Antibiosis in Cotton to Pink Bollworm

F. Douglas Wilson, Jayne L. Szaro, and Benny R. Stapp, USDA-ARS, Western Cotton Research Laboratory

ABSTRACT

Ninety-nine germplasm lines and a resistant check line of cotton, Gossypium hirsutum L., were infested artificially in the field with eggs of pink bollworm (PBW), Pectinophora gossypiella (Saunders), and evaluated for an antibiosis type of resistance to the insect and also for yield potential. All 99 lines came from crosses of well-adapted cultivars, or the nectariless, or nectariless-okra-leaf versions of those cultivars, with previously identified sources of antibiosis (a type of resistance that affects the growth and development of the insect once inside the boll). Twenty-three of the 99 were selected for low PBW damage or for a combination of high lint yield and low damage.

INTRODUCTION

Cultivars (varieties) of cotton, Gossypium hirsutum L., that carry natural resistance to pink bollworm (PBW), Pectinophora gossypiella (Saunders), would be valuable to growers because they would reduce insecticide costs and also the environmental hazards associated with insecticide use. We have identified two mutant traits, nectariless (N), and okra-leaf (L), that impart low levels of resistance to PBW. In addition, we have identified several sources of antibiosis (a type of resistance that affects the growth and development of the insect once inside the boll).

A major objective of our research is to combine resistance sources in superior genetic backgrounds. One objective of this study was to screen lines, which combined antibiosis with the nectariless, or nectariless-okra-leaf traits, for PBW resistance and yield potential.

MATERIALS AND METHODS

Seed of AET-5 (the line used as the PBW-resistant check) and of 99 F3 to F7, and BC1F3 to BC3F3 lines were planted in peat pots in the greenhouse at Phoenix on 27 March 1986. These lines had come from crosses of various cultivars, or the nectariless or nectariless-okra-leaf versions of those cultivars, with a source of antibiosis (listed in Table 1). Seedlings were transplanted to the field at the Maricopa Agricultural Center (MAC) on 10 April 1986.

Plot size was one row of 22 plants; plants were spaced 46 cm (18 inches) apart; rows were spaced 1 m (40 inches) apart. Experimental design was a 10 x 10 simple lattice, repeated (two replications). Cultural practices were standard for the farm except that no insecticides were applied.

Beginning 24 June and every 2 weeks thereafter until 5 August 10 plants per plot were sprayed, using a constant-pressure sprayer, with a gum xanthan:distilled water solution of PBW eggs (1 part eggs: 1,200 parts solution).

As soon as bolls started to open, seed cotton was harvested every 2 weeks until all seed cotton had been harvested. Seed cotton was weighed and ginned; lint and seed samples were weighed for yield estimates. A volumetric (35 mL) seed sample was drawn and X-rayed to produce radiographs for determining the number of undamaged and PBW-damaged seeds.

RESULTS AND DISCUSSION

Twenty-three lines were selected that had no more seed damage than AET-5 or that combined low seed damage with high lint yield (Table 1). Lines having AET-5 in their background had the lowest mean seed damage; those having T39C-1-L in their background had the highest mean lint yield. Seed damage among the 23 lines varied from 38 to 109% of that of AET-5. Lint yield varied from 91 to 236% of that of AET-5.

A commercial susceptible cultivar was not included in this experiment. However, in an adjacent experiment, 'Stoneville 825' plants, transplanted the same day and spaced the same distance apart, yielded 1,495 kg/ha lint. This compared to a range of 864 to 2,241 kg/ha lint among the 23 lines. These data show that it is possible to combine the level of antibiosis shown by AET-5 with a yield potential as high as that of a commercial cultivar.

Table 1. Seed damage and lint yield of a PBW-resistant check line and 23 hybrid lines selected for resistance.

Source of Antibiosis*	Lines selected (no.)	Seed damage Mean (%)	Seed damage Range (%)	Lint yield Mean (Kg/ha)	Lint yield Range (Kg/ha)
AET-5	8	7.6	4.8-11.3	1,463	1,051-1,557
AET-5NL	3	10.8	8.7-14.0	1,335	864-1,164
AET-5NSL**	3	10.4	8.8-13.1	1,467	1,317-1,654
T39B-2-L***	1	13.4	--	1,112	--
T39C-1-L***	7	10.0	5.9-12.4	1,797	1,123-2,241
(AET-5 X T-167	1	8.4	--	964	--
(All hybrid lines)	99	--	4.8-27.8	--	864-2,241
(AET-5 check)	1	12.8	--	950	--

*-The other parent of the selected hybrid lines was one of the following:
Deltapine NSS, Deltapine 90, Deltapine 733, DES 24NL, DES 56N, DES 56NL, Stoneville 506, Stoneville 825, Stoneville 8701N, Stoneville 8737N.
**N=nectariless, S=smoothleaf, SS=semi-smoothleaf, L=okra leaf.
***L in these two cottons denotes low seed damage, not okra leaf.