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Abundance of Natural Enemies of Cotton Insects Under Intercropping System

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ABSTRACT

The effect of intercropping in cotton on the population of aphids, leafhoppers and bollworms and their natural enemies was investigated. Intercropping did not show any variations on the pest population of aphids and leafhoppers. Significantly increased activity of coccinellids in cotton intercropped with cowpea was observed. Higher parasitism on *Earias* spp. was recorded in cowpea and soybean intercropped cotton as compared to onion and pure cotton.

KEY WORDS: Intercropping, cotton, cowpea, soybean, coccinellids, parasitism, *Earias* spp.

The abundance and activity of insect population within a field are closely associated with the nature of surrounding crop. It has been established that cotton intercropped with okra recorded a higher incidence of spotted bollworm and pink bollworm (Litsinger and Moody, 1976), while castor as intercrop reduced the leafroller and leafhopper infestation (Saxena and Basit, 1982). Intercropping of cotton with cowpea, sorghum and maize, and strip cropping of alfalfa colonized higher level of natural enemies than in monocropping (Smith, 1967; Smith and Raynolds, 1972; Usembo, 1976; Baliddawa, 1985).

The impact of intercropping systems in cotton on the abundance of aphids (*Aphis gossypii* Glover), leaf hoppers (*Amrasca devastans* Distant) and the activity of entomophagous coccinellids (*Menochilus sexmaculatus* Fabricius and *Coccinella* sp.) and Braconids (*Rogas aligarhensis Qadri* and *Agathis fabiae* Nixon) were investigated and results are presented in this paper.

MATERIALS AND METHODS

Field experiments were conducted at Coimbatore during 1984, 1985 and 1986 cropping seasons). Cotton (Cv.MCU 5 VT) was raised in paired rows at a spacing of 40 cm between rows and 110 cm between pairs and 30 cm between plants in a row, and in the alternate rows the intercrops were raised. The intercropping systems adopted in the present study were: 1) Cotton and cowpea (Cv.Co. Vu.623), 2) Cotton and soybean (Cv.Co.1), 3) Cotton and country onion and 4) Cotton alone. The design of the experiment was split plot. The two main plot treatments were 1) crops under insecticidal regime and 2) no protection. In sub-plots, the intercrops were raised and the plot size was 35 m^2. Observations on the populations of aphids, leafhoppers and the predatory beetles were taken regularly in 40 leaves of 20 randomly selected plants at the rate of two leaves per plant from the plots not treated with insecticides.

The larvae of different instars of *Earias insulana* Boisd. and *E. vittella* (Fabricius) were collected from various treatments at weekly intervals from 40 days after sowing and brought to laboratory and reared on okra fruits till the emergence of moths or parasites. The larval collection was stopped as soon as the intercrop was harvested. The parasites that emerged from each cropping system were identified, and percent parasitism was analysed statistically.

RESULTS AND DISCUSSION

The population of aphids and leafhoppers in different cropping systems did not show any significant differences as the level of incidence was low. However cotton-cowpea cropping system recorded significantly higher population of coccinellids (*M. sexmaculatus* and *Coccinella* sp.) in different years than in pure crop. The higher level of aggregation of coccinellids in cowpea-cotton intercropping system might be due to early immigration of coccinellids from the colonization source to mixed crop habitats than to monocropping because of the greater attractiveness of mixed

TABLE 1. The abundance of aphids*, leafhoppers** and coccinellid beetles under intercropping systems

Cropping system	Population/10 leaves								
	1984			1985			1986		
	aphids	leaf-hoppers	coccinel-lids	aphids	leaf-hoppers	coccinel-lids	aphids	leaf-hoppers	coccine-lids
Cotton+Cowpea	32.6	7.4	4.3a	32·3	14.0	4.0a	34.9	6.5	6.4a
Cotton+Soybean	27.5	6.5	1.6b	29.3	15.3	2.0b	40.6	7.5	2.0b
Cotton+Onion	27.1	5.1	2.0b	26.0	13.3	1.5b	26.9	6.2	2.7b
Cotton alone	27.8	9.1	1.5b	26.5	13.5	2.0b	25.0	6·2	1.7

*Difference between the means in different seasons not significant
**Means followed by the same letters are not significantly different (P=0.05) by L.S.D.

TABLE 2. Abundance of parasites of spotted bollworms under different intercropping systems

Cropping system	1985		1986
	Parasitism* on *Earias* spp. %	Bollworm** Incidence %	Parasitism* on *Earias* spp. %
Cotton+Cowpea	24.8a	5.7	35.2a
Cotton+Soybean	40.6a	5.1	32.9b
Cotton+Onion	26.9b	6·4	13.9b
Cotton alone	25.0b	6.2	18.2b

*Means followed by the same letters are not significantly different (P=0.05) by L.S.D.
**Differences between the means not significant.

cropping by providing vital food, shelter and resting sites. Further, *Aphis craccivora* Koch infesting cowpea also would have provided additional prey to coccinellids. Similarly cowpea as intercrop in maize, beans in potato, melon in mustard were reported to harbour higher population of coccinellids, syrphids, and spiders than the pure crops (Risch, 1981; Baliddawa, 1985).

The bollworm infestation was generally low and there was no significant differences between the different cropping systems. However, there was a significant increase in the parasitic activity on *Earias* spp. in cotton intercropped with cowpea and soybean. The two years mean parasitism in cowpea and soybean intercropped cotton was 35 and 36.7 per cent as compared to 20.4 in onion and 21.6 per cent in pure crop. The important parasites recovered were *R. aligharensis* constituting 80% of parasites followed by *A. fabiae*. Increased degree of parasitism on cotton bollworm in the zones intercropped with cowpea, alfalfa and sesame have been reported earlier (Baliddawa, 1985; Lester and Furr, 1972). The increased parasitism might be due to the availability of nectar, pollen and existence of favourable microclimate in intercropped zones of the agro-eco system (Risch, 1981). These results are of great significance in the management system, as intercrops besides giving additional economic benefits through intercrops to the farmers, harbour a sizeable increased population of natural enemies which exert considerable biotic pressure on the population of phytophagous insects.

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REFERENCES

Baliddawa, I.W. 1985. Plant species diversity and crop pest control. An analytical review. *Insect Sci. Applic.*, **6**, 479-487.

Lester, M.L. and Furr, R.E. 1972. *Heliothis* populations in cotton-sesame interplantings. *J. Econ. Entomol.*, **65**, 1524-1525.

Litsinger, J.A. and Moody, K. 1976. Integrated Pest Management in multiple cropping systems. In, "*Multiple cropping*" (R.T. Papendica, P.A. Sachez and G.B. Trip. eds.), 293-316 pp.

Risch, S.J. 1981. Insect herbivore abundance in tropical monoculture and polycultures; an experimental test of two hypothesis. *Ecology*, **62**, 1325-1340.

Saxena, K.N. and Basit, A. 1982. Interference with the establishment of the leafhopper *Amrasca devastans* on its host plants. *Proc. 5th Int. Symp. on Insect Plant Relationship*, Wageningen 1982, pp. 153-162.

Smith, R.F and Reynolds, H. T. 1972. Effect of manipulation of cotton agroecosystem on insect populations. In, "*The careless technology*" (M. T. Farvar and J.P. Mitter Eds.), pp. 373-406.

Usembo, E.I. 1976. Approaches to integrated control of cotton pest in Mid Western States of Nigeria. Unpublished Ph.D. thesis, University of London.

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Studies of the Effect of Insecticides on *Trichogramma achaeae* Nagaraja and Nagarkatti (Hymenoptera : Trichogrammatidae)

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ABSTRACT

The effect of 15 insecticides used in one or the other time in cotton on the susceptibility and emergence of *Trichogramma achaeae* Nagaraja and Nagarkatti was studied under laboratory conditions. All the insecticides except fenvalerate gave 100 per cent mortality. Maximum parasitism was observed when the unparasitized eggs of *Corcyra cephalonica* (Stainton) were treated with permethrin, oxydemeton methyl and fenvalerate. When the insecticides were tested on parasitized eggs, it was found that fenvalerate, permethrin, oxydemeton methyl, DDT, dimethoate, deltamethrin and phosphamidon were comparatively safe to this parasitoid. Emergence of parasitoids was significantly affected in 1 and 2 day-old parasitized eggs. Emergence in all the insecticidal treatments was significantly reduced.

KEY WORDS: *Trichogramma achaeae*, insecticide susceptibility

Trichogramma achaeae Nagaraja and Nagarkatti (Hym., Trichogrammatidae) is an important indigenous egg parasitoid of cotton bollworms, *viz.*, *Earias* sp. and *Pectinophora gossypiella* (Saunders). Parasitism on the former varied from 14-72 per cent and on latter from 12-54 per cent (Maninder *et al.*, 1983). Mass rearing and periodical releases of egg parasitoids have been advocated in India for the control of cotton bollworms (Anonymous, 1987a). Insecticides are known to be highly harmful to the beneficial insects especially the egg parasitoids (Awate *et al.*, 1977; Xie *et al.*, 1984; House *et al.*, 1985; Singh and Varma, 1986; Varma and Singh, 1987). A substantial amount of insecticides are used on cotton crop for the control of insect pests (Anonymous, 1987b). Therefore, it was desirable to know the effect of various insecticides used in cotton environment on the egg parasitoid, *T. achaeae* so as to select insecticides which would be less harmful to the parasitoid, for integrated control programme.

MATERIALS AND METHODS

Fifteen insecticides as shown in Table 1 which are used for the control of insect pests of cotton in Punjab were employed for this study (Anonymous, 1987b). Adults of *T. achaeae* were multiplied on the eggs of rice moth, *Corcyra cephalonica* (Stainton). Frozen eggs of *C. cephalonica* were mounted on cards (10.0 × 2.5 cm) @ 200 per card. The cards were sprayed with different insecticides by employing the technique of Varma and Singh (1987). The spray fluid used for each treatment was 1.5 ml. The cards used for control were sprayed with tap water. The cards after shade drying were exposed in glass tubes (15 × 2.5 cm) to fifty unsexed adult parasitoids with a sex ratio of 1:3.2 (male: female) (24 hr old). The treatments were replicated three times.