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Influence of Host Plant Architecture and Insecticidal Schedule on the Natural Enemies of Cotton Whitefly, *Bemisia tabaci* Genn.*

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ABSTRACT

The glabrous varieties of cotton favoured higher parasite activity on whitefly, recording more than 40 percent parasitisation, while hairy varieties recorded higher number of predatory mites. The integrated management programme involving natural insecticides of plant and animal origin was significantly superior in conserving the parasite and predatory populations compared to the existing (bollworm based) schedule as well as a schedule involving some new and highly effective insecticides.

Key words : Parasites, predators, *Bemisia tabaci*, cotton varieties, integrated management programme.

The cotton whitefly, *Bemisia tabaci* Genn., is a serious pest of common field crops of India. The recurrent outbreaks of this pest in several cotton growing states from 1984 onwards exposed the inadequacy of the existing control measures. In the process of identifying an alternate strategy to manage this pest, studies were made at Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh. Three aphelinid parasites and three phytoseid mites were found to regulate this pest under natural situation on cotton ecosystem inaddition to common predators like coccinellids, chrysopids, spiders as well as a few fungal pathogens (Venugopal, 1987). In the present study, the influence of host plant architecture and leaf pubescence as well as the insecticides on the activity of these natural enemies of whitefly was studied.

MATERIALS AND METHODS

Twenty lines of cotton, *Gossypium hirsutum* which exhibited differential reaction to *B. tabaci.*, [resistant (8 cultures); moderately resistant (5 cultures) and susceptible/highly susceptible (7 cultures)] were shown in the field in two rows of 10 m length. These were observed for plant architecture (open / bushy) and leaf pubescence (glabrous / sparsely hairy/hairy/densely hairy) at 40 days after sowing. In the process of recording counts on the nymphs of whitefly (No/cm^2), observations were also made simultaneously on the parasitism due to aphelinids and predator numbers (phytoseid) per leaf at 60, 90 and 120 days of sowing. The data were subjected to analysis of variance to draw relevant conclusions.

In another experiment, the influence of different insecticidal treatment schedules viz., (i) bollworm based schedule involving repeated applications of synthetic pyrethroids (ii) integrated management schedule involving natural products as insecticides and (iii) maximum protection schedule involving new and effective insecticides on six different cotton cultures of varied nature i.e., glabrous (LPS 141, LK 861), sparsely hairy (L 39), hairy (MCU 5) and densely hairy (ADB 10, 050 and JKHY 1) on the incidence of natural enemies was studied. Counts on parasites and predators per cm^2 area of leaf and 10 leaves respectively were recorded along with whitefly counts at 10 day intervals.

RESULTS AND DISCUSSION

The parasite activity was observed to be more in open plant types than in bushy types. Similarly, the high activity of the parasites was noticed in cotton cultures possessing glabrous foliage. On the other hand, the predators seemed to have a marked preference to cotton cultures having dense-hairy leaves (Fig.1).

LK 861, a glabrous cotton culture resistant to whitefly recorded 48.9 per cent nymphal parasitism while in DHY 286, a densely hairy variety susceptible to whitefly recorded the lowest parasitism of 2.1 percent. The activity of predatory mites was almost absent in glabrous cultures like D 53, LPS 141, NHV 1,2F and KH 97FBRN as against maximum activity observed in hairy cltures like MCU

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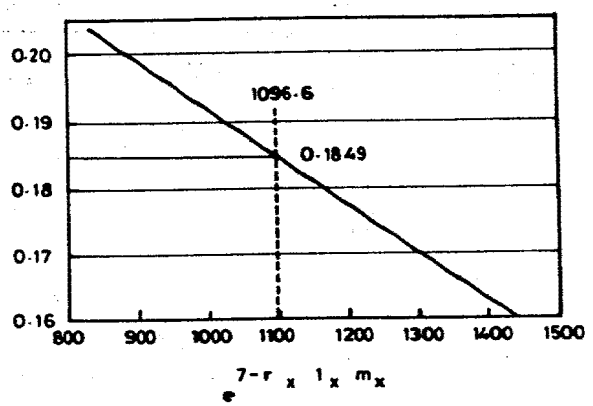
Table 1. Influence of cotton plant characters on nymphal parasitization and predators of whitefly

Culture	Reaction to whitefly	Plant type	Leaf type	Parasitism	No. of Predators 10 leaves
L 081	MS	0	SH	7.9	4.0
LK 861	R	0	G	48.9	0.5
G Cot 12	MS	B	DH	10.8	8.0
Supriya	MS	0	SH	18.4	2.5
G Cot 100	MS	B	SH	13.0	4.5
D 53	R	0	G	35.7	0.0
LPS 141	R	0	G	41.6	0.0
NHV 1	R	(Okra)	G	47.0	0.0
2F	R	B	G	31.6	0.0
A 102	R	0	G	30.1	0.5
ADB 10050	S	B	DH	7.5	4.5
B 1007	S	B	DH	7.2	7.0
DHY 286	S	B	DH	2.1	8.0
JK 97 FBRN	R	0	G	16.5	0.0
MERS 17	MS	0	SH	18.8	7.0
JK 286	R	0	G	38.3	0.5
Sharada	HS	B	H	8.9	3.0
L 389	S	B	SH	21.2	7.0
LRA 5166	HS	B	H	12.2	4.0
MCU 5	HS	B	H	12.4	9.3
Mean				21.51	3.52
SD				14.48	3.27

Reaction : R = Resistant, MS = Moderately susceptible, S = Susceptible, HS = Highly susceptible

Plant type : O = Open, B = Bushy, G = Glabrous

Leaf type : SH = Sparsely hairy, H = Hairy, DH = Densely hairy, G = Glabrous



5, G cot12, DHY 286, B 1007 and L 389 (Table 1). The order of parasitism was 36.2, 15.9, 11.2 and 6.9 per cent in glabrous, sparsely hairy,hairy and densly hairy cultures respectively. In respect of predators, a reverse trend was observed with 0.2, 5.0,5.4 and 6.9 nos/10 leaves in these groups.

Irrespective of the varieties involved, integrated management of whitefly was found to be significantly superior to other insecticidal schedules in promoting natural enemies with highest levels of parasitism of 29.8 and 35.7 percent during khariff and summer seasons respectively (Table 2).

Maximum protection schedule involving new and effective insecticides was found highly detrimental to parasitism during khariff and summer seasons. There were significant differences with respect to parasitism in the different varieties, when the overall activity of parasites was considered under the three different insecticidal schedules. LPS 141 recorded the highest level of parasitism of 30.3 and 34.2 percent during 'Khariff' 1986 and summer 1987 seasons respectively. On the other hand, the hybrid JKHy1 exhibited least nymphal parasite activity of 14.7 and 26.3 percent during 'Khariff' and summer seasons respectively.

Adoption of integrated management schedule was also found beneficial to the predators of whitefly, recording highest populations of 3.3 and 4.2/10 leaves during 'Khariff' 1986 and summer 1987 seasons respectively as against the lowest

Table 2. Varietal and treatmental interaction on parasitization of whitefly

Main treatments (varieties)	1986-87 Khariff				1987 Summer			
	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean
LPS 1 41	33.5 (35.3)	44.4 (41.8)	6.2 (13.7)	28.0 (30.3)	36.2 (37.0)	42.1 (40.5)	17.8 (25.1)	32.0 (34.2)*
L 389	18.6 (25.5)	28.7 (32.2)	2.0 (5.9)	16.4 (21.2)	24.6 (29.7)	30.2 (33.3)	19.4 (25.9)	24.7 (29.6)
ADB 10050	12.0 (19.8)	16.3 (23.2)	0.1 (1.8)	9.5 (15.0)	21.2 (27.4)	29.4 (32.8)	17.5 (24.7)	22.7 (28.3)
JKHy 1	9.9 (18.2)	13.3 (21.2)	1.1 (4.7)	8.1 (14.7)	19.2 (26.0)	27.6 (31.7)	13.4 (21.3)	20.1 (26.3)
LK 861	24.7 (29.8)	39.4 (38.9)	1.0 (4.5)	21.7 (24.4)	28.8 (32.5)	45.2 (42.3)	15.0 (22.7)	29.7 (32.5)
MCU 5	10.9 (19.1)	13.7 (21.60)	4.5 (12.2)	9.7 (17.6)	21.5 (27.7)	30.4 (35.5)	16.1 (23.6)	22.7 (28.3)
Mean	10.9 (24.6)	26.0 (29.8)	2.5 (7.1)		21.5 (30.1)	30.4 (35.7)	16.1 (23.9)	

* Figures in parentheses are transformed values

	Varieties	Treatments	Varieties	Treatments
C.D. (P = 0.05)	4.46	3.11	3.36	1.58
Interaction	7.61	7.49	3.86	5.13

T_1 = Boll worm schedule T_2 = Integrated management T_3 = Maximum protection

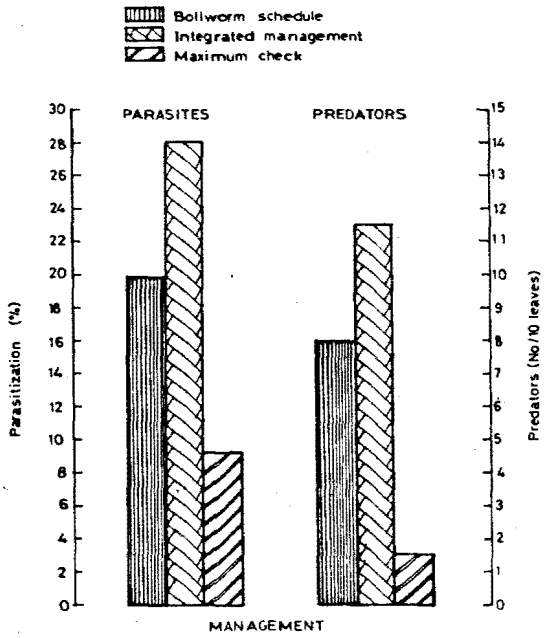
Table 3. Varietal and treatmental interaction on the densities of predatory mites of whitefly

Main treatments (varieties)	1986-87 Kharif				1987 Summer			
	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean
LPS 1 41	3.7 (1.9)	3.4 (2.0)	0.1 (0.7)	2.4 (1.6)	5.3 (2.4)	9.0 (3.1)	2.3 (1.7)	5.5 (2.4)*
L 389	7.7 (2.8)	6.0 (3.6)	1.3 (1.2)	5.0 (2.3)	11.7 (3.5)	19.0 (4.5)	3.0 (1.8)	11.2 (3.3)
ADB 10050	11.7 (3.5)	7.0 (4.2)	0.7 (1.0)	6.5 (2.9)	9.3 (3.1)	22.0 (4.7)	2.3 (1.7)	11.2 (3.2)
JKSHY 1	11.7 (3.5)	9.3 (3.6)	0.3 (0.9)	7.1 (2.7)	5.3 (2.4)	22.3 (4.8)	1.7 (1.5)	9.8 (2.9)
LK 861	4.0 (2.1)	1.3 (2.4)	0.1 (0.7)	1.8 (1.7)	5.0 (2.3)	11.0 (3.4)	1.0 (1.2)	5.7 (2.3)
MCU 5	11.7 (3.5)	8.3 (3.9)	2.3 (1.6)	7.4 (3.0)	8.7 (3.0)	20.3 (4.6)	2.0 (2.6)	10.3 (3.0)
Mean	8.4 (2.9)	5.9 (3.3)	0.8 (1.0)		7.6 (2.8)	17.3 (4.2)	2.1 (1.6)	

* Figures in parentheses are means of (x + 0.5)

	Varieties	Treatments	Varieties	Treatments
C.D. (P = 0.05)	0.41	0.30	0.42	0.24
Interaction	0.74	0.70-	0.59	0.67

T_1 = Boll worm schedule T_2 = Integrated management T_3 = Maximum protection



populations recorded in the maximum protection schedule. The role of cotton varieties on the build up of predators of whitefly was not consistent from season to season. The popular variety MCU 5 recorded the highest population of 3/10 leaves during 'Khariff' season while L 389 recorded 3.3/10 leaves during summer (Table 3). However, LPS 141 and LK 861 were found to be consistently least attractive to whitefly predators during both the seasons.

The activity of predatory mites was almost nil in glabrous cultures but the parasite activity was promoted. Plant biophysical characters are found to have direct relation with natural enemies (Azab *et al.*, 1969; Greathead, 1976; Jordan and Van Lantern, 1978; Khalifa, 1984). Recent review by Gerling (1986) revealed the importance of host plant architecture on the parasites and predators of whitefly.

The integrated schedule involving insecticides of plant and animal origin was found least harmful to the natural enemies of whitefly (Fig. 2). Under the present situation, the mass rearing and releasing of natural enemies in field conditions is very much limited due to various reasons. The only alternative is to conserve and encourage the natural enemies with the use of safer and selective chemicals as part of an integrated pest management programme.

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