INSECT RESISTANCE IN TWO RECENTLY RELEASED SWEET CORN INBREDS, GTS1 AND GTS2[1]

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ABSTRACT

Two recently released sweet corn inbreds, 'GTS1' and 'GTS2,' were evaluated as inbreds and in hybrid combination for their resistance to the corn earworm, *Heliothis zea* (Boddie). Based on the weight of 6-day-old larvae and on damage to corn ears in the field at 15 days after silking, the level of resistance to the corn earworm was slightly altered from the original '471-U6' and '81-1.' A slight change in the mechanisms of resistance was shown in that GTS1 showed a slight antibiotic effect which apparently enhanced the performance of its hybrid.

Key Words: Corn earworm, *Heliothis zea,* sweet corn, plant resistance.

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INTRODUCTION

In the review by McMillian and Wiseman (1972), insect resistance studies involving the two white sweet corn inbreds '471-U6' and '81-1' and their hybrid combinations have been reported on numerous occasions by researchers of the Insect Biology and Population Management Research Laboratory. Purdue Agricultural Experiment Station released 471-U6 and 81-1 inbreds in 1953. These inbreds were found to possess not only a high level of resistance to corn earworm (CEW), *Heliothis zea* (Boddie), in hybrid combination but also excellent quality for fresh market sweet corn (Smith 1953).

Wiseman et al. (1972) found the plant resistance mechanism of 471-U6 × 81-1 to be tolerance. Later, we described several of the physical characteristics associated with resistance in this tolerant corn (Wiseman et al. 1977). We report here the inbred and hybrid performance (with regard to CEW resistance) of two newly released yellow inbreds, 'GTS1' and 'GTS2,' that were developed from 471-U6 and 81-1 inbreds (McMillian et al. 1980).

MATERIALS AND METHODS

Both resistant 471-U6 × 81-1 and GTS1 × GTS2, as well as their reciprocals, and susceptible 'Stowell's Evergreen,' 'White Delight,' and 'Silver Queen,' were evaluated for CEW resistance. The tests for CEW resistance in inbred performance included susceptible 'P39,' and resistant 81-1, 471-U6, GTS1 and GTS2. The tests in both years included laboratory and field evaluations. Hybrid and inbred tests were arranged in a randomized complete block design in 1981, with six replications for both laboratory and field evaluations. The 1982 field test was

[1] In cooperation with the University of Georgia College of Agriculture Experiment Stations, Coastal Plain Station, Tifton, GA.

conducted as a split-plot design with six replications. Whole plots were artificial and natural infestations of *H. zea* larvae, and sub-plots were corn entries. The 1982 laboratory test was arranged as a randomized complete block with six replications. Each field plot in each year was 6.1 m long and 0.76 m wide. Accepted agronomic practices were used in growing and maintaining the field plots of corn.

In the field tests, 10 silk masses from the top ears of each plant were infested when silks were ca. 2 days old with ca. 35 CEW eggs per silk mass (Wiseman et al. 1974). The damage on the ears was rated for corn earworm injury (Widstrom 1967) 15 days after infestation. For the laboratory evaluation, 10 silk masses per plot per corn line were excised and brought into the laboratory. The exposed silks were removed and the channel silk masses were placed, one silk mass per diet cup, with one neonate CEW larva. The laboratory tests were conducted at $26.7 \pm 2°C$ and $70 \pm 5\%$ RH for 6 days. Individual larval weights were recorded per plot. Plot means were used in calculating the ANOVA, and means were separated using Duncan's multiple range test.

RESULTS AND DISCUSSION

Table 1 illustrates the mean weight of 6-day-old CEW larvae and ear damage (cm penetration, Widstrom 1967) at 15 days after infestation for the GTS1 and GTS2 hybrid combinations and other corn entries tested. Ear damage for 471-U6 × 81-1 and its reciprocal was significantly lower in 1981 than for GTS1 × GTS2 or its reciprocal. However, in 1982, both GTS1 × GTS2 and 471-U6 × 81-1 and their reciprocals had similar ear damage, but both hybrids had significantly less damage than White Delight, Silver Queen, or Stowell's Evergreen. In 1981, the mean weight of CEW larvae were significantly lower when they fed on silks of GTS1 × GTS2 and the reciprocal than when they fed on other cultivar silks. But in 1982, weight of larvae fed silks of GTS1 × GTS2 and 471-U6 × 81-1 and their reciprocals were not significantly different. Resistance in 471-U6 × 81-1 has been shown to be tolerance (Wiseman et al. 1972). However, tolerance would not confer a detrimental effect on CEW larval weight. Therefore, since no differences in weights of larvae were found in 1982, the resistance of GTS1 × GTS2 could also be classified as tolerance with possibly a low level of antibiosis.

Table 1. Mean weight of 6-day-old corn earworm larvae and ear damage ratings for selected sweet corn cultivars and GTS1 and GTS2 hybrid combinations.*

Corn entry	$\bar{x}$ wt. (mg) of larvae		Damage ratings†	
	1981	1982	1981	1982
Stowell's Evergreen	166.4 a	36.2 b	6.3 a	8.3 a
Silver Queen	153.3 a	56.6 a	5.3 b	5.5 b
White Delight	124.8 b	56.9 a	5.9 ab	6.4 b
471-U6 × 81-1	124.8 b	31.3 b	3.5 c	4.2 c
81-1 × 471-U6	122.5 b	29.6 b	3.6 c	3.9 c
GTS1 × GTS2	97.8 c	22.6 b	5.7 ab	3.8 c
GTS2 × GTS1	93.4 c	20.7 b	5.2 b	4.0 c

* Means within a column followed by the same letter are not significantly different ($P = 0.05$) as separated by Duncan's multiple range test. Means include 10 larvae or ratings per plot and six replications.

† Damage ratings were made according to the cm penetration scale devised by Widstrom (1967).

Table 2 summarizes the results of testing inbreds. Corn earworm larval weights were significantly less when they fed on GTS1 and GTS2 than when they fed on 81-1 or P39 in 1981. However, CEW larval weights were significantly less when they fed on GTS1 and 471-U6 than when they fed on P39 and 81-1 in 1982. Since GTS1 is the yellow counterpart of 471-U6, it is possible that when the yellow genes were transferred to GTS1 that a low level of antibiosis could have been transferred also. Thus, the reduced weight of CEW larvae feeding on the GTS1 and GTS2 hybrid combination (Table 1) could have been due to the influence of GTS1 in hybrid combination. Damage ratings for 81-1 and GTS2 were not available for 1981. However, ear damage ratings for GTS1 and 471-U6 were not significantly different. In 1982, ear damage ratings for 81-1, 471-U6, GTS1 and GTS2 were not significantly different.

Table 2. Mean weight of 6-day-old corn earworm larvae and ear damage ratings for selected sweet corn cultivars and GTS1 and GTS2 inbreds.*

Corn entry	Larval wt. (mg)		Damage ratings†	
	1981	1982	1981	1982
P39	75.6 b	48.5 b	9.9 a	10.5 a
81-1	125.4 a	72.7 a	–	8.9 b
471-U6	66.3 bc	14.9 c	8.3 a	8.8 b
GTS1	54.9 c	18.1 c	6.8 a	9.5 ab
GTS2	54.1 c	35.9 bc	–	8.6 b

* Means within a column followed by the same letter are not significantly different ($P = 0.05$) as separated by Duncan's multiple range test.

† Damage ratings were made according to the cm penetration scale devised by Widstrom (1967).

In summary, the two years' data indicate that resistance of GTS1 and GTS2 to injury by larvae of *H. zea* as inbreds or in hybrid combination is due to tolerance and possibly a low level of antibiosis. The introduction of yellow genes into the original 471-U6 and 81-1 did not alter the level of resistance of GTS1 or GTS2 to *H. zea* larvae. However, there was a slight change in the mechanisms of resistance, especially for GTS1 and its possible effect in hybrid combination, as indicated by the reduced weights of larvae that fed on the inbred silks.

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