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In Situ Conservation of Arthropod Natural Enemies of Crop Pests

D. N. Yadav, K. L. Mathew and Anand Jha

AICRP on Biological Control of Crop Pests and Weeds
Gujarat Agricultural University, Anand - 388 110

ABSTRACT

An entomophage park of 0.2 ha area conserved 28 species of arthopods *in situ*, which were natural enemies to several species of insect pests. The major entomophages conserved were *Trichogramma chilonis, Geocoris ochropterus, Chrysoperla carnea, Rogas aligrahensis, Chelomenus sexmaculatus, Coccinella septempunctata* etc. The entomophages were very active throughout the year in the park as it was not disturbed and kept free from insecticide applications. It is suggested that by establishing entomophage Park, biodiversity of natural enemies of insect pests could be conserved, and this reserve could be utilized later for control of insect pests of crops.

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INTRODUCTION

There has been a phenomenal growth in agricultural production in India in the last four decades; mainly due to the introduction of high yielding crop varieties and adoption of modern technologies. Still, the losses due to pests and diseases remain as the major constraint in increasing the productivity. The annual loss due to pests was estimated to be over Rs. 8000 crores in 1983. Crop losses due to just one species of insect, *Helicoverpa armigera* (Hubner) which infests many ecomonically important crops is estimated to be over Rs. 2000 crores per annum in the country (Raheja and Tewari, 1990).

Chemical pesticides have been very popular among the farmers to combat the ravages of crop pests in the last three decades. Out of Rs. 2800 crores worth of chemical pesticides used in agriculture, Rs. 1600 crores worth are spent on cotton crop alone, where as the crop occupies only about 5 per cent of the total cropped area in the country. Further Rs. 1100 crores worth of chemical pesticides are used for the control of only bollworms in cotton (Ghosh, 2000). The ill effects of the chemical insecticides on the natural enemies have been know since last two decades which have been documented by Manjunath (1974); Yadav *et al.*, (1983); Natrajan, (1990) and Gill *et al.*, (1992). During the years, a few of the entomophages have become scarce (AICRP, 2000) in Gujarat. Therefore, it is imperative to find out ways and means to protect them from extinction. In the present study, an attempt has been made to conserve arthropod natural enemies and enhance natural biological control.

MATERIALS AND METHODS

Establishment of Entomophage Park

During 1998-99 about 0.2 ha fallow land was selected for the establishment of entomophage park at the Anand campus of Gujarat Agricultural University. In this park, the crops conducive to biocontrol agents were grown in appropriate succession keeping in mind the occurrence of

pests and their natural enemies. Besides, uneconomical plants, which harbour natural enemies, were also grown or allowed to grow. Selected flowering plants (both seasonal and perennial) as a food source for the adult parasitoids and predators were also grown. It was also ensured that some vegetation always remain in the park. No chemical insecticide was sprayed in this area. The area designated for the entomophage park was demarcated from the surroundings by a hedge of the *Lantana camera* except for a part of one of the sides where building stood. The arthropod natural enemy fauna was monitored regularly in the park and also in agricultural fields of the locality where pesticides were sprayed frequently.

RESULTS AND DISCUSSION

Although the area of the park was very small, it supported and conserved a good number (28) of entomophages (Table 1), which were mostly found about in pesticide treated areas (Table 2). The noteworthy result of the study was the activity of *Trichogramma* spp. on the eggs of *H. armigera, Earias vittella* Fab. and *Catopselia pyranthe* L. throughout the year. Since host eggs were continuously available on different host plants, population of *Trichogramma* remained very high in the area throughout the year. This suggests that by reserving even very small areas in different localities and agro-climatic/ geographic regions as entomophage park, the endemic populations of entomophages could be conserved. By doing so, the vast genetic variations that have evolved during the past million of years will be saved from extinction. Moreover, the genon that suits to each locality will be conserved *in-situ*. Another important feature of the study was the round the year abundance of butterfly, *C. pyranthe* which deposited large number of eggs on *Cassia occidentalis* L. These eggs were heavily parasitised by *T. chilonis* and *T. achaeae* (Table 3). Similarly, a large population of *Geocoris ochropterus* Fieber (Hemiptera: Lygaidae) and *Chelomenes sexmaculata* Fab. (Coleoptera: Coccinelidae), *Chrysoperla carnea,* etc. were conserved even during summer months in sizeable numbers (Table 4 and 5). The other entomophages conserved included spiders, staphylenid, *Paederus fuscipes* Curtis, braconid, *Rogas aligarhensis* Quadri, Chrysopid, *Chrysoperla carnea* and *Trichogramma* sp. in good numbers. The flowering plants *viz.,* marigold, *Tagetis erracta, camera* and *Justicia jendurosa* grown in the park served as good source of good for the natural enemies. *Lantana,* particularly attracted a large number of white butterfly, *C. pyranthe* (10-15 in number during September). Manjunath *et al.* (1970) reported attraction of *H. armigera* moths to the flowers of marigold for oviposition. He also reported that *H. armigera* eggs laid on marigold were heavily parasitised by *T. chilonis.* Similary, *Bracon brevicornis* Wesm an ecto-larval parasitoid of black headed caterpillar of coconut, *Opisina arenosella* Walk lived longer and laid greater number of eggs, when the females were fed on nector of the flower of *J. jendurosa* (Yadav, 1985). In Egypt, *Lantana harbours* whitefly, *Bemisa tabaci* and its pupal parasitoid, *Encarsia mundus* (Rao and Reddy, 1992). Habitat manipulation have also been tried to enhance natural biological control (Bugg *et al.* 1991; Fye, 1972; Javier and Altieri. 1990; Letourneau and Altieri, 1983 and Nordlund *et al.*, 1984). Thus, from the present study it is apparent that by providing favourable niches and environment, entomophage fauna can be conserved. However, it remains to be seen how far such an entomophage fauna would be able to suppress the pest population in the target crop (s) grown in the vicinity without the intervention of chemical pesticides and how it sustains itself in the coming years. The study in this connection is under progress.

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TABLE 1

Various arthropod natural enemies found in the entomophage park.

Species	*Crops in which the entomophages found*						
Trichogramma chilonis	Cassia	Cotton	Tomato	Sunnhemp	Marigold	Senna	Groundnut
Chrysoperla carnea	Cotton	Senna	Maize	Brinjal	Groundnut	Lucerne	Duranta
Mallada Boninensis	Cotton	Senna	Brinjal	Groundnut	Duranta		
Brown lacewing	Cotton	Duranta	Brinjal				
Geocoris ochropterus	Cotton	Maize	Brinjal	Marigold	Groundnut	Lucerne	Sunnhemp
Paederus fuscipes	Cotton	Maize	Brinjal	Sunnhemp	Lucerne	Groundnut	
Rhinocoris fuscipes	Tobacco	Cotton	Brinjal	Groundnut	Sunnhemp		
Nesidiocoris tenius	Tobacco	Tomato	Mastgandha				
Menochilus sexmaculatus	Cotton	Maize	Brinjal	Groundnut	Sunnhemp	Lucerne	Duranta
Coccinella septumpuntata	Cotton	Maize	Brinjal	Groundnut	Sunnhemp	Lucerne	
Coccinella transversalis	Cotton	Maize	Brinjal	Groundnut	Sunnhemp	Lucerne	
Rogas aligarhensis	Cotton						
Bracon greeni	Cotton						
Apantelis angaleti	Cotton						
Mantis	Cotton	Lantana					
Nabis	Cotton	Sunnhemp	Lucerne	Groundnut			
Orius	Cotton	Maize	Marigold				
Encarsia	Cotton	Brinjal					
Scymnus	Cotton	Duranta	Maize				
Spiders							
Clubiana sp.	Cotton	Sunnhemp	Groundnut	Lantana	Maize	Lucerne	
Oxyopes sp.	Cotton	Sunnhemp	Groundnut	Lantana	Maize	Lucerne	
Crabspider	Cotton						
Unidentified green spider	Tobacco						
Charops obtusa	Cotton	Cassia					
Agathis	Cotton						
Apantelis sp.	Cassia						
Syrphids	Cotton	Maize	Lucerne	Groundnut			
Predatory ants	Cotton	Groundnut	Cassia	Senna			

TABLE 2

Entomophage fauna found in park and irrigated cotton fields outside the park.

Species	Park	Places outside the park					
		Karjan (3)*	Awakhal (6)	Kurali (5)	Dhaboi (5)	Sinor (5)	Kayavarhon (6)
Trichogramma chilonis	+	-	+	-	-	-	-
Rogas aligarhensis	+	-	-	-	-	-	-
Geocoris ochropterus	+	-	-	-	-	-	-
Chelomenus sexmaculata	+	+	+	+	+	+	+
Coccinella septumpuntata	+	-	-	-	-	-	-
Chrysoperla carnea	+	+	+	-	+	+	+
Mallada boninensis	+	-	-	-	-	-	
Spiders							
Clubiana sp.	+	+	+	+	-	-	+
Oxyopes sp.	+	-	+	-	+	-	-
Crabspider	+	-	-	-	-	-	-
Unidentified green spider	+	-	-	-	-	-	-
Rhinocoris fuscipes	+	-	+	-	-	-	-
Brumus sp.	+	-	-	-	-	-	-
Aphidius sp.	+	-	-	-	-	-	-
Scumnus sp.	+	-	-	-	-	+	-
Ants	+	-	+	-	-	-	-
Paederus fuscipe	+	-	+	-	-	-	-
Mantis	+	-	+	-	-	-	+

Note : + = pres = absent

* Number of examined.

TABLE 3

Occurrence of *Trichogramma* sp. (*T. chilonis* and *T. achaeae*) in *Catopsilla pyranthe* on *Cassia* Anand during 1998-99.

Period		Per cent parasitism
August	I	25.4
	II	48.3
September	I	40.7
	II	25.8
October	I	32.5
	II	27.8
November	I	35.9
	II	42.4
December	I	30.2
	II	40.2
January	I	40.1
	II	47.9
February	I	72.8
	II	81.8
March	I	44.7
	II	51.6
April	I	54.2
	II	52.4
May	I	74.8
	II	78.5
June	I	85.5
	II	65.3
July	I	75.0
	II	66.6
August	I	60.0
	II	75.0
September	I	66.6

Note : I = first fortnight
II = second fortnight

TABLE 4

Population of predatory fauna in insecticides free (Entomophage park) and treated cotton field.

Sr. No.	Species	Mean population of entomophage/plant	
		Entomophage park	Chemical treated
1.	*Chrysoperla carnea*	0.15-2.6**	0.1-0.2
2.	*Menochilus sexmaculata*	0.8-14.09	0.1-0.2
3.	*Geocoris ohropterus*	0.2-2.2	0.0
4.	Spider	0.3-1.45	0.0
5.	Staphylenids	0.05-3.5	0.0

TABLE 5

Extent of parasitism by *Trichogramma* sp. and *Rogas aligarhensis* in cotton.

Sr. No.	Species	Per cent parasitism	
		Entomophage park	Farmers field
1.	*Trichogramma sp.*	75-96.2	0.0
2.	*Rogas aligarhensis*	5.0-33.1	0.0

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