VARIETAL RESISTANCE TO THE SUGARCANE BORER IN PLANT CANE, 2021

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The sugarcane borer (SCB), *Diatraea saccharalis*, is the most destructive insect attacking the Louisiana sugarcane crop. Varietal resistance to the SCB is a key pest management strategy, and resistant varieties have reduced insecticide usage by approximately 50%. Continued assessment of SCB resistance among commercial and experimental sugarcane varieties is critical to maintaining the success of this strategy in IPM programs. Resistance is assessed annually in small-plot field trials conducted at the Sugar Research Station in St. Gabriel, LA.

Four advanced experimental sugarcane varieties of the L- and Ho- 2015 and 2016 series of the variety development program were included in addition to commercial varieties. Commercial varieties known to be resistant included HoCP 85-845, L 01-299, and HoCP 04-838. Additional resistant varieties which are not produced commercially included Ho 08-9003 and N-21. Susceptible commercial varieties included HoCP 00-950 and L 12-201. Additional commercial varieties evaluated included those with intermediate or unknown levels of SCB susceptibility (HoCP 09-804, L 01-283, L 11-183, Ho 12-615, Ho 13-739, L 14-267, and HoCP 14-885). All varieties were planted in one-row 7-m plots on August 18, 2020, 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 November 8, 2020. The numbers of bored internodes and total internodes were recorded. 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 replication as a random effect.

Differences in the percentage of bored internodes were detected among varieties ($F = 3.64$; df= 17, 62; P <0.001). Percentage bored internodes was approximately 4-fold greater in susceptible varieties relative to resistant varieties (Table 1). Recently released commercial varieties including L 11-183, L 12-201, L 14-267, and HoCP 14-885, did not differ from the susceptible standard, HoCP 00-950. The advanced experimental lines considered for release in 2022 (HoL 15-508 and L 15-306) appeared similarly susceptible. Conversely, modern commercial varieties, Ho 12-615 and Ho 13-739, had comparable levels of injury to known resistant varieties. Results suggests a range of SCB resistance remains present in variety development program.

Table 1. *Diatraea saccharalis* injury among commercial and experimental sugarcane varieties in plant cane, St. Gabriel, LA, 2021

Variety	% bored internodes (LS Means ± SEM)
L 11-183	18.2 ± 2.1 a
HoCP 00-950	13.5 ± 2.1 a
HoCP 14-885	12.6 ± 2.3 ab
Ho 16-608	10.7 ± 2.1 ab
L 15-306	10.7 ± 2.1 ab
L 12-201	8.8 ± 2.1 ab
HoL 15-508	8.6 ± 2.1 ab
L 14-267	8.5 ± 2.3 ab
N-21	7.1 ± 2.1 b
Ho 16-600	6.9 ± 2.1 b
Ho 13-739	5.8 ± 2.1 b
L 01-283	5.7 ± 2.4 b
HoCP 85-845	5.2 ± 2.1 b
Ho 08-9003	4.6 ± 2.1 b
L 01-299	4.5 ± 2.6 b
HoCP 04-838	3.9 ± 2.1 b
HoCP 09-804	3.6 ± 2.1 b
Ho 12-615	3.4 ± 2.1 b

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

INFLUENCE OF SUGARCANE VARIETY ON MEXICAN RICE BORER SURVIVAL AND DEVELOPMENT

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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. Several cultivars with resistance to stem borers have been identified through field trials, but the mechanisms behind this resistance are poorly understood. Mechanisms of resistance include traits that deter oviposition by moths, impede larval establishment, or retard larval development. These potential resistance mechanisms were investigated through a series of greenhouse and laboratory assays.

Assays included a greenhouse choice assay (oviposition preference), a greenhouse no choice assay (larval establishment), and a laboratory diet incorporation assay (larval development). The two greenhouse assays included three resistant cultivars (HoCP 85-845, L 01-299, and N-21), two susceptible cultivars (HoCP 00-950 and HoCP 04-838), and recently released commercial cultivars (Ho 12-615 and L 12-201). In the oviposition preference choice assay, MRB pupae from a laboratory-reared colony were released in the center of a replication (n=5) surrounded by one pot of each sugarcane variety. Moths emerged, mated, and oviposited freely among sugarcane varieties. Numbers of eggs and egg masses per plant were then recorded. In the no choice assay, MRB eggs from the lab colony were pinned on plants (n=5) of each of the same varieties. Larval survival to stalk entry was recorded after 3 weeks. In the diet incorporation assay, leaf tissue of four resistant cultivars (L 01-299, HoCP 85-845, Ho 08-9003, and N-21) and two susceptible cultivars (HoCP 00-950 and HoCP 04-838) was obtained from a field trial. Leaf tissue was ground into a powder and mixed with artificial borer diet used in rearing. Individual diet cups were prepared with each variety (n=30) and a diet-only control. Individual larvae were placed in each cup, and the days to pupation was recorded. All data were analyzed with generalized linear mixed models (SAS, Proc Glimmix) with variety as a fixed effect and replication as a random effect.

In the choice assay, differences were not detected ($P > 0.05$) among cultivars in the number of eggs or oviposition events per plant, and data are not presented. In the no-choice assay, percentage of boring success was affected by cultivar ($F = 4.51$; df = 6, 28.0; P=0.003), and ranged from 4.5–11.7%. Boring success was 1.5-fold greater in cultivars L 12-201, HoCP 00-950, and HoCP 04-838 relative to Ho 12-615 (Figure 1). In the larval development assay, variety influenced days to pupation ($F = 13.95$; df = 6, 81.0; P <0.001). Cultivars HoCP 85-845 and N-21 had a 1.8-fold increase in days to pupation compared to the artificial diet control, while HoCP 04-838 was not significantly different from the artificial diet control (Figure 2).

Results confirm resistance levels assessed from field studies and suggest factors affecting larval establishment and development may be more important to resistance than oviposition preference.

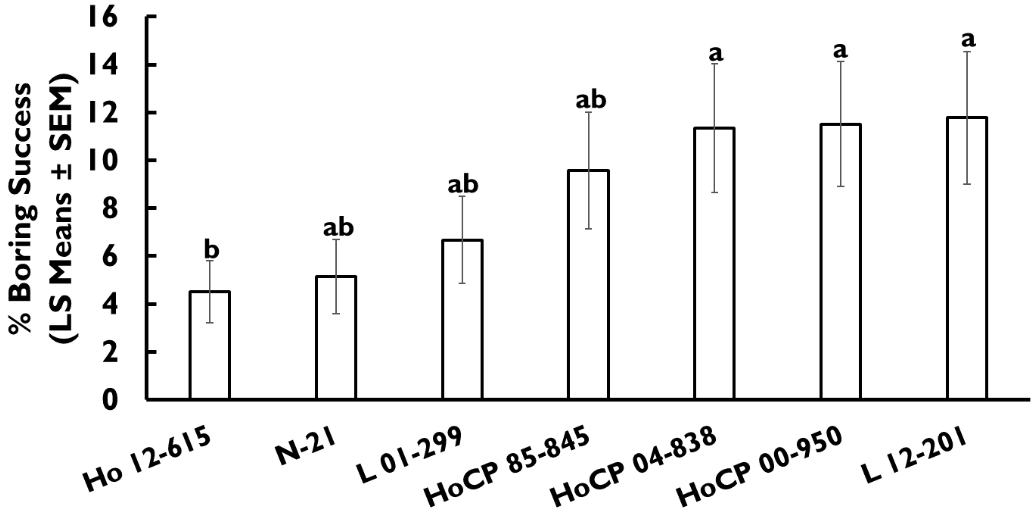

Figure 1. *Eoreuma loftini* neonate establishment among commercial sugarcane cultivars. Bars that share a letter are not significantly different (Tukey's HSD, α=0.05).

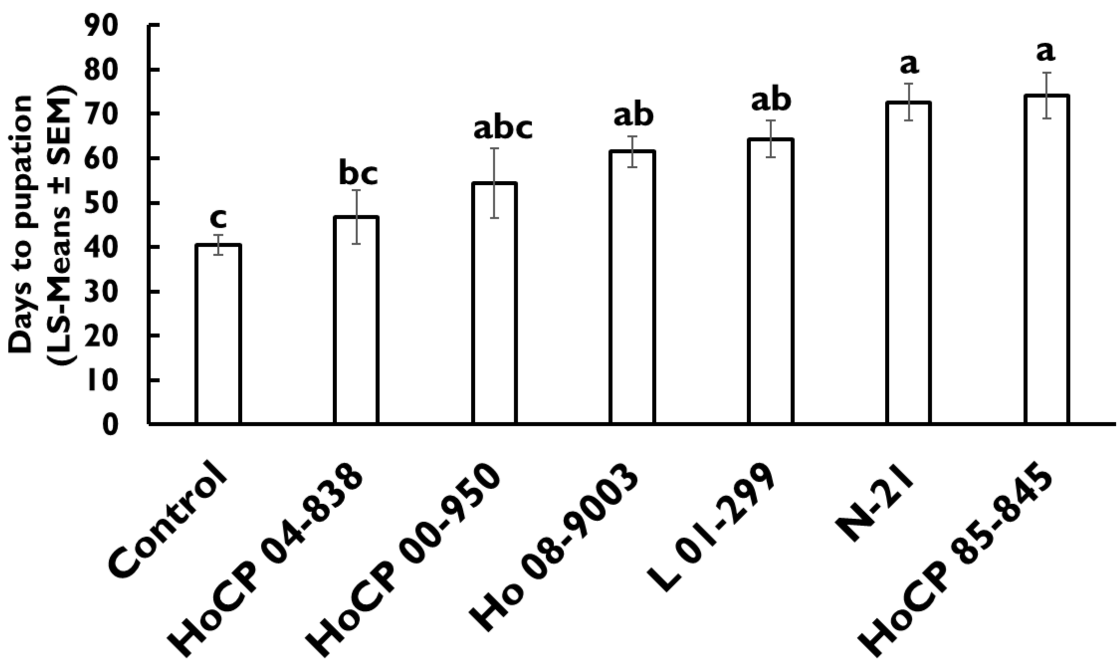

Figure 2. *Eoreuma loftini* days to pupation as influenced by cultivar. Bars that share a letter are not significantly different (Tukey's HSD, α=0.05).

EVALUATION OF SOIL-APPLIED INSECTICIDES FOR CONTROL OF WIREWORMS AT PLANTING

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Wireworms (Coleoptera: Elateridae) are sporadic pests of sugarcane which feed on seed cane at planting and have potential to reduce plant populations. One of two currently labeled organophosphate insecticides is applied at planting to approximately 25% of plant cane acres. This product is hazardous to the applicator and detrimental to beneficial insects, thus alternative insecticides are needed. Further, a new neonicotinoid insecticide, thiamethoxam (Platinum®, Syngenta) is anticipated to receive EPA registration for use in sugarcane in coming years, but the product has scarcely been tested for efficacy against wireworms. Additional interest in broflanilide and other experimental insecticides for wireworm control has led to a need for product efficacy evaluation. Assessing insecticidal control of wireworms in sugarcane has historically be challenging due to the unpredictable nature of infestations. This study investigated influence of insecticides on plant cane emergence in two field trials conducted in plots with artificial pest pressure.

Trials were conducted at the USDA Sugar Research Unit North Farm in Schriever, LA, and the LSU AgCenter Sugar Research Station in St. Gabriel, LA. Prior to planting, wireworm larvae were hand collected from commercial sugarcane fields on multiple dates during the summer. In each experiment, one larvae per row-foot was placed in each plot and lightly covered with earth. Seed cane was planted in each plot at a rate of 3.5 mature internodes per row-foot. Treatments were applied over the top of the seed cane with a back-pack sprayer calculated to deliver 15 gallons per acre. The Schriever trial included Platinum along with three rates of an experimental insecticide (A22466). The St. Gabriel trial included 4 rates of Broflanilide applied to the seed cane in addition to one rate applied to the soil after covering. The industry standard, Thimet, was also included. Both trials included an infested control and an uninfested control. The seed cane was covered with soil immediately following the application. Sugarcane emerged naturally, and stand counts were taken at approximately 4 and 10 weeks after planting (Schriever trial) and 6 weeks after planting (St. Gabriel). Tiller counts were converted to tiller per acre prior to analysis. Data were analyzed with generalized linear mixed models (SAS, Proc Glimmix) with treatment as a fixed effect and replication (n=5) as a random effect.

Treatments were detected at both fall sampling dates in the Schriever Trial with the greatest plant populations observed in plots treated with Platinum and the highest rate of A22466 (Table 1). Significant differences in plant populations were not detected ($P > 0.05$) among treatments in the St. Gabriel Trial, though stand was greatest in the uninfested control and middle rates of broflanilide. Results suggest new chemistries show promise in protecting plant cane stands from wireworm damage. Further, results demonstrated the utility of inoculated plots in assessing product efficacy in wireworm control. On-going research will assess treatment effects on spring plant populations and sugarcane yields.

Table 1. Sugarcane stand as affected by insecticide treatments (LS Means ± SEM), Schriever, LA, 2021

Treatment	Rate	Tillers per acre 26 Oct 2021	Tillers per acre 13 Dec 2021
Infested control	NA	15,636 ± 1,682 d	33,636 ± 4,909 c
Uninfested control	NA	24,545 ± 2,100 bc	42,727 ± 5,909 abc
A22466	2.74 fl oz/acre	22,545 ± 2,027 c	45,273 ± 4,909 abc
A22466	4.56 fl oz/acre	22,364 ± 2,009 c	41,090 ± 5,364 bc
A22466	6.84 fl oz/acre	29,627 ± 2,318 ab	48,909 ± 3,818 ab
Platinum	5.67 oz/acre	33,455 ± 2,464 a	54,727 ± 5,909 a
	F =	8.40	6.31
	df =	5, 20	5, 20
	P =	<0.001	0.001

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

Table 2. Sugarcane stand as affected by insecticide treatments (LS Means ± SEM), St. Gabriel, LA, 2021

Treatment	Rate	Tillers/acre 13 December 2021
Un-infested control	NA	15,246 ± 5,372
Infested control	NA	12,052 ± 4,501
Broflanilide	0.57 fl oz/acre	14,230 ± 4,937
Broflanilide	1.14 fl oz/acre	17,860 ± 3,339
Broflanilide	2.28 fl oz/acre	17,860 ± 2,759
Broflanilide	4.56 fl oz/acre (uninfested)	14,520 ± 2,759
Thimet low	3 lbs/acre	11,616 ± 3,485
Broflanilide	1.4 fl oz/acre pre-emergence, soil applied	8,712 ± 4,646