SMALL PLOT ASSESSMENT OF INSECTICIDES AGAINST THE SUGARCANE BORER

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A study was conducted at the LSU AgCenter St. Gabriel Research Station, St. Gabriel, LA to evaluate insecticides for control of the sugarcane borer (SCB) *Diatraea saccharalis* (F.) (Lepidoptera: Crambidae). Nine different insecticide treatments, in addition to an untreated check, were assessed for season-long control of SCB in a randomized complete block design with five replications in a field of ratoon HoCP91-555 cane planted in August 2003. Insecticide treatments were applied to 3-row plots (6 ft x 30 ft) on 26 July when infestation counts reached a threshold of 5% of the plants infested with live first or second instar SCB larvae in the leaf sheaths. The treatments were applied using a CO_2 sprayer mounted on an all-terrain vehicle with an 8005 flat-fan nozzle (one per row) delivering 10 gpa at 35 psi. Prior to test initiation, Lorsban 15G (15 lb/acre) and Karate Z (1 oz/acre) were applied directly to the soil in the last week of June 2005 and on July 22nd, respectively, to suppress fire ant predation on SCB larvae. SCB damage to sugarcane was assessed by counting the number of bored internodes and the total number of internodes in each of nine treatments and the untreated control (15 stalks per plot) from each plot at the time of harvest (4 November). Data were analyzed using a one-way analysis of variance (Proc Mixed) with means separated with Tukey's HSD ($P < 0.05$).

Maximum damage in insecticide treated plots was 12% SCB bored internodes with all treatments significantly less than the untreated check (34.4% bored internodes). Novaluron at the 8 oz/acre rate showed maximum borer control (84.3% of check), while V-10170 provided the least level of control (65.1% of check) (Table 1). The other treatments provided intermediate levels of suppression.

Table 1. Insecticidal control of sugarcane borer in a small plot test at the St. Gabriel Research Station, 2005.

Treatment/Formulation	Rate(oz/A)	% Bored Internodes[b]
Diamond 0.83EC	**8.00**	**5.4d**
Diamond 0.83EC	12.00	5.8cd
Karate Z	1.92	6.0cd
Mustang Max 0.8EC	4.00	7.4bcd
Confirm 2F	**8.00**	**11.2bcd**
Prolex 1.25EC	2.00	10.4bcd
Baythroid 2E	2.10	11.8bc
S-1812 4EC	6.4	11.2b
V-10170 50%WDG	20gm/A	12.0b
Check	**--**	**34.4a**
F-value		28.18

[a]All treatments were applied with Latron CS-7 at 0.25% v/v.
[b]Means within column followed by the same letter are not significantly different ($P < 0.05$, Tukey's HSD).

SMALL PLOT ASSESSMENT OF INSECTICIDES AGAINST THE MEXICAN RICE BORER

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Insecticidal control of the Mexican rice borer (MRB) was evaluated at Santa Rosa, Texas. A randomized block experimental design was conducted with 5 replications of the variety CP 70-1210 plantcane crop during the summer of 2005. Each plot consisted of three 24-ft rows. Insecticide treatments were applied on 16 May, 8 June, 27 June, and 29 July with the surfactant CS-7 at a rate of 0.25% vol/vol with a Knapsack Solo sprayer with a pressure of 25-35 psi at 20 gpa using an 8002 hollow cone nozzle. Data on the percent MRB bored internodes was collected on 19 August from 5-7 stalks on the center row of each plot. The proportion of bored internodes was analyzed using a generalized linear model (Proc Glimmix, SAS Institute 2004) with a binomial distribution.

Confirm (8oz/ac), Novaluron (12oz/ac), and a mix of Novaluron (9oz/ac) and Prolex (2.0oz/ac) reduced injury significantly; 2-fold, 3.4-fold and 5.7-fold, respectively.

Table 1. Insecticidal control of Mexican rice borer at small plot level, Santa Rosa, Texas, 2005.

Treatment/ formulation[a]	Rate oz/ac	% MRB bored internodes[b]
Novaluron + Prolex	**9.0+ 2.0**	**4.3c**
Novaluron	12.0	7.2bc
Confirm	8.0	12.2bc
Novaluron	9.0	14.3abc
Baythroid	2.8	10.7ab
Untreated	**--**	**24.4a**

[a]All treatments were applied with Latron CS-7 at 0.25%v/v.
[b]Means within the same column followed by the same letter are not significantly different ($P > 0.05$; Tukey's [1953] HSD) (df = 5, 24).

EARLY SEASON EVALUATION OF SUGARCANE VARIETAL RESISTANCE TO THE SUGARCANE BORER

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Eleven sugarcane varieties were evaluated for their susceptibility to the sugarcane borer (SCB) at the early growth stage at Burns Point in St. Mary Parish. A randomized complete block design was used with four replications. Plots for each variety were 15-ft and the number of deadhearts caused by SCB was counted on April 27 and May 24, 2005. Data on number of deadhearts (per 15-ft plot) were analyzed using Proc Glimmix (SAS Institute 2004).

Significant differences among varieties were detected showing HoCP 01-561 the most significant with the highest number of deadhearts (50,820/acre). This variety also had the highest number of bored internodes (49%) in our 2004 variety screening test. Among the three standards, LCP 85-384 had the highest number of deadhearts (32,234/acre), while HoCP 85-845 showed significantly less susceptibility to SCB in its early growth stages (Table 1). The projected number of deadhearts on a per acre basis shows that susceptible varieties such as HoCP 01-561 have the potential to produce substantial SCB early season populations, while resistant varieties like HoCP 01-523 will be expected to have only 15-20% of those early season populations. These numbers also indicate the importance of development and commercialization of insect resistant varieties.

Table 1. Deadhearts by sugarcane borer in different sugarcane varieties at Burns Point in St. Mary Parish, 2005.

Variety	Deadhearts/15-ft	Deadhearts/acre
HoCP 01-561	17.5a	50820
L 02-324	12.8ab	37171
LCP 85-384	**11.1bc**	**32234**
L 02-342	10.6bc	30782
L 02-316	9.4bcd	27297
HoCP 91-555	**9.3bcd**	**27007**
US 02-99	7.9bcd	22941
HoCP 01-551	6.8cde	19747
L 02-325	6.4cde	18585
HoCP 85-845	**5.3de**	**15391**
HoCP 01-523	3.0e	8712
$P > F^a$	0.04	

Means within the same column followed by the same letter are not significantly different ($P > 0.05$; Tukey's HSD).

MONITORING OF SUGARCANE BORER RESISTANCE TO TEBUFENOZIDE (CONFIRM)

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Continuous use of similar insecticide chemistries exerts selection pressure on insect physiology which may cause insecticide resistance. The sugarcane borer (SCB), *Diatraea saccharalis* (F.) has a long history of resistance development against a wide range of insecticide classes. Our previous studies have shown indication of resistance development in some areas due to continuous use of Confirm® over several years in Louisiana sugarcane industry. In 2005, we continued monitoring for the potential development of resistance in SCB against Confirm®. Borers were collected from four different field locations and tested in the laboratory over a range of Confirm® doses incorporated into artificial diet. After seven days, the borers were transferred from treated to regular diet and data on pupation was recorded for each strain. The Alexandria strain was collected from corn fields where no Confirm® has ever been applied thus serving as a standard to compare strains. The Duson strain was collected from locations where Confirm® has been consistently used for the last several years and control failures have been observed by the consultant.

Our results indicate that areas such as St. Gabriel and St. Mary where rotation of chemistries has been practiced showed little signs of resistance buildup (Table 1). However, Duson strain showed 3.78 and 7.0 times increase in resistance ratios at LC_{50} and LC_{90} levels, respectively. This strain also had the highest pupation and was able to pupate even at concentrations where no other strain survived (Fig. 1). These studies indicate that Confirm® can only be preserved for longer period of time and phenomenon of resistance buildup delayed only if rotation of chemistries is practiced.

Table 1: Changes in susceptibility of sugarcane borer to Confirm.

Strain	LC_{50}	LC_{90}	RR_{50}	RR_{90}
Alexandria	0.14	0.31	1	1
St. Mary	0.20	1.23	1.42	3.96
St. Gabriel	0.22	0.72	1.57	2.32
Duson	0.53	2.17	**3.78**	**7.00**

LC= Lethal concentration necessary to kill 50 and 90% of respective cultures
RR= Resistance ratio in comparison to Alexandria standard

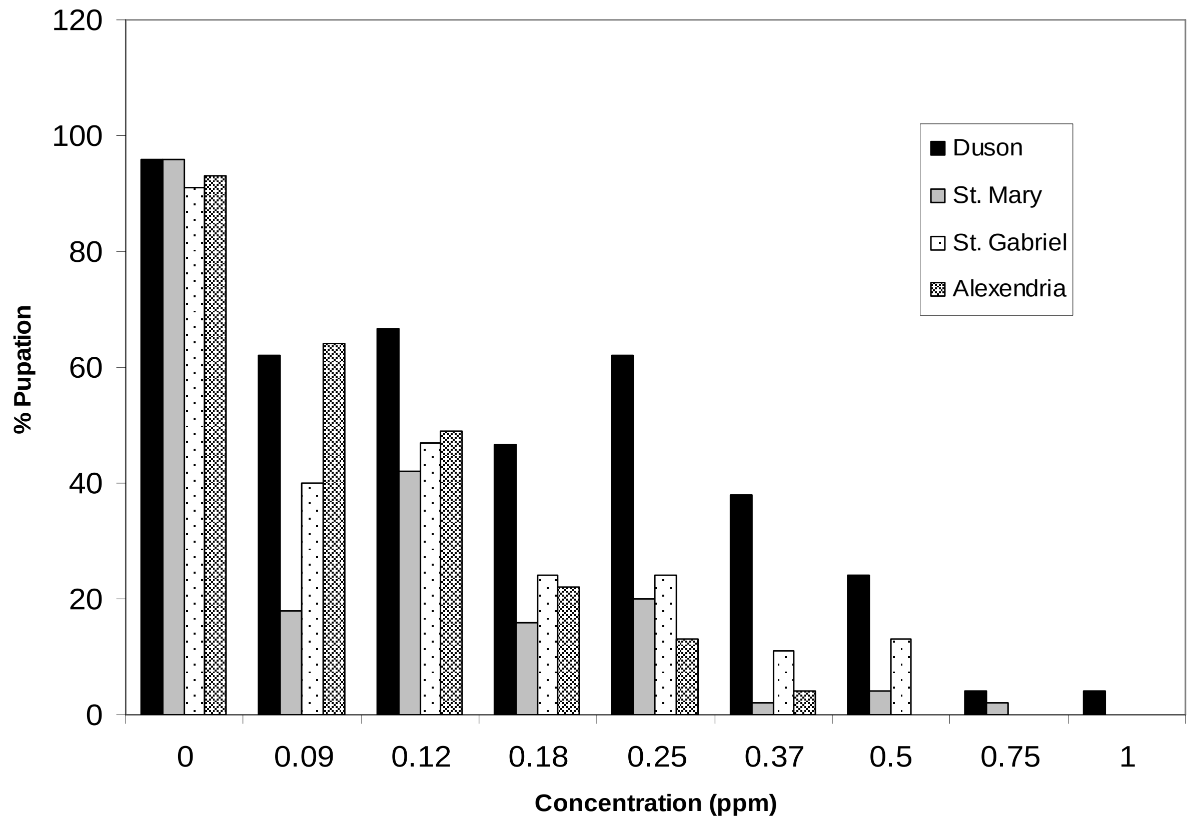

Fig.1. Tebufenozide effects on pupation of field collected strains of the sugarcane borer.

RESISTANCE TO THE SUGARCANE APHID AMONG COMMERCIAL SUGARCANE CULTIVARS IN LOUISIANA

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The sugarcane aphid, *Melanaphis sacchari* is the main vector of sugarcane yellow leaf virus which causes sugarcane yellow leaf disease. Tests for antixenosis (preference or non preference), antibiosis (negative effects of plant on insect biology), and tolerance (plant's ability to withstand injury) were conducted in the greenhouse to assess potential sources of host plant resistance in current Louisiana sugarcane germplasm. The varieties tested include LCP 85-384, HoCP 91-555, Ho 95-988, HoCP 96-540, and L 97-128. For antixenosis tests, 50 apterous nymphs were released at the center of a wooden platform that had one leaf from each variety stuck at the margins. The aphids were recovered after 24 hours. There were four replications of each variety in one experiment and the experiments were repeated three times. For antibiosis tests, two aphids were confined in a clip-on cage on one leaf of each variety with data collected daily to maturity assessing days in reproduction and number of nymphs produced per aphid. Based on this data, intrinsic rate of increase of aphids (r_m) on each variety was calculated. Tolerance was assessed by recording chlorophyll content readings from aphid infested and noninfested leaves of each variety.

Antixenosis tests did not show difference in aphid preference, but antibiosis tests indicate pronounced variation among varieties. The days in reproduction and number of nymphs produced were highest in L 97-128 and least on HoCP 91-555. Calculations based on r_m indicated that L 97-128 was the most susceptible variety and HoCP 91-555 depicted the strongest antibiosis (Fig. 1). Other varieties showed intermediate levels of antibiotic resistance. Similar results were recorded in tolerance tests, as L 97-128 suffered maximum chlorophyll loss and HoCP 91-555 was able to produce more chlorophyll in the infested than in the noninfested leaf tissues (Fig. 2).

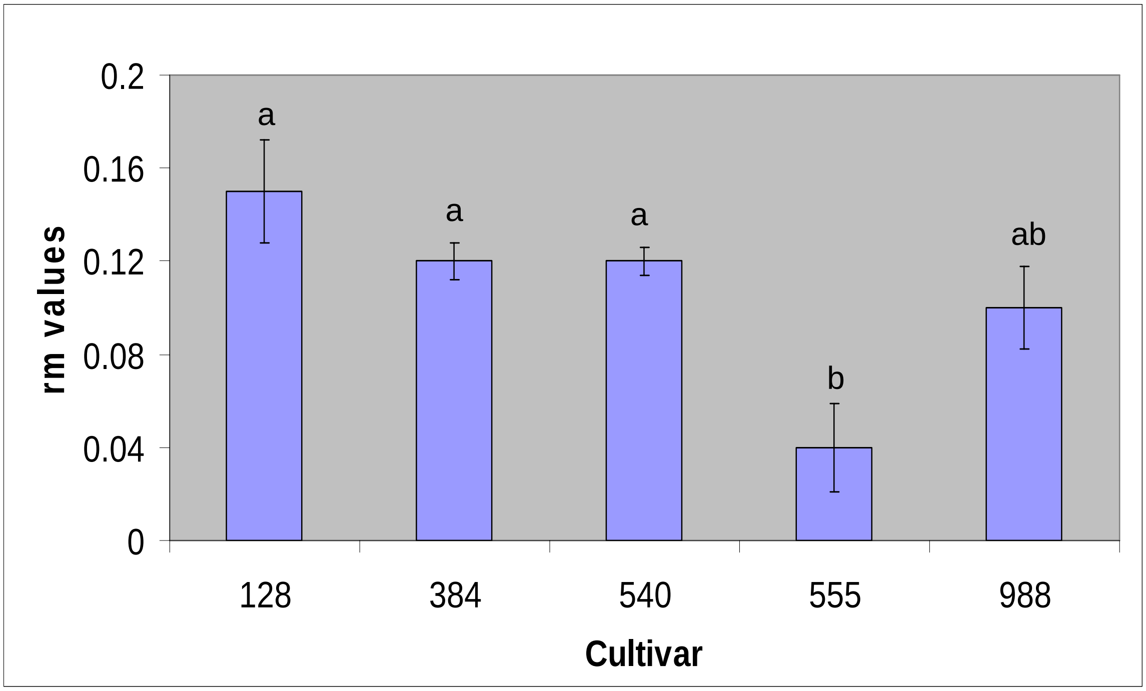

Fig. 1. Effect of sugarcane cultivars on population growth rate (r_m) of sugarcane aphid.

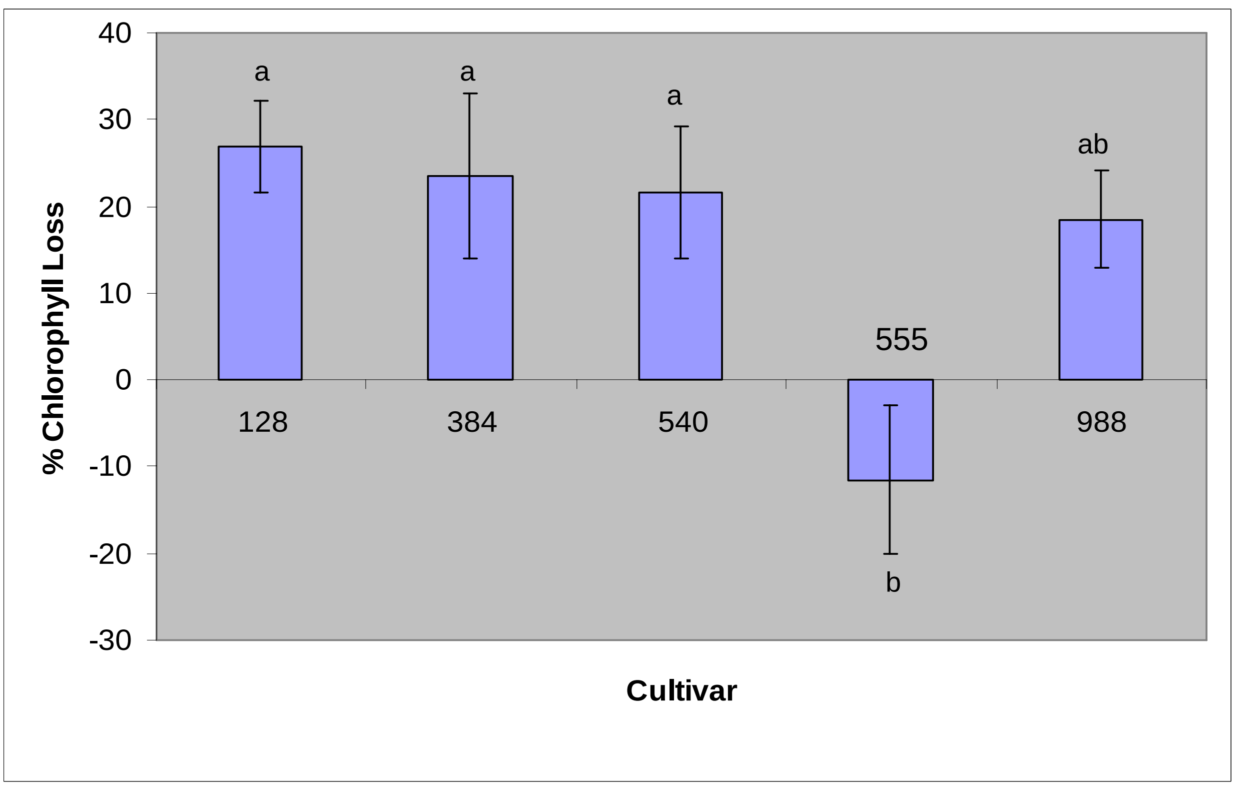

Fig. 1. Effect of sugarcane cultivars on chlorophyll loss due to sugarcane aphid feeding.

MONITORING MEXICAN RICE BORER MOVEMENT

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Cooperative studies on the Mexican rice borer (MRB), *Eoreuma loftini* (Dyar), between the LSU AgCenter, the Texas A&M University research stations at Beaumont and Weslaco, the Texas Department of Agriculture and the Louisiana Department of Agriculture and Forestry were conducted to monitor the movement of this insect towards Louisiana and to study the population dynamics of this devastating pest of sugarcane that can not be controlled with simple insecticide applications. The MRB has been the major economic pest in Texas sugarcane since it established in 1980, quickly surpassing the pest severity of the sugarcane borer, *Diatraea saccharalis* (F.).

A major monitoring effort has been on-going since 2000 with the various cooperating agencies as well as with the assistance from farmers, county agents, and consultants. After the discovery in Brazoria, Colorado, Fort Bend, Waller and Wharton Counties in 2000, Harris and Austin Counties in 2001, Galveston in 2002, Chambers and Liberty in 2004, a new county was documented with MRB invasion (Jefferson) in 2005 (Fig. 1 and Table 1). The MRB is now found within seven miles of Beaumont, ~30 miles from the Louisiana border and has been moving at a rate of 14.4 miles/year since it was discovered in Texas in 1980. Each year, infestations in newly invaded counties were initially low, but consistently increased the following year. Regulatory activities involving both Departments of Agriculture will continue to be important to Louisiana sugarcane farmers in order to delay the invasion of this very serious pest.

Extensive attempts involving several millions of dollars in research to introduce MRB parasites have not resulted in effective control in the Lower Rio Grande Valley of Texas. In our program, alternative control methods involving varietal resistance and cultural practices were investigated. In a field experiment in 2004, the newly released varieties Ho 95-988 (57 % MRB bored internodes) and L 97-128 (47.4 %) were as susceptible as LCP 85-384 (54.4 %). Moderate levels of resistance have been identified among several other varieties, including CP 70-321 and HoCP 85-845. A 2-year field study assessed the role that irrigation could play on the effective management of MRB when used in combination with variety selection and insecticide applications. Seven applications at the 8oz/acre rate of Confirm® (tebufenozide) were sprayed every 2 weeks (June to mid August). The untreated (non-irrigated) LCP 85-384 had an average of 66 % MRB bored internodes across both years, compared to nearly 35 % under the heavy insecticide pressure. Irrigation reduced injury levels 2-fold in HoCP 85-845 and LCP 85-384. Using irrigation water without applying insecticides, injury in both resistant and susceptible varieties still exceeded an average across both years of 23 and 35 % bored internodes, respectively. Greenhouse oviposition experiments on sugarcane showed that 100% of the eggs were laid on dry leaf material, which increased under stress, thus explaining the breakdown of resistance under non-irrigated conditions. Our work has emphasized the importance of using multiple tactics in combination to manage this pest, which will be necessary when MRB becomes established in the Louisiana sugarcane industry. Appreciation is expressed to the

American Sugar Cane League for grants to the LSU Sugarcane Entomology program in partial support of this work, also supported by national USDA competitive grants and collaboration with county agents and agricultural consultants.

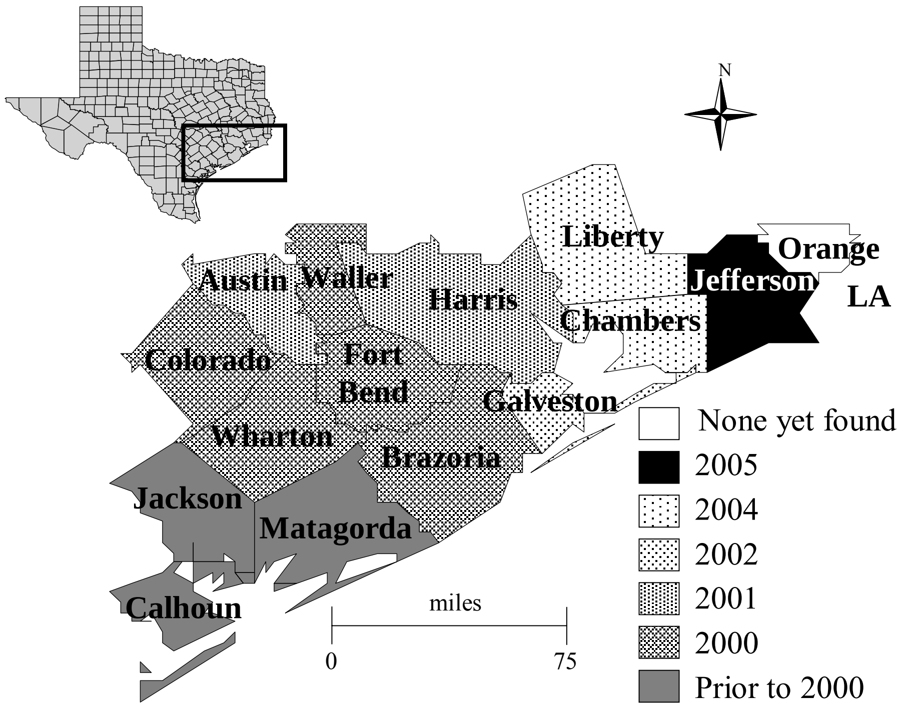

Fig. 1. Movement of the Mexican rice borer through the East Texas rice and sugarcane area, 2000-2005.

Table 1. Pheromone trap collections of Mexican rice borer (*Eoreuma loftini*) moths in Southeast Texas during 2005[1].

Texas Counties									
New Discovery	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Total**
Jefferson	0	0	0	1	2	2	0	-	**5**
Previously Known Counties									
Brazoria	455	718	420	554	1322	3757	846	-	**8072**
Chambers	-			397	287	1583	1576	-	**3843**
Colorado	174	236	236	82	330	1145	367	21	**2591**
Galveston	-	426	463	595	161	941	786	-	**3372**
Jackson	150	110	67	16	-	-	-	6	**349**
Liberty	-	22	44	222	177	603	499	19	**1586**
Matagorda	260	601	151	1219	1436	1008			**4675**
Waller	-	30	426	657	895	3107	974	26	**6115**
No MRB Collected									
Orange	-	-	0	0	0	0	0	0	**0**

[1]Number of moths per two traps per month.

Table 2. Pheromone trap collections of Mexican rice borer (*Eoreuma loftini*) moths in Southeast Texas from 2003 to 2005.

Texas counties	2003	2004	2005
Liberty	0	413	1586
Chambers	0	6	3843
Jefferson	0	0	5