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EFFECT OF DIFFERENT HOST ON BIOLOGY AND FEEDING POTENTIAL OF GREEN LACEWING, *CHRYSOPERLA CARNEA* (STEPHENS) (NEUROPTERA: CHRYSOPIDAE)

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Abstract

A Study on effects of different hosts on biology of *Chrysoperla carnea* (Stephens) was carried out under laboratory conditions at 26±2°C and 65±5% R. H. indicated that the incubation period of eggs of *C. carnea* females feeding on different hosts as larvae was significantly different from each other. The biology of *C. carnea* was completed in 26 days on *A. craccivora* followed by *A. gossypii* (31 days) and *Corcyra cephalonica* (45 days). A single larva of *C. carnea* consumed *A. gossypii* and 97.33 eggs of *Corcyra cephalonica* followed by *A. gossypii* (80.00±2.65 nymphs/adults) and *A. craccivora* (64.33±0.67 nymphs/adults) per day. However, the all three larval instars of *C. carnea* consumed 369.00±6.11 eggs of *C. cephalonica* followed by *A. gossypii* (277.67±4.37 nymphs/adults) and *A. craccivora* (206.67±1.86 nymphs/adults) during whole larval period.

Key words: Biology, feeding potential, *Chrysoperla carnea*, aphids

Introduction

Biological control is relatively permanent, safe, economical and environmentally friendly. It can be defined as "the action of parasites, parasitoids, predators and pathogens to keep the pest populations at a lower average than the economic injury level". The safety of biological control is outstanding because many natural enemies are host-specific or restricted to a few closely related species. Therefore the non-target species are not affected. Efficient natural enemies often continue to have a suppressing affect year on insect pests (DeBach, 1964).

The genus *Chrysoperla* contains several important species of predatory insects of which the common green lacewing, *Chrysoperla carnea* (Stephens) has been recorded as an effective generalist predator of aphids, coccids, mites and mealy bugs etc. (Singh and Manoj, 2000; Zaki and Gesraha, 2001). Larvae of *C. carnea* are voracious and efficient biological control agents for various phytophagous arthropods (McEwen *et al*., 2001). 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 (Michaud, 2001). It has significant potential for commercialization and use against a variety of crop pests in combination with other insect pest management tactics. It is estimated that possibly up to one third of the successful biological insect pest control programmes are attributable to the introduction of *C. carnea* and release of insect predators (Williamson and Smith, 1994). The knowledge of biology plays an important role in mass production and its utilization in pest management programme. To insight the information on description and duration of different stages of *C. carnea*, to start a biological programme using *C. carnea*; mass-rearing techniques which are economical as well as posses higher biological efficiency need to be worked out.

Material and Methods

Biology of *Chrysoperla carnea* on three natural hosts was studied in Bio-control laboratory, Sardar Vallabh Bhai Patel Uni. of Agric. and Tech., Meerut (U.P.) India during 2011. Experiment was designed in Complete

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Randomized Block Design (CRD) with three replications each having ten pairs of adult *C. carnea*. These adults were confined in a glass jar (15 cm dia). The upper open end of glass jar was covered with black muslin cloth and was tightened with rubber band. The adults were provided with nutritional diet containing equal volume of proteinex, honey and powdered yeast dissolved in little quantity of distilled water inside the glass jar with the help of small of plexi glass strips. The diets were provided with the interval of 24 hours.

Female green lacewing laid eggs on the walls of chimney and muslin cloth. The eggs were harvested with the help of sharp razor and were placed singly in test tube (7.5 -1 cm. dia.) with the help of camel hairbrush and test tubes were covered with cotton swab. After hatching the newly hatched larvae were fed on eggs of *Corcyra cephalonica* (0.2 gm/tube) that were provided with the interval of fours days. The process was continued until the formation of cocoons. The cocoons formed were removed gently with camel hairbrush from the test tubes and were shifted to other empty glass chimneys to observe and record the emergence of adults.

Daily observations were made on the fecundity (number of eggs laid by a female), larval period, pupal period and adult longevity. Data recorded was analyzed by a computer software package. The natural hosts were cotton aphids, *Aphis gossypii* (Glov.), *A. craccivora* (nymphs/adults) and rice meal moth, *Corcyra cephalonica* (eggs). The first two hosts were collected from field. However, the eggs of *C. cephalonica* taken from laboratory culture, maintained for this purpose were provided to the larvae of *C. carnea*. This experiment had three replications and each treatment consisted of 50 individuals. The experiment was conducted at 27±2ºC and 60±5 % RH.

Results and discussion

Freshly laid eggs were shining, green in colour and cigar shaped. The colour of the eggs changed to light grayish green towards hatching. Eggs are laid, mostly on the under surface of the glass jar in singly. A single female laid 180-205 eggs during her life. eggs per female, thus supporting the present findings.

The present investigation shows that incubation period of the eggs of 4.33±0.33, 3.33±0.33 and 3.33±0.33 days on *A. gossypii*, *A. craccivora* and *C. cephalonica*, respectively (Table 1). The results are in close conformity with the findings of Sattar *et. al*. (2011) who found incubation period 2.25, 2.28, 2.36, 3.85, 2.25 and 2.80 days on *A. gossypii*, *P. solenopsis*, *S. cerealella*, *H. armigera*, *P. gossypiella* and mixed host diet respectively.

Table 1: Biology of lacewing, *Chrysoperla carnea*

Developmental period		*A. gossypii*	*A. craccivora*	*C. cephalonica*
Incubation period		4.33±0.33	3.33±0.33	3.33±0.33
1st instar		2.67±0.33	2.00±0.00	2.33±0.33
2nd instar		3.67±0.33	3.33±0.33	4.00±0.58
3rd instar		5.00±0.57	4.33±0.33	4.33±0.33
Total larval period		11.33±1.20	9.67±0.33	10.67±0.67
Prepupal period		1.33±0.33	1.00±0.00	1.33±0.33
Pupal period		8.33±0.33	8.67±0.33	11.00±0.58
Developmental period		25.33±1.67	22.67±0.33	26.33±0.67
Longevity	Male	19.67±0.88	17.67±0.88	32.33±0.88
	Female	31.00±1.00	26.00±1.53	45.00±0.58

The duration of first instar maggot was completed in 2.67±0.33, 2.00±0.00 and 2.33±0.33 days on *A. gossypii*, *A. craccivora* and *C. cephalonica*, respectively. The second instar larvae completed in 3.67±0.33, 3.33±0.33 and 4.00±0.58 days on *A. gossypii*, *A. craccivora* and *C. cephalonica*, respectively. However, the third and final instar larvae completed in 5.00±0.57, 4.33±0.33 and 4.33±0.33 days on *A. gossypii*, *A. craccivora* and *C. cephalonica*, respectively (Table 1). The total larval period completed in 11.33±1.20, 9.67±0.33 and 10.67±0.67 days on *A. gossypii*, *A. craccivora* and *C. cephalonica*, respectively. These findings are supported to the findings of Sattar *et al*. (2011) who observed the complete larval developmental period was 8.50, 9.50, 12.37, 11.37, 8.25 and 11.00 days on *A. gossypii*, *P. solenopsis*, *H. armigera*, *P. gossypiella*, *S. cerealella*, and mixed host diet, respectively. The shortest and the longest larval period of *C. carnea* were recorded as 8.25 and 12.37 days on *S. cerealella* and *H. armigera* eggs, respectively.

The present investigation showed that the pre-pupal period of *C. carnea* lasted for 1.33±0.33, 1.00±0.00 and 1.33±0.33 days on *A. gossypii*, *A. craccivora* and *C. cephalonica*, respectively (Table 1). However the newly formed pupa was silver in colour, which became shining silver with the advancement of time. The pupa appeared like round in shape. The pupal period lasted for 8.33±0.33, 8.67±0.33 and 11.00±0.58 days on *A. gossypii*, *A. craccivora* and *C. cephalonica*, respectively (Table 1). These results are similar to those of Sattar *et al*. (2011) who found the cocoon period of *C. carnea* was 7.75, 7.75, 8.37, 8.50, 7.37 and 8.25 days fed on *A. gossypii*, *P. solenopsis*, *H. armigera*, *P. gossypiella*, *S. cerealella*, and mixed host diet, respectively. Bansod and Sarode (2000) studied biology and feeding potential of *C. carnea* on different hosts and noted developmental period of *C. carnea* ranged from 18.6 days on *Aphis cracivora* to 22.7 days on *H. armigera* neonate larvae. The duration of development of *C. carnea* was significantly different on three aphid species. Liu and Chen (2001) determined the development, survival and predation of *C. carnea* on three aphid species, *A. gossypii*, *M. persicae* and *L. erysimi*. Survival was significantly different on aphid species; when larvae were fed on *A. gossypii* and *M. persicae*, 94.4 and 87.6% individuals developed to adult stage, respectively; whereas, only 14.9% when fed *L. erysimi*. Duration of development was significantly short (19.8 d) when fed *A. gossypii* followed by *M. persicae* (22.8 d) and *L. erysimi* (25.5 d). The adult lacewing was more or less spherical in shape with green coloured transparent wing. The males were smaller than the females in general. The longevity of male *C. carnea* was 19.67±0.88, 17.67±0.88 and 32.33±0.88 on *A. gossypii, A. craccivora* and *C. cephalonica* however, female have 31.00±1.00, 26.00±1.53 and 45.00±0.58, respectively (Table 1). These results are similar to those of Sattar *et al*. (2011) who found male longevity 21.75±0.49, 20.25±0.25, 19.75±0.25, 19.62±0.32, 23.62±0.42 and 20.00±0.46 and female longevity was 38.00±0.65, 32.25±0.72, 30.87±0.39, 30.87±0.35, 38.62±0.62 and 31.25±0.99 on *A. gossypii*, *P. solenopsis*, *H. armigera*, *P. gossypiella*, *S. cerealella*, and mixed host diet, respectively.

Feeding potential of *C. carnea*

For studying feeding potential of *C. carnea*, the observations were recorded at temperature 27±2ºC and 60±5 % RH. The data presented in Table 2a and 2b indicates that the rate of feeding among different larval instars varies greatly.

Table 2(a): Feeding potential of *C. carnea* on daily basis

Stages of larvae	*A. gossypii*	*A. craccivora*	*C. cephalonica*
1st instar	14.00± 0.58	15.67±1.76	18.00±0.58
2nd instar	20.33±0.33	26.67±0.88	34.00±0.58
3rd instar	30.00±0.58	37.67±0.88	45.333±1.20
Total consumption	64.33±0.67	80.00±2.65	97.33±1.20

* Mean of three replications

Table 2(b): Feeding potential of *C. carnea* during their life

Stages of larvae	*A. gossypii*	*A. craccivora*	*C. cephalonica*
1st instar	41.67±0.88	30.67±2.40	38.00±0.58
2nd instar	60.67±1.20	53.00±1.16	118.33±6.36
3rd instar	175.33±3.84	123.00±3.79	212.67±3.48
Total consumption	277.67±4.37	206.66±1.86	369.00±6.11

· Mean of three replications

First instar maggot consumed an average of 14.00±0.58 *A. craccivora* and 15.67±1.76 *L. erysimi* and 18.00±0.58 eggs of *C. cephalonica*, respectively (Table 2a). The second instar maggot consumed an average 20.33±0.33, 26.67±0.88 and 34.00±0.58 on *A. gossypii*, *A. craccivora* (nymphs/adults) and eggs of *C. cephalonica*, respectively. The third instar maggot consumed an average of 30.00±0.58, 37.67±0.88 and 45.333±1.20, respectively. The total number of aphid consumed per day by all three instar varied from 64.33±0.67, 80.00±2.65 and 97.33±1.20 respectively on *A. gossypii*, *A. craccivora* (nymphs/adults) and eggs of *C. cephalonica* (Table 2a).The total consumption of first instar 41.67±0.88, 30.67±2.40 and 38.67±0.58 of *A. gossypii*, *A. craccivora* (nymphs/adults) and eggs of *C. cephalonica*, during their life respectively (Table 2b). Second instar consumed 60.67±1.20, 53.00±1.16 and 118.33±6.36 of *A. gossypii*, *A. craccivora* (nymphs/ adults) and eggs of *C. cephalonica*, respectively. However, the third and final instar larvae consumed consumed 175.33±3.84, 123.00±3.79 and 212.67±3.48 of *A. gossypii*, *A. craccivora* (nymphs/adults) and eggs of *C. cephalonica*, respectively. The total number of aphid consumed during whole larval period varied from 277.674.37, 206.66±1.86 and 369.00±6.11 respectively on *A. gossypii*, *A. craccivora* (nymphs/adults) and eggs of *C. cephalonica* (Table 2b). These findings are supported to the findings of Swaminathan *et al*. (1999) and Sattar *et al*. (2011). The gradual increase in the feeding rate of older instars with the increase their sizes of *C. carnea* explains there increased requirements of food. These findings are similar to those of Liu and Chen (2001) *C. carnea* consumed more *A. gossypii* (292.4) and *M. persicae* (272.6) than *L. erysimi* (166.4). Zheng *et al*. (1993) found a highly significant positive correlation between prey consumed during larval stage and adult body weight of *C. carnea*.

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