VARIETAL RESISTANCE TO THE SUGARCANE BORER IN PLANT CANE

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The sugarcane borer (SCB), *Diatraea saccharalis*, is the most destructive insect attacking the Louisiana sugarcane crop. Cultivar resistance to the SCB, is categorized as a combination of physical and chemical characteristics that impede larval feeding and stalk entry. The most common method used to assess sugarcane cultivar resistance in the practice is the counting of bored internodes. However, this practice does not incorporate the larvae that survived until adulthood inside of the stalk. Measuring the emergence per stalk allows for assessment of potential moth production. These two measures to evaluate resistance were merged in one single relative resistance ratio that incorporates both values.

Six advanced experimental sugarcane varieties of the L- and Ho- 2014 and 2015 series, program and ten commercial varieties (L 01-299, HoCP 85-845, HoCP 96-540, HoCP 00-950, HoCP 04-838, L 01-283, L 12-201, Ho 12-615, Ho 13-739 and HoCP 09-804) were evaluated for susceptibility to SCB during 2020 in plant cane. Additional varieties included Ho 08-9003 a cultivar developed through selection for SCB resistance an N-21 which is known to be resistant to stem borers in South Africa. All varieties were planted to one-row 7-m plots on September 3, 2019, at the LSU AgCenter Sugar Research Station in St. Gabriel, in a randomized block design with five replications. In order to increase the SCB population in the experimental plots, rows of corn were planted in between two-row plots and were inoculated with laboratory-reared SCB larvae early in the season. A 12-stalk sample was cut from each plot on October 27, 2020. The number of bored internodes, total internodes, and moth emergence holes from each sample was recorded. Relative survival was calculated as the ratio of emergence holes over the number of bored internodes. The relative resistance ratio is calculated based on rankings within replications for percentage bored internodes and relative survival. Ratios approaching 1 indicate a high degree of susceptibility relative to other cultivars evaluated. All data were analyzed with generalized linear mixed models (SAS, PROC GLIMMIX). The Kenward–Roger method was used to estimate denominator degrees of freedom and the Tukey's HSD (α=0.05) was used for mean separations. Models included "Variety" as a fixed effect and "Rep" as a random effect. The percentage bored internodes model used a binomial distribution, other models used Gaussian distributions.

SCB injury varied among cultivars (Table 1). Differences in in the percentage of bored internodes (F = 52.39; df= 17, 72; P <0.001), in the number of emergence holes/stalk (F = 7.11; df= 17, 72; P <0.001), and the relative resistance ratio (F = 6.42; df= 17, 72; P <0.001) were detected among the cultivars evaluated. Percentage bored internodes was more than 8-fold greater in susceptible standard HoCP 00-950 and recently released commercial variety L 12-201 than in varieties with known resistance, HoCP 85-845 and Ho 08-9003. Adult emergence per stalk followed a similar trend with approximately 16-fold more emergence holes in susceptible varieties relative to resistant varieties. The relative resistance ratio was least in the widely grown variety, L 01-299, which was classified as highly resistance, further demonstrating the utility of this variety in SCB IPM. Experimental varieties in the 2014 and 2015 series were all rated as either susceptible or intermediate levels of resistance.

Table 1. *Diatraea saccharalis* injury (LS Means ± SE) and resistance classification among commercial and experimental sugarcane cultivars plant cane, St. Gabriel, LA, 2020

Cultivar	Percentage of bored internodes[a*]	No. emergence holes/stalk (± 0.21)*	Relative survival (± 0.06)	Relative Resistance Ratio (± 0.07)*	Resistance Category
HoCP 00-950	29.4 ± 1.5a	2.07a	0.43	0.84a	Highly Susceptible
L 12-201	29.0 ± 1.6a	1.77ab	0.39	0.81a	Highly Susceptible
Ho 15-971	27.4 ± 1.5a	1.15abc	0.28	0.69ab	Susceptible
L 11-183	22.6 ±1.5ab	1.03abc	0.31	0.69ab	Susceptible
L 15-306	22.3 ± 1.4ab	1.08abc	0.30	0.68abc	Susceptible
L 14-267	16.5 ± 1.2bc	0.87bc	0.34	0.64abcd	Susceptible
HoCP 96-540	16.4 ± 1.2bc	0.90bc	0.29	0.56abcdef	Intermediate
HoCP 14-885	15.6 ± 1.3c	0.45c	0.20	0.52abcdef	Intermediate
HoL 15-508	15.1 ± 1.2cd	0.78bc	0.30	0.58abcde	Intermediate
HoCP 09-804	11.5 ± 1.1cde	0.42c	0.24	0.49abcdef	Intermediate
Ho 12-615	10.0 ± 0.9de	0.63c	0.34	0.54abcdef	Intermediate
Ho 13-739	9.9 ± 1.0de	0.58c	0.33	0.52abcdef	Intermediate
L 01-283	9.7 ± 1.0de	0.45c	0.29	0.49abcdef	Intermediate
N-21	9.4 ± 1.0e	0.25c	0.17	0.36bcdef	Resistant
HoCP 04-838	4.8 ± 0.7f	0.20c	0.21	0.31cdef	Resistant
L 01-299	4.6 ± 0.7f	0.12c	0.13	0.19f	Highly Resistant
HoCP 85-845	3.6 ± 0.6f	0.13c	0.20	0.28def	Resistant
Ho 08-9003	3.6 ± 0.6f	0.12c	0.19	0.26ef	Resistant

[a] Standard error for individual means reported for data analyzed with a binomial distribution.
*Means which share a letter are not significantly different (Tukey's HSD, α=0.05).

MEXICAN RICE BORER EXPANSION IN LOUISIANA

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The Mexican rice borer (MRB) (*Eoreuma loftini*) is an invasive insect which is a damaging pest of sugarcane and other grass crops. The MRB has been the dominate pest of sugarcane in Texas since the 1980s, and was first detected in Louisiana in 2008. MRB populations can be monitored with pheromone traps. These bucket traps are baited with a female sex pheromone which can detect adult male moths even at low population densities. Eastward spread through Texas and into Louisiana has been monitored with pheromone traps since 2000.

As of December of 2020, the MRB has been detected in 16 Louisiana Parishes: Acadia, Allen, Avoyelles, Beauregard, Calcasieu, Cameron, Evangeline, Iberia, Jefferson Davis, Lafayette, Pointe Coupee, Rapides, St. Landry, St. Martin, Vermilion, and West Baton Rouge (Figure 1). High populations are present in rice producing areas of Acadia, Calcasieu, Cameron, and Jefferson Davis Parishes. MRB populations have increased recently in sugarcane production regions of Pointe Coupee, Vermillion, and West Baton Rouge with many fields requiring insecticidal protection. Detection of MRB larval infestations in sugarcane plots on the Dean Lee Research Station in July of 2020 provided the first record of the pest in Rapides Parish. Infestations were subsequently found in commercial sugarcane fields in Rapides as well as adjacent Avoyelles Parish, and substantial acreage was treated with insecticide.

Continued eastward expansion into sugarcane production regions along the Mississippi River and Bayou Lafourche in future years is anticipated. This spread is unlikely to be mitigated through management, but care should be taken to avoid increasing the rate of spread. Movement of sugarcane, particularly seed cane, to uninfested areas should be avoided. Transportation of sugarcane to the mill is thought to have minimal impact on MRB spread due to the rapidity of processing cane upon arrival. Still, cane should be taken the closest mill wherever possible. Movement of alternative hosts including rice, hay, and other grasses should also be avoided. Detection of MRB in new areas should be reported to LSU AgCenter extension agents.

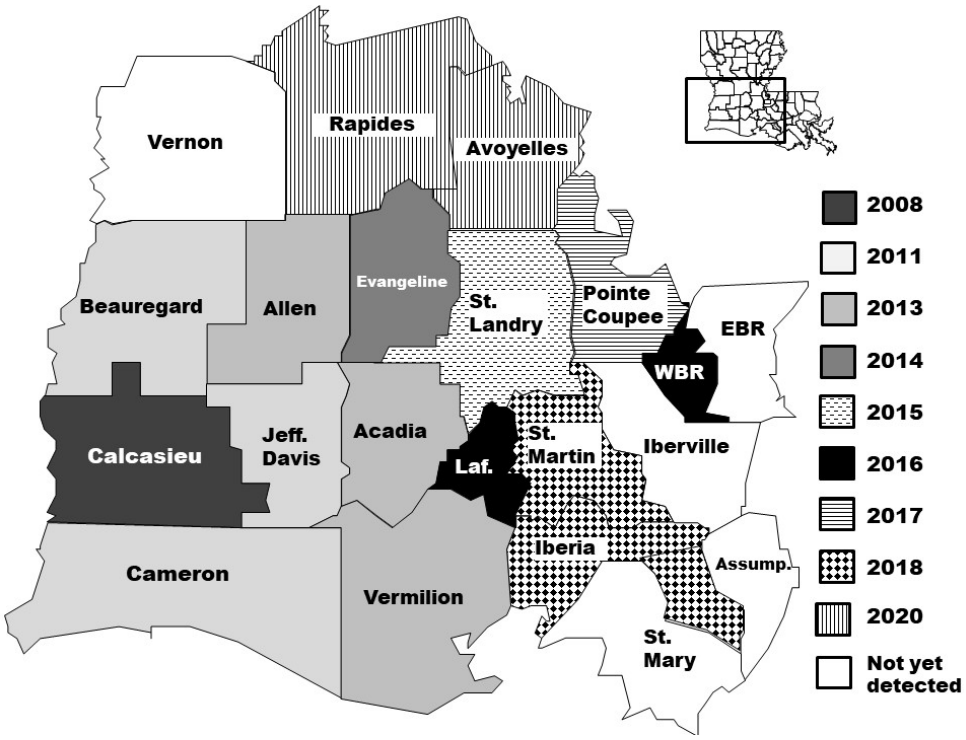

Figure 1. Mexican rice borer range expansion in Louisiana, 2008–2020.

VARIETAL RESISTANCE TO THE MEXICAN RICE BORER IN PLANT CANE

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Varietal resistance to stem borers including the sugarcane borer (SCB), *Diatraea saccharalis*, and the Mexican rice borer (MRB), *Eoreuma loftini*, is a major component of integrated pest management programs in sugarcane. Resistant varieties have greatly contributed to a >50% reduction in insecticide applications over the past 20 years. Continued evaluation of borer susceptibility among modern commercial varieties is required to effectively implement this valuable pest management strategy. While susceptibility is often similar to both SCB and MRB, exceptions exist. This requires examination of varietal susceptibility to each pest in separate experiments. This study aims to evaluate susceptibility to the MRB among widely grown and newly released commercial sugarcane varieties.

A field trial was conducted at the Texas AgriLife Beaumont station where MRB pest pressure is consistently high. The trial included six varieties with known levels of MRB susceptibility: HoCP 85-845 and L 01-299 (resistant), HoCP 96-540 and L 01-283 (intermediate), and HoCP 04-838 and L 00-950 (susceptible). The trial also included six more recently released varieties never before evaluated for MRB susceptibility: HoCP 09-804, L 12-201, Ho 12-615, Ho 13-739, L 14-267, and HoCP 14-885. Varieties were planted September 11, 2019 to one-row 5-m plots in a randomized block design with five replications. Plots were maintained throughout the growing season according to recommended practices. Plots were exposed to enhanced natural infestations by suppression of fire ant populations. A 12-stalk sample was cut from each plot on November 17, 2020. The number of bored internodes and total internodes was recorded. Adult emergence data were collected from only two reps and are not presented. Data were analyzed with a generalized linear mixed model (SAS, PROC GLIMMIX) with variety as a fixed effect and replication as a random effect with a binomial distribution. The Kenward–Roger method was used to estimate denominator degrees of freedom and the Tukey's HSD (α=0.05) was used for mean separations.

Differences in the percentage of bored internodes among varieties were detected (F = 49.8; df= 11, 48; P <0.001). Percentage bored internodes in plots of the most heavily injured variety, L 12-201, was more than 5-fold greater than in the resistant standard, HoCP 85-845 (Table 1). Three previously unassessed varieties were more heavily injured than the susceptible standard, HoCP 00-950. Recently released Ho 12-615 and Ho 13-739 demonstrated some resistance to MRB. Interestingly, HoCP 04-838, which was among the most heavily injured in four previous trials, appeared resistant in this trial. This suggests potential for environmental factors to influence resistance expression. Research evaluating MRB resistance among modern cultivars should be continued in future years.

Table 1. *Eoreuma loftini* injury (LS Means ± SEM) and resistance classification among commercial sugarcane varieties, plant cane, Beaumont, TX, 2020

Cultivar	Percentage of bored internodes*
HoCP 85-845	6.3±1.1g
HoCP 04-838	7.1±1.2g
Ho 12-615	9.6±1.5fg
Ho 13-739	9.7±1.5fg
L 01-299	11.5±1.7ef
L 14-267	13.5±1.9def
HoCP 96-540	15.7±2.1cde
L 01-283	16.7±2.3cd
HoCP 00-950	18.1±2.4cd
L 09-804	21.2±2.6bc
HoCP 14-885	25.4±3.0ab
L 12-201	31.9±3.4a

*Means which share a letter are not significantly different (Tukey's HSD, α=0.05).

LARGE PLOT EVALUATION OF INSECTICIDAL CONTROL OF THE MEXICAN RICE BORER IN LOUISIANA

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The Mexican rice borer (MRB), *Eoreuma loftini*, is the most destructive insect attacking sugarcane in Texas and is increasing in economic importance in Louisiana. The MRB has been expanding eastward and northward into Louisiana sugarcane production regions since 2008 and damaging infestations have been reported with increasing frequency in recent years. As of 2020, MRB infestations in sugarcane have been documented in Vermilion, Iberia, Pointe Coupee, West Baton Rouge, Rapides, and Avoyelles Parishes. Insecticidal control of MRB has been evaluated in Texas sugarcane, and farmers there are spraying to control the pest after having abandoned the practice for the past 30 years. Sugarcane in Louisiana is routinely scouted for the presence of sugarcane borer, *Diatraea saccharalis,* infestations from late-May through early-September. Fields are sprayed if infestations exceed economic thresholds. Prevathon (chlorantraniliprole) has become the most widely used insecticide due to its effective and long-lasting control of SCB. It is unknown if the chemical control strategies used for SCB will also be effective against MRB.

A trial was conducted with in cooperation with a commercial farmer in Vermilion Parish The trial evaluated Prevathon at the high (20 fl oz/acre) and low (14 fl oz) labeled rates applied with a ground sprayer. A field of L 01-299 was scouted on June 26, 2020 and MRB infestations were determined to be 6% of stalks with larvae in the leaf sheaths, above the recommended threshold to trigger an insecticide application. The treatments were randomized to approximately 5-acre plots (20 rows, 1,900 feet long) arranged in a randomized block design with three replications. The application was made on June 29, 2020 with a ground sprayer with a 5-row boom delivering 20 gallons per acre. No adjuvants were included. Control was assessed on Oct 22, 2020 by taking 15 stalk samples from the front and back of each plot and recording the number of bored internodes and total internodes. Percentage bored internodes was analyzed with a generalized linear mixed model (SAS Proc Glimmix) with treatment included as a fixed effect and rep and rep*treatment as random effects using a binomial distribution. Means were separated with Tukey's HSD.

Both treatments reduced the level of MRB injury relative to the non-treated control ($F = 14.31$; df = 2, 11; $P = 0.001$), but did not differ from each other. This suggests the low rate is sufficient to provide effective control of MRB, and may allow for reduced treatment cost. The level of MRB injury in the non-treated plots was low relative to prior studies. This low level of injury occurred despite having infestations exceeding threshold levels suggesting sampling protocols and thresholds should be re-evaluated. The resistant cultivar, L 01-299, appears to have avoided high levels of stalk injury despite having larvae feeding in the sheaths.

Table 1. MRB injury as affected by insecticide treatments, Vermilion Parish, LA 2020

Treatment	Rate (fl oz/acre)	Percentage bored internodes
Non-treated	NA	3.0 a
Prevathon	14.0	0.6 b
Prevathon	20.0	0.5 b