

COMUNICACIONES

External versus internal damage estimates of stalk boring by *Diatraea saccharalis* (F) 1/ in two tropical maize populations in México*

Sumario En dos variedades de maíz tropical que estuvieron creciendo bajo diferentes niveles de infestación del barrenador de la caña de azúcar, se hicieron correlaciones entre el número de perforaciones por tallo del barrenador o el número de entrenudos con perforaciones y el largo de los túneles por planta, número de entrenudos con túneles por planta y el largo de los túneles por entrenudos. El número de entrenudos con perforaciones, la más fácil medida, tuvo una correlación alta con el largo total de los túneles y el número de los entrenudos con túneles bajo condiciones de infestación artificial e infestación natural muy fuerte. El número de entrenudos con perforaciones se recomienda para ser usado en programas de mejoramiento para resistencia al barrenador de la caña de azúcar.

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Screening for insect resistance requires rapid, accurate damage estimates of large numbers of plant genotypes. Screening for tropical maize resistance to stalk boring by the sugarcane borer (SCB), *Diatraea saccharalis* (F), involves splitting stalks and measuring tunnels, a time consuming process that may significantly delay breeding progress. Ortega (1) reported highly significant correlations between damaged internodes and borer holes or tunnels, and between tunnels and borer holes. This study was made to determine if the number of external borer holes or number of hole-bearing internodes could be substituted for the internal measurements of tunnel length per plant, number of tunneled internodes, or tunnel length per tunneled internode.

1/ Lepidoptera: Pyralidae

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Materials and methods

Trials were planted at two stations of the International Maize and Wheat Improvement Center (CIMMYT) in Mexico. Tlaltizapán, Morelos (planted 5 May, 1976, harvested 10 September, 1976) is subtropical at an altitude of 940 m. Poza Rica, Veracruz (planted 26 May, 1976, harvested 13 September, 1976) is tropical at an altitude of 60 m. Natural SCB populations were low at Tlaltizapán, and high at Poza Rica.

The plant materials used were several selection cycles of Tuxpeño-1, a late-maturing tropical white dent and Mezcla Amarilla, an intermediate-maturing tropical yellow flint. Both are CIMMYT open-pollinated varieties.

Four replications of three 5-meter-long rows spaced at 75 cm between rows and variable spacing, depending on height of the selected cycle, between plants per plot were arranged in randomized complete blocks. Plant populations ranged from 40,000 to 65,000 plants per hectare. Data were recorded from the center row of each plot.

Protection against fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith) and SCB included carbofuran 3G (1 kg AI/ha) applied with the seed. Postemergence treatments varied with the infestation schedule and location and consisted of foliar sprays of carbaryl 80WP (2.4 kg AI) and methyl parathion 47EC (0.5 kg AI in 400 l H₂O/ha) until early whorl stage, after which trichlorfon 2.5G (0.5 kg AI/ha) was used. In Poza Rica seeds were treated with chloroneb 65WP (5g AI/kg seed). Maneb zinc 80WP (0.8 kg AI/400 l H₂O/ha) was applied 8 times before flowering, to attempt control of sorghum downy mildew, *Sclerospora sorgi* (Kulk.) and leaf blights, especially tarspot, *Phyllachora maidis* Maubl.

Treatments were:

1. Insecticide check
2. Artificial SCB infestations at mid-whorl and mid-silk.
3. Natural infestation. These were made for other experimental purposes, but for this analysis the treatment represents natural SCB infestation, as no insecticides were applied.

The infestation method was that described by Peairs (2). Midwhorl SCB infestation levels were 130 and 65 larvae per plant in Tlaltizapán and Poza Rica, res-

pectively. Infestation level at mid-silk was about 130 larvae per plant.

The number of putative borer holes, both entrance and exit, and the number of internodes with holes were determined after grain harvest. Plants were split and total tunnel length and number of tunneled internodes were determined.

Results and discussion

Linear correlation coefficients for borer holes per plant and holebearing internodes against the three internal damage estimates are presented for Poza Rica (Table 1) and Tlaltizapan (Table 2).

Borer holes per plant and hole-bearing internodes could be used to predict differences in tunnel length per plant and tunneled internodes in uniformly infested plants (the SCB treatment in either location). These differences could also be predicted in plants

under heavy natural infestation (natural infestation in Poza Rica). Differences in lightly infested plants could not be predicted (natural infestation in Tlaltizapan). Differences among lightly and heavily infested plants could be predicted ('All' at both stations). The correlations for tunnel length per tunneled internode (similar to mean tunnel length) were significant only among lightly and heavily infested plants under low natural infestation ('All' in Tlaltizapan). If mean tunnel length were considered important, this variable would generally have to be measured directly. Selecting against total tunnel length per plant should be similar to selecting against mean tunnel length, if the infestation is uniform.

Coefficients differed between population within a station and comparison, although usually not enough to change significance. It may be advisable to verify these correlations for the varieties grown in a region, before relying solely on external damage estimates

Table 1.—Linear correlation coefficients External vs internal stalk damage - Poza Rica, Mexico, 1976

	Tuxpeño-1 ^{1/}		Mezcla amarilla ^{2/}	
	Borer holes	Hole-bearing internodes	Borer holes	Hole-bearing internodes
Tunnel length per plant				
Check	0.19446	0.18182	0.31925	0.40838*
SCB	0.70480**	0.73541**	0.62794**	0.71792**
Natural	0.55166**	0.54353**	0.41406*	0.51387**
All	0.70984**	0.71174**	0.66690**	0.70162**
Tunnelled Internodes				
Check	0.20612	0.20659	0.41820*	0.51798**
SCB	0.86714**	0.92179*	0.81662**	0.88715**
Natural	0.68940**	0.68343**	0.47871*	0.59403**
All	0.82533**	0.83361**	0.79263**	0.83553**
Tunnelled length per tunnelled internode				
Check	0.10370	0.03107	0.05690	0.06573
SCB	-0.17760	-0.22303	-0.19154	-0.26573
Natural	-0.20515	-0.20661	-0.02479	0.02258
All	-0.12827	-0.14074	-0.12238	-0.12437

1/ N=60 for 'All' and 20 for the single treatments

2/ N=72 for 'All' and 24 for the single treatments

* Significant at the 5% level.

** Significant at the 1% level

Table 2.—Linear correlation coefficients - External vs internal damage Tlaltizapan, Mexico, 1976.

	Tuxpeño-1 ^{1/}		Mezcla amarilla ^{2/}	
	Borer holes	Hole-bearing internodes	Borer holes	Hole bearing internodes
Tunnel length per plant				
Check	0.35260	0.40407	0.87409**	0.87206**
SCB	0.73309**	0.76082**	0.86044**	0.78187**
Natural	0.18672	0.13244	0.27793	0.23955
All	0.89023	0.88529**	0.92727**	0.94667**
Tunnelled Internodes				
Check	0.55222**	0.56456**	0.88559**	0.89115**
SCB	0.86453**	0.87887**	0.91624**	0.95608**
Natural	0.25485	0.18068	0.37524	0.32231
All	0.94514**	0.94622**	0.94065**	0.96360**
Tunnelled length per tunnelled internode				
Check	-0.06377	0.03107	0.05690	0.06573
SCB	0.51757*	0.54740*	0.17134	0.18129
Natural	-0.00966	0.01409	0.22392	0.25129
All	0.46674**	0.46415**	0.30965**	0.32848**

1/ N=60 for "All" and 20 for the single treatments

2/ N=72 for "All" and 24 for the single treatments

3/ Check coefficients inflated because several plots were accidentally infested with SCB.

* Significant at the 5% level.

** Significant at the 1% level.

Correlations for hole-bearing internodes versus tunnel length per plant or tunnelled internodes were generally higher than those for exit holes. The former is less time consuming (as inspection of an internode ceases as soon as one exit hole is found).

Summary

Correlations between borer holes per stalk or hole-bearing internodes per stalk and tunnel length per plant, tunnelled internodes per plant, and tunnel length per tunnelled internode were made in two tropical maize varieties grown under different levels of infestation by the sugarcane borer. Hole-bearing internodes, the easiest measurement, was highly correlated with total tunnel length and tunnelled internodes under conditions of artificial infestation and heavy natural infestation. This measurement was recommended for use

in breeding programs for resistance to sugarcane borer stalk damage.

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