

Field evaluation of inundative release of *Chrysoperla carnea* (Stephens) against pest complex of cotton

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Abstract

To assess the impact of inundative release of *Chrysoperla carnea* (Stephens) against cotton pests a field experiment was conducted at college farm, B. A. College of Agriculture, Anand Agricultural University, Anand (Gujarat) during 2000-01 to 2002-03. Experimental results concluded that one (14000 larvae/ ha) and two (28000 larvae/ha) releases of *C. carnea* significantly suppressed the population of aphid, *Aphis gossypii* G, leaf hopper, *Amrasca bigutulla bigutulla* Ishida and white fly, *Bemisia tabaci* Gen. Similarly, the incidence of spotted bollworm *Earias* sp. to developing buds and green bolls also reduced and increased the yield of seed cotton. Significantly highest (1949 kg/ha) yield was found in case of two releases over one release (1558 kg/ha) as against 1287 kg/ha in case of control (without release). Economics of different treatments evaluated revealed that relatively higher (1:1.87) Incremental Cost Benefit Ratio (ICBR) was found in case of two releases of chrysopids while single release of chrysopids exhibited 1:1.35 ICBR value.

Key words: Field evaluation, inundative release, *chrysoperla*, cotton

Introduction

In recent years biological control of crop pests has received considerable attention over the world. Various biocontrol agents are used for the suppression of pests. Amongst the various bioagents so far recorded in cotton ecosystem, the chrysopid, *Chrysoperla carnea* (Stephens) (Chrysopidae: Neuroptera) appears to be an important and efficient predator against sucking pests as well as eggs of *Helicoverpa armigera* (Hubner). This chrysopid predator can be amenable in the laboratory and works well in fields when it not disturbed. Integration of *Trichogramma chilonis* Ishii and *C. carnea* with two sprays of monocrotophos (0.04 %) proved effective against cotton pests in Gujarat (1). According to Singh (2), the sucking pests of cotton may be checked by releasing chrysopids at 1 lakh per ha at fortnightly intervals. Earlier, inundative release of *Chrysoperla* larvae against green peach aphid, *Myzus persicae* (Sulzer) on green pepper (3) and citrus aphid, *Toxoptera citricida* (Kirkaldy) on citrus (4) have been evaluated. Except these solitary reports, no much work has been

done to assess the impact of chrysopid release against cotton pests. In view of obvious advantages of this potential predator in biological control of cotton pests, the present study was indented.

Material and methods

To initiate culture of *C. carnea* in laboratory, adults of the predators were collected from cotton fields and reared to obtain eggs. The predatory grubs obtained were initially cultured on its natural host and then subsequently cultured on the eggs of rice moth, *Corcyra cephalonica* St. by following standard practiced developed by Patel *et al.* (5). In order to assess the impact of inundative release of chrysopid predator, *C. carnea* against cotton pests, a field experiment was conducted at college farm, B. A. College of Agriculture, Anand Agricultural University, Anand (Gujarat) during three consequent years (2000-01 to 2002-03). For the purpose, a cotton field of 0.2 ha area having Gujarat cotton hybrid-10 grown at a distance of 120 X 60 cm was selected. The crop was raised following standard agronomical practices

Table 1. Impact of *Chrysoperla carnea* release on sucking pests of cotton

Sr. No	Treatments	Mean no. of insects/ 15 leaves											
		Aphid				Leaf hopper				Whitefly			
		2000-01	2001-02	202-03	Pooled	2000-01	2001-02	2002-03	Pooled	2000-01	2001-02	2002-03	Pooled
1.	C. carnea one release	7.57 (56.30)	7.62 (57.06)	9.87 (96.42)	8.35 (68.72)	2.36 (4.57)	2.43 (4.90)	2.96 (7.76)	2.58 (5.66)	2.38 (4.66)	2.50 (5.25)	2.71 (6.35)	2.53 (5.40)
2.	C. carnea two releases	7.02 (48.28)	7.22 (51.13)	8.99 (79.82)	7.74 (58.91)	2.12 (3.49)	2.23 (3.97)	2.21 (3.88)	2.19 (3.79)	2.09 (3.370)	2.22 (3.93)	2.08 (3.33)	2.13 (3.54)
3.	Control without release	13.88 (191.65)	13.38 (178.02)	14.51 (209.54)	13.92 (192.77)	3.58 (11.82)	3.53 (11.46)	3.51 (11.32)	3.54 (11.53)	2.96 (7.76)	3.18 (9.11)	3.16 (8.99)	3.10 (8.61)
	S.E.m ±	0.35	0.38	0.27	0.75	0.10	0.06	0.08	0.15	0.07	0.07	0.04	0.07
	C.D. at 5%	1.13	1.23	0.88	2.49	0.34	0.21	0.25	0.47	0.21	0.23	0.14	0.23
	C.V.(%)	19.96	22.00	13.34	14.22	21.17	12.71	15.38	12.75	14.37	14.88	9.55	12.10

* $\sqrt{X+1}$ transformed values. Figures in parenthesis are retransformed values

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Table 2. Impact of *Chrysoperla carnea* release on cotton bollworms and cotton yield.

Sr. No	Treatments	Damage (%) by <i>Earias</i> on											
		Buds				Green bolls				Yield kg/ha			
		2000-01	2001-02	2002-03	Pooled	2000-01	2001-02	2002-03	Pooled	2000-01	2001-02	2002-03	Pooled
1.	<i>C. carnea</i> one release	19.22* (10.84)	18.22 (10.00)	18.04 (9.59)	18.49 (10.06)	27.94* (21.95)	27.44 (21.24)	27.23 (20.94)	27.54 (21.37)	1556	1536	1583	1558
2.	<i>C. carnea</i> two releases	15.46 (7.11)	15.48 (7.12)	16.44 (8.01)	15.79 (7.40)	24.47 (17.16)	24.88 (17.43)	23.49 (15.89)	24.28 (16.91)	1833	1820	2194	1949
3.	Control without release	21.81 (13.80)	22.91 (15.15)	23.32 (15.67)	22.68 (14.87)	32.57 (28.98)	32.66 (29.12)	31.09 (26.67)	32.11 (28.25)	1278	1313	1250	1287
	S.E.m ±	0.26	0.25	0.23	0.26	0.72	0.58	0.21	0.62	42	41	98	27.42
	C.D. at 5%	0.84	0.83	0.74	0.83	2.35	1.88	0.67	2.05	119	130	318	87.26
	C.V.(%)	7.35	7.24	6.59	7.12	12.69	10.21	9.78	12.93	13.58	12.77	13.02	12.45

* Arc sin transformed values Figures in parenthesis are retransformed values

Table 3. Economics of different treatments used in the study

Sr. No.	Treatments	Yield of cotton (kg / ha)	Increase in yield over control (kg / ha)	Gross income (Rs./ha)	Cost of treatments including labour charges (Rs/ha)	Net gain (Rs/ha)	ICBR
1.	<i>C. carnea</i> one release	1558	271	7452.50	3175	4278	1: 1.35
2.	<i>C. carnea</i> two releases	1949	662	18205.00	6350	11855	1: 1.87
3.	Control without release	1287	-	-	-	-	-

Price: Seed cotton Rs. 27.50 / Kg
Bioagents Rs. 225/ 1000 eggs

except chemical treatments. The whole cotton field was divided into three equal blocks. Each block considered as one treatment. There were three treatments i.e. one and two releases of *C. carnea* larvae @ 14,000 /ha in each release and untreated control (without release). A distance of 10 metres was maintained between the treatments. Each block under respective treatment was divided into five equal quadrates. Five plants were randomly selected from each quadrate and tagged for recording the various observations. Population of sucking pests viz; aphid (*Aphis gossypii* G.), leafhopper (*Amrasca bigutulla bigutulla* Ishida) and whitefly (*Bemisia tabaci* Gen.) was recorded from three leaves (top, middle and bottom) of each tagged plants. Thus, in all 15 leaves were examined and based on this mean population of each sucking pest per 15 leaves was worked out. The data were subjected to statistical analysis following square root transformation and presented in Table 1.

The incidence of spotted bollworm, *Earias* sp. on developing intact buds and green bolls was assessed by examining total and damaged buds as well as green bolls present on five tagged plants from each sub plot. Based on the observations, *per cent* incidence of spotted bollworm in each treatment was calculated. The values obtained were subjected to statistical analysis following arc sin transformed values and present in Table 2.

Picking wise yield of harvested seed cotton was weighed separately for each treatment at the time of harvest and based on the data yield in kg/ha was calculated (Table 2). Economics of each treatment was worked out based on the yield data, prevailing market price of seed-cotton and cost of treatments. The

Incremental Cost Benefit Ratio (ICBR) values thus obtained are presented in Table 3.

Results and discussion

Data (Table 1) on population of sucking pests recorded in different treatments clearly shows that its numbers reduced significantly in chrysopid released plots as compared to untreated (without release) control. Incidence of aphid, *A. gossypii* was found to be more or less equal level in both the treatments of chrysopid release as it indicates non-significant difference between them. The release of *Chrysoperla* gave better protection against aphids. The treatment of one and two releases of chrysopid exhibited on an average of 68.72 and 58.91 aphids per 15 leaves as against 192.77 aphids per 15 leaves in control. The difference on impact of one and two releases of *Chrysoperla* on leafhopper was not much evident during first and second year of experimentation, however pooled results showed significant variation in both the released treatments. Significantly low (3.79 hoppers per 15 leaves) population of *A. bigutulla bigutulla* was revealed in treatment of two releases than single release (5.66 hoppers per 15 leaves). Significant reduction of *B. tabaci* population following two releases (3.54 whiteflies per 15 leaves) of chrysopid predator was found over one release (5.40 whiteflies per 15 leaves). On the other hand the untreated plots exhibited significantly maximum (8.61 whiteflies per 15 leaves) population of whitefly suggesting better protection against this pest.

Both the treatments of chrysopid released provided significantly better control of spotted bollworm to buds and green bolls (Table 2). Pooled results indicated that

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two releases of *Chrysoperla* in cotton suppressed the pest effectively and exhibited 7.40 and 16.91 per cent incidence to buds and green bolls, respectively. The corresponding values for one release were 10.06 and 21.37 per cent, respectively.

Reduction in pest population following the release of chrysopid predator reflected on yield of seed cotton. Seed cotton yield recorded in different treatments (Table 2) revealed significant impact of inundative release. Significantly highest yield was found in case of two releases (1949 kg/ha) of chrysopid followed by single release (1558 kg/ha). Both the released treatments produced significantly higher yields over untreated control (1287 kg/ha). Increase in yield following one and two releases of *C. carnea* was 271 and 662 kg/ha respectively over control (without release). Higher (Rs.11855 /ha) net gain per hectare was revealed in case of two releases than single release. Relatively higher (1:1.87) Incremental Cost Benefit Ratio (I.C.B.R.) was noticed when two releases of chrysopids were made whereas single release exhibited 1:1.35 I.C.B.R. value (Table 3).

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