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SUGARCANE RESISTANCE TO STALKBORERS (LEPIDOPTERA:PYRALIDAE) IN SOUTH TEXAS

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ABSTRACT

Evaluation of 5 commercial sugarcane clones (cultivars) and 54 noncommercial clones which are part of the Texas A&M University sugarcane breeding program indicated that there were significant differences among clones to injury by the Mexican rice borer, *Eoreuma loftini* (Dyar). The commercial clone CP 70-321 was among the most resistant clones in all tests. However, the clones TCP 83-3196 and TCP 83-3180 were significantly less injured than CP 70-321, and 7 other clones exhibited levels of resistance similar to CP 70-321. *Eoreuma loftini* injury levels averaged 29.4% bored internodes; the sugarcane borer, *Diatraea saccharalis* (F.) population levels were low in both years causing less than 1.0% bored internode injury to sugarcane.

RESUMEN

Se evaluaron 5 cultivares comerciales y 54 no comerciales de caña de azucar, los cuales hacen parte del programa de mejoramiento de la Universidad de Texas A&M. Se reportan diferencias significativas entre los cultivares a el daño del barrenador mexicano del arroz *Eoruma loftini* (Dyar). El cultivar comercial CP 70-321 fue el mas resistente en todas las pruebas. Sinembargo, los cultivares TCP 83-3196 y TCP 83-3180 tuvieron un daño significativamente menor que CP 70-321 y otros 7 cultivares los cuales

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mostraron resistencia similar a CP 70-321. Los niveles de daño de *Eoreuma loftini* dieron un promedio de 29.4 % de entrenudos barrenados; los niveles de poblacion del barrenador de la caña *Diatraea saccharalis* (F.) fueron bajos en ambos años causando menos del 10% de dano a los entrenudos.

Stalkboring pyralids have been the most serious insect pests of the sugarcane (interspecific hybrids of *Saccharum*) industry in the Lower Rio Grande Valley (LRGV), Texas, since its inception in 1972. During the 1970's, the sugarcane borer, *Diatraea saccharalis* (F.), was the primary pest (Fuchs et al. 1973), until establishment of the braconid parasitoid *Cotesia flavipes* (Cameron) (Fuchs et al. 1979) brought about biological control.

The Mexican rice borer, *Eoreuma loftini* (Dyar), an immigrant from Mexico, was first detected in the LRGV in 1980 (Johnson 1981) and has replaced *D. saccharalis* as the primary pest. Insecticidal control has been inconsistent and generally unsatisfactory with less than 75% injury reduction using either ground or aerial applications of labelled insecticides at recommended rates (Johnson 1985, Pfannenstiel et al. 1990a, b). The lack of success with insecticidal control, classical biological control (Browning & Melton 1987, Hawkins et al. 1987, Smith et al. 1987), or entomophagous nematodes (Pfannenstiel & Browning 1989) have led to increased emphasis on plant resistance.

Plant resistance has been an important component of an IPM program against *D. saccharalis* on sugarcane in Louisiana for many years (Bessin et al. 1990, Hensley et al. 1977, Mathes & Ingram 1942). Plant resistance to *D. saccharalis* has been associated with increased yields even when insecticidal control was effective and economical (Hensley & Long 1969). As part of an IPM program where insecticides are less effective, as with *E. loftini*, plant resistance can be even more important. However, plant resistance has not been pursued in depth in sugarcane relative to *E. loftini*, and differential susceptibility to *E. loftini* among clones has been detected only recently (Ring & Browning 1990). Identification of resistant clones and the subsequent incorporation of resistance into commercial clones (cultivars) may reduce the effects of insects on sugarcane yields.

Sugarcane clone resistance to stalkborers may be classified into 4 categories: 1) unattractiveness of the host-plant to the adults for oviposition, 2) host-plant characters unfavorable for entry of the larvae into the plant, 3) adverse effects of the host plant to larval development and survival, and 4) the ability of the host-plant to yield in spite of a high infestation (Mathes & Charpentier 1969). Seasonal injury differences among clones (bored internodes) under field conditions may be due to resistance to stalk entry by early larval instars (Bessin et al. 1990), differential selection of clones for oviposition by adults, or some aspects of antibiosis (larval survival).

We examined the injury by *E. loftini* and *D. saccharalis* to 5 commercial sugarcane clones (cultivars) and 54 noncommercial clones which were in advanced stages of screening for yield and disease resistance as part of the Texas A&M University sugarcane breeding program. Our objectives were to identify levels of resistance to *E. loftini* among clones and to document sugarcane injury by *D. saccharalis*.

Materials and Methods

In 1988-89, 9 field plantings of 40 noncommercial clones (4 fields in second ratoon, 13 clones; 2 fields in first ratoon, 15 clones; and 3 fields in plant cane, 12 clones) and the Texas commercial clones (cultivars) CP 70-321, NCo 310, and CP 65-357 were evaluated for injury by *E. loftini* and *D. saccharalis*. In 1989-90, 3 plantings of 18 noncommercial clones (all plant cane) and the Texas commerical clones (cultivars) NCo 310, CP 68-350, and CP 70-324 were evaluated. A severe freeze in December, 1989 prevented further evaluation of the plantings evaluated in 1988-89. Plots were 4 10-m long rows of sugarcane on a 1.5-m row spacing. There were no buffers between plots although each group of plots was buffered within a commercial sugarcane clone (cultivar). Field layout was a randomized complete block design with all clones in each planting replicated 4 times within each field. Sugarcane management practices were the same as for the commercial field where each planting was located. Management included from 0-3 aerial applications at labelled rates of either monocrotophos (Azodrin 5) or azinphosmethyl (Guthion 2L) during May-September.

To evaluate stalkborer injury to each clone at harvest, 25 stalks were removed from the outer 2 rows of each plot, split longitudinally and examined. The total number of internodes and the number of internodes injured by *E. loftini* and *D. saccharalis* were counted per stalk. Injury by the 2 stalkborer species was separated by differences in larval tunnel construction. *E. loftini* tunnels are generally packed with frass, restricted to 1 internode, and found throughout the internode. *D. saccharalis* tunnels are usually open, often more than 1 internode is injured, and usually the tunnels are in the center of the stalks.

For analysis, the number of injured internodes attributable to each species was divided by the total number of internodes in each stalk to yield a percentage of injured internodes. Percentages in each planting were subjected to analysis of variance (Proc GLM, SAS Institute 1985). The null hypothesis that clone was not an important source of variation was tested using the planting by clone interaction term as the error term (McIntosh 1983), and means were separated using Duncan's multiple range test (SAS Institute 1985).

Results and Discussion

Evaluations in the 1988-89 and 1989-90 seasons showed significant differences ($P < 0.05$) in bored internode injury by *E. loftini* among clones for each planting (Tables 1 and 2). *Eoreuma loftini* bored internodes ranged from 10.7% (second ratoon TCP 83-3180) to 53.4% (plant cane NCo 310) in 1988-89 (Table 1). The commercial cultivar CP 70-321 was injured significantly less than the cultivar NCo 310. CP 70-321 was among the most resistant clones, usually exhibiting either the least damage of all clones (first ratoon), or no significant difference from the least injured clone (plant cane). Only 2 clones evaluated were injured less than CP 70-321 in any planting, and 11 clones reacted as equally resistant. The clones exhibiting least injury were TCP 83-3196 and TCP 83-3180 from the second ratoon plantings.

Injury in 1989-90 ranged from 19.0% bored internodes (TCP 82-3101) to 37.4% (CP 81-1320) (Table 2). Although CP 70-321 was not evaluated in the 1989-90 tests, its sibling CP 70-324 exhibited low levels of *E. Loftini* injury. This was the only example in these studies of progeny of the same cross showing similar levels of injury.

Injury by *D. saccharalis* was not significantly different among clones in 1988-89 ($P > 0.05$), with less than 3% bored internodes. Significant differences in *D. saccharalis* injury were observed in 1989-90 ($P < 0.05$), however, injury averaged less than 1.0% for all plantings and the population was too low to evaluate sugarcane resistance. Injury by *D. saccharalis* in Texas sugarcane prior to establishment of *C. flavipes* averaged 18.7% bored internodes in untreated plots in 1972 (Fuchs et al. 1973) and about 31% (12 to 51%) in 1977 (Reeves 1978). Our results suggest a dramatic reduction in *D. saccharalis* injury since the mid 1970's. Overall injury to sugarcane by stalkborers, however, appears to have remained approximately the same, with the range of bored internodes (10.7-53.4%) similar to that observed in the mid 1970's. Direct yield reduction per internode bored by *E. loftini* has not been determined for any clone, therefore effects of equivalent percentages of bored internodes by the 2 species cannot be directly compared.

TABLE 1. MEXICAN RICE BORER INJURY (PERCENT BORED INTERNODES) IN SECOND RATOON, FIRST RATOON, AND PLANT CANE SUGARCANE PLANTINGS, LRGV, TEXAS, 1988-89.

Second Ratoon		First Ratoon		Plant Cane	
Clone	% Bored Internodes	Clone	% Bored Internodes	Clone	% Bored Internodes
TCP 83-3190	32.0 a	CP 84-723	44.2 a	NCo 310	53.4 a
TCP 83-3215	30.2 ab	TCCP 84-3232	35.5 b	TCP 85-802	52.7 a
NCo 310	28.2 bc	TCP 84-3257	35.4 b	TCP 85-3290	52.6 a
CP 83-631	27.5 bcd	TCP 84-3259	35.2 b	TCP 85-3340	43.4 b
CP 65-357	27.1 bcd	TCP 84-3231	33.5 bc	TCP 85-3287	42.6 b
TCP 83-3217	26.0 cd	TCP 84-3230	31.3 cd	TCP 85-3319	41.8 b
PM 72	24.5 de	LCP 81-30	30.2 de	TCP 85-3310	41.4 b
CP 72-1370	24.4 de	NCo 310	29.7 de	TCP 85-3289	41.4 b
TCP 83-3210	21.9 ef	L 80-38	29.1 def	LCP 81-10	40.1 b
TCP 83-3206	21.7 ef	L 81-26	28.6 def	CP 85-810	36.1 c
Mex 74-1901	20.5 f	CP 84-720	27.6 ef	CP 72-370	34.3 c
TCP 83-3211	17.0 g	TCP 84-3271	26.8 ef	CP 70-321	28.0 d
TCP 82-3101	16.4 g	TCP 84-3263	26.1 f	TCP 85-3342	27.1 d
CP 70-321	15.9 g	L 80-2	20.1 g	CP 85-818	26.2 d
TCP 83-3196	11.4 h	CP 84-750	18.0 g	MEAN	40.08
TCP 83-3180	10.7 h	TCP 84-3266	17.7 g		
MEAN	22.22	CP 70-321	16.8 g		
		MEAN	28.58		

[1]Means within % bored internode columns followed by the same letter are not significantly different ($P > 0.05$, Duncan's Multiple Range Test, SAS 1985).

This study suggests that 7 noncommercial clones exhibited low levels of stalkborer injury and could show promise for commercial use particularly if they are agronomically acceptable and provide good yield characteristics. Data on sugarcane clone resistance to *E. loftini* injury could be utilized in conjunction with data generated through the breeding program on clone yield and disease resistance to select new clones for release to Texas sugarcane producers. Integration of plant resistance studies into the Texas A&M University breeding program offers potential for reduced yield losses due to *E. loftini* injury.

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TABLE 2. MEXICAN RICE BORER INJURY (PERCENT BORED INTERNODES) IN PLANT CANE SUGARCANE PLANTINGS, LRGV, TEXAS, 1989-90.

Clone	*E. loftini*	*D. saccharalis*
CP 81-1320	37.4 a	0.4 bcd
TCP 86-3346	37.3 a	0.1 cd
CP 80-1743	31.8 b	0.9 a
TCP 86-3361	30.6 bc	0.2 bcd
TCP 84-3271	30.1 bc	0.1 cd
TCP 86-3369	29.2 bcd	0.1 cd
CP 81-1405	28.3 cde	0.2 bcd
TCP 86-3374	28.0 cde	0.1 cd
TCP 83-3215	27.8 cde	0.4 bcd
CP 80-1953	27.6 cde	0.4 bcd
NCo 310	27.6 cde	0.3 bcd
TCP 83-3211	27.2 de	0.3 bcd
CP 86-936	25.8 def	0.6 ab
CP 80-1151	25.4 ef	0.0 d
CP 86-946	22.8 fg	0.2 bcd
TCP 83-3196	22.7 fg	0.6 ab
CP 70-324	21.3 gh	0.3 bcd
CP 68-350	20.3 gh	0.2 bcd
CP 80-1827	20.1 gh	0.3 bcd
TCP 86-3368	20.1 gh	0.3 bcd
TCP 82-3101	19.0 h	0.9 a
MEAN	26.69	0.33

[1]Means within stalkborer species followed by the same letter are not significantly different ($P > 0.05$, Duncan's Multiple Range Test, SAS 1985).

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ADDITIONS TO THE PHORID FAUNA (DIPTERA: PHORIDAE) OF NORTH AMERICA NORTH OF MEXICO

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ABSTRACT

The phorid genus *Melaloncha* Brues and the species *Beckerina setifrons* Borgmeier, *Coniceromyia latimana* (Malloch), *Megaselia lanceata* Borgmeier, *Megaselia luteicauda* (Borgmeier), and *Melaloncha nigricorpus* Borgmeier are reported for the first time from North America north of Mexico. *Megaselia seclusa* Beyer is synonymized with *M. lanceata* [NEW SYNONYMY]. New locality records are given for *Dohrniphora divaricata* (Aldrich). Alterations to existing keys are suggested that will allow identification of these taxa.

RESUMEN

Se reporta por primera vez en Norte America al norte de Mexico, el genero phorid *Melaloncha* Brues y las especies *Beckerina setifrons* Borgmeier, *Coniceromyia latimana* (Malloch), *Megaselia lanceata* Borgmeier, *Megaselia luteicauda* (Borgmeier), and *Melaloncha nigricorpus* Borgmeier. *Megaselia seclusa* es sinonimo de *M. lanceata*