larva of *C. carnae* consumed Banana aphid highest in number as compare to rest of prey species. The
result also reveals that the larvae of *C. carnae* 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 anylysis 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 obsereved on *P.nigronervosa, U. carthami* and *E. devastans*. It was evaluated that the larvae 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^{-day}) of the 1st instar lavae
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.

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 preffered 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 *Helicoverpa armigera*, respectively. Similarly, our result agreed with [17] who observed that less duration of *C. carnea* larvae required on eggs of different hosts as compare 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. carnae* 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 pery 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%.

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