Anzeiger für Schädlingskunde Pflanzenschutz Umweltschutz

67. Jahrgang · Heft 8 · Dezember 1994

Anz. Schädlingskde., Pflanzenschutz, Umweltschutz 67, 165–167 (1994)

ISSN 0340-7330

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Development and feeding potential of the green lacewing *Chrysoperla carnea* Steph. (Neur. Chrysopidae) on different insect pests of cotton

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With 2 tables

Abstract

Results of laboratory experiments revealed that the total development period (egg to adult emergence) of the common green lacewing Chrysoperla carnea lasted for 19.15, 19.35, 19.95, 20.15, 20.60 and 22.50 days when the larvae were fed with Bemisia tabaci, eggs of Corcyra cephalonica, Heliothis armigera, Aphis gossypii, Amrasca biguttula and neonates of Heliothis armigera respectively. Larval development was rapid on eggs of C. cephalonica (8.20 days) and prolonged on neonates of H. armigera (11.10 days). Pupal development period was quicker on B. tabaci and A. biguttula (7.40 days) and prolonged on neonates of H. armigera (8.40 days).

During development each larva of C. carnea consumed an average of 732.35 eggs of C. cephalonica, 662.53 eggs of H. armigera, 419,18 A. gossypii, 409.55 neonates of H. armigera 329.70 pupae of B. tabaci and 288.45 nymphs of A. biguttula. In all the cases, the third instar larvae consumed the major portion of the total number consumed (60–80%). The most suitable preys, resulting in rapid development, for C. carnea were pupae of B. tabaci and eggs of C. cephalonica.

1 Introduction

The influence of prey on the development and survival of insect predators has been examined for several predatory species (e. g. Blackman, 1967; Hagen et al., 1976; Hydorn and Whitecomb, 1979; Principi and Canard, 1984; Tauber and Tauber, 1987). Such studies indicate that a specific prey observed to be eaten in the field is not necessarily suitable for survival and development, moreover, the suitability of prey for polyphagous predators can vary greatly.

Inundative releases of laboratory bred green lacewing *Chrysoperla carnea* Steph. were found effective in controlling several pests on several crops. (Ridgway and Murphy, 1984). In India studies on the use of Chrysopids have been reported on cotton pests (Manjunath et al., 1976; Dhandapani et al., 1992). *C. carnea* was mass reared under laboratory condition on eggs of rice moth *Corcyra cephalonica* Staint. by group rearing method developed by Patel et al. (1988). The present study reports the biology and predatory potential of *C. carnea* when fed with different prey insects viz., eggs of rice moth *C. cephalonica*, eggs and neonates of american bollworm *Heliothis armigera* (Hbn.) cotton aphid *Aphis gossypii* Glov., leaf hopper *Amrasca biguttula biguttula* Ish. and cotton whitefly *Bemisia tabaci* (Genn.) under laboratory conditions.

2 Materials and methods

Laboratory experiments were conducted at the biocontrol laboratory, Tamil Nadu Agricultural University, Coimbatore, during January–June, 1992. Cultures of the prey insects viz., *C. cephalonica* and *H. armigera* were maintained as per the methods developed by Navarajan Paul (1973) and Nagarkatti and Satya Prakash (1974) respectively. The other prey insects viz., *A. gossypii, B. tabaci* and *A. biguttula* were maintained separately on potted cotton plants in glass house condition.

Eggs of *C. carnea* were collected by destalking and placed singly in glass vials (10 cm dia) at 28 ± 2 °C. The experiments were conducted as a completely randomised block design, each treatment consisting of feeding the respective preys to twenty newly hatched *C. carnea* larvae, considering each individual as one replicate. Fresh adequate number of preys were provided daily to the *C. carnea* larvae.

Before feeding with fresh preys', the number of prey eaten (empty chorion and whitefly pupae, collapsed larvae, aphids and leaf hopper nymphs) on the previous day was recorded. Green lacewing larvae were checked daily for ecdysis. Data on larval development period, pupal period, dates of adult emergence were collected. All data were analysed by Duncan's multiple range test (DMRT).

3 Results

The results of the influence of prey insects on development of *C. carnea* are summarised in table 1. Among the different prey insects tested, the rapid development of larvae was recorded on *C. cephalonica* eggs (8.20 days). All the 3 instars of *C. carnea* have shown prolonged period of development when fed with neonate larvae of *H. armigera*. The total larval development period was extended to 11.10 days when fed with *H. armigera* neonates. The third instar larvae of *C. carnea* alone required 4.35 days when fed *A. biguttula*. Pupal development period was significantly shorter (7.40 days) on *B. tabaci* and *A. biguttula*. Total development period (egg to adult

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Table 1. Effect of larval preys on biology of *Chrysoperla carnea**

Prey	Larval period (days)				Pupal period (days)	TLC: Egg to adult emergence (days)
	I instar	II instar	III instar	Total		
Corcyra cephalonica eggs	3.00^{c}	2.00^{b}	3.20^{c}	8.20^{d}	8.15^{a}	19.35^{c}
Heliothis armigera eggs	3.10^{c}	2.00^{b}	3.50^{bc}	8.60^{cd}	8.35^{a}	19.95^{bc}
Heliothis armigera neonates	4,15^{a}	2.80^{a}	4.15^{a}	11.10^{a}	8.40^{a}	22.50^{a}
Aphis gossypii	3.20^{c}	2.15^{b}	3.70^{b}	9.05^{c}	8.10^{a}	20.15^{b}
Amrasca biguttula	3.65^{b}	2.20^{b}	4.35^{a}	10.20^{b}	7.40^{b}	20.60^{b}
Bemisia tabaci	3.50^{b}	2.10^{b}	3.15^{c}	8.75^{cd}	7.40^{b}	19.15^{c}

* Mean of 20 replications
Means followed by letters in common within columns are not significantly different at p = 0.05 (DMRT).

emergence) was shorter on *B. tabaci* (19.15 days) followed by eggs of *C. cephalonica* (19.35 days) and it prolonged when fed with *H. armigera* neonates (22.50 days). Cent per cent survival of the predator was recorded on all the prey insects.

Third instar larvae of *C. carnea* consumed 10.54 per cent more *C. cephalonica* eggs than *H. armigera* eggs (table 2). The percentage of prey consumed by different *C. carnea* larval instars are as follows: 4.72–9.60% by first instar, 11.16–31.06% by second instar and 62.65–80.36% by third instar. The number of prey consumed was found to be maximum in the case of eggs of *C. cephalonica* (732.35) followed by eggs of *H. armigera* (662.53). A total of 409.55 neonate larvae of *H. armigera* and 419.18 *A. gossypii* were required to complete the *C. carnea* larval development. Minimum number of prey insects were consumed by *C. carnea* larvae in the case of *B. tabaci* (329.70) and *A. biguttula* (288.45 nymphs).

4 Discussion

The biology of *C. carnea* on six different prey insects were examined. *C. carnea* could successfully complete its development on all the preys tested. Among them, the larval development was faster on the laboratory prey *C. cephalonica*. Similar observations on the suitability of laboratory preys over other natural preys were made by AWAKALLAH et al. (1976), ALROUECHDI (1982) and BEGLYAROV and PONOMAREVA (1983). Differences in the larval development period have been reported for *C. carnea* reared on various prey insects (CANARD and PRINCIPI, 1984). The prolonged developmental period of *C. carnea* fed with neonate larvae of *H. armigera* may be due to the fact that the quality of food is less suitable and nutritive than eggs. Similar reports were given by EL-DAKROURY et al. (1979).

The results also indicated that the second and third instars were more various than the first instar. Similar observations were also recorded by LINGREN et al. (1968), EL-DAKROURY et al. (1979), OBRYCKI et al. (1989) on *C. carnea*; SAMSON and BLOOD (1980) on *Chrysopa signata* Schn.; RU-NGUYEN et al. (1975) on *Chrysopa lanata* Banks and KRISHNAMOORTHY and MANI (1982) on *Chrysopa scelestes* Banks.

The consumption pattern observed in the present study (first instar < second instar < third instar) with more than 80% in the third instar is comparable with that observed for other chrysopid species feeding on insect eggs and aphids (PRINCIPI and CANARD, 1984; OBRYCKI et al., 1989).

The present study shows that *C. carnea*, the common green lacewing, will feed and complete its life cycle on several insect pests of cotton. The temporal occurrence of these cotton pests are in early, middle and later stages of the cotton crop and the multivoltine nature of *C. carnea* under tropical Indian conditions which overlaps with the cotton insect pests occurrence makes it one of the naturally occurring biotic factor for the pest suppression. Hence in cotton eco-system, the green lacewing which is generally tolerant to many pesticides may well fit in the integrated pest management programmes.

Table 2. Predatory potential of *Chrysoperla carnea* on different prey insects

	Number consumed*			
Prey insect	I instar	II instar	III instar	Total
1. Eggs of *Corcyra cephalionica*	47.75	200.53	482.73	732.35
	(1.6534)^{a}	(2.2946)^{a}	(2.6814)^{a}	(2.8640)^{a}
2. Eggs of *Heliothis armigera*	44.60	205.78	415.05	662.53
	(1.6462)^{a}	(2.3090)^{a}	(2.6150)^{b}	(2.8426)^{b}
3. Neonates of *H. armigera*	35.65	45.70	325.83	409.55
	(1.5409)^{b}	(1.6573)^{c}	(2.5120)^{c}	(2.6122)^{c}
4. *Aphis gossypii*	19.78	65,73	335.13	419.18
	(1.3054)^{c}	(1.7767)^{b}	(2.5228)^{c}	(2.6215)^{c}
5. *Bemisia tabaci*	31.65	67.45	235.65	329.70
	(1.4840)^{b}	(1.7908)^{b}	(2.3667)^{d}	(2.5167)^{d}
6. *Amrasca biguttula*	16.20	50.45	231.80	288.45
(1.2016)^{d}	(1.6663)^{c}	(2.3624)^{d}	(2.4597)^{e}	

* Mean of 20 observations
Figures in parantheses are log(x)
Means followed by letters in common within columns are not significantly different (p = 0.05) by DMRT.

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