Leptotrachelus dorsalis (Coleoptera: Carabidae): A Candidate Biological Control Agent of the Sugarcane Borer in Louisiana

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LEPTOTRACHELUS DORSALIS (COLEOPTERA: CARABIDAE): A CANDIDATE BIOLOGICAL CONTROL AGENT OF THE SUGARCANE BORER IN LOUISIANA

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Abstract

Following registration and the wide-spread use of insect growth regulators (e.g. tebufenozide and novaluron) for control of sugarcane borer, *Diatraea saccharalis* (F.) (Lepidoptera: Crambidae), in Louisiana, larvae of the ground beetle, *Leptotrachelus dorsalis* (F.) (Coleoptera: Carabidae, have become more abundant in sugarcane fields. In a survey of the 18 parishes growing sugarcane in Louisiana, *L. dorsalis* was found in 8 (44%) of those parishes. The highest number of beetles occurred in a field where 10% of the stalks sampled were harboring larvae. Laboratory studies revealed a developmental period of 37 d from egg deposition to adult emergence. Three larval instars were identified with the first 2 lasting 5 d, and the third instar requiring 17 d. In a voracity study, larvae were found to consume on average 798 first instar sugarcane borer larvae per ground beetle larva. Seventy-five percent of those sugarcane borer larvae were consumed by third instar beetle larvae. Field surveys suggest that adults migrate into sugarcane fields when above-ground internodes form on the sugarcane stalk (June) and increase in numbers thereafter. All 3 instars of the beetle can be found in sugarcane fields during the critical period of Jun to Sep when sugarcane is subject to economic injury by sugarcane borer. If *L. dorsalis* are abundant in fields during establishment of second generation sugarcane borer, our data suggests they are capable of holding the average season-long damage at or below 10% bored internodes. This level of damage is the recognized economic injury level for sugarcane borer in Louisiana. Our study indicates that *L. dorsalis* is a good candidate for continued research on augmentative releases as a strategy to increase beetle numbers in sugarcane fields early in the growing season and thus enhance their efficacy as predators of sugarcane borer larvae.

Key Words: *Diatraea saccharalis,* fire ants, habitat manipulation, augmentative release, predators

Resumen

Con el registro y amplio uso de los reguladores de crecimiento de insectos (por ejemplo tubufenozida y novalurón) para el control del barrenador de la caña, *Diatraea saccharalis* (F.) (Lepidoptera: Cambidae) en Louisiana, las larvas del escarabajo de tierra, *Leptotrachelus dorsalis* (F.) (Coleoptera: Carabidae), han aparecido recientemente en los campos de caña de azúcar. En un sondeo de los 18 municipios que siembran caña de azucar en Louisiana, se encontró *L. dorsalis* en 8 (44%) de los municipios. Se encontró el mayor número de escarabajos en un campo donde habian larvas en el 10% de los tallos muestrados. Los estudios de laboratorio revelaron un período de desarrollo de 37 dias desde la deposición de los huevos hasta la emergencia de los adultos. Se identificaron tres estadios larvales; cada uno de los 2 primeros estadios duró 5 días, y el tercer estadio duró 17 días. En el estudio sobre voracidad, las larvas depredadoras consumieron un promedio de 798 larvas del primer estadio del barrenador de la caña de azúcar por cada larva del escarabajo de tierra. Setenta y cinco por ciento de estas 798 larvas del barrenador de la caña de azúcar fueron consumidas por el tercer estadio de las larvas del escarabajo de tierra. Los estudios de campo sugieren que los adultos migran hacia los campos de caña de azúcar cuando se forman los entrenudos de los tallos de caña de azúcar encima la superficie de la tierra (en junio) y luego aumentan en número. Se puede encontrar los tres estadios de larvas del escarabajo en los campos de caña de azúcar durante el período crítico de junio hasta septiembre cuando la caña de azúcar está sujeta a pérdidas económicas hechas por el barrenador de caña de azúcar. Si *L. dorsalis* es abundante en los campos durante el establecimiento de la segunda generación del barrenador de caña de azúcar, nuestros datos indican que son capaces de mantener el promedio del daño hecho por el barrenador por toda la temporada igual o menos de 10% de los entrenudos perforados. Este nivel de daño es reconocido como el umbral de daño económico hecho por el barrenador de la caña en Louisiana. Nuestro estudio indica que *L. dorsalis* es un buen candidato para continuar investigaciones sobre el incremento de liberaciones como un estrategia para aumentar la cantidad de escarabajos en los campos de caña de azúcar de manera temprana en la temporada del cultivo, asi mejorando su eficacia como depredadores de las larvas del barrenador de la caña.

Beneficial arthropods provide a significant proportion of the season-long control of the sugarcane borer, *Diatraea saccharalis* (F.) (Lepidoptera: Crambidae), in Louisiana with the bulk of this control (90%) resulting from predation by the red imported fire ant, *Solenopsis invicta* (Buren) (Hymenoptera: Formicidae) (Hensley 1971). The balance of biological control comes from an array of species representing numerous predatory arthropod taxa (Negm & Hensley 1967). Sugarcane borer larva parasitoids and egg parasites are less abundant with only Lixophaga diatraeae (Townsend) (Diptera: Tachinidae), *Alabagrus stigma* (Brullé) (Hymenoptera: Braconidae), and *Trichogramma sp*. (Hymenoptera: Trichogrammatidae) presently established (White et al. 2004). In many agroecosystems, insecticides have had a profound impact on the presence and abundance of beneficial insects (Hensley et al. 1961). This has certainly been the case for the Louisiana sugarcane industry where the use of insecticides began with the botanical compound ryania and the inorganic compound cryolite, advanced to the organochlorines and then organophosphates, was then followed by the pyrethroids, and currently the insect growth regulators (IGR) (Hensley 1971; Rodriguez et al. 2001). The IGR tebufenozide, an ecdysone agonist causing precocious incomplete molting in some lepidopterans (Retnakaran et al. 2001), was first labeled in Louisiana for sugarcane borer control in 1997. Labeling tebufenozide for sugarcane ushered in an era of green chemistry for the Louisiana sugarcane agroecosystem apparently having a profound impact on the abundance of arthropod predators in the field (Hensley 1971). One species that we hypothesize has benefitted from this new chemistry is the ground beetle *Leptotrachelus dorsalis* (F.) (Coleoptera: Carabidae). With a reduction in use of broad spectrum insecticides for sugarcane borer control, the larvae of this beetle are now able to exploit the sugarcane ecosystem and can be an important predator of larvae of the sugarcane borer.

The earliest reference of this ground beetle in Louisiana sugarcane was by Negm & Hensley (1969), but these authors do not indicate if the specimens they reported were adults or larvae. We presume they were adults because the larval stages of this species have not been described (Erwin and White, in prep.). They did, however, report that the *L. dorsalis* specimens were observed feeding on sugarcane borer eggs. No reference was made of them feeding on sugarcane borer larvae. Fuller & Reagan (1988) reported that the dominant canopy-dwelling carabid in an experiment comparing sugarcane borer predation in sweet sorghum and sugarcane was *L. dorsalis*. Again, we presume these authors were reporting *L. dorsalis* adults. They reported higher *L. dorsalis* numbers where fire ants were excluded with a soil application of the persistent insecticide chlordane. Insecticides were not used to control sugarcane borer in their study thereby permitting *L. dorsalis* the opportunity to become well established.

Specimens of *L. dorsalis* have been collected from most states of the eastern US including Kansas and South Dakota and eastward including the Province of Ontario, Canada. Outside of the US specimens have been collected from Barbados, Cuba, and Hispaniola. (Smithsonian Institution database of Western Hemisphere Carabidae). In Barbados, *L. dorsalis*, was reported as a predator of the sugarcane thrips, *Fulmekiola serrata* (Kobus) (Thysanoptera: Thripidae) (Peck 2009).

Knowledge of the immature stages of *L. dorsalis* is lacking. It was not until our laboratory successfully reared a larva to the adult beetle that the identity of what was thought to be a new insect in Louisiana sugarcane fields was determined to be *L. dorsalis*. The objectives of this research were: 1) to determine the seasonal abundance and distribution of *L. dorsalis* (adults and larvae) within the Louisiana sugarcane agroecosystem, 2) to acquire information on the life stages of the beetle, and 3) quantify predation during the critically important time of Jun through Sep when the sugarcane borer is considered an economic pest of sugarcane in Louisiana (Hensley 1971).

Materials and Methods

Adult Distribution and Abundance in Sugarcane Fields

From 3 to 25 Aug 2004 we conducted a statewide survey for *L. dorsalis* in those parishes where sugarcane is cultivated in Louisiana. One hundred fields from 18 parishes were surveyed. As the area in sugarcane cultivation varied in each parish, the number of fields surveyed also varied; the number surveyed per parish ranged from 1-13. Each field was approximately 8 km distance from one another. A random sample of 40 stalks were chosen from each field and searched for both adult and immature *L. dorsalis*. Our search of a stalk did not include a search of tunnels within stalks. Laboratory observations suggests that large *D. saccharal-*

lis larvae, fourth and fifth instar, are too large for *L. dorsalis* larvae to attack and they are the stages found within the stalk.

Developmental Time and Larval Voracity Study

On 22 Apr and 19 May 2010, 2 adults (sex not determined) were caught in a light trap at the USDA, ARS Ardoyne Research Farm (29°38'11" N, 90°50'25" W) located near Schriever, Louisiana. These adults were brought back to the laboratory and held in an autoclavable Magenta® culture vessel (Chicago, Illinois) (77 × 77 × 97 mm). The container was kept on a table top under ambient conditions (23 °C and 12:12 h (L:D)) and contained tissue paper to provide hiding cover and a small section of dampened sponge to enhance humidity. On 20 July we collected our first of what would ultimately be 121 eggs collected from these 2 adults. Eggs were found deposited singly on the sponge. Each egg was carefully removed by cutting out the small section of sponge harboring the egg, and this was placed in a second Magenta® culture vessel with moistened filter paper on the bottom. The larvae are cannibalistic and must be held separately. All of these Magenta® culture vessels were then placed in a larger plastic bin (4 × 28 × 17 cm) that in turn was placed into a growth chamber set at 23 °C and 14:10 (L:D). The temperature in the bin ranged from 27-29 °C and humidity ranged from 34-84%. We also included a number of larvae that we collected from the field to increase our sample size.

Using the resulting larvae we conducted a voracity study to determine the biological control potential of the species. Only larvae that emerged from eggs deposited in the laboratory and only those individual larvae that subsequently completed development to adult were included in the study. For this study we fed larva first instar sugarcane borer larvae at a number just above that which each beetle larvae could consume during a 24-h period. This required that the number of sugarcane borer larvae offered be adjusted on a day to day basis. All dead sugarcane borers as well as cadavers of borers left following predation were removed daily to avoid repeated counting. We also noted when each larva molted by locating the exuvia. These data were used to determine developmental times for each stadium. We continued to count and replace sugarcane borer larvae until pupation. At this time the pupa was removed and placed in a clean cup until adult emergence; the number of d until adult emergence was noted. Descriptive statistics (mean, standard error of the mean, 95% confidence limits) were calculated with Analysis Tool of Excel (Microsoft Office Excel 2003, Redmond, Washington).

Evaluation of Biological Control Potential

Annually, the Sugarcane Research Unit conducts detailed evaluations of sugarcane varieties that are nearing release to sugarcane farmers for their response to sugarcane borer feeding (White et al. 2008). These variety evaluations presented an opportunity to evaluate the potential of *L. dorsalis* as a biological control agent of the sugarcane borer. Individual plots in these trials were 3, 4.9 m rows, with a 1.2 m alley between plots, and an inter-row spacing of 1.8 m. The experimental design was a split plot and was replicated 4 times. The main plots were those plots treated with insecticide and those not receiving insecticide treatments while 10 sugarcane varieties were the subplots. Tebufenozide was our insecticide of choice as it is very selective for the sugarcane borer and has no activity against *L. dorsalis*. Red imported fire ants were suppressed in these evaluations with an application each of 2 ant baits (Extinguish®, hydramethylnon + methoprene, Wellmark International, Schaumberg, Illinois; Amdro®, hydramethylnon, BASF, Research Triangle Park, North Carolina). This was primarily done to reduce variability in the evaluations that may be caused by ant predation. Undoubtedly this practice eliminated predation of *L. dorsalis* by fire ants as well. At the beginning of Jun in 2008, 2009, and 2010 and continuing weekly until the end of Aug each year, 10 stalks from each non-insecticide treated plot were randomly sampled for sugarcane borer larvae and *L. dorsalis* adults and larvae. Only the top third of a stalk was searched as this is the location of the internodes that are suited for entry by the sugarcane borer larvae (White 1993). Immature beetles are rarely found outside of this zone although adults can be found most anywhere on the sugarcane plant, but they also appear to be associated more with the sugarcane canopy. Pitfall traps were placed in 4 alleyways between plots for 3 growing seasons to verify our decision to limit searching to just sugarcane stalks. Individual stalks were searched by pulling back the leaf-sheath and searching behind the sheath and the surface of the associated internode. We estimated the larval instar of both *L. dorsalis* and the sugarcane borer and recorded the number of both for each stalk sampled.

Results and Discussion

Adult Distribution and Abundance in Sugarcane Fields

Table 1 summarizes the results of our statewide survey. Abundance of *L. dorsalis* averaged less than one beetle per stalk (adults and larvae) and beetles were found in 15% of the fields surveyed. The low incidence may be caused by a scarcity of native habitat, i.e. cattail, *Typha latifolia* L., and predation by fire ants. Also, the insecticide use history for a given field was unknown to us. Pyrethroids are still labeled for use in Louisiana and some of the fields we sampled may have re-

TABLE 1. RESULTS OF A SURVEY FOR THE GROUND BEETALE, *LEPTOTRACHELUS DORSALIS* IN SUGARCANE PRODUCING PARISHES OF LOUISIANA, 2004.

Parish	Number of fields surveyed	Number of *L. dorsalis* found[a]
Ascension	3	1
Assumption	4	0
Avoyelles	5	1
Calcasieu	10	3
Iberia	13	0
Iberville	3	1
Lafayette	1	0
Lafourche	9	0
Point Coupee	7	3
St. Charles	2	0
St. James	3	0
St. John	3	0
St. Landry	4	2
St. Martin	13	4
St. Mary	11	2
Terrebonne	3	0
Vermilion	2	0
West Baton Rouge	4	0
Total	100	17

[a]Counts include both larvae and adults.

ceived an application of one of these broad spectrum insecticides for borer control. Similarly, Steiner (1984) reported that in Maryland *L. dorsalis* occurs frequently in sweep net samples, but is not abundant.

Developmental Time and Larval Voracity Study

In the laboratory, *L. dorsalis* requires approximately 37 d to develop from egg to adult (Table 2). With the exception of the third instar, each instar required approximately 5 d for completion. The third instar's developmental time was roughly 3 times that of the other stadia. We believe this value to be accurate as only one time did we record what was thought to be a fourth instar molt. Although it was easy to locate exuviae, it was important that individual cups were inspected daily as sugarcane borer larvae will consume the exuvia if allowed sufficient time.

L. dorsalis are voracious predators consuming on average 800 first instar sugarcane borer per larvae. The first instars averaged 8 larvae per d while second and third instars averaged approximately 35 per d for 26 d (Table 3). The third instar larvae were responsible for 75% of the total sugarcane borers consumed, as this instar is twice as large as first instar beetle larvae. We were able to anticipate when a molt was eminent as daily consumption would decrease precipitously followed by about a 24-h period of no feeding. Larvae would quickly resume eating following the molt.

Evaluation of Biological Control Potential

Behaviorally and morphologically, *L. dorsalis* larvae appear well adapted as a predator of sugarcane borer larvae. Larvae of the sugarcane borer first migrate to the leaf-sheaths of the young, elongating sugarcane internodes and feed there for approximately 10 d before they begin to bore into the stalk. This area appears to be the exclusive domain of *L. dorsalis* larvae and the area that pest management consultants search when making recommendations for controlling the sugarcane borer with insecticides. The compressed body form of the beetle larva allows them to easily access sugarcane borer larvae feeding behind the leaf sheath. Adults ranged far more widely on the plant than larvae, but appear to be exclusively arboreal as they were never caught in pit fall traps.

Figure 1 summarizes 3 years (2008, 2009, and 2010) of sampling both *L. dorsalis* and sugarcane borer populations in our yield reduction studies. Each data point represents the total beetle larvae and sugarcane borer larvae collected from 400 stalks. *L. dorsalis* numbers increased very early in the 2008 growing season and continued to increase through mid-August. We propose that the early build-up of *L. dorsalis* in this experiment caused the overall number of bored internodes to be the lowest in 2008 (9.9%). On the other hand in 2009 and 2010, *L. dorsalis* numbers were slower in developing and their numbers remained lower throughout the season; and as a result, bored internode numbers averaged 13.6 and 15.1% in 2009 and 2010, respectively. Because *L. dorsalis* inhabits a riparian environment, dry conditions are not conducive for adult migration into sugarcane fields. This, in turn, delays the build-up

TABLE 2. MEAN DEVELOPMENT PERIOD, STANDARD ERROR, AND LOWER AND UPPER 95% CONFIDENCE LIMITS FOR IMMATURE STAGES OF *LEPTOTRACHELUS DORSALIS*.

Stage	Sample Size[1]	Stadia (days)	Std. error	Lower 95% C.L.	Upper 95% C.L.
Egg	49	6.1	0.12	5.9	6.3
First instar	48	5.0	0.11	4.8	5.2
Second instar	57	4.4	0.12	4.2	4.6
Third instar	69	16.9	0.73	15.7	18.1
Pupa	56	4.5	0.09	4.3	4.7

[1]Sample size varied as some field collected larvae were included in the sample.

TABLE 3. MEAN NUMBER OF BORER LARVAE EATEN BY LARVAL INSTARS OF *LEPTOTRACHELUS DORSALIS,* STANDARD ERROR OF MEAN, AND LOWER AND UPPER 95% CONFIDENCE LIMITS.

Stage	Sample size[1]	Number of larvae eaten[2]	Std. error	Lower 95% C.L.	Upper 95% C.L.
First instar	37	40	2.2	36.3	43.7
Second instar	37	152	13.4	123.0	174.0
Third instar	37	606	66.1	497.3	714.7

[1]Only those larvae that completed all stages of development were included.
[2]first instar = 4mm; second instar = 6mm; third instar = 9mm.

in the numbers of their larvae. Monthly rainfall during Apr and May 2008—the 2 months preceding the important period near 1 Jun when aboveground internodes begin to be formed—was almost 3 times greater in 2008 than 2010 (196 mm in 2008 vs. 77 mm in 2010). However, rainfall in the 2 mo preceding adult emigration into sugarcane during 2009 was comparable to that in 2008; 170 mm of rain fell in Apr and May 2009. We are uncertain why *L. dorsalis* numbers were lower in 2009.

Further evidence for the effectiveness of *L. dorsalis* to control sugarcane borer can be found by reviewing the accumulation of bored internodes in stalks for each study year and comparing this to seasonal abundance of *L. dorsalis* and sugarcane borer larvae. In 2008, the sugarcane borer susceptible variety, 'Ho 00-950', (Tew et al. 2009) accumulated 66% of the total number of bored internodes it would sustain for the season by the time internode no. 7 was formed (Fig. 2). Assuming the first internode was formed by the first of Jun and every 10 d thereafter a new internode was formed (Ring et al. 1991), we estimated the date for formation of the seventh internode to be between 22 and 29 Jul. This date was approximately 2 wk after the large number of *L. dorsalis* larvae were sampled on 15 Jul. This is also the approximate date of the start of the fourth generation of the sugarcane borer. Sugarcane borer larvae numbers remained low from that point through the remainder of the season while *L. dorsalis* numbers continued to increase. This was not the case in 2009 and 2010, during which the accumulation of 60% of the total bored internodes did not occur until internode 11 was formed (the first wk of Sep). The numbers of *L. dorsalis* remained low throughout the entire season with the exception of a spike in the numbers of around 16 Aug 2010 (Fig. 1). By the time of this spike in *L. dorsalis* numbers the seasonal calendar was approaching 15 Sep; the date after which treating for sugarcane borer is no longer recommended (LSU AgCenter 2010).

Other beneficial arthropods, both predators and parasites, reduce developing sugarcane borer numbers in Louisiana. However, when compared to the red imported fire ant, these are secondarily important (Hensley 1971; Reagan 1986). This generalist predator is the only beneficial arthropod in Louisiana capable of maintaining sugarcane borer at sub-economic levels, but they were controlled in our studies. While making weekly infestation counts the only other predator we encountered was the occasional earwig (Dermaptera). Also, while making bored internode counts we split several stalks, but found only the occasional Cuban fly, *Lixophaga diatraeae* (Townsend) puparium. *Trichogramma* sp. can be important as egg parasites late in the season (Sep onwards). However, sugarcane borer egg masses are not easily located so getting an accurate estimate of egg parasitism is difficult to obtain and therefore was not monitored in our study.

The age structure of *L. dorsalis* during the critical period of Jun through Aug is also summarized in Fig. 1. Our data reveal that all 3 instars were present during the period that we monitored insects in our yield reduction test. We suggest 3 possible explanations for the presence of all 3 instars. First, *L. dorsalis* females lay eggs over an extended period of time. We collected 121 eggs from the 2 beetles we caught in a light trap from 20 Jul until 14 Sep; a total of 56 d. We ceased monitoring egg production after 14 Sep. Secondly, migration of adults into sugarcane continues over an extended period of time. We collected additional adult beetles throughout our sampling period and set them up in Magenta® culture vessels. These were caught while surveying plots in the yield reduction study and not with blacklight traps. From 2 of these containers, each holding 5 adult beetles, we collected an additional 18 eggs from one container and 67 eggs from another. Thirdly, *L. dorsalis* is multivoltine. Determining the oviposition site in sugarcane fields (e.g., on the sugarcane plant or at soil level) will be important in gaining insight into why multiple larval stages are present throughout the growing season.

Carabid beetles are important polyphagous natural enemies in agricultural landscapes with the potential of restraining population growth of many pest species (Menalled et al. 1999). Under favorable conditions, *L. dorsalis* appears capable of developing sufficient population numbers to reduce and maintain sugarcane borer numbers at a level that stalk damage is keep below the economic injury level. Larvae can consume an

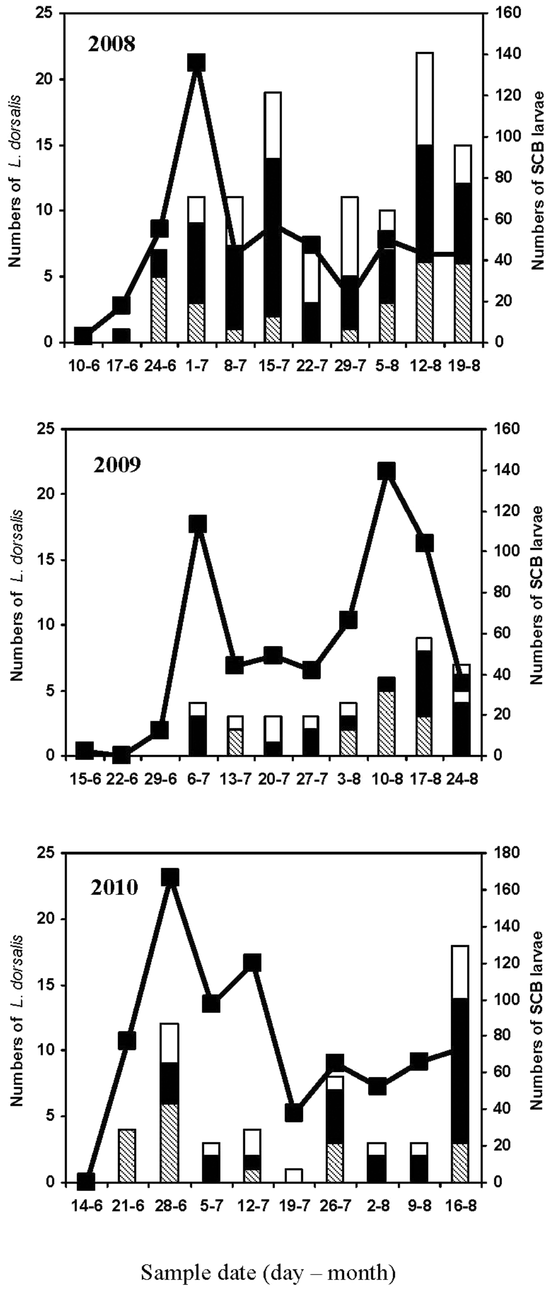

Fig. 1. *Leptotrachelus dorsalis* instar population structure and their impact on sugarcane borer larvae numbers. USDA-ARS Ardoyne Research Farm, Schriever, LA. 2008-2010. The x-axis is sample date (day-month).The total number of sugarcane borer larvae (■—■) is read on the right y-axis. The total number of L. dorsalis larvae is read on the left y-axis (▧= first instar, ■ = second instar, □= third instar). The weekly sample size was 400 stalks.

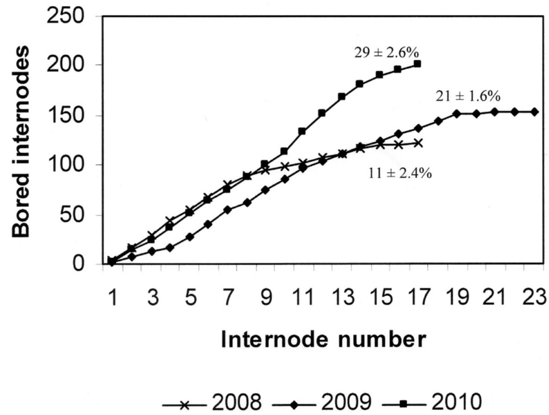

Fig. 2. Accumulation of sugarcane borer damaged internodes during the growing season for the susceptible sugarcane variety HoCP 00-950. Values are at harvest mean percent bored internodes ± the standard error of the mean (n = 40 stalks per year).

average of 30 first instar sugarcane borer larvae per d or during the 26 d that it is a larva, a total of approximately 800 first instars. Egg and larval predation by adult beetles should also be considered. However, periodic freezes occur in the Louisiana sugarcane agroecosystem and the sugarcane plant and insects undergo periods of dormancy and inactivity. Under these conditions it is difficult for biological control organisms to consistently rebound to a density sufficient to impact pest populations before economic injury occurs. Additionally, although sugarcane is a perennial crop, burning of the crop and crop residue prior to and after harvesting the entire crop also disrupts stability (Cherry 2003). Obrycki et al. (2009) provided an in-depth discussion of the role of conservation biological control techniques in promoting Coccinellidae for aphid pest suppression, their role in management of selected aphid pests, and examined strategies to improve levels of aphid suppression by coccinelids. Habitat manipulation and augmentative releases, which are possible strategies suggested for coccinelids, might also be adopted to overcome shortfalls by *L. dorsalis.*

Habitat manipulation might include maintaining or establishing stands of *Typha* spp., commonly known as cattail. Larochelle & Larivière (2003) identified *Typha* as an important vegetative habitat for *L. dorsalis*. However, in Louisiana implementing this practice would be unlikely, or be greatly restricted, because maintenance of proper drainage within sugarcane fields is critical, and dense stands of cattail are likely to impede drainage. Therefore, we are investigating a strategy of augmentative releases, which involves holding adults over winter at low temperatures and then releasing them into sugarcane fields just prior to the formation of above-ground-internodes in Jun. In Australia, researchers using a similar approach with coccinellid beetles achieved limited success in controlling chrysomelid leaf beetles in Eucalyptus (Baker et al. 2003). However, those authors report that the approach may only be economically viable in small, environmentally sensitive areas.

We have conducted a preliminary investigation of the feasibility of this approach with *L. dorsalis*. In 2010, 64 adult beetles were reared from larvae collected in the field that year. These were placed in Magenta® culture vessels (5-6 beetles per container) on 8 Oct and held at 10 °C. Beginning 5 Jan 2011 beetles were brought out of cold storage and monitoring for eggs or larvae was begun. Although mortality of adults held over winter was high (42%), by 18 Mar we had collected 6 larvae from these adults. These preliminary results are encouraging and we plan to expand our efforts to rear as many adults as possible from larvae collected in the field. These adults will be released the following year into a commercial field of sugarcane the first of Jun in an effort to augment native infestations of *L. dorsalis*. For the short term, however, the best practice for enhancing *L. dorsalis* in Louisiana sugarcane fields is the continued use of insect growth regulators to the extent that it is possible without incurring pesticide resistance.

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