Best Time for Application of Insecticides for Controlling *Deltocephalus menoni* (Hemiptera: Cicadellidae), a Vector of Sugarcane White Leaf Disease in Sri Lanka

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ABSTRACT

White Leaf Disease in sugarcane caused by a phytoplasma, which is transmitted by Deltocephalus menoni (Hemiptera: Cicadellidae), has become a severe threat to the sugarcane industry in Sri Lanka. Therefore, monitoring of vector populations and the application of insecticides are required to contain secondary transmission of the disease. This study aims at studying the feeding calendar of D. menoni during 24 hours of a day to determine the best time for population studies and insecticide application. The study was conducted at the Entomology laboratory of the Sugarcane Research Institute, Sri Lanka, using insect-feeding chambers fixed to the top leaf of 4-month-old sugarcane plants of the variety SL 96 128. Water-starved 150 insects; fifty from each nymph and male and female adults were inserted individually into the feeding chamber. The area stained due to the honeydew excreted by the insect was measured hourly using the Bromocresol-treated filter papers, and its variation was analysed by the Analysis of Variance and mean separation by Least Significant Difference at 5% probability. The results revealed that both the nymphs and the adult males and females showed a similar pattern of honeydew secretion, and hence, their feeding. The excretion of honeydew was significantly higher from 6.00 am to 9.00 am and 4.00 pm to 7.00 pm than that at other times of a day. Population studies and insecticide application for controlling of D. menoni should be carried out during these time periods for more efficient results.

Keywords: *Deltocephalus menoni,* Population studies, Sri Lanka, Sugarcane white leaf disease, Vector

INTRODUCTION

White Leaf Disease in sugarcane (WLD) caused by phytoplasma has become devastating with significant losses in both cane yield and sugar content in cane, and hence, a serious threat to the sustenance of the sugar industry in Sri Lanka. The causal organism of WLD transmits primarily through infected seed cane and secondarily by the insect vector, *Deltocephalus menoni* (Hemiptera: Cicadellidae). Knowing the precise population and time for application of insecticides to control WLD-transmitting vector has become a necessity to contain the further spread of the disease in sugarcane plantations. Both the nymphs and the adults of *D. menoni* feed on phloem sap of sugarcane leaves. *D. menoni* spends the daytime within the soil or occasionally on the leaf sheaths at the base of the plants and on sugarcane trash (Senevirathne, 2008). It comes out of their hiding places to the canopy for feeding, and therefore, it is the best time to kill a higher number of the vector by insecticide application. Knowledge of the pattern of feeding on a day by the vector on leaves is required to determine the best times for undertaking population studies and application of insecticides for its more efficient control. The present study was conducted to identify the feeding calendar of *D. menoni to* determine the best time periods for undertaking population studies and application of insecticides on *D. menoni* by identifying the time of the day when the vector is feeding on sugarcane leaves, for its efficient control.

MATERIALS AND METHODS

The study was conducted in the Entomology laboratory of the Sugarcane Research Institute (SRI), Uda Walawe, Sri Lanka, from October to December 2016 using four-month-old sugarcane plants of the variety SL 96 128 produced through meristem culture. *D. menoni* was reared according to the methods developed by Senevirathne, (2008). A total of 150 insects, fifty from each nymph and adult males and females (2 days after ecdysis) were separately used for the test. The test insects were water starved for 3 hours before placing them in the feeding chamber prepared with transparent sheets with dimensions 5x3x5 cm, which were attached to the top leaf of each test plant. Twenty-four Bromocresol green-treated filter paper strips with 3 cm width and 5cm length, attached, were fixed at the bottom of the feeding chamber to measure the area stained due to honeydew excreted by *D. menoni*. This arrangement is depicted in Figure 1.

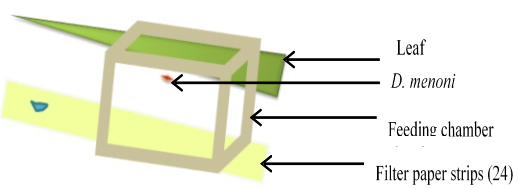

Figure: 1 Feeding chamber set up for measuring excreted honeydew by *D. menoni*

The water-starved insects were introduced individually into the feeding chamber and allowed to feed on sugarcane leaves without any disturbance. The filter paper strip in the chamber was slowly drawn out in a way that the next portion of the strip moves into the chamber, one hour after an introduction and at one-hour intervals. After 24 hours, honey-dew-stained filter paper strips were collected and air-dried. Honey dew-stained area on the paper for each hour was measured with a transparent 1 mm^2 grid. The variations in honey dew-stained areas for nymphs and male and female adults were analysed by the Analysis of Variance (ANOVA) and mean separation was done using Least Significant Difference (LSD) at the 5% probability level.

RESULTS AND DISCUSSION

The nymphs and both male and female adults showed a similar pattern of honeydew production at different times of a day (Fig 2). The highest honeydew production was recorded during the 4.00 to 5.00 pm (9.6 to 10.08 mm^2) during the day. The honeydew production was comparatively high from 6.00 am to 9.00 am and 4.00 pm to 7.00 pm.

A similar pattern of feeding by several leafhopper species has been reported elsewhere. In a study on grape leafhopper (*Erythroneura elegantula)* Kido and Stafford (1965) found that the number of droppings increased during the morning hours (6.00 to 9.00 am), reached a peak, and then decreased in the early afternoon. This decline was followed by an increase in the late afternoon or early evening (3.00 to 6.00 pm). Naito (1977) has confirmed that the stylet insertion behaviour of leafhoppers shows apparent diurnal fluctuations. According to the observations on the performance of *Nepholeltix cincliceps* on rice leaves, the insects behave vigorously, repeating the insertion successively in the evening (5.00 to 9.00 pm). After 10.00 pm *N. cincliceps* rest, and in the early morning, 5.00 to 6.00 am, the frequency of insertion is slightly high. He has also confirmed that the leafhopper population in the canopy has a significant positive correlation with

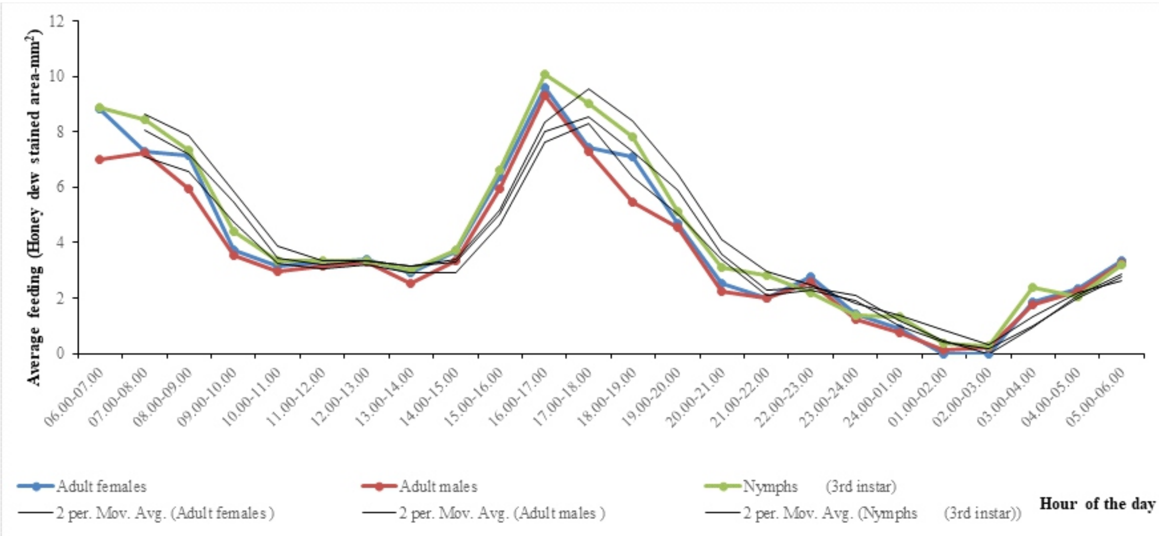

Figure 2: Average honeydew excretion by nymphs and male and female adults of *D. menoni* in an hour during 24 hours

relative humidity at 8.00 am and an increase in the rate of feeding at low temperatures and a decrease at high temperatures. Similarly, the current study has also shown a slower rate of feeding during the daytime (9.00 am to 4.00 pm) due to high temperature (< 33.7^{o}C) than that in the morning (22.3 ^{o}C) and in the evening (22.5 ^{o}C) when the temperature is low. In this study, it has been observed that the rate of honeydew excretion by the nymphs of *D. menoni* was higher than that of the adults of which the females excrete honeydew at a higher rate than the males.

CONCLUSIONS

Nymphs, male and female adults of *D. menoni* showed a similar feeding pattern in terms of the amount of honeydew secretion at different times of the day by feeding on sugarcane leaves. The peak feeding times found in this study are 6.00 to 9.00 am in the morning and 4.00 to 7.00 pm in the evening. Therefore, the above time periods are the best times for population studies and the application of insecticides for increasing the efficiency of controlling *D. Menoni* population to control white leaf disease in sugarcane.

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