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A Study on the Management of Some Pests of Groundnut (*Arachis hypogaea* L.) With Biocontrol Agents

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ABSTRACT

Results of a field experiment conducted to compare the field efficacy of biocontrol agents with locally recommended practice of using chemical insecticides revealed that use of *Trichogramma chilonis* (Ishii) (1,00,000/ha) and *Chrysoperla carnea* (Banks) (50,000/ha) 40 and 55 days after sowing could effectively check the population of *Helicoverpa armigera* (Hubn.) and *Bemisia tabaci* (Genn.). This was on par with insecticides. Application of Nuclear Polyhedrosis Virus of *Spodoptera litura* (Fb.) at 250 larval equivalents +2.5 kg crude sugar/ha could effectively control the larval population of *S. litura*. Pod yield was increased significantly in biocontrol plots which was on par with chemical insecticide-treated plots.

KEY WORDS: Groundnut, biocontrol, *Helicoverpa armigera*, *Spodoptera litura, Bemisia tabaci, Empoasca kerri*

Groundnut (*Arachis hypogaea* L.) an important oilseed crop is grown in India in about 67 lakh ha (Anon., 1989). An estimated annual loss of Rs.150 crores in groundnut due to pests has been reported (Amin, 1983). *Spodoptera litura* (Fb.), leafhopper, *Empoasca kerri* Pruti (Ghorpade and Thakur, 1989), *Helicoverpa (=Heliothis) armigera* (Hb.) and whitefly, *Bemisia tabaci* Genn. (Vasantharaj David and Kumaraswami, 1975) are some of the major pests on groundnut. Unrestrained application of chemical pesticides for pest control has created several complications. Among the alternate methods, biocontrol agents are ecologically sound and effective. Although studies on many natural enemies have been reported on groundnut, no systematic attempts were made to utilize bioagents together in field level. Hence an experiment was conducted to determine the efficacy of the egg parasitoid *Trichogramma* (Ishii), the predator *Chrysoperla carnea* and the Nuclear Polyhedrosis Virus of *S. litura* in comparison with locally recommended insecticides in the management of pests on groundnut.

MATERIALS AND METHODS

A field experiment was carried out on 40 day old groundnut cv. TMV 7 at Tindivanam in Tamil Nadu, during September - December, 1990. Plots of one ha area were marked in randomised block design with five replications. Observations were recorded in 100 tagged plants in each replication, prior to and after 15 and 30 days of treatment. *H. armigera* and *S.litura* larval populations and leaf damage were recorded in morning hours in top three compound leaves. The populations of whitefly nymphs and leaf hoppers were counted from top, middle and bottom leaflets in each tagged plant.

The following biocontrol agents were released at 40 and 55 days after sowing (DAS), when the incidence of pests was severe.

i. *T. chilonis* at 1,00,000 parasitoids/ha/release

ii. *C. carnea* at 50,000/ha/release

iii. *S. litura* NPV at 250 LE/ha

Table 1. Efficacy of combined release of *Trichogramma chilonis*, *Chrysoperla carnea* and NPV of *Spodoptera litura* against groundnut whiteflies and Leaf hoppers

Treatment	Pest population / Plant - DAT					
	Whitefly nymphs			Leaf hoppers		
	0	15	30	0	15	30
Biocontrol	16.0	7.6[a]	1.2[a]	8.4	12.3[b]	16.7[b]
Insecticide*	19.1	11.4[a]	3.6[a]	7.7	3.4[a]	0.4[a]
Control	14.1	23.4[b]	29.7[b]	6.3	17.4[b]	18.9[b]

DAT - Days after first treatment
* Two rounds of insecticides
Means followed by similar letters in vertical columns are statistically not different (P = 0.05) by DMRT

Table 2. Efficacy of combined release of *Trichogramma chilonis*, *Chrysoperla carnea* and NPV of *Spodoptera litura* against *Heliothis armigera* and *Spodoptera litura*

Treatment	Larval population / 5 plants - DAT					
	H. armigera			*S. litura*		
	0	15	30	0	15	30
Biocontrol	7.5	3.0[a]	1.3[a]	11.5	7.7[b]	0.3[a]
Insecticide*	8.6	2.3[a]	0.2[a]	11.2	4.1[a]	0.2[a]
Control	6.2	8.4[b]	3.8[b]	10.2	11.8[c]	4.7[b]

DAT - Days after first treatment
* Two rounds of insecticides
Means followed by similar letters in vertical columns are statistically not different (P = 0.05) by DMRT

Corcyra cephalonica (Stainton) eggs differentially parasitized by *T. chilonis* and pasted in cards of size 10 x 2.5 cm having 3000 parasitoids were tied randomly on the bottom leaves avoiding the border rows of the field. *C. carnea* first instar grubs were distributed uniformly through small paper bits. NPV of *S. litura* with crude sugar 2.5 kg/ha as adjuvant was sprayed with a backpack hydraulic sprayer (Aspee, Bombay) with a hollow cone nozzle using Ca. 500 litres of spray fluid/ha. Five days after each release, 50 eggs of *H. armigera* were collected randomly in each plot and per cent parasitism was worked out.

An unprotected field and a field treated with locally recommended practices (Farmers' plot) 500 m away from each other and of one acre size and with similar agronomic practices, variety and crop age were fixed for comparison. In the farmers' plot, chlorpyriphos (200 g ai/ha) on 40 DAS and endosulfan (700 g ai/ha) on 55 DAS were applied, with a backpack hydraulic sprayer. At harvest, pod yield was recorded. The data collected were subjected to analysis of variance and the means compared with L.S.D.

RESULTS AND DISCUSSION

The results revealed that the whitefly population was effectively controlled by the biocontrol agents but *E. kerri* was not controlled (Table 1). The chemical insecticides were effective against both.

In India, the scope for the increased utilization of *Trichogramma* spp. as a component in the management of *H. armigera* was emphasised by Sudha Nagarkatti (1981). About 32.3 per cent parasitization on groundnut was observed by Sithanantham *et al.*

Table 3. Efficacy of combined release of *Trichogramma chilonis*, *Chrysoperla carnea* and NPV of *Spodoptera litura* in the control of leaf damage by *H. armigera* and *S.litura* on groundnut

Treatment	% Leaf damage days after treatment (DAT)		
	0	15	30
Biocontrol	74.51 @	58.51	26.51
Insecticide*	77.88	54.55	17.18
Untreated plot	71.34	82.24	64.06
L.S.D. (P = 0.05)	9.58	13.79	15.22

DAT - Days after treatment
@ - Angular transformed values
* - Two rounds of insecticides

probably by acting as a phagostimulant (Dhandapani *et al.*, 1987). However, the leaf hopper population was not brought down in biocontrol plot which might be due to the active movement of the nymphs and adults which make it difficult for the *C. carnea* grubs to prey on them.

The unparasitized *H. armigera* eggs after hatching may be preyed upon by *C. carnea* grubs. Effectiveness of *C. carnea* preying on noctuid larvae like *H. armigera* has already been reported (Morrison, 1985; Yadav and Patel, 1987). In the present investigations, higher adut *C. carnea* activity was observed in the predator released plots. The data on

Table 4. Economics of Biocontrol of pests in groundnut

Treatment	Pod yield kg/ha	Market value @ Rs.5/ kg (Rs. / ha)	Net gain (Rs. / ha)	Cost of cultivation Rs. / ha	Cost benefit ratio
A. **Bicontrol field** (*Trichogramma* @ Rs.60/ha/release *Chrysopa* @ Rs.80/ha/release NPV of *S.litura* @ Rs.176/ha/spray Application charges @ Rs.60/ha/spray)	2220	11,100	8024	3076	1:3.61
B. **Insecticide - treated field** (Chlorpyriphos - Rs.250/ha/spray Endosulfan - Rs.260/ha/spray Application chargesRs.60/ha/spray)	2319	11,595	8465	3130	1:3.70
C. **Untreated field**	1650	8,250	5750	2500	1:3.30

(1981). In the present study, 28.0 per cent egg parasitism was observed in biocontrol plot whereas, it was 0.0 and 4.0 per cent in farmers' plot and untreated plot respectively. Utilization of *Trichogramma* for pest suppression has the major advantage that by killing the pest at egg stage, damage to crop by the larvae is prevented.

Effectiveness of NPV in control of *S. litura* on groundnut was reported by Krishnaiah *et al.* (1984) and Sachithanantham (1988). In the present study, addition of crude sugar could increase the effectiveness of NPV

whitefly population also revealed the effectiveness of *C. carnea*. Morrison (1985) reported that *C. carnea* could attack adult and the immature stages of soft bodied phytophagous crop pests. Combined use of biocontrol agents was attempted on cotton by Yadav and Patel (1987) and Sithanantham and Navarajan Paul (1989).

Pod yield was highest in farmers' plot followed by biocontrol plot and these two were statistically on par and superior to untreated plot. The net return per ha was highest in the insecticide treated plots and the biocontrol

plots gave almost the same return (Table 4). Groundnut is grown largely under dryland conditions with minimum investment. Long term benefits could be achieved through the use of environment-friendly biocontrol agents.

Chrysopa spp. have better advantage over other predators. They are tolerant to many insecticides (Bartletti, 1964; Lingren and Ridgway, 1967). Also, the larvae are apparently not killed by systemic insecticides that are injurious to other predators (Ahmed *et al.*, 1954; Ahmed, 1955; Ridgway *et al.*, 1967). Thus, they could be well integrated into a program of control that includes certain conventional or systemic insecticides.

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