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Feeding potential of *Chrysoperla carnea* (Stephens) on *Corcyra cephalonica* (Stainton) at different temperature levels

Timke SH, Shetgar SS and Khandare RY

Abstract
Green lacewing, *Chrysoperla carnea* Stephens (Neuroptera: Chrysopidae) is the most effective polyphagous predator of different species of aphids and is commonly known as “aphid lion”. It is now commonly reared in laboratory and used extensively all over the country in combination with other insect pest management tactics. The data indicated in respect of feeding potential of *C. carnea* that the lowest number of eggs of *C. cephalonica* (342.64 and 11.31 mg) were consumed by larva of *C. carnea* in order to complete its development in a minimum period of 6.96 days followed by 25 ^{0}C temperature (726.19 and 23.96 mg) with larval developmental period of 10.81 days and 20^{0}C temperature (1401.69 and 46.26 mg) with larval developmental period of 20.93 days.

Keywords: Feeding potential, *Chrysoperla carnea*, *Corcyra cephalonica*, temperature

Introduction

Amongst the predators, Chrysopid (green lace wing), a Neuropterean insect has been found a potential predator. It is popularly known as ‘Green eye bug’. In India, 65 species of Chrysopids belonging to 21 genera have been recorded. The genus *Chrysoperla* contains several important species of predatory insects of which the common green lacewing, *Chrysoperla carnea* (Stephens) is a potential predator of soft bodied arthropods including insects *i.e.*, aphids, caterpillar, leafhopper, whiteflies, thrips and insect eggs (Carrillo and Elanov, 2004) [1]. *C. carnea* can easily be mass reared in the laboratory and used against insect pest in the field (Syed *et al*., 2008) [9]. The common green lacewing is best known as biocontrol agent (Memon *et al*., 2015) [6]. Interest in using beneficial predators as a component of integrated pest management programs for field and horticultural crops has recently increased, as growers seek alternatives to insecticides for managing insect pests. The application of the predator reduces the use of insecticides and save money spent on importing pesticides (Zia *et al*., 2008) [12]. After knowing the importance of *C. carnea* in agricultural systems, it is important to develop efficient pest management strategies that are simple, economical, sustainable and bio-friendly based on biological control. The objectives of the studies were achieved to determine feeding efficiency of *C. carnea* on eggs of *Corcyra cephalonica* and finding the differences in the predatory potential of *C. carnea* at each temperature levels for effective management of insect pests on agricultural crops.

Materials and Methods

The common green lacewing, *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae), has long been considered as an important natural predator and one, which can be manipulated for improved pest control. With this in view, the studies on feeding potential of *C. carnea* at different temperature levels *viz.*, 20, 25 and 30 ^{0}C maintained in BOD incubator in a completely randomized design were conducted at the Department of Agricultural Entomology, College of Agriculture, Latur.

Rearing of predator and prey

The population of *C. cephalonica* was built up on large scale under laboratory condition in order to have its continuous supply as food to the *C. carnea* under investigation. The initial culture of *C. carnea* in the form of eggs was obtained from NBAII, Bangalore. The eggs after hatching were reared individually on eggs of rice moth, *C. cephalonica* as a food in vials.

The vials were cleaned and *Corcyra* eggs were provided to the larvae every day until pupation. After adult emergence the male and female adults were distinguished based on their abdominal size. The abdominal size of female was large as compared to male adults.

Adult rearing

The adults that emerged on the same day were placed in ovipostion cage for the purpose of egg laying. The castor pollens and cotton swabs dipped into drinking water, 50 per cent honey solution and proteinex mixture (equal quantity of proteinex + fructose + honey + powdered yeast dissolved in small quantity of water) were kept in the lid of plastic container as food for the adults. The inner surface and top of the container were covered by black century thick paper in order to serve as oviposition substrate. Thus, the freshly laid eggs were used for investigation on biology, biometrics, life-fecundity and feeding potential of *C. carnea* at different temperatures.

Corcyra egg requirement:

The eggs of *Corcyra cephalonica* is given as feeding material for the larvae in the laboratory. Total quantity of *Corcyra* eggs required for rearing of 100 larvae is 4.25 ml. *i.e* 0.0425 ml/grub.

Feeding potential on eggs of *C. cephalonica*

Fifty larvae of predator comprising 10 larvae in each replication were used to fed on sterilized eggs of *C. cephalonica* separately. The known number of eggs was provided to the larvae of *C. carnea* daily until pupation. The observations on the number of eggs consumed by each larval instar of *C. carnea* were recorded daily after 24 hours of exposure till pupation. The mean weight of 100 sterilized eggs of *C. cephalonica* was also taken in order to work out the feeding potential of *C. carnea* on weight basis using the data on its feeding potential on number basis.

Results and Discussion

The significantly ($P<$ 0.05) more number of eggs of *C. cephalonica* (101.11 in 6.57 days) were consumed by first larval instar of *C. carnea* at 20^0 C temperature as compared to other temperature levels. However, its per day consumption did not differ significantly ($P<0.05$). It is also evident from the results presented in Table 1 that the feeding efficiency of first larval instar of *C. carnea* on weight basis was observed to be significantly ($P<0.05$) more at 20^0 C temperature (3.34 mg) over 25^0 C (1.42 mg) and 30^0 C temperatures (1.14 mg). The similar trend was also observed when per day consumption was taken into account.

The results presented in Table 2 indicated that significantly ($P<0.05$) more number of eggs of *C. cephalonica* (297.01 in 7.04 days) were consumed by second larval instar of *C. carnea* at 20^0 C temperature followed by 25^0 C temperature (136.02 in 3.66 days) and 30^0 C temperature (63.30 in 2.02 days). However, its per day feeding efficiency did not differ significantly ($P<0.05$).

It is also observed that second larval instar of *C. carnea* consumed significantly highest total quantity of eggs of *C. cephalonica* at 20^0 C temperature (9.80 mg) over 25^0 C (4.49 mg) and 30^0 C temperatures (2.08 mg). The similar trend was also observed when per day consumption of eggs on weight basis was taken into account.

The significantly ($P<$ 0.05) more number of eggs of *C. cephalonica* (1003.57 in 7.32 days) were consumed at 20 ^{0}C temperature by third larval instar of *C. carnea* followed by 25^0 C (547.05 in 4.09 days) and 30 ^{0}C (244.82 in 1.98 days). While their per day eggs consumption was observed to be non-significant. The significantly ($P<$ 0.05) highest quantity of eggs of *C. cephalonica* to the tune of 33.12 mg was consumed by third larval instar of *C. carnea* at 20 ^{0}C temperature followed by 25 ^{0}C (18.05 mg) and 30 ^{0}C temperatures (8.08 mg). Its per day eggs consumption was also observed in similar trend (Table 3).

The data (Table 4) showed that significantly ($P<0.05$) more total number of eggs of *C. cephalonica* (1401.69 in 20.93 days) were consumed by I-III larval instars of *C. carnea* at 20^0 C temperature followed by 25^0 C temperature (726.19 in 10.81 days) and 30^0 C (342.64 in 6.96 days). However, their total consumption of eggs of *C. cephalonica* in terms of weight at these temperature levels was also observed in similar trend.

It seems from the data on feeding potential of *C. carnea* on eggs of *C. cephalonica* at different temperature levels that the feeding potential was increased when it was grown at 20^0 C temperature as compared to 25 and 30^0 C temperatures. This could be because of lengthened larval period of *C. carnea* at 20^0 C temperature. Canard and Principi (1984) [2], Frazer (1988) [4], Venzon and Carvalho (1993) [10] and Canard (1997) [3] stated that predator efficiency is affected by diet and temperature.

The results on feeding potential of *C. carnea* on eggs of *C. cephalonica* at different temperature levels are in good line with the earlier workers. Josiane and Sonia (2003) [5] reported that the larva of *C. externa* consumed 499.1, 341.7 and 215.1 small aphids and 126.4, 105.6 and 67.0 medium aphids when grown at 15^0 C, 20^0 C and 25^0 C temperatures, respectively. Subhan *et al*. (2009) [8] recorded 804.94 sterilized eggs of *C. cephalonica* consumed by *C. carnea* when grown at 24^0 C temperature. The consumption capacity of *C. carnea* on *A. craccivora* was observed to be maximum (320.5 ± 22.79) at 15^0C temperature. While it was minimum (143.3 ± 1.25) when reared on *L. erysimi* at 30^0 C temperature (Yadav and Pathak, 2010) [11]. Pathak and Mishra (2011) [7] reported that consumption of eggs of *C. cephalonica* by the larvae of *C. carnea* was increased with decrease in temperature.

Table 1: Feeding potential of first larval instar of *C. carnea* on eggs of *C. cephalonica* at different temperature levels

Temperature levels	Duration (days)	Number of consumed eggs		Weight of consumed eggs (mg)	
		Total	Per day	Total	Per day
20^0C	6.57	101.11 (10.05)	15.39 (3.92)	3.34	0.51
25^0C	3.06	43.12 (06.57)	14.09 (3.75)	1.42	0.46
30^0C	2.96	34.52 (05.88)	11.66 (3.42)	1.14	0.38
S.E. +	0.09	0.60	0.24	0.02	0.008
C.D. at 5%	0.29	1.85	N.S.	0.06	0.024
C.V. (%)	5.16	2.26	3.88	2.28	3.790

Figures in parentheses indicate square root transformed values

Table 2: Feeding potential of second larval instar of *C. carnea* on eggs of *C. cephalonica* at different temperature levels

Temperature levels	Duration (days)	Number of consumed eggs		Weight of consumed eggs (mg)	
		Total	Per day	Total	Per day
20^0 C	7.04	297.01 (17.24)	42.19 (6.49)	9.80	1.39
25^0 C	3.66	136.02 (11.67)	37.16 (6.09)	4.49	1.23
30^0 C	2.02	63.30 (07.95)	31.34 (5.59)	2.08	1.03
S.E. +	0.12	1.51	0.64	0.05	0.02
C.D. at 5%	0.37	4.65	N.S.	0.15	0.06
C.V. (%)	6.27	2.04	3.90	2.05	3.77

Figures in parentheses indicate square root transformed values

Table 3: Feeding potential of third larval instar of *C. carnea* on eggs of *C. cephalonica* at different temperature levels

Temperature levels	Duration (days)	Number of consumed eggs		Weight of consumed eggs (mg)	
		Total	Per day	Total	Per day
20^0 C	7.32	1003.57 (31.66)	137.10 (11.71)	33.12	4.53
25^0 C	4.09	547.05 (23.38)	133.75 (11.57)	18.05	4.41
30^0 C	1.98	244.82 (15.64)	123.64 (11.11)	8.08	4.08
S.E. +	0.13	1.09	0.86	0.036	0.03
C.D. at 5%	0.41	3.37	N.S.	0.112	0.09
C.V. (%)	6.43	0.41	1.46	0.41	1.46

Figures in parentheses indicate square root transformed values

Table 4: FFeeding potential of I-III larval instars of *C. carnea* on eggs of *C. cephalonica* at different temperature levels

Temperature levels	Duration (days)	Total number of consumed eggs	Total weight of consumed eggs (mg)
20^0 C	20.93	1401.69 (37.43)	46.26
25^0 C	10.81	726.19 (26.95)	23.96
30^0 C	6.96	342.64 (18.50)	11.31
S.E. +	0.26	2.66	0.09
C.D. at 5%	0.79	8.21	0.27
C.V. (%)	4.42	0.72	0.73

Figures in parentheses indicate square root transformed values.

Table 5. Consumption capacity of larval instars of *C. carnea* on eggs of *C. cephalonica* at different temperature levels

Parameters	Temperature levels of *C. carnea*			S.E. ±	C.D. at 5%	C.V. (%)
	20^0 C	25^0 C	30^0 C			
Duration of Ist instar larvae	6.57	3.06	2.96	0.09	0.29	5.16
Total number of eggs consumed by Ist instar larvae	101.11 (10.05)	43.12 (06.57)	34.52 (05.88)	0.60	1.85	2.26
Per day eggs consumption by Ist instar larvae	15.39 (3.92)	14.09 (3.75)	11.66 (3.42)	0.24	N.S.	3.88
Total weight of eggs consumed (mg) by Ist instar larvae	3.34	1.42	1.14	0.02	0.06	2.28
Per day weight of eggs consumed (mg) by Ist instar larvae	0.51	0.46	0.38	0.008	0.024	3.790
Duration of IInd instar larvae	7.04	3.66	2.02	0.12	0.37	6.27
Total number of eggs consumed by IInd instar larvae	297.01 (17.24)	136.02 (11.67)	63.30 (07.95)	1.51	4.65	2.04
Per day eggs consumption by IInd instar larvae	42.19 (6.49)	37.16 (6.09)	31.34 (5.59)	0.64	N.S.	3.90
Total weight of eggs consumed (mg) by IInd instar larvae	9.80	4.49	2.08	0.05	0.15	2.05
Per day weight of eggs consumed (mg) by IInd instar larvae	1.39	1.23	1.03	0.02	0.06	3.77
Duration of IIIrd instar larvae	7.32	4.09	1.98	0.13	0.41	6.43
Total number of eggs consumed by IIIrd instar larvae	1003.57 (31.66)	547.05 (23.38)	244.82 (15.64)	1.09	3.37	0.41
Per day eggs consumption by IIIrd instar larvae	137.10 (11.71)	133.75 (11.57)	123.64 (11.11)	0.86	N.S.	1.46
Total number of eggs consumed by Ist to IIIrd instar larvae	1401.69 (37.43)	726.19 (26.95)	342.64 (18.50)	2.66	8.21	0.72
Total weight of eggs consumed (mg) by IIIrd instar larvae	33.12	18.05	8.08	0.036	0.112	0.41
Per day weight of eggs consumed (mg) by IIIrd instar larvae	4.53	4.41	4.08	0.03	0.09	1.46
Total weight of eggs consumed (mg) by Ist to IIIrd instar larvae	46.23	23.96	11.31	0.09	0.27	0.73

Figures in parentheses indicate square root transformed values.

Conclusion
The present research finding demonstrates that the eggs of rice meal moth, *C. cephalonica* were more preferred host of *C. carnea* hence; it can be utilized as mass rearing diet of this predator. In respect of feeding potential of *C. carnea* lowest number of eggs of *C. cephalonica* were consumed at 30 ^{0}C in a minimum period of 6.96 days and at 25 and 20 ^{0}C temperatures it was 726.19 (10.81 days) and 1401.69 (20.93 days). This result guides the entomologist to consider the *C. carnea* as efficient bio-control agent in eco-friendly management of pests on agricultural crops and so, enhancing the potential of predators.

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References

1. Carrillo M, Elanov P. The potential of *Chrysoperla carnea* as a biological control agent of *Myzus persicae* in glass houses. Annl. Appl. Biol 2004;32:433-439.
2. Canard M, Principi MM. Development of Chrysopidae, In: Canard, M., Semeria, Y. and New, TR. (Eds). Biology of Chrysopidae. The Hague, W. Junk Publishers 1984, 57-75.
3. Canard M. Can lacewings feed on pests in winter? (Neuroptera: Chrysopidae and Hemerobiidae). Entomphaga 1997;42:113-117.
4. Frazer BD. Predators, In: A. K. Minks and P. Harrewijn (Eds). Aphids, their biology, natural enemies and control. Amsterdam. Elsevier 1988, 217-230.
5. Josiane TC, Sonia MN. Development and consumption of *Chrysoperla sexterna* (Hagen) (Neuroptera: Chrysopidae) fed with *Cinra* spp. (Hemiptera: Aphididae) under three temperatures. Revista Brasileira de zoologia. 2003;**20**(4):573-576.
6. Memon AS, Omar D, Muhamad R, Sajap AS, Asib N, Gilal AA. Functional responses of green lacewing, *Chrysoperla nipponensis* (Neuroptera: Chrysopidae) reared on natural herb based artificial diet. Journal of Entomology and Zoology studies 2015;3(6):80-83.
7. Pathak PH, Mishra S. Effect of temperature on development and consumption capacity of an insect predator *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae). Journal of Applied bioscience 2011;37(1):64-67.
8. Subhan S, Shetgar SS, Badgujar AG, Dhurgude SS, Patait DD. Life-fecundity tables of *Chrysoperla carnea* (Stephens) on *C. cephalonica* (Stainton). Journal of Entomological Research 2009;33(4):355-360.
9. Syed AN. Ashfaq M, Ahmad S. Comparative effect of various diets on development of *Chrysoperla carnea* (Neuroptera: Chrysopidae). Int. J Agri. Biol 2008;10:728-730.
10. Venzon M, Carvalho CF. Desenvolvimento larval, pre-pupal e pupal de *Ceraeochryso cubana* (Hagen) (Neuroptera: Chrysopidae) em diferentes dietas e temperatures. Anias da Sociedade Entomologica do Brasil 1993;22:477-483.
11. Yadav R, Pathak PH. Effect of temperature on the consumption capacity of *C. carnea* (Stephens) (Neuroptera: Chrysopidae) reared on four aphid species. The Bioscan 2010;5 (2):271-274.
12. Zia K, Hafeez F, Khan RR, Arshad M, Ullah UN. Effectiveness of *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae) on the population of *Bemisia tabaci* (genn.) (Homoptera: Aleyrodidae) in different cotton genotypes. J Agri Soc Sci 2008;4:112-116.