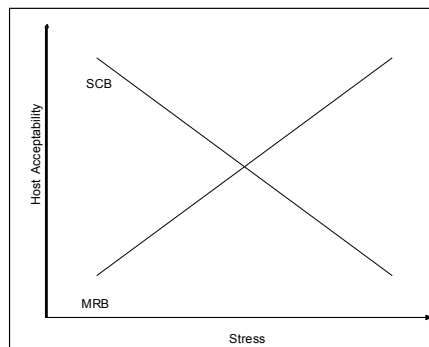


## A Tale of Two Borers

### *It was the best of times, it was the worst of times ...*

Our old nemesis, the sugarcane borer, is being effectively managed. Although still damaging our fields, in 2008, less than 50% of our acreage required an application of insecticide to prevent economic loss from occurring. Unfortunately, an emerging nemesis, the Mexican rice borer, was at last found in our state. Two specimens were collected in pheromone traps on December 15, 2008, near two rice fields northwest of Vinton. Where as in Charles Dickens', 'A Tale of Two Cities', the two main protagonists were studies in contrast; we propose that in our story, although extremes in behavior do exist, our two protagonists have important similarities. And it is because of these similarities our story too, can have a positive ending.

Conceptually there are important dissimilarities in the behavior of the two stem borer species (Figure 1). The Mexican rice borer (MRB) is a pest of stressed cane, while the sugarcane borer (SCB) is a pest of actively growing sugarcane. This contrast in behavior would suggest that it would be impossible to select simultaneously for resistance to both species and therefore, we must immediately begin the long process towards developing resistant varieties to this new pest.



**Figure 1.** Relationship of the sugarcane borer (SCB) and the Mexican rice borer (MRB) to increasing levels of plant stress.

However, Ring and Browning (Texas A&M University) reported the following for MRB: 1) first instar larvae move up the stalk to green leaf sheaths and begin feeding; 2) older internodes are less severely attacked than younger internodes; 3) increasing hardness of the rind and reduced availability of nutrients may account for this; and 4) pest management decisions should be based on estimates of larval densities in leaf sheath and internode age distribution. For those that practice sugarcane borer pest management, does this list have an air of familiarity? We propose that due to similarities in larval feeding behavior of the two species, selecting for resistance to one species will obtain resistance to the other, i.e. cross resistance. Cross resistance would benefit both the

Louisiana and Texas sugarcane breeding programs as it would eliminate the need for maintaining dual breeding strategies to develop resistance to both species.

While searching for markers associated with Mexican rice borer resistance, we had the opportunity to evaluate 80 sugarcane varieties for the response to not only the Mexican rice borer, but also the sugarcane borer. Because of the structure of the varieties chosen for this marker work, we were also presented with an opportunity to evaluate for cross resistance. The cane was planted in 2005 on the SRS Farm near the Santa Rosa, Texas. The field design was a randomized complete block with four replications. Individual plots were single rows, 20 ft. long. Thirty varieties were from Louisiana, representing both commercial varieties and varieties from our RSB (recurrent selection for borer resistance) program. The Louisiana population therefore represented sugarcane borer susceptible and resistant varieties. The other 50 varieties were from the Texas A&M University sugarcane breeding program (2002 breeding series; stage 4) and their resistance status to either stem borer was unknown and therefore represented a random population. Data were collected from both the plant-cane crop and the first-stubble crop. The data, percent borer-damaged internodes, were computed as the ratio of the bored internodes per plot to the total number of internodes per plot, expressed as a percentage. We used two contrasts in tunneling behavior to distinguish between the MRB and SCB when making bored internode counts. First, the SCB primarily makes longitudinal tunnels in internodes, whereas the MRB often bores around and across the internode causing transverse tunnels. Second, the MRB larvae maintain closed tunnels by plugging the traversed area with frass; the SCB does not. Our objective was to analyze the strength of the association for percent borer-damaged internodes between the two pests using a series of statistical procedures.

In our first analysis we found that the Mexican rice borer was not surprisingly the dominate species encountered during our study. Moreover, even though Louisiana varieties had never been screened against the Mexican rice borer, those LA varieties identified as resistant to the sugarcane borer were also significantly less bored by the Mexican rice borer than those identified as susceptible to the sugarcane borer. In a second analysis we saw that the factors that influence the percent borer-damaged internodes were similar for the sugarcane borer and the Mexican rice borer; further evidence for cross resistance.

Our final analysis look at what varietal traits, such as plant

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population, were associated with resistance to both the SCB and MRB. This interpretation is based on the odds of insect damage occurring in one population relative to another. Louisiana varieties previously selected for resistance to the sugarcane borer were 40% less likely to incur Mexican rice borer damage and 50% less likely to incur sugarcane borer damage compared to susceptible varieties. Or, if one considers all 80 varieties, then sugarcane borer resistant varieties were 32% less likely to incur Mexican rice borer damage and 61% less likely to incur sugarcane borer damage than their susceptible counterparts. All of our results suggest that the sugarcane borer resistance status of a variety would be useful as a predictive tool in determining how it reacts when exposed to infestation by the Mexican rice borer. Or, cross resistance exists between the sugarcane borer and the Mexican rice borer.

In concluding our story 'A Tale of Two Borers', we end by considering other similarities with Dickens classic novel, 'A Tale of Two Cities'. The two stories share important themes with one another. First, both stories share a theme of darkness and light. With the darkness there is uncertainty, fear and peril. We are uncertain as to how significant a pest the Mexican rice borer will become and we fear if we will be able effectively and economically control the insect. However, we also share the theme of resurrection. That is the belief that we can succeed in managing the Mexican rice borer, but sacrifice may be necessary to achieve success. Consultants may have to spend more time in grower fields (at least initially) to gain experience in timing of insecticide applications, but they will quickly get up that learning curve. The Louisiana variety program may have to sacrifice sugar levels (at least initially) to gain the levels of resistance needed to effectively manage the Mexican rice borer. However, it seems that the work we have done in developing resistance to the sugarcane borer will assist us in more quickly getting resistance varieties out to the grower. Finally, we will intensify our research on other aspects of controlling the Mexican rice borer. Research on insecticide efficacy will identify better insecticides. Research on ecology of the pest will help in devising area-wide control strategies. While the importation of beneficial insects will more quickly establish biological agents needed to assist in the season-long control of the Mexican rice borer.

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fueron similares en ambas plagas; una evidencia más de resistencia cruzada.

En nuestro análisis final miramos a cuáles características varietales tales como la población de tallos, estaban asociadas con la resistencia tanto al SCB como al MRB. Esta interpretación se basa en las probabilidades de que ocurra un daño de insecto en una población en relación a otra. Las variedades de Louisiana seleccionadas previamente por su resistencia al barrenador de la caña tuvieron un 40% menos de probabilidades de tener un daño por el barrenador mexicano y un 50% menos de probabilidades de tener un daño por el barrenador de la caña, en comparación con las variedades susceptibles. Por otra parte, tomando en cuenta todas las 80 variedades, entonces las resistentes al barrenador de la caña fueron en un 32%, menos susceptibles al daño por el barrenador mexicano y un 61% menos probable de tener daño por el barrenador de la caña, que las contrapartes susceptibles. Todos nuestros resultados sugieren que la resistencia al perforador de la caña sería de utilidad como instrumento de predicción para determinar como responde una variedad al ser expuesta a infestaciones del barrenador mexicano del arroz, o que existe una resistencia cruzada entre las dos plagas.

Concluyendo nuestra exposición 'Historia de dos Barrenadores', finalizamos con otras similitudes con la clásica novela de Dickens, 'Historia de dos Ciudades'. Ambas historias comparten aspectos importantes. Primero, ambas tratan el tema de la oscuridad y la luz. Con la oscuridad hay incertidumbre, temor y peligro. No sabemos hasta que punto el barrenador mexicano del arroz se pueda convertir en una plaga importante y tenemos el temor de que podamos efectiva y económicamente controlar el insecto. Sin embargo, también compartimos el tema de la resurrección y es la creencia de que podremos tener éxito en el manejo de esta nueva plaga, pero será necesario sacrificarse para alcanzar esa meta. Los consultores tal vez tendrán que pasar más tiempo en los campos cañeros (al menos al inicio) para adquirir experiencia en cuánto a programar las aplicaciones de insecticida, aunque éstos rápidamente superarán esta curva de aprendizaje. El programa de variedades de Louisiana tendrá tal vez que sacrificar los niveles de azúcar (al menos inicialmente) para obtener los niveles de resistencia necesarios para manejar eficientemente esta nueva plaga. Sin embargo, al parecer el trabajo realizado en el desarrollo de resistencia al barrenador de la caña nos ayudará a hacer llegar al cañero variedades resistentes más rápidamente. Finalmente, intensificaremos nuestra investigación sobre otros aspectos del control del barrenador mexicano del arroz. La investigación sobre la eficiencia de insecticidas identificará mejores productos. Así mismo, la investigación sobre la ecología de la plaga ayudará a diseñar estrategias de control a nivel de todo el área, mientras que la importación de insectos beneficiosos establecerá más rápidamente los agentes biológicos necesarios para contribuir a un control de esta plaga durante toda la estación.

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