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Dhurgude SS
Insect Parasitology Research Scheme, Vasantrao Naik Marathwada Krishi, Vidyapeeth, Parbhani, Maharashtra, India

Kharth GS
Insect Parasitology Research Scheme, Vasantrao Naik Marathwada Krishi, Vidyapeeth, Parbhani, Maharashtra, India

Patait DD
Insect Parasitology Research Scheme, Vasantrao Naik Marathwada Krishi, Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
Dhurgude SS
Insect Parasitology Research Scheme, Vasantrao Naik Marathwada Krishi, Vidyapeeth, Parbhani, Maharashtra, India

Feeding potential of *Chrysoperla carnea* (Stephens) on *Corcyra cephalonica* (Stainton)

Dhurgude SS, Kharth GS and Patait DD

Abstract
Feeding potential of *Chrysoperla carnea* larvae on different stages of *Corcyra cephalonica* was investigated in laboratory condition at Insect Parasitology Research Scheme, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The predator were very active and successfully consumed sterilized eggs of *C. cephalonica*, unsterilized eggs of *C. cephalonica* and neonat larvae eggs of *C. cephalonica* and the daily predation rate of *C. carnea* larvae increased during first two larval instars and reached to it's peak in third larval instar. The more number of neonat larvae eggs of *C. cephalonica* (874.72) were consumed by *Chrysoperla carnea* larvae followed by sterilized eggs of *C. cephalonica* (808.44) and unsterilized eggs of *C. cephalonica* (608.62).

Keywords: Feeding potential, *Chrysoperla carnea*, predatory efficiency, *Corcyra cephalonica*

Introduction
Insects, diseases, weeds and nutritional factors are major constrains acting against the quality and quantity of crop yield. The pest and disease problems and forced the growers to use heavy dosages of pesticides consequently. The indiscriminate use of chemical pesticides in agricultural crops have created many problems. Resulting the development of resistance to insecticides, pesticides residue on food, air, water and soil, pest resurgence, killing of natural enemies, harmful effect on non-target organisms including pollinators and disruption of ecosystem, hereby increasing the cost of production and hazard on human beings and animals (Palikhe, 2002; Atreya, 2007; Neupane, 2010; Sharma *et al*., 2012) [9, 2, 8, 15].
These negative impacts of chemical pesticides on human health and environment, have led to realize the need for alternative method, which is environmentally friendly, economically viable and sustainable method of insect pest management. It can reduced or minimized through the development, dissemination and promotion of alternative method such as botanical pesticides (Aker, 2015; Kafle, 2015) [1, 6], biological pest control (Pinstrup-Andersen and Hazell, 1985) and IPM approach (Neupane, 2010) [8]. It is important to reduce the pesticides application on crops by using or conserving the biologically derived predator in the field such as Green lacewing, *Chrysoperla carnea* (Stephens) (Sarwar, 2014) [14].
In India 65 species belonging to 21 genera have been recorded from various crop ecosystems (Sing and Jalali, 1994). Among these, *Chrysoperla carnea* and *Mallada boninensis* are most common ones (Burke and Martin, 1956 and Whit Comb and Bell, 1964) [3, 18]. Green lacewing, *Chrysoperla carnea* (Stephenes) (Neuroptera: Chrysopidae) is the predominant species. It is being mass multiplied and utilized for the management of crop pests (Gautam, 1994) [4]. The most adult Chrysopids are non-predatory, but their larval instars are predatory in nature. Release of laboratory reared *Chrysoperla carnea* (Stephenes) were also found effective in controlling various pests on several crops (Ridgway and Murphy, 1983) [12].
After knowing the importance of Chrysoperla carnea (Stephenes) in agricultural system, it is important to develop efficient pest management strategies that are simple, economical, sustainable and bio-friendly based on biological control. The objective of this study was to determine feeding efficiency of *Chrysoperla carnea* on *Corcyra cephalonica*.

Materials and Methods
The studies on predatory potential of Chrysoperla carnea on *C. cephalonica* were carried out under laboratory controlled condition. Fifty larvae of predator comprising of 10 larvae in each replication were used to fed upon the preys *viz*, sterilized, unsterilized eggs and neonate larvae of *C. cephalonica* separately.

The known number of preys was provided to larvae of *Chrysoperla carnea* daily until pupation. The observation on the number of prey consumed by each larval instar of *Chrysoperla carnea* were recorded daily after 24 hours of exposure till pupation.

Result and Discussion

Table 1: The mean larval instar duration of *C. carnea* on *C. cephalonica*

Prey	Larval duration (day)			
	I	II	III	Total
Sterilized eggs of *C. cephalonica*	3.84	2.52	3.64	10.00
Usterilized eggs of *C. cephalonica*	3.74	3.04	3.12	9.9
Neonat larvae of *C. cephalonica*	5.32	3.62	4.46	13.34
Mean	4.3	3.06	3.74	11.08
SE + _	0.043	0.042	0.035	0.067
CD at 5%	0.133	0.1307	0.107	0.21
CV (%)	2.35	3.1	2.07	1.36

The data presented in Table 1 and 2 revealed that *C. carnea* pass through three instars when feed on each of the preys under study. The results on predatory potential of *C. carnea* 0n *C. cephalonica* revealed that the significantly lowest number of usterilized eggs of *C. cephalonica* (608.62) were consumed by larvae of *C. carnea* in order to complet its development in minimum period of 9.90 days followed by sterilized eggs of *C. cephalonica* (808.44) with the larval developmental period of 10 days and neonates of *C. cephalonica* (874.72) with larval developmental period of 13.34 days.

Table 2: Feeding potential of *C. carnea* on diff erent preys

Prey	Total consumption			
	I	II	III	Total
Sterilized eggs of *C. cephalonica*	47	127.78	633.26	808.44
Unsterilized eggs of *C. cephalonica*	31	108.88	469.02	608.62
Neonate larvae of *C. cephalonica*	57	153.3	664.6	874.72
Mean	135	389.96	588.96	763.93
SE + _	0.432	1.0122	8.39	8.3137
CD at 5%	1.3312	3.1192	25.85	25.6193
CV (%)	2.14	1.74	3.19	2.43

Table 3: Mean per day feeding potential of *C. carnea* on different preys

Prey	Total consumption / day		
	I	II	III
Sterilized eggs of *C. cephalonica*	12.35	50.71	174.11
Unsterilized eggs of *C. cephalonica*	8.29	35.74	149.73
Neonate larvae of *C. cephalonica*	10.72	42.37	149.02
SE + _	0.15	0.56	2.1
CD at 5%	0.45	1.73	9.24
CV (%)	3.13	2.92	4.25

It is evident from Table 3 - I II and III instar larvae of *C. carnea* consumed significantly maximum number sterilized eggs of *C. cephalonica* to the extent of 12.35,50.71 and 174.11 per day over Usterilized eggs of *C. cephalonica* to the tune of 8.29, 35.74 and 149.73 per day and neonate of *C. cephalonica* to the extent of 10.72, 42.37 and 149.02 per day, respectively. The larval feeding potential *M. boninensis* was reported to be on an average 628.75 eggs of *C. cephalonica* (Joshi and Yadav, 1990) [5]. Unnikrishan (1995) [17] reported the per larval feeding potential of *M.boninensis* to the tune of 700 to 730 eggs of *C. cephalonica*. According to Nehare *et al*. (2004) [7], the mean larval consumption of *M. boninensis* on inactivated eggs of *C. cephalonica* was 734.66. Ramkumar *et al*. (2005) [11] recorded the predatory potential of *M. boninensis* to the extent of 724.7 eggs of *C. cephalonica*. It was observed that maximum food consumption (60-67%) by third instar larvae of *C.carnea* followed by second (20-24%) and first instar (10-17%) respectively (Yadav and Pathak, 2010) [19].

S. Subhan (2007) [13] reported that significantly minimum duration to the extent of 9.90 days was required to complete the entire larval development of *C. carnea* by feeding on 597.36 unsterilized eggs of *C. cephalonica* followed by 9.97 days by feeding on 804.94 sterilized eggs of *C. cephalonica* and 13.89 days by feeding on 874.82 neonates of *C. cephalonica*. However, I, II and III instar larvae of *C. carnea* consumed significantly maximum number of sterilized eggs of *C. cephalonica* to the extent of 10.78, 39.76 and 126.88 per day over unsterilized eggs of *C. cephalonica* to the extent of 9.44, 33.85 and 79.85 per day respectively. The maximum number of neonates consumed by predator was due to its lengthened larval duration (13.89 days).

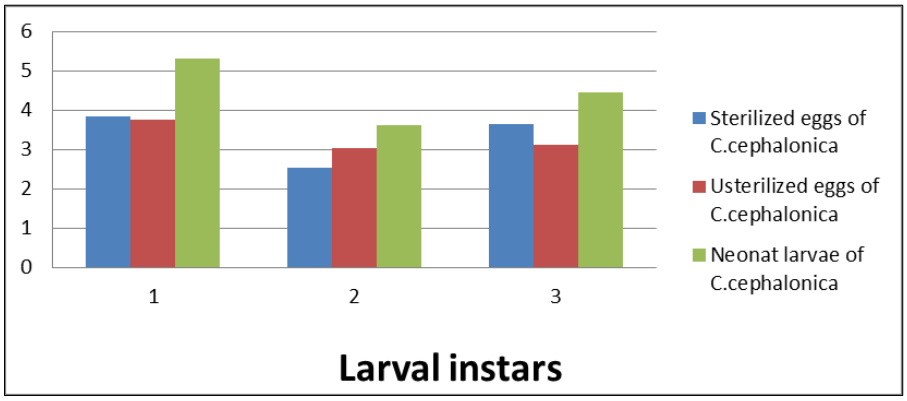

Fig 1: The mean larval instar duration of *C. carnea* on *C. cephalonica*

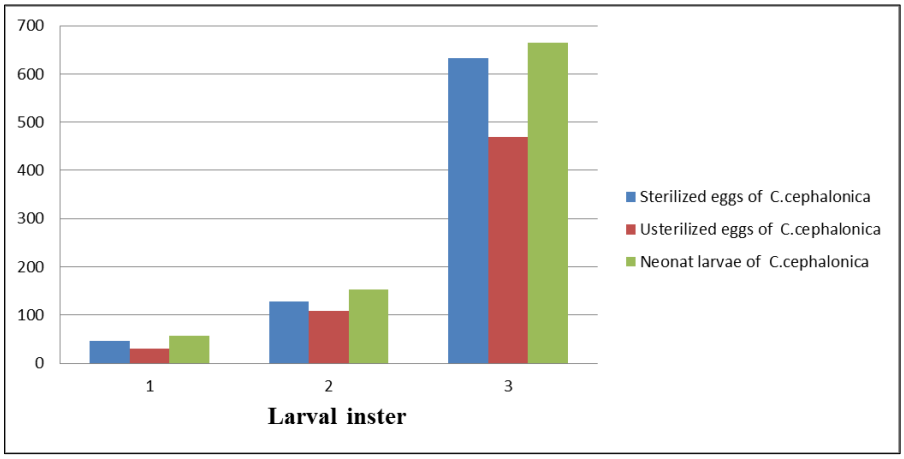

Fig 2: Feeding potential of *C. carnea* on diff erent preys

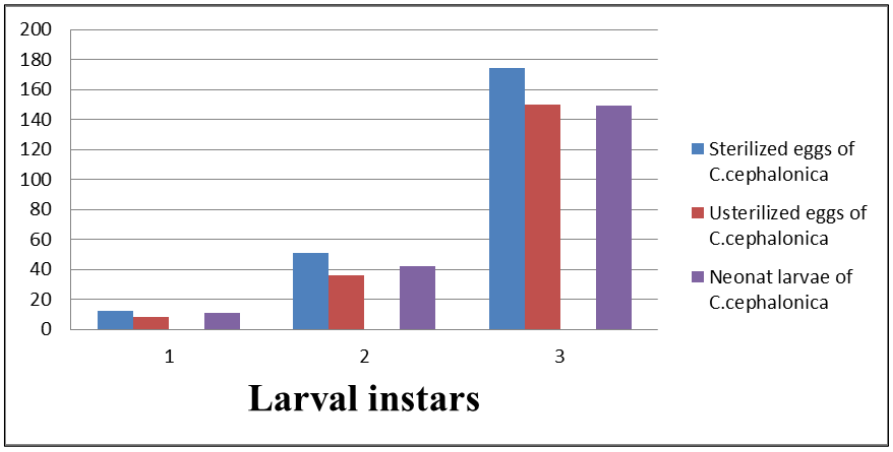

Fig 3: Mean per day feeding potential of *C. carnea* on different preys

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