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## Different Cotton Strains Screened for Resistance to *Heliothis* Spp. (Lepidoptera: Noctuidae) in the Field

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**Abstract:** In a field experiment, conducted at the University of Georgia, Department of Entomology, Coastal Plain Experiment Station, it was concluded that LAHG 810063, STHG 4-4, STHG 3-1 showed resistance, ARS TX HIGOS3, GATIR 84-662, LAHG 820060, showed intermediate resistance and TAMCOT CAB-CS showed partial resistance to susceptibility to *Heliothis* spp. (HS). The MISCOT strains showed susceptibility to HS.

**Key words:** Screening, Resistance, Susceptibility, Terminals, Cotton, Squares, Cotton, Strains

### Introduction

Cotton is a marvellous plant (Khan and Aziz, 1998). It is world's most important textile fibre and oil seed crop. The threat of *Heliothis* complex to the cotton industry is well known (Glover *et al.* 1975). *Heliothis* spp. (HS), the tobacco budworm (TBW), *Heliothis virescens* (F.) and the bollworm (BW), *Heliothis zea* (Boddie) are the principal insect pests in the cotton belt of the United States (Metcalf and Luckman, 1994). They inflict 63 percent yield losses to cotton (Schwartz, 1983). Various techniques have been used to screen cotton strains for resistance to these pests. Dahms (1972) identified 16 possible criteria for evaluation of insect resistance in crop plants including number of eggs laid, number of larvae attracted to a cultivar when given a free choice and damage done by the insects to the plants as important ones. The resistance of an experimental strain is usually measured by comparing the strain with a cultivar known to be 'susceptible' (Painter 1951; Dahms 1972; Namken *et al.*, 1983). Cotton strains for resistance to HS can be screened by counting eggs, larvae or damaged fruit (Niles, 1980). Parrot *et al.* (1981) evaluated the performance of 11 cotton lines under field conditions subjected to high levels of TBW using Stoneville 7AGN as check. Zummo *et al.* (1983) indicated certain cotton cultivars more resistant than others to TBW by showing less damage to the plant parts. Jones *et al.* (1987) showed LAHG 810063 and LAHG 820060 especially promising as genetically enhanced HS breeding stocks.

The objective of these studies is to screen cotton strains for resistance to HS in the field using Stoneville 213, a commercial, susceptible check.

### Materials and Methods

A field experiment was conducted at the University of Georgia, Coastal Plain Experiment Station Tifton Georgia, USA. Twenty strains of cotton (including Stoneville 213 as a susceptible check) were planted on May 8 at the Ponder Experimental Farm in plots maintained under 3 levels of pest management. In level A, cypermethrin (Cymbush<sup>R</sup> 3E) was applied at the rate of 0.056 kg (ai)/ha twice weekly for 17 times from July 6 through September 1. In level B, the insecticide was applied at the same rate at two week intervals for four times from July 14 through August 25, while in Level C no insecticide was applied. The cotton strains were replicated 3 times in each level using randomized block designs. The plots consisted of two rows, 10.67 m in length and 1.83 m in width. Fertilizer was applied at a rate of 42.01, 84.028, 126.04 kgs of N, P, K per ha, respectively. Also 33.61 kgs of nitrogen/ha was side

dressed four weeks after planting.

The criteria to screen cotton lines for resistance to HS was counting eggs and larvae of the pest on ten terminals/plot and recording the larval damage on 25 squares and/or bolls per plot on weekly basis. The number of eggs and larvae recorded per 10 terminals/plot from July 6 through September 7 for 10 weeks is shown as recorded, while the number of the damaged squares and/or bolls recorded/25 squares and or bolls sampled per plot from July 21 through September 8 for 8 weeks are shown in percentage. The statistical analysis was done as 3 randomized block designs nested with the main plots using SAS (SAS, 1986). T Tests (LSD) as recommended by Benedict (1983) were applied to the means and based on the groupings of the t tests and following Aslam *et al.* (1999), the lines which showed significantly higher infestation/damage by the HS, when compared with Stoneville 213 were classified as highly susceptible. The lines which did not differ from Stoneville 213 in showing infestation/damage by HS were classified as susceptible, while the lines which showed significantly less infestation/damage by HS than the susceptible cultivar were classified as intermediately susceptible, partially susceptible, partially resistant, intermediately resistant, resistant and highly resistant depending upon nature of grouping of t tests.

### Results and Discussion

Table 1 reveals that on the basis of number of eggs of HS laid per 10 terminals, LAHG 810063, showed high resistance, STHG 4-4, ARS-TX-HIGOS1, STHG 3-1 and LAHG 810065 showed resistance; PD-0786, GATIR 84-662, ARS-TX-HIGOS2, TIFCOT56, LAHG 820060, ARS-TX-HIGOS3 and STHG 6-1 showed intermediate resistance; TAMCOT CD 23H showed partial resistance; DES 220 and TAMCOT CAB-CS showed partial susceptibility. MO 84-701 showed intermediate susceptibility and all MISCOT lines showed equal susceptibility to HS.

On the basis of larval population when compared with the susceptible cultivar, STHG 3-1 and STHG 4-4 showed high resistance, LAHG 810060, LAH G810065, ARS-TX-HIGOS2, LAHG 810063 and STHG 6-1 RESISTANCE; ARS-TX-HIGOS1, TAMCOT-CD 3H, ARS-TX-HIGOS3 and GATIR 84-662 intermediate resistance; DES 920, TAMCOT CAB-CS, PD-0786 and TIFCOT 56 partial resistance; MISCOT 7913-51, MO 84-701 and MISCOT TB 27-7 partial susceptibility and MISCOT 7913-835 intermediate susceptibility to HS (Table 1). The number of eggs and larvae on cotton lines were significantly correlated (Table 2).

**Aslam et al.: Different Cotton Strains Screened for Resistance to HS**

Based on larval damage to squares, STHG 3-1 and STHG 6-1 showed high resistance; LAHG 810065 and ARS-TX-HIGOS2, resistance; ARS-TX-HIGOS1, TIFCOT 56, GATIR 84-662, ARS-TX-HIGOS3, LAHG 810060, STHG 4-4 and LAHG 810063 intermediate resistance; PD-0786, TAMCOT CD 3H and TAMCOT CAB-CS partial resistance, MO 84-701 and DES 920 partial susceptibility; MISCOT 7913-835 and MISCOT 7913-51 intermediate susceptibility and MISCOT TB-27-7 susceptibility to HS when compared with Stoneville 213 (Table1). The number of larvae and squares damaged by HS were significantly correlated (Table 2). The number of HS eggs and larvae and the per cent squares of cotton strains damaged by HS varied inversely with the intensity of the management levels (Table 3).

Table 1: Number of *Heliothis* spp. eggs and larvae per 10 terminals and per cent squares of cotton strains damaged by *Heliothis* spp. Tifton, GA

Cotton Strains	No. of eggs	No. of Larvae	% Squares Damaged
PD-0786	2.97 cde	2.07 efg	10.2 de
STHG 4-4	2.19 gh	0.99 i	5.8 ghi
STHG 3-1	2.18 gh	1.00 i	4.6 i
STHG 6-1	2.21 fgh	1.31 hi	4.5 i
LAHG 810063	1.80 h	1.37 hi	5.3 ghi
LAHG 820060	2.44 e-h	1.57 ghi	6.4 ghi
LAHG 810065	2.14 gh	1.52 ghi	5.3 ghi
TAMCOT CAB-CS	3.24 bc	2.27 def	9.8 def
TAMCOT CD3H	3.14 cd	1.72 fgh	9.8 def
ARS-TX-HIGOS1	2.18 gh	1.72 fgh	7.9efg
ARS-TX-HIGOS2	2.72 c-g	1.37 hi	5.2 hi
ARS-TX-HIGOS3	2.30 e-h	1.64 gh	6.9 ghi
MO 84-701	3.90 b	2.89 bc	12.2 cd
DES 920	3.28 bc	2.67 cde	12.1 cd
MISCOT TB 27-7	4.69 a	2.68 bcd	16.3 ab
MISCOT 7913-835	5.16 a	3.27 b	14.1 bc
MISCOT 7913-51	5.01 a	3.25 bc	14.2 bc
Stoneville 213	5.13 a	3.98 a	18.4 a
GATIR 84-662	2.87 c-f	1.63 gh	7.3 fgh
TIFCOT 56	2.5. d-g	2.00 fg	7.3 fgh

Means followed by same letters are not significantly different from one another at p=0.05

Table 2: Correlation between different criteria used to evaluate resistance of cotton strains to *Heliothis* spp. Tifton, GA

Criteria	Correlations		
<i>Heliothis</i> spp/10 terminals	1	2	3
Eggs	1	x	0.92**
Larvae	2	1	x
Per cent squares damaged by <i>Heliothis</i> spp Larvae	3	x	1

Correlation Coefficients with \*\* are significant at significance level p<0.01, N=20

Table 3: Number of *Heliothis* spp. eggs and larvae per 10 terminals and per cent squares of cotton strains damaged by *Heliothis* spp. in 3 levels of pest management, Tifton, GA

Levels	No. of eggs	No. of Larvae	Per cent Squares Damaged
A	2.2167 c	1.3630 c	6.2667 c
B	2.0600 b	2.1907 b	9.5750 b
C	4.0350 a	2.5815 a	11.7000 a

Means followed by same letters are not significantly different from one another at p=0.05

On the basis of the above discussion, it could be concluded that LAHG 810063, STHG 4-4, STHG 3-1 showed resistance, ARS TX HIGOS3, GATIR 84-662, LAHG 820060, showed intermediate resistance and TAMCOT CAB-CS showed partial

resistance to susceptibility to *Heliothis* spp. (HS). The MISCOT strains showed susceptibility to HS. Aslam et al. (1999) in another field experiment with 5 cotton strains reported the resistance of LAHG 810063, ARS-TX-HIGOS1 and STHG 4-4 to HS. Jones et al. (1987) also declared LAHG 810063 a promising resistant breeding stock and Bird et al. (1986) reported that TAMCOT CAB-CS had partial to intermediate resistance to bollworm.

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