SHORT COMMUNICATION

PATTERN OF PINK STEM BORER *SESAMIA INFERENS* (WALKER) INCIDENCE IN DIFFERENT CROP SEASONS AND *SACCHARUM* SPP.

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Abstract

The pattern of occurrence of pink stem borer *Sesamia inferens* (Walker) (Lepidoptera: Noctuidae) in three crop years (2010-13) and four *Saccharum* spp., namely *S. officinarum*, *S. robustum*, *S. barberi* and *S. sinense* from the world sugarcane germplasm collection was analyzed with non-parametric statistical tools. In comparative analysis of deadheart data from three years, Friedman ANOVA by ranks and Wilcoxon matched pairs rank post-hoc tests did not show significant differences among the three years for *S. officinarum*. Percent deadhearts was significantly lower in 2011 in *S. robustum* and *S. barberi* but higher in 2011 in *S. sinense*. In comparative analysis of the response of the four *Saccharum* spp. to the borer, assessed on the basis of the highest borer incidence among the three years for all accessions, Kruskal-Wallis H test by ranks and multiple comparison tests placed *S. officinarum* and *S. sinense* on par with each other but significantly higher than *S. robustum* and *S. barberi*, which themselves were on par with each other. With lower pink borer incidence rates, *S. robustum* and *S. barberi* emerged as sources of resistance to the borer and can serve as parents for the transfer of the trait in to commercial hybrids with wider genetic base.

Key words: *Saccharum* spp., accessions, pink borer, *Sesamia inferens*, incidence pattern

Among the nearly 200 insect pests that attack sugarcane in India (David et al. 1986; Mukunthan and Nirmala 2002), lepidopteran borers constitute a group of serious pests across the country. The pink stem borer *Sesamia inferens* (Walker) (Lepidoptera: Noctuidae) is an oriental species that occurs in the Indian subcontinent, China, Pakistan, Japan, Taiwan, Indonesia, Solomon Islands, Southeast and East Asia. Although it has a wide host range that includes rice, sugarcane, maize, wheat, ragi, sorghum, bajra, barley and grasses, it has been regarded as a minor pest of sugarcane in the country until recent reports of high levels of damage in the crop (Choudhary and Shrivastava 2007). Following the occurrence of the borer in sugarcane germplasm collection maintained in an isolated crop habitat about four years ago, its incidence levels and possibility of resistance in accessions of *Saccharum* spp. have been studied (Mahesh et al. 2013, 2014). In the present communication, the pattern of occurrence of this pest in different years and four *Saccharum* spp. from the world germplasm bank is presented based on the data generated by the authors during 2010-13 and analyzed using non-parametric methods of statistical analysis.

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The pink borer incidence data collected in three consecutive crop seasons (2010-13) and four *Saccharum* spp., namely *S. officinarum*, *S. robustum*, *S. barberi* and *S. sinense* at the Sugarcane Breeding Institute Research Centre (SBIRC), Kannur, Kerala State, India, served as inputs for the present study. Pink borer damage was assessed during March-May, the peak period of its activity, as percent deadhearts from the number of damaged shoots with deadhearts and total number of shoots in different accessions as reported in the previous studies (Mahesh et al. 2013, 2014). Data on weather parameters were also recorded during the study period.

Non-parametric analysis was used to analyze the unreplicated data of pink borer deadhearts from three crop years and four *Saccharum* spp. Friedman ANOVA by ranks and Kendall concordance coefficient test for multiple dependent samples were applied to the three year (2010-13) data for individual *Saccharum* spp. with accessions as blocks and years as treatments. Post-hoc analysis was carried out using Wilcoxon matched pairs rank test with a Bonferroni correction that set a significance level of $P<0.017$ for each of the three two-year combinations. Kruskal-Wallis ANOVA by ranks and multiple comparison tests were applied to the highest deadheart data among the three years for each accession with the four *Saccharum* spp. taken as treatments. Box plots were used for graphical depiction of means and their significant differences. The analyses were performed using StatSoft Inc. (2004).

Pink borer infestation showed a general decline from 2010 to 2012 in the four *Saccharum* spp. with some common and unique trends (Fig. 1). In comparative analysis of deadheart data from *S. officinarum*, Friedman ANOVA by ranks (χ^2 = 5.59; df=2;

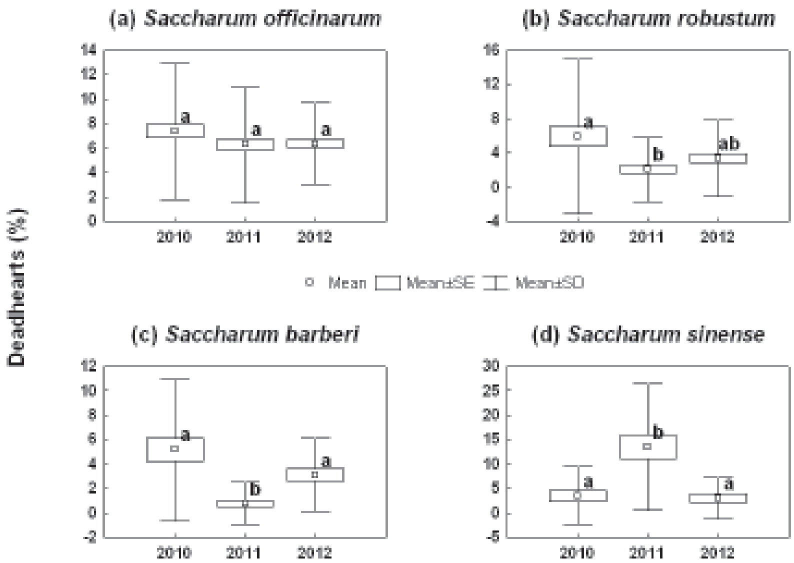

Fig. 1. Pink borer *Sesamia inferens* infestation rates in accessions of *Saccharum* spp. in three consecutive years. Bars with different letters are significantly different by Friedman ANOVA by ranks and Wilcoxon matched pairs rank test with a Bonferroni correction (*P*<0.017)

N=110; *P* = 0.061; Kendall coefficient of concordance=0.025) and post-hoc analysis by Wilcoxon matched pairs rank tests did not show significant differences among the three years (Fig. 1a). In *S. robustum*, percent deadhearts differed significantly among the three years (χ^2= 9.74; df=2; N=64; *P*<0.008; coefficient of concordance=0.076) with significantly lower infestation in 2011 than in 2010 (Fig. 1b). In *S. barberi*, percent deadhearts differed significantly among the three years (χ^2= 18.58; df=2; N=39; *P*<0.0001; coefficient of concordance=0.238) with significantly lowest infestation in 2011 (Fig. 1c). In *S. sinense*, percent deadhearts differed significantly among the three years (χ^2=15.02; df=2; N=28; *P*<0.001; coefficient of concordance=0.268) with significantly highest infestation in 2011 (Fig. 1d).

uniform borer levels in all three years despite a declining trend from 2010 to 2011. While *S. robustum* and *S. barberi* displayed a similar trend of lower incidence in 2011, *S. sinense* showed the opposite trend of higher incidence in the same year. Weather factors apparently had limited role to play as indicated by the uniformity in temperature and humidity parameters (Table 1) during the three study years. Also, the gradual decline in total rainfall and marginal decline in relative humidity over the three years would not have contributed to the observed pattern in borer incidence. These observed temporal trends in borer incidence could partly be related to the variable response of the accessions, whose role was indicated by the generally low yet accession size dependent values of Kendall coefficient of

Table 1. Mean monthly weather parameters recorded at SBIRC, Kannur, Kerala, South India, during 2010-13 crop seasons

Parameter	2010	2011	2012
Minimum temperature (°C)	20.17 - 25.32[a]	19.58 - 23.42	20.47 - 25.66
Maximum temperature (°C)	28.98 - 34.13	29.69 - 34.78	29.51 - 33.85
Morning RH (%)	90.16 - 94.88	88.04 - 97.05	89.88 - 95.05
Afternoon RH (%)	79.35 - 93.92	74.73 - 89.79	74.24 - 86.61
Total monthly rainfall (mm)	0.0 - 1096.2 (4003.3)[b]	0.0 - 978.6 (3432.9)	0.0 - 722.1 (2539.6)

[a] Range over 12 months
[b] Annual rainfall (mm)

The results of the Friedman ANOVA by ranks indicated that accessions of the four *Saccharum* sp. supported differential pink borer incidence among the three study years with three different trends. *Saccharum officinarum* harbored statistically

concordance, in the four *Saccharum* spp. Despite the higher number of accessions and apparently wider geographical representation than in the other three species, *S. officinarum* accommodated uniform pest incidence among the three years.

Directional location of the germplasm collection in the eastern and western blocks of SBIRC in alternate years may also have contributed partly to the differential response among the three years.

In comparative analysis of the response of the four *Saccharum* spp., assessed on the basis of the highest borer incidence among the three years for all accessions, the extent of pink borer deadhearts ranged 1.47 - 29.41% in *S. officinarum*, 0.00 - 30.77% in *S. robustum*, 0.00 - 21.05% in *S. barberi* and 0.00 - 37.04% in *S. sinense*. Kruskal-Wallis H test by ranks showed a more clear-cut trend in the form of significant differences among the four *Saccharum* spp. (χ^2 = 21.07; df=3; N=241; *P*=0.001) for percent deadhearts. Multiple comparison z′ and p values established that *S. officinarum* and *S. sinense* were on par with each other but significantly higher than *S. robustum* and *S. barberi*, which themselves were on par with each other (Fig. 2) for deadheart incidence.

In the comparative study of different *Saccharum* spp., the study years 2010 for *S. officinarum*, *S. robustum* and *S. barberi,* and 2011 for *S. sinense* apparently contributed most to the composite data compiled on the basis of highest borer incidence. Evaluation of accessions of *Saccharum* spp. on the highest attack rate, instead of the mean of three study years, was expected to prevent under- or over-rating of accessions and render the screening process more rigorous by allowing for year-to-year (Fig. 1) and spatial variation in borer incidence. The analysis established distinct differences among the four *Saccharum* spp. with *S. sinense* displaying the highest overall incidence, obviously due to the

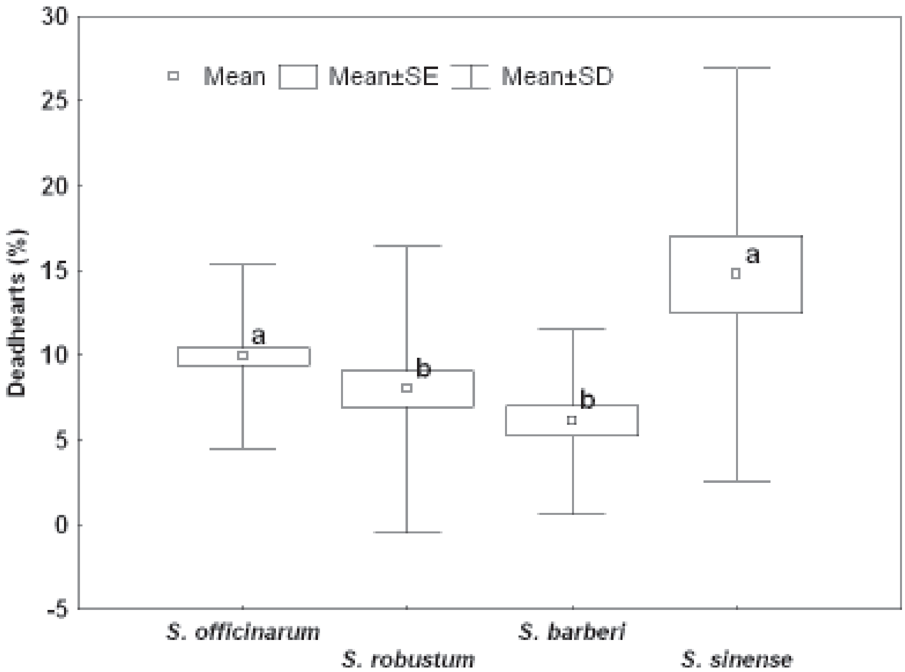

Fig. 2. Comparative infestation rates of pink borer *Sesamia inferens* in accessions of four *Saccharum* spp. Bars with different letters are significantly different by Kruskal-Wallis ANOVA by ranks and multiple comparison tests (*P*<0.05)

unusually higher incidence in 2011, yet remaining on par with *S. officinarum*. Only 15-28% of accessions in these two species qualified to be included in the resistance category (Mahesh et al. 2013, 2014). With lower incidence rates, *S. robustum* and *S. barberi* emerged as a source of resistance to pink borer with nearly half the accessions tested in each occupying the highly resistant and resistant categories (Mahesh et al. 2014). The two species exhibited the potential to serve as parents for the transfer of pink borer resistance in to commercial hybrids with wider genetic base in the event of the pest assuming more serious status.

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