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Comparative Resistance of Transgenic and Conventional Cotton Against Bollworms Complex

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ABSTRACT

The comparative resistance of eight genotypes of transgenic and conventional cotton to bollworms was studied under field conditions. The results revealed that infestation of spotted bollworm was significantly high on squares, flowers and green bolls of FH-900. The infestation of American bollworm of cotton was high on FH-900 followed by CIM-109, CIM-446 and NIAB Karishma. The infestation on green bolls and flowers of FH-900 caused by pink bollworm was significantly high followed by CIM-446 and CIM-473. However, overall infestation of bollworm complex was found to be high on FH-900 as compared to other genotypes of transgenic and conventional cotton. It can be inferred from the results that FH-900 was more susceptible to bollworm complex; however, IRFH-901 emerged as comparatively resistant genotype to bollworms.

Key Words: Transgenic; Conventional; Cotton; Resistance; Bollworms

INTRODUCTION

Insect pests are the major impediment in maximizing cotton production. Among them, cotton bollworms damage the cotton very severely. According to an estimate, bollworms reduce the annual potential of cotton production by 20-25% (Anonymous, 2003).

For averting losses due to insect pests, entire reliance has been on insecticides which have not only created problems of health hazards, development of resistance in insects and environmental pollution etc. (Soerjani, 1988), but also have increased the expenditure from 500 million rupees in 1983-84 to 7741 million rupees during 2000-2001 (Anonymous, 2001).

These facts demand that instead of depending upon provisional pest control tactics extensive research should be carried out to device some long lasting and sound pest control strategies. One of the safe measures to evade such a situation is to grow resistant cotton cultivars. i.e., finding out comparative resistance in transgenic and conventional cotton genotypes, is a pre-requisite for the success of such a strategy. Bt. cotton provides an alternative by replacing insecticides with a toxin within the plant (International Cotton Advisory Committee, 2000). According to Layton *et al*. (1997) overall performance of Bt. Cotton was better than conventional varieties. Transgenic cotton is extensively used in developed countries. In Australia, there has been 60% reduction in pesticide usage on Bt. Cotton in most of the regions (Fitt *et al.*, 1988). But in Pakistan, no serious attention in given on transgenic cotton and all the work is done on conventional cotton. So very few information on the comparative resistance of transgenic and conventional cotton except that of foreign workers, i.e., Fitt *et al.* (1998), Allen *et al.* (1999), Novillo *et al.* (1999), Cui *et al.* (2000), Moser *et al.* (2000), Ridge *et al.* (2000), Wu-kong *et al.* (2000) and Yousaf *et al.* (2001) is available. Keeping in view the endeavour of aforementioned researchers, this project was planned to study the comparative resistance of transgenic cultivars and conventional varieties under the local agro-climatic conditions.

MATERIALS AND METHODS

The comparative resistance was studied at Ayub Agricultural Research Institute Faisalabad. There were eight cotton genotypes viz., IRFH-109, IRCIM-443, IRCIM-448 (Transgenic cultivars), NIAB-Karishma, CIM-109, CIM-446, CIM-473 and FH-900 (Conventional cultivars). The experiment was laid out in Randomized Complete Block Design with treatments having three repeats each. The data of bollworm's population was taken from squares, flowers and green bolls on weekly basis from August to October. There were three rows of cotton in each treatment and five plants were selected at random from each row, for recording pest population. These plants were tagged to avoid repetition. The mean population on different plant parts i.e., squares; flowers and green bolls were calculated on percentage infestation basis. Percent infestation was considered to be an indirect reflection of comparative resistance of transgenic and conventional cotton against bollworm complex. The data regarding percent infestation were subjected to DMR Test.

RESULTS AND DISCUSSION

The data on percentage infestation of spotted bollworm, American bollworm and Pink bollworm on squares, flowers and green bolls was recorded (Table I, II & III).

The data in Table I revealed that the maximum infestation of 14.67% on squares was recorded on variety FH-900 followed by the varieties, CIM-109, CIM-473 and CIM-446 with infestation of 12.19, 11.97 and 11.19%, respectively. Similarly, maximum infestation (9.55%) of spotted bollworms on flowers was recorded on the variety FH-900 while the minimum infestation of 1.40% was recorded on genotype IRCIM-443. However, the genotype IRCIM-448 and IRFH-901 showed comparatively better resistance against spotted bollworms. While in case of green bolls percent infestation, FH-900 was most susceptible with 10.76% damage and genotype IRFH-901 (2.38%) was the resistant one, followed by IRCIM-443 (2.42%) and IRCIM-448 (2.79%), respectively. The significant infestation was observed among different genotypes. These findings on percent infestation of spotted bollworm on squares, flowers and green bolls conform to those already completed by Davis *et al*. (1995), Kerby *et al.* (1995), Layton *et al.* (1997), Novillo *et al.* (1999), Obando-Rodriguez *et al.* (1999), Cui *et al.* (2000), Moser *et al.* (2000) and Yousaf *et al.* (2001).

Data in Table II revealed that the maximum infestation (7.21%) of American bollworm was recorded on squares on variety FH-900 while the minimum (3.37%) was recorded on the genotype IRFH-901. There was non-significant difference among the genotypes, CIM-109, CIM-446, NIAB-Karishma and IRCIM-448. In case of flowers, the maximum infestation was recorded on FH-900 (4.31%) and minimum (2.28%) was recorded on genotype IRFH-901. On green bolls, the maximum infestation was recorded on FH-900 (5.65%) and the minimum (2.69%) was recorded on genotype IRFH-901. However, there was non-significant difference among the genotypes CIM-109, CIM-446, CIM-473, NIAB Karishma, IRCIM-448 and IRCIM-443. These findings on percent infestation of American bollworm on squares, flowers and green bolls are in close conformity with those of Rumel *et al.* (1994), Kerby *et al.* (1995), Harris *et al.* (1996), Jones *et al.* (1996), Bacheler and Mott (1996), Allen *et al.* (1999), Cui *et al.* (2000), Moser *et al.* (2000), Allen *et al.* (2000) and Yousaf *et al.* (2001).

Data in Table III revealed that maximum infestation (3.37%) of pink bollworm was recorded on flowers on FH-900 while the minimum 1.95% on genotype IRFH-901. However, there was no significant difference among the genotypes CIM-473. CIM-446, CIM-109, NIAB Karishma, IRCIM-443 and IRCIM-448. The percentage damage caused by the pink bollworm on green bolls indicated that maximum damage 2.56% was recorded on FH-900 and minimum 1.27% on IRFH-901. However, non-significant difference was observed on the remaining varieties. These findings on percent infestation of pink bollworm on flowers and green bolls are compatible with those of Wilson *et al.* (1992), Flint *et al.* (1995), Watson *et al.* (1995), Jones *et al.* (1996), Roof *et al.* (1997), Novillo *et al.* (1999), Moser *et al.* (2000) and Gody-Avila *et al.* (2000).

Table I. Percent mean infestation of spotted bollworms on squares, flowers and green bollworms on different genotypes of cotton

Sr.No.	Variety	Squares	Flowers	Green bolls	Overall mean
1	FH-900	14.67a	9.55a	10.76a	10.50a
2	CIM-109	12.19b	5.17bc	6.02c	8.81b
3	CIM-446	11.19b	3.77cd	8.00b	7.79bc
4	CIM-473	11.97b	4.24bcd	7.18bc	7.82bc
5	NIAB-Karishma	8.51c	6.73b	7.11bc	7.45c
6	IRCIM-448	8.26c	2.80cd	2.79d	4.61d
7	IRCIM-443	7.65c	1.40d	2.42d	3.82d
8	IRFH-901	6.89c	1.73d	2.38d	3.66d

Means sharing common letters do not differ significantly to each other.

Table II. Percent mean infestation of American bollworms on squares, flowers and green bollworms on different genotypes of cotton

Sr.No.	Variety	Squares	Flowers	Green bolls	Overall mean
1	FH-900	7.21a	4.31a	5.65a	5.72a
2	CIM-109	6.71ab	4.09ab	5.51ab	5.20b
3	CIM-446	6.52b	4.07ab	4.99b	5.19b
4	CIM-473	6.45b	3.36b	4.38c	5.06b
5	NIAB-Karishma	5.60c	3.55bc	4.33c	4.85b
6	IRCIM-448	4.09d	3.05cd	3.11b	3.41c
7	IRCIM-443	4.02d	2.65de	3.02d	3.22c
8	IRFH-901	3.37e	2.28e	2.69d	2.78d

Means sharing common letters do not differ significantly to each other.

Table III. Percent mean infestation of Pink bollworms on squares, flowers and green bollworms on different genotypes of cotton

Sr.No.	Variety	Flowers	Green bolls	Overall mean
1	FH-900	3.37a	2.56a	2.97a
2	CIM-109	2.98b	2.21b	2.67ab
3	CIM-446	3.02ab	2.33ab	2.67ab
4	CIM-473	3.05ab	2.30ab	2.59b
5	NIAB-Karishma	2.88b	2.02bc	2.45b
6	IRCIM-448	2.29c	1.83cd	2.05c
7	IRCIM-443	2.29c	1.69d	1.99c
8	IRFH-901	1.95c	1.27e	1.61d

Means sharing common letters do not differ significantly to each other.

However, the overall infestation of bollworm complex was found to be high on FH-900 as compared to other cultivars. It can be concluded from the results that FH-900 was the most susceptible to bollworm complex, where as IRFH-901, IRCIM-443 and IRCIM-448 emerged as comparatively resistant cultivars to bollworm complex.

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