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Studies on Varietal Resistance and Chemical Control of Whitefly (*Bemisia tabaci* Genn.) in Cotton

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Abstract: The present study was conducted to evaluate cotton varieties against whitefly, to investigate its population trend and to evaluate best insecticide for its management. Six varieties were tested to see the level of preference of whitefly on different varieties. Only variety K-68/9 showed some resistance against this pest where as CIM-240 and NIAB-78 were more susceptible to the whitefly. Whitefly made its appearance from last week of July and continued up to December. Its maximum population was recorded on 21st October. Five pesticides were also tested against this pest; Tamaron 600 SL (methamidophos) gave best control of this pest. The overall cumulative effect of different treatments on different cotton varieties with time interval against this pest showed good response of the treatments after 3 days spray. While overall commutative effect of treatments on the different cotton varieties, good response was observed on CRIS-9.

Key words: Cotton, varietal resistance, chemicals, whitefly

INTRODUCTION

Cotton (*Gossypium hirsutum*) production is the main source of raw material for industry and cotton crop provide some 40% of total export earning for Pakistan, either as raw cotton (lint), cotton yarn, or cotton textile goods. It is estimated that cotton production provides a livelihood to over one million farmers and around four million members of their families. In addition directly and indirectly many more will be wholly or partially employed or supported by cotton crop in villages and towns the ginning factories, transportation services the textile industry; vegetable oil extraction the export houses and shipping services and in the infrastructural and institutional support service (Black, 1987).

Cotton is attacked by a variety of insect pests, which cause about 30% loss every year but some times this level may go up to 40-50% (Baig, 1992).

Initially during seedling and vegetative growth the crop is damaged by sucking insect pests such as cotton aphid, whitefly, thrips and jassid etc. later on bollworm complex cause heavy losses at the time of flowering and fruiting by damaging the fruit bodies. Amongst these insect pests, the sucking pests cause maximum loss to the crop particularly whitefly and aphids during vegetative growth. These insect pests besides sucking the plant sap are responsible for transmitting various diseases to the crop, including the deadly disease of cotton leaf curl virus.

Generally pesticide play a vital role in pest control strategy, but one should know that all the pesticide are poisonous and cause hazards to very living organisms including human beings. In addition to this, these pesticides are the chief source of environmental pollution. In Pakistan the use of pesticides is being considered synonymous to plant protection. No doubt it is a very important component of plant protection strategy but its indiscriminate use has created many problems. So it is urgently needed that proper pesticide for proper pest should be applied at proper time, besides some varieties of cotton has natural resistant due to their Antixenosis or Antibiosis behaviors. Keeping in view the importance of this crop and the use of pesticide the present study was conducted to evaluate cotton varieties against whitefly, to investigate its population trend and to evaluate best insecticide for its management.

MATERIALS AND METHODS

Studies on the chemical control and varietal preference of whitefly (*Bemisia tabaci* Genn.) were carried out at the Agriculture Development Institute Khan Pur Nasirabad Baluchistan in June 1999. Three experiments were conducted, the details of these are given below.

Chemical trial: For these purpose six commercial cotton varieties i.e., Cris-9, Shaheen, K-68, Niab-78, CIM-109 and CIM-240 were tested. These varieties were sown in the 1st

week of June during Kharif season. The experiment was carried out Randomize Complete Block (RCB) design with split-split plot arrangement. The experiment was comprised of three replication; each replication plot size was 2090.3184 M² (45.72x45.72 m). Plots were divide in to six main plots A for chemical, B (sub plots) for variety and C (Sub-sub plots) for analysis of variance of time factor. Between two main plots there was a buffer zone of one meter to avoid drift effects of the chemicals. Plant to plant and row-to-row distance were 15 and 76 cm, respectively. Name of pesticides their dose and formulation are as follows:

Treatments	Common name	Trade name	Formulation	Dose/acre
T ₁	Monocrotophos	Nuvacron	40 WSC	1000 mL
T ₂	Methamidophos	Tamaron	600 SL	600 mL
T ₃	Endosulfan	Thiodan	35 EC	1250 mL
T ₄	Prophenophos	Curacron	500 EC	800 mL
T ₅	Diafenthuran	Polo	500 EC	250 mL
T ₆	Control	-	-	-

These plots were observed daily for the presence of the whitefly. When the population of whitefly reached to 5 per leaf the desire solution of each insecticide were prepared and sprayed with knapsack sprayer. Twenty leaves per treatment were randomly selected from upper middle and lower leaves. The numbers of whitefly were converted on per leaf basis and post spray data were recorded for 1, 2, 3, 7 and 14 days.

Varietal preference trial: To study the varietal preference and relative resistance of different varieties of cotton, the same six cotton cultivars tested for chemical trials were tested here. These varieties were sown on 1st week of June during the Kharif season.

The experiment was carried out in RCB design have three replications and each replication plot size was 45.72x7.62 m. there were only six plots A for the size cotton varieties and B for analysis of variance for time factor in each replication. Plant to plant and row-to-row distance was 6 and 30 inches, respectively. Counting of whitefly was carried out at weekly interval after the appearance of it. The number of whitefly was counted on 20 leaves randomly selected per plot alternating upper, middle and lower leaves, respectively. The relative population density of whitefly on these varieties was converted in to mean number of whitefly per leaf. The data obtained were statistically analysed using Ftest and LSD test was applied for mean separation.

RESULTS AND DISCUSSION

Varietal preference (Population density of the Whitefly *Bemisia tabaci* Genn.): The whitefly population started

to appear on variety CIM-240 with a population of 0.6/leaf on 26-07-1999. The maximum average population of 50.967/leaf was recorded on the same variety on 21-10-1999 and followed by NIAB-78 with a population of 30.767/leaf on 28-10-1999. On the basis of seasonal average maximum population of 16.195/leaf was found on CIM-240 and minimum of 7.105/leaf was recorded on variety K-68/9. Luo *et al.* (1989) reported that the *B. tabaci* appeared in cotton field from early July and regular population peaks were observed in August to September. Our observations are in agreement with this study. Ozgur *et al.* (1990) also find out that in Turkey the population density of whitefly remained low until the end of July on cotton thereafter it started to increase. This increase coincided in August to September. As the varietal preference is concerned Ozugar *et al.* (1988) tested 25 cotton cultivars and found that *Gossypium hirsutum* cv. La 5100NS proved highly resistant to whitefly. The variety has glabrous leaf. Similarly Natarjan (1990) reported that density of *B. tabaci* nymphs increased as leaf hair density increased. In present study, the variety CIM-240 also has got broader leaf area and somewhat glabrous leaves that might be the reason to have maximum pressure of whitefly (Table 1).

Chemical control of whitefly (*B. tabaci* Genn.): The infestation of cotton whitefly ranged from 1.794 to 4.511 with a mean of 3.175/leaf where monocrotophos was sprayed while infestation ranged from 1.406 to 4.272 with a mean 2.839, from 1.733 to 4.522 with a mean 3.122, from 2.078 to 4.744 with a mean 3.583, from 2.189 to 4.839 with a mean 3.092 on plots respectively, treated with Methamididphos, Endosulfan, Prophenophos and Diafenthuran. On treated plot it ranged from 6.722 to 11.18 with a mean of 8.922 white flies/leaf (Table 2).

On the basis of seasonal average, the minimum and maximum population of 2.839 and 3.380/leaf was recorded in T₂ and T₄, where Tamaron and Curacron was used, respectively (Table 2). The statistical analysis of the data indicated that the performance of Tamaron was better and significantly different from all the treatments, whereas all the other treatments were significant to each other and also highly significant to untreated check. These results clearly indicate that whitefly population has not developed resistance to the classical pesticide, because the crop is newly introduced in Nasirabad, Balochistan. Although statistically all the pesticides were significantly different from each other and highly significant to the untreated one while generally all of these pesticides give more or less the same results. We can recommend these pesticides trustfully to the farmers. Newly introduced Polo of CIBA (Novartis) also give satisfactory results

Table 1: Population trend of the whitefly (*Bemisia tabaci* Genn.) on different cotton varieties

Variety	Dates of observation of whitefly in different varieties																			Avg.		
	12/7	19/7	26/7	2/8	9/8	16/8	23/8	1/9	8/9	15/9	22/9	29/9	7/10	14/10	21/10	28/10	4/11	11/11	18/11		25/11	3/12
CRIS-9 (V ₁)	0.00	0.00	0.00	0.343	0.700	1.500	1.800	2.600	2.90	3.53	3.87	5.53	8.17	10.43	13.97	21.44	25.4	23.77	18.37	6.7	3.8	7.372E*
Shaheen (V ₂)	0.00	0.00	0.00	0.00	0.600	1.33	1.700	2.167	3.03	3.63	4.6	5.97	7.71	10.1	14.67	17.9	26.2	26.63	23.43	14.67	4.97	8.045D
K-68/9(V ₃)	0.00	0.00	0.00	0.00	0.433	1.033	1.767	2.4	2.93	3.6	4.3	5.433	7.1	9.77	13.77	17.3	22.23	23.97	18.67	9.93	4.67	7.105F
NIAB-78 (V ₄)	0.00	0.00	0.00	0.433	0.633	2.233	3.167	4.00	5.2	6.8	9.0	10.97	15.44	23.07	27.9	30.77	28.67	24.97	19.23	11.43	4.77	10.87B
CIM-109 (V ₅)	0.00	0.00	0.00	0.00	0.333	1.15	1.9	2.433	3.63	4.67	7.17	9.033	12.2	18.9	26.37	28.1	23.77	18.77	14.0	9.33	4.67	8.88C
CIM-240 (V ₆)	0.00	0.00	0.00	1.0	1.5	2.443	3.7	5.233	6.7	9.23	11.03	19.94	30.9	42.5	50.97	49.67	40.47	28.53	19.43	10.73	5.5	16.2A

*Average means in the column followed by the same letter(s) are not significant at 5% level of probability

Table 2: Effect of different insecticides on whitefly (*Bemisia tabaci* Genn.) on cotton crop

Treatments	Dose/acre (mL)	Population density/leaf after treatment in days					Average
		1	2	3	7	14	
T ₁	1000	3.750 IJ*	2.733 P	1.794 R	3.089 NU	4.511 GH	3.175 BC **
T ₂	600	3.583 IJKL	2.244 Q	1.406 S	2.689 P	4.272 H	2.839 D
T ₃	125	3.633 IJK	2.600 P	1.733 R	3.122 MNO	4.522 GH	3.122 C
T ₄	800	3.822 I	2.861 OP	2.078 Q	3.394 KLM	4.744 FG	3.380 B
T ₅	250	3.350 LMN	1.556 RS	2.189 Q	3.528 JKL	4.839F	3.092 C
T ₆		6.722 E	7.889 D	8.917 C	9.906 B	11.18 A	8.922 A

Table 3: Varietal interaction in relation to pesticide toxicity/effect against the whitefly (*Bemisia tabaci* Genn.)

Treatments	CRIS-9 (V ₁)	Shaheen (V ₂)	K-68/9 (V ₃)	NIAB-78 (V ₄)	CIM-109 (V ₅)	CIM-240 (V ₆)
T ₁	2.613 QR*	3.593 FGH	3.293HIJK	3.393 GHIJ	3.013 LMNU	3.147 IJKLM
T ₂	2.207 S	3.133 JKLMN	2.860 NOPQ	2.973 MNU	2.893MNOP	2.967 MNO
T ₃	2.513 R	3.527 FGH	3.420 GHI	3.273 HIJKL	2.980 MNO	3.020 KLMNO
T ₄	3.033 LMNO	3.867 E	3.513 FGH	3.713 EF	3.053 KLMNO	3.100 KLMNO
T ₅	2.633 PQR	3.607 EFG	3.287 HIJKL	3.133 JKLMN	3.053 KLMNO	2.840 OPQ
T ₆	8.653	8.973 BC	9.107 AB	8.693 D	9.367 A	8.740 CD
Average	3.609 D	4.450 A	4.247 AB	4.197 BC	4.060 BC	3.969 C**

Table 4: Commulative effect of different treatments on whitefly (*Bemisia tabaci* Genn.) on different cotton varieties

Variety	Pest population at different time intervals after the treatments				
	1	2	3	7	14
CRIS-9 (V ₁)	4.022 G*	2.733 NO	2.589 O	3.464 IJK	5.250 C
Shaheen (V ₂)	4.694 D	3.878 GH	3.578 I	4.528 DE	5.572 B
K-68/9 (V ₃)	4.356 E	3.478 IJK	3.228 KLM	4.517 DE	5.656 B
NIAB-78 (V ₄)	4.039 FG	3.522 IJ	3.139 LM	4.494 DE	5.789 AB
CIM-109 (V ₅)	4.072 FG	2.994 MN	2.817 NO	4.433 DE	5.983 A
CIM-240 (V ₆)	3.678 HI	3.272 JKL	2.767 NO	4.311 EF	5.817AB
Average	4.144 C**	3.314 D	3.09 E	4.288 B	5.678 A

*Mean in the column and row followed by the same letter(s) are not significantly different at 0.05 level of probability.

**Mean in the column followed by the same letter(s) are not significantly different at 0.05 level of probability

(control). Similarly observation were also recorded by Darwsh and Fergal (1990) where nine pesticides were tested and they found that Tamaron Combi (methamidophos + triflumuron) was among the most effective pesticides against the whitefly. These observations are partially in agreement with our findings. From India Nimbalkar *et al.* (1993) reported that when monocrotophos product was applied at a depth of 10 cm at sowing time gave good control of whitefly. Nagia *et al.* (1992) sprayed monocrotophos 4 times at 20-22 days intervals on an 85-day-old cotton crop. The pesticide gave good control of whitefly. Similarly Karuppuchamy *et al.* (1986) determined the effectiveness of 10 insecticidal treatments against major insect pests of cotton in rice-fallow-cotton rotation and found the monocrotophos (0.04%) gave good control of whitefly.

But Nimbalkar *et al.* (1993) reported that the product gave a moderate control of whitefly in cotton fields.

Varietal interaction in relation to pesticide toxicity/effect against whitefly:

The overall average cumulative effect of chemicals on different cotton varieties against whitefly indicated that the good response was observed on V₁ (CRIS-9) whereas poor performance was observed in V₂ (Shaheen). Tamaron give good control of whitefly on all the varieties and followed by polo. No literature available, which could indicate that no one so far has worked on his aspect. Therefore, further research will be required to conduct on this important aspect of cotton crop.

Cumulative effect of different pesticides on whitefly on different varieties:

This indicated that the best control

was observed at 3 days interval followed by 2 days interval where the insect count was 3.019 and 3.014/leaf, respectively. This is also a new direction of research. So we could not find any literature on the subject to compare our studies. Present studies have opened a new direction to researchers to think over it.

Recommendations: Tamaron 600 SL recommended for this pest followed by Polo. 1st spray should be made during 2nd week of September, 2nd spray should be made after 14 days of 1st spray. Variety K-68/9 is recommended as a resistant variety for this pest and also this pest comes earlier in the August.

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