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Comparative Resistance of Different Cotton Varieties Against Bollworm Complex

MUHAMMAD ASLAM[1], MUHAMMAD RAZAQ, NOOR ABID SAEED AND FAHEEM AHMAD
Department of Agricultural Entomology, University College of Agriculture, Bahauddin Zakariya University, Multan, Pakistan
[1]Corresponding author's e-mail: aslamuca@hotmail.com

ABSTRACT

Comparative resistance of twenty two cotton varieties (BH-121, BH-125, BH-147, CIM-473, CIM-482, CIM-499, CIM-511GE, CIM-707, CRIS-467, CRIS-468, DNH-157, FNH-1000, FNH-945, MNH-633, MNH-635, MNH-636, NIBGE-1, RH-510, SLH-244, SLH-257, VH-141 and VH-142) against bollworms, i.e. pink bollworm, *Pectinophora gossypiella* (Saunders), American bollworm, *Helicoverpa armigera* (Hubner) and two species of spotted bollworms, *Earias* spp. was studied at the Central Cotton Research Institute (CCRI), Multan, Pakistan. BH-147 and NIBGE-1 were most susceptible varieties against spotted, American and pink bollworm and CRIS-468 was relatively resistant. The varieties CIM-499, MNH-633, MNH-635, SLH-257 and VH-142 were moderate in their degree of resistance against bollworm complex.

Key Words: Cotton; *Gossypium hirsutum* L.; Varieties; Bollworms; Resistance

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is an important fiber and oil seed crop. It contributes about 55% of the total edible oil production in Pakistan (Shah *et al*., 1999). It is estimated that about 20-40% loss occurs annually due to different pests of cotton. Now, this crop is becoming less profitable because of heavy pest attack resulting in low yield. The average yield/ha has been decreased from 768 kg/ha in eighties to 511 kg/ha in late nineties. The yield has also been fluctuating in recent years as 613 kg/ha was recorded in 2001 and 579 kg/ha in 2002 (Government of Pakistan, 2003). The decrease in yield is mainly contributed to heavy losses by pink bollworm, *Pectinophora gossypiella* (Saunders) (Gelechiidae: Lepidoptera), American bollworm, *Helicoverpa armigera* (Hubner) (Noctuidae: Lepidoptera) and spotted bollworms, *Earias* spp. (Arctiidae: Lepidoptera) (Ahmad, 1999). Due to development of insecticide resistance in *Helicoverpa armigera* and other bollworms, the losses have been increased (Ahmad *et al.*, 1999).

Plant resistance provides control of insect pests without any additional cost. It is also economical and environmentally safe (Pedigo, 1989; Khan & Sexena, 1998). By using resistant varieties the pest population can easily be controlled without insecticide application (Hua & Hua, 2000). Ali and Ahmad (1982), Bughio *et al.* (1984), Jin *et al*. (1999) and Khan *et al.* (2003) have reported variations in resistance level in cotton varieties.

To cope with the problems, new varieties are introduced for possible resistance against pests. As the evaluation of new varieties for resistance against bollworms is an important component of integrated management of bollworms. Therefore, present studies were planned to screen newly developed cotton cultivars from various research organizations under local agro-climatic conditions of Multan.

MATERIALS AND METHODS

The experiment was conducted at the Central Cotton Research Institute (CCRI), Multan, Pakistan during 2001. Twenty-two cotton varieties namely BH-121, BH-125, BH-147, CIM-473, CIM-482, CIM-499, CIM-511GE, CIM-707, CRIS-467, CRIS-468, DNH-157, FNH-1000, FNH-945, MNH-633, MNH-635, MNH-636, NIBGE-1, RH-510, SLH-244, SLH-257, VH-141 and VH-142 were sown on June 6 in a Randomized Complete Block Design with three replications. The net plot size was 9.8 x 4.6 m having six rows, with row-to-row and plant-to-plant distance of 75 and 23 cm, respectively. The recommended agronomic practices were conducted. To calculate the combined infestation of spotted bollworm and American bollworm, total number of fruiting parts (buds, flowers and bolls) and number of damaged fruiting parts was counted from six plants in each plot and per cent damage of the fruiting parts was calculated.

To record the pink bollworm infestation, twenty green susceptible bolls (bolls that can easily be pressed between the index finger and thumb), collected from each plot at random, were dissected and examined monthly and per cent green boll infestation was calculated. To find the per cent seed damage by pink bollworm, 100 g seed of each variety was ginned out at the end of the season and examined for the single and double seed damage and the per cent seed damage was calculated. The data were subjected to the analysis of variance (ANOVA) and means were separated by LSD test at P= 0.05, using MSTAT-C software (Michigan State University, 1982).

RESULTS AND DISCUSSION

Infestation of Spotted bollworms and American bollworm on different cotton varieties. Based on mean seasonal per cent damage of fruiting parts (buds, flowers and bolls), all cotton varieties under study were significantly different in their response against spotted and American bollworm damage (Table I). These findings are similar to those of (Hormchan *et al*., 1987; Singh & Lal, 1993; Mohan *et al*., 1996; Murthy *et al*., 1998; Jackson *et al*., 2000), who reported a significant varietal variation in resistance against spotted and American bollworms. The maximum per cent damage of fruiting parts was recorded on CIM-511GE followed by BH-147 and CIM-482, both having non-significantly different damage to fruiting parts. Varieties FNH-1000, CIM-473, VH-141, FNH-945, MNH-636, CIM-707, NIBGE-1, MNH-635 and MNH-633 had non-significant difference but higher per cent damage of fruiting parts than that in CIM-499, SLH-257 and VH-142, latter having non-significant difference among themselves. Mean per cent damage in CRIS-468, CRIS-467, BH-125, SLH-244, BH-121 and DNH-157 was statistically same, while the variety RH-510 had minimum mean per cent damage of fruiting parts. None of the variety was free from the damage caused by spotted and American bollworm, but CIM-511GE, BH-147 and CIM-482 were relatively more susceptible and RH-510 was relatively more resistant to spotted and American bollworms, than all the varieties under study.

Infestation of Pink Bollworm on Different Cotton Varieties

Per cent green boll damage. All the varieties under study showed a significant difference in per cent green boll damage caused by pink bollworm (Table I). These findings are in accordance with those of Singh and Agarwal (1987), Wilson and Smith (1992) and Jin *et al.* (1999), who found a significance difference in per cent green boll damage. Per cent green boll damage on variety RH-510 was significantly different and highest than all other varieties. CIM-499, BH-125, CIM-707, DNH-157, BH-147 and MNH-633 had non-significant but lower per cent green boll damage than that in RH-510. All other remaining varieties, except CIM-473, had non-significant difference and lower per cent damage than those mentioned above. Per cent green boll damage in CIM-473 was minimum among all the varieties. The mean seasonal per cent green boll damage in all the varieties was above economic threshold level (ETL), i.e. 5-10% green boll damage (Ahmad, 2001). The results showed that all the genotypes were susceptible to pink bollworm damage. RH-510 was found relatively more and CIM-473 less susceptible than other varieties.

Per cent seed damage. Based on mean per cent seed damage all the varieties were significantly different (Table I). The maximum and non-significantly different per cent seed damage was recorded in varieties SLH-257, RH-510 and CRIS-467. The varieties BH-121, CIM-473, DNH-157, BH-125, SLH-244 and BH-147 were non-significantly different but had lower per cent seed damage as compared to SLH-257, RH-510 and CRIS-467. FNH-945, FNH-1000 and CIM-707 had non-significantly different but higher per cent seed damage than those in MNH-635, MNH-636, MNH-633, VH-142 and CIM-482 having non-significantly different and lower per cent, seed damage compared to all other varieties.

Table I. Seasonal mean percent fruiting parts damaged by bollworms in different cotton varieties

	Spotted and American bollworm	Pink bollworm infestation	
Varieties	**Fruiting parts damage**	**Green boll damage**	**Seed damage**
BH-121	12.54 hij	39.62 cd	6.19 b
SLH-244	12.61 hij	37.92 cd	5.02 cde
VH-141	17.14 abcd	35.92 de	4.74 def
CIM-511GE	18.52 a	38.14 cd	4.28 def
DNH-157	14.49 ij	41.69 bcd	5.22 bcd
MNH-633	15.31 cdefgh	40.51 bcd	2.12 h
FNH-1000	17.97 abc	36.93 cde	2.86 gh
CRIS-468	14.25 efghi	35.33 de	4.58 def
NIBGE-1	15.75 abcdefg	38.35 cd	4.56 def
VH-142	14.80 defghi	38.02 cd	1.95 h
CIM-499	15.10 defghi	46.77 ab	3.97 efg
BH-125	13.50 ghi	43.34 abc	5.09 bcde
CRIS-467	14.13 fghi	37.73 cd	9.08 a
BH-147	18.46 ab	40.66 bcd	5.02 cde
CIM-482	18.45 ab	35.04 de	1.78 h
RH-510	10.41 j	49.34 a	9.34 a
MNH-635	15.68 bcdefg	39.16 cd	2.62 h
CIM-473	17.96 abc	30.59 e	6.03 bc
SLH-257	15.05 defghi	36.44 de	10.21 a
FNH-945	17.00 abcde	36.09 de	3.56 fg
MNH-636	16.79 abcdef	36.85 cde	2.61 h
CIM-707	15.95 abcdefg	43.13 abc	3.02 g

Means followed by same letters are non-significantly different from each other, (LSD; P=0.05)

It is evident from the results that all the varieties showed variable resistance to infestation of bollworm complex. CIM-482 was relatively more resistant and RH-510 was relatively more susceptible to pink bollworm infestation. Against spotted and American bollworms, relatively more resistant variety was RH-510, while CIM-511GE was relatively more susceptible.

When resistance against all three bollworm species was taken into account the results conclude that BH-147 and NIBGE-1 were most susceptible varieties against spotted, American and pink bollworms and CRIS-468 was relatively resistant. The varieties CIM-499, MNH-633, MNH-635, SLH-257 and VH-142 were moderate in their degree of resistance, while RH-510 was comparatively more resistant against spotted and American bollworms but more susceptible against pink bollworm.

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