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EVALUATION OF SOME NEW PROMISING COTTON STRAINS AGAINST BOLLWORM COMPLEX

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Abstract: Seven cotton strains, i.e. CIM-78, CIM-80, CIM-81, CIM-84, CIM-95, CIM-96 and Cyto-55 were tested for their resistance against bollworm complex under sprayed and unsprayed conditions at Multan. Cyto-55 and CIM-95 were susceptible, while CIM-78, CIM–80, CIM-81 and CIM-84 were less susceptible to American, *Helicoverpa amigera* and Spotted, *Earias spp.* bollworms. CIM-78 and CIM–80 were susceptible to pink bollworm, *Pectinophora gossypiella*. CIM-78, CIM-80, CIM-81 and CIM-84 produced better yield under both sprayed and unsprayed conditions. Cyto-55, CIM-95 and CIM-96 were tolerant against pink bollworm under both conditions, but produced lower yield.

Keywords: Cotton, *Earias spp., Helicoverpa armigera,* spray regime.

INTRODUCTION

Cotton is one of the most important cash crops in Pakistan. It is attacked by 145 species of insect and mite pests [Huque 1994]. According to Satpute *et al.* [1988], the yield loss in *Gossypium hirsutum* cotton due to sucking pests, bollworms and both was 8.45, 16.55 and 17.35 quintal ha^{-1} respectively.

Ali and Ahmad [1982], Singh and Lal [1993] and Singh *et al.* [1996] studied comparative resistance in different varieties against *Earias spp*., whereas resistance in cotton cultivars against *Helicoverpa armigera* has been evaluated in the past by Jin *et al.* [1999] and Jackson *et al.* [2000]. Resistance against pink bollworm on cotton cultivars has also been studied [Raqib *et al.* 1985, Kalsy *et al.* 1985, Wilson 1990, Jin *et al.* 1999]. Insecticides are necessary tools for management of cotton pests in almost all the cotton production systems [Castle *et al.* 1999].

High cotton yield depends mainly upon the cultivation of promising varieties. As the older varieties loose yield potential after sometime, new cultivars are released from time to time. The newly released cultivars require thorough evaluation for insect pests. This step is considered important and necessary in development of improved and resistance cultivars [Soomro *et al.* 1986, Chaudhry and Arshad 1989].

Keeping in view the significance of cotton crop, its yield loss and insect pests' severity, present studies were conducted to evaluate recent lines of cotton for their resistance against bollworms under sprayed and unsprayed conditions.

MATERIALS AND METHODS

The experiment was conducted at experimental area of the Entomology Section, Central Cotton Research Institute, (CCRI), Multan. The study was conducted under sprayed and unsprayed conditions in two separate experiments. Each trial was laid out in a Randomized Complete Block Design with three replications. There were 21 plots in each trial and a net plot size was 7.62 x 7.62 meters. Plot to plot distance was 150 cm. Seven cotton varieties viz. CIM-78, CIM-80, CIM-81, CIM-84, CIM-95, CIM-96 and Cyto-55 were sown on June 6, 2001. Distances between rows and plants were 75 and 23 cm, respectively. All the recommended agronomic practices were carried out.

Percent damage, i.e. combined infestation of *Earias spp*. and *Helicoverpa armigera* was recorded weekly starting from 16 August 2001 till the end of September. For this purpose total immature fruiting parts (buds and flowers), mature fruiting parts (bolls) and damaged fruiting parts of all consecutive plants were counted within length of 134 cm per plot. The damage caused by pink bollworm was recorded by examining 20 randomly collected green bolls from each plot. These bolls were dissected, and damage caused by pink bollworm was recorded. The damage was recorded on 20 August, September and October 2001. The crop was picked on 12 November. At this time more than 50 percent bolls were ready for picking. Seed cotton yield of each treatment was converted to yield per hectare.

Insecticides were sprayed (in experiment under sprayed conditions only) when damage of bollworms reached their respective economic threshold levels. Economic threshold level for *Helicoverpa armigera,* (five brown eggs or three small larvae per 25 plants), for *Earias* spp. (3-5 larvae per 25 plants) and for *Pectinophra gossypiella* (five larvae per 100 bolls or 5-10% fruiting part damage) recommended by Ahmad [2001] was followed. Insecticides (as mentioned in Table 1) were sprayed by hand operated knapsack sprayer. Data was analyzed by analysis of variance and means were separated with least significant difference [Steel and Torrie 1960].

Table1: Insecticides with dates and dose for trial under sprayed conditions.

Sr. No.	Date of spraying	Insecticides	Dose per Acre (ml)
1	23-08-2001	Cypermethrin 10EC	250
2	30-08-2001	Bifenthrin 10EC	250
3	06-09-2001	Polytrin-C 440 EC (Cypermethrin+Profenophos)	600
4	18-09-2001	Lorsban 40EC (Chloropyriphos) and Fenvalerate 20EC	1000 and 330
5	28-09-2001	Deltamethrin 2.5EC	250

RESULTS AND DISCUSSION

UNSPRAYED PLOTS

Immature Fruiting Parts Damage

Percent damage to immature fruiting parts due to *Earias* spp. and *Helicoverpa armigera,* on cotton strains under study was not significantly different (Table 2). Ahmad *et al*. [1987] reported similar results. They studied five strains of cotton and found that there was non-significant difference among the strains with respect to the damage caused by *Earias* spp.

Table 2: An overall percent damage of different fruiting parts by various bollworms to different strains under unsprayed conditions.

Strains		American & spotted bollworm damage (%)			Pink bollworm damage** (%)	Seed cotton yield (kg ha^{-1})**
		Immature fruiting parts (n.s.)	Mature fruiting parts**	Total fruiting parts (n.s.)		
S1	CIM-78	15.40	18.58b	16.35	31.67a	1021.89bc
S2	CIM-80	15.18	11.21b	13.91	31.67a	993.19c
S3	CIM-81	16.56	15.07b	15.82	20.00bc	1291.72a
S4	CIM-84	17.92	17.52b	17.31	20.00bc	677.43d
S5	CIM-95	18.13	16.25b	17.39	23.33b	510.95e
S6	CIM-96	22.67	36.55a	23.98	16.67c	40.19g
S7	Cyto-55	19.35	43.99a	21.07	15.00c	140.38f

** = Highly significant. n.s. = Non-significant.

Mature Fruiting Parts Damage

Percent damage due to *Helicoverpa armigera* and *Earias* spp. on mature fruiting parts of cotton strains under study was highly significantly different (Table 2). The highest and statistically similar damage was observed on Cyto-55 and CIM-96. All other strains had statistically similar and lower damage than Cyto-55 and CIM-96. Bughio *et al*. [1984] and Jackson *et al*. [2000] found significant differences in damage due to *Earias* spp. on different cotton cultivars.

Total (Immature + Mature) Fruiting Parts Damage

All the strains under study were statistically similar regarding the damage due to *Helicoverpa armigera* and *Earias* spp (Table 2).

Green Boll Damage Due to Pink Bollworm

Based on the pink bollworm damage, all the strains were significantly different from each other (Table 2). The highest and statistically equal boll damage was found in CIM-78 and CIM-80 (31.67%) followed by CIM-95 (23.33%), CIM-81 and CIM-84 (20%), CIM-96 (16.67%) and Cyto-55 (15%). Results in the present investigations are similar to those of Jin *et al*. [1999], they investigated cotton hybrid varieties for resistance / susceptibility to pink bollworm and found significant difference among the varieties.

Seed Cotton Yield

The yield of cotton strains under unsprayed conditions was highly significantly different from each other (Table 2). Maximum seed cotton yield was observed in CIM-81 (1291.72 kg ha^{-1}) followed by CIM-78 (1021.89 kg ha^{-1}), CIM-80 (993.19 kg ha^{-1}), CIM-84 (677.43 kg ha^{-1}), CIM-95 (510.95 kg ha^{-1}), Cyto-55 (140.38 kg ha^{-1}) and minimum on strain CIM-96 (40.19 kg ha^{-1}).

SPRAYED PLOTS

Fruiting Parts Damage

Percent damage due to both species to immature, mature and total fruiting part of tested cotton strains was non-significantly different (Table 3).

Table 3: An overall percent damage of different fruiting parts by various bollworms to different strains under sprayed conditions.

Strains		American and spotted bollworm damage (%) Immature fruiting parts (n.s.)	Mature fruiting parts (n.s.)	Total fruiting parts (n.s.)	Pink bollworm damage** (%)	Seed cotton yield (kg ha^{-1}) **
S1	CIM-78	11.11	7.28	9.37	15.00a	1532.84d
S2	CIM-80	9.39	6.83	8.13	8.33b	1825.62b
S3	CIM-81	11.28	7.89	9.65	8.33b	1664.88c
S4	CIM-84	12.18	6.84	9.94	13.33a	1911.74a
S5	CIM-95	13.96	7.13	10.70	5.00bc	1481.17e
S6	CIM-96	11.87	10.80	11.04	1.67c	361.68g
S7	Cyto-55	14.97	8.84	13.56	6.67b	436.31f

** = Highly significant. n.s. = Non-significant.

Green Boll Damage Due to Pink Bollworm

Based on pink bollworm damage, cotton strains were highly significantly different (Table 3). Cotton strain CIM-78 (15%) was statistically similar to CIM-84 (13.33%) in respect of pink bollworm damage, while Cyto-55 (6.67%), CIM-80 (8.33%) and CIM-81 (8.33%) had statistically similar and higher damage than CIM-95 (5.00%) and CIM-96 (1.67%).

Seed Cotton Yield

The yield of cotton strains under sprayed conditions was highly significantly different from each other (Table 3). Maximum seed cotton yield was observed in CIM-84 (1911.74 kg ha^{-1}). No strains were statistically similar with respect to yield. Cotton strains Cyto-55, CIM-95 and CIM-96 were more susceptible to *Helicoverpa armigera* and *Earias* spp. as these showed the highest damage to mature fruiting parts, whereas, these strains were found tolerant to attack of pink bollworm. However, these strains had lower yield. It is known fact, that yield is dependent not only on insect infestation but also upon other factors such as genetic potential of varieties, varieties' response to ecological conditions etc. Strains CIM-78 and CIM-80 were more susceptible to pink bollworm attack but less susceptible to *Helicoverpa armigera* and *Earias* spp. based on the damage to mature fruiting parts. Strains CIM-78, CIM-80, CIM-81 and CIM-84 had the highest seed cotton yields. Lowest yield was observed in Cyto-55, CIM-95 and CIM-96 under both unsprayed and sprayed conditions.

It is concluded that strains CIM-78, CIM-80, CIM-81 and CIM-84 were excellent with respect to low level of *Helicoverpa armiger* and *Earias* spp. attack on bolls and higher seed cotton yield even after having more attack of pink bollworm. Further studies are required for the evaluation of these strains at different locations and for characters responsible for resistance.

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