

An Assessment of Major Pests of Sugarcane in Sri Lanka

V. K. A. S. M. Wanasinghe*, K. M. G. Chanchala and N. C. Kumarasinghe

Sugarcane Research Institute, Uda Walawe, Sri Lanka

*Corresponding Author: vkasunethrawanasinghe@yahoo.com

ABSTRACT

All sugarcane varieties grown in commercial plantations of Sri Lanka are attacked by different pest species with different infestation levels. Regular monitoring of the population levels of these pests and their natural enemies and their damage on the crop is required to adopt control measures to minimise crop losses. Therefore, field surveys were conducted in Uda Walawe, Sevanagala, Pelwatte, Hingurana, and Passara from January to December 2013 to assess the damage levels of internode borer, shoot borers and termites. In addition, the populations of woolly aphid along with the natural predators were also studied in the same year in Passara. Four sugarcane fields of 0.5 ha each were selected randomly from each location on each sampling day, and three plots with size of 25m x 10m were selected randomly from each field for collecting data. The total number of internodes and the number of internode borer infested fresh internodes of 100 randomly-selected plants, the number of total plants and the number of shoot borer-infested plants and the termite-infested plants in each plot were collected at monthly intervals. The analysis of variance was carried out. No severe damages of internode borer, shoot borers and termites were recorded during 2013. But their damages were comparatively high during the dry months of the year, i.e., from February to March and from June to September. High to moderate infestations of woolly aphid were recorded in Passara area throughout the year. The natural predators of woolly aphid, *Dipha aphidivora*, *Micromus* sp. and *Eupeodes* sp. were also reported throughout the year in Passara area. A sudden outbreak of any of these pests can be occurred at any time, and therefore, regular monitoring is essential to avoid such outbreaks.

Keywords: Internode borer, Shoot borers, Sri Lanka, Sugarcane, Termites, Woolly Aphid

INTRODUCTION

Utilisation of varietal resistance is the most suitable practical method for the management of pests in sugarcane plantations. However, there are several constraints to identify sources of resistance and to breed varieties resistant to pests (Mukunthan, 2002). In order to identify the varietal response to pests, all high-yielding varieties developed by the Sugarcane Research Institute (SRI), Sri Lanka, are inspected for pest infestations under natural environmental conditions in sugarcane-growing areas of the country. Those varieties detected to be highly susceptible to pest

damages will not be recommended for commercial cultivation.

All sugarcane varieties grown in commercial plantations are attacked by a number of pest species and Integrated Pest Management (IPM) approaches are adopted to minimise these pest damages (Kumarasinghe, 1999). Regular monitoring of pest infestations is essential to avoid pest outbreaks (Dent, 1993). The surveys conducted by SRI in commercial sugarcane-growing areas of Sri Lanka revealed that Sugarcane Woolly Aphid (SWA) (*Ceratovacuna lanigera*, Homoptera: Aphididae), Internode Borer (INB) (*Chilo sacchariphagus indicus*, (Lepidoptera:

Pyralidae), Pink Borer; *Sesamia inferans* Lepidoptera: Noctuidae; one of two major shoot borer species of sugarcane in Sri Lanka, and Termites (Isoptera) are the major pests of sugarcane. Several natural enemies of sugarcane pests have been identified in Sri Lanka, which helps to keep the pest population levels below threshold levels. So far, six species of natural predators of SWA; *Dipha aphidivora* (Lepidoptera: Pyralidae), *Micromus* sp. (Neuroptera: Hemorabiidae), *Eupeodes* sp. (Diptera: Syrphidae), *Micraspis discolor* (Coleoptera: Coccinelidae), *Synonycha* sp. (Coleoptera: Coccinelidae) and *Micraspis allardi* (Coleoptera: Coccinelidae) have been identified from sugarcane plantations in Sri Lanka (Wanasinghe *et al.*, 2012). Regular assessment of population levels of these pests and their natural enemies and their damage intensity on the crop is required to provide information for screening and selecting sugarcane varieties tolerant to these pests and to advise sugar companies and farmers for adopting the most suitable control measures to minimise crop losses while protecting the sugarcane-growing environment for sustainable sugarcane production.

This study was undertaken with the following objectives:

- i. to assess the spatial and temporal variation of damage intensity of internode borer (INB), shoot-borer and termites in sugarcane plantations in Sri Lanka.
- ii. to analyse the population densities of SWA and its natural predators in Passara area.

MATERIALS AND METHODS

Study locations

Field surveys were conducted in five locations; research farm at Uda Walawe and commercial sugarcane plantations at Sevanagala, Pelwatte, and Hingurana in the dry zone (annual rainfall 1,300 – 1,600mm) and Passara in the

intermediate zone (annual rainfall 1,750 – 2,500mm) of Sri Lanka from January to December 2013. The climate is characterised by a bi-modal rainfall distribution pattern where nearly two-thirds of rainfall is received during September to January or *Maha* season. There is a small peak during March to May or *Yala* season but the rainfall is erratic. The rain-fed sugarcane is planted during these two rainy periods, i.e., *Maha* and *Yala*. Nearly 50% of sugarcane plantations in Uda Walawe and Sevanagala and all plantations in Hingurana are cultivated under irrigation.

Sampling

Four sugarcane fields, 0.5 ha each, were selected randomly from each location on each sampling day and three plots size of 25m x 10m were selected randomly from each field for collecting information on pest damages. A minimum distance of 0.5 km was maintained between two fields. The application of insecticides for controlling pests was withheld throughout the study period.

Data collection

Damage intensity of INB

The total number of internodes and the number of INB-infested fresh internodes in 100 randomly-selected plants from each plot were recorded at monthly intervals.

Damage intensity of shoot borers

The number of total plants/tillers and the number of shoot borer-infested plants/ tillers (with “*Dead Hearts*”) in each plot were recorded at monthly intervals.

Damage intensity of termites

The number of total plants and the number of termite-infested plants in the selected plots in each field were counted at monthly intervals.

Infestation of SWA and its natural predator populations

The number of total plants and the SWA-infested plants and the number of natural

predators were recorded in selected farmer fields at monthly intervals in Passara area. The population levels of three natural predators, i.e., *Dipha aphidivora*, *Micromus* sp. and *Eupeodes* sp on ten randomly-selected SWA-infested plants were counted at monthly intervals to estimate the population of each predator.

Analysis

The percentage damage intensity due to INB, shoot borers, termites, and infestation level of SWA were estimated using the information recorded during the field survey. These percent damage levels were transformed into square root values to have normal distribution. The analysis of variance was carried out to determine the significance of spatial and temporal variation of damage of INB, shoot borers and termites using the SAS software (for Windows 9.0).

RESULTS AND DISCUSSION

Variation of INB, shoot borers and termite damage in different locations

The damage intensities of INB, shoot borers and termites in sampling locations were low, and there was no economic damage recorded during the year 2013 (Table 1). Comparatively very low levels of INB and shoot borer damages were recorded in Passara area. The sugarcane varieties, *Alu UK* and *Co 527* grown in Passara

observed to be less susceptible to two species of borers. High priority should be given to select sugarcane varieties with low susceptibility to both borer species to avoid build-up of their populations beyond economic threshold levels.

Comparatively high damage incidence of shoot borers was recorded at Hingurana. The experiments conducted to determine the parasitism level of the larval parasitoids of borer pests of sugarcane in Sri Lanka revealed that the larval parasitoid of shoot borers *Cotesia flavipes* was absent in sugarcane plantations at Hingurana (Unpublished data). The lack of larval parasitoid could be one of a reasons for the higher population level of shoot borers at Hingurana, in addition to the presence of paddy fields adjacent (host plants of *Sesamia inferans*) to sugarcane fields. Furthermore, all the shoot borer-infested fields at Hingurana were highly infested with gramineae weeds due to poor weed management practices, and *S. inferans* larvae were observed in these weeds having 'dead-heart symptom'. Those weeds provide conditions conducive for rapid multiplication and spread of the shoot borer. Nine species of grasses in local cane fields have been recorded as collateral hosts for the *Sesamia inferans*, and they provides more congenial conditions for egg laying and for the survival of the first two larval instars before attacking cane (Rajendra, 1979).

Table 1 Damage intensities (Means± SE) of INB, shoot borers and termites in different study locations during 2013.

Type of pest	Uda Walawe	Sevanagala		Pelwatte	Hingurana	Passara
		Rain-fed	Irrigated			
INB	3.44	3.89	1.09	3.21	2.89	0.49
	±2.61a	±2.27a	±0.94b	±1.87a	±1.74a	±0.8b
Shoot borers	0.19	0.15	0.11	0.20	0.21	0.09
	±0.04a	±0.03ab	±0.07b	±0.06a	±0.09a	±0.03b
Termites	0.14	0.10	0.00	0.03	0.02	0.11
	±0.04a	±0.06a	±0.01b	±0.02b	±0.02b	±0.04a

Note: Means in a row with the same letter are not significantly different at 0.05 probability level.

According to the results, the damage incidences of termites in plantations under rain-fed conditions were higher than those under irrigated conditions. Farmers and industries with rain-fed cultivations should give high priority to manage the damages of termites during the dry season. Since chemical application is harmful to the environment, addition of compost or manure, sowing green manure crops, removal of queen, crop rotation, use of maize cobs for mechanical control, use of plant parts and plant extracts such as leaves and seeds of neem tree, latex of *Calotropis* plant, etc. are some of the most preferred methods (Ahmed *et al.*, 2008; Upadhyay, 2013).

Temporal variation of pest damages

Damage intensity levels of INB: The highest intensity of INB damage in all locations was recorded from June to September 2013 that coincide with the dry period (Figure 1).

Borers cause significant crop loss during dry periods of every year in all commercial plantations in Sri Lanka. During this study, the highest percentage damage was nearly 9% in the month of August at Sevanagala rain-fed

sector. The action threshold for the INB in Sri Lanka has been estimated at 13-15% bored internodes on the cane variety Co 775 at the age of 4-5 months (Seneviratne *et al.*, 2001). The damage levels found in the surveyed plantations in different locations during the year 2013 were below the action threshold level (from 0.49 to 3.89%). The presence of natural enemies and the use of correct management practices may be the reason for the low level of damages of INB.

Damage intensity of shoot borers: The highest percentage damage intensity levels of shoot borers in all locations were recorded in the first and the third quarters of the year that coincide with the dry periods (Figure 2). The recommended management practices should be followed to reduce the crop losses due to shoot borers during those time periods. Maintenance of weed-free plantations, conservation of natural enemies (Kumarasinghe, 1999), removal of infested plants, trash mulching, light earthing-up, sprays of granulosis virus of shoot borers with a dose of 10^7 - 10^9 IB/ml, application of insecticides to soil are adopted to reduce the shoot borer incidences (Srivastava, 2012).

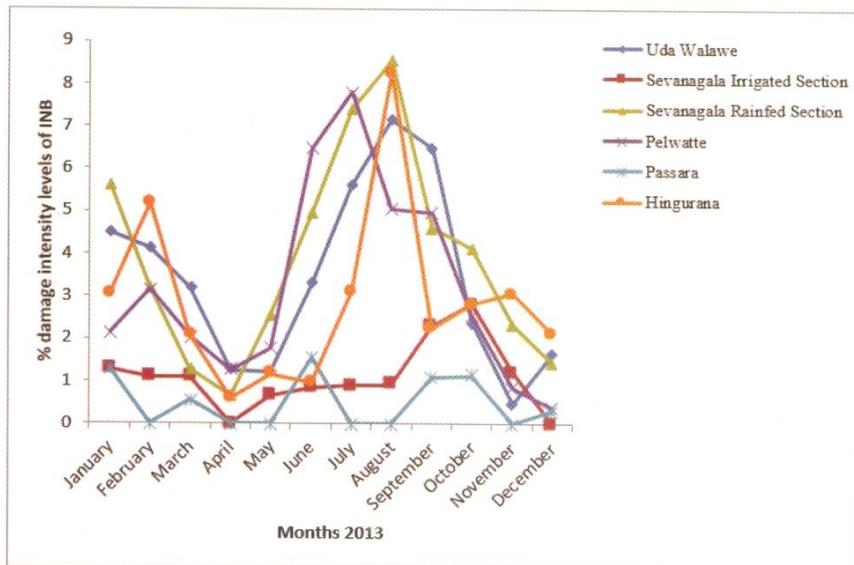


Figure 1 Percentage damage intensity of INB in different study locations of Sri Lanka during 2013

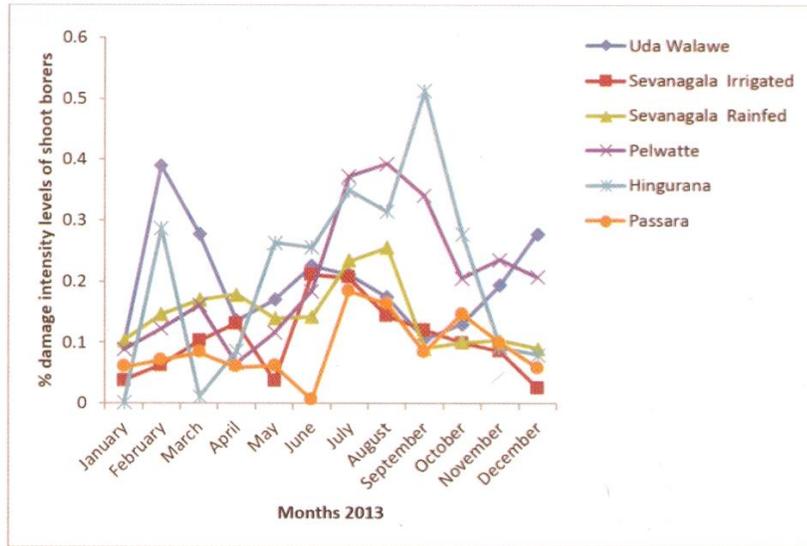


Figure 2 Percentage damage intensity levels of shoot borers in different study locations in year 2013

Damage intensity of termites: The highest damage intensity levels of termites were recorded from February to April and from September to October 2013 that coincide with the dry periods (Figure 3). Termites attack to any growth stage of the sugarcane crop, and a field

study in the research farm, Uda Walawe showed that the planted seed setts were more susceptible to termite attacks than the other growth stages (Unpublished data, 2014). Suitable recommended insecticides as

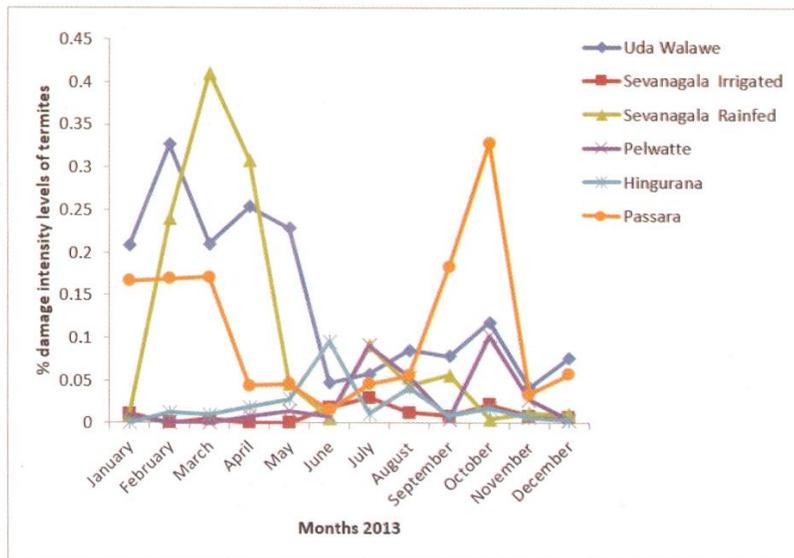


Figure 3 Percentage damage intensity levels of termites in different study locations in Sri Lanka during 2013

a sett treatment should be used to reduce the termite damage for seed setts which are planted during both *Yala* and *Maha* seasons in rain-fed cultivations. Three insecticides with different modes of action are being screened against the termites of sugarcane in Sri Lanka. Proper irrigation can be practised to reduce the termite damages in irrigated cultivations.

Infestation of SWA and its natural predator populations in Passara

High to moderate SWA infestations were recorded throughout the year in farmer fields in Passara area with sugarcane varieties, *Alu Uk* (Local), Co 527 and SL 83 06 (Figure 4). The first two varieties were highly infested with SWA compared to the variety SL 83 06. The highest infestation levels were recorded during the first five months of the year. SWA was first reported in sugarcane plantations in Badulla district in January 2006 (Kumarasinghe, 2007), and the subsequent outbreaks in other sugarcane plantations were recorded during the

later months of the same year with highest RH (80-82%) and the lowest sunshine hours (3.2-3.75 h) (Kumarasinghe and Basnayake, 2009). In India, the morning relative humidity and cloudy days during June to January favoured the severe outbreak of SWA populations (Patil *et al.*, 2004 a). Comparatively high relative humidity (86%) and low average temperature (16-30 °C) are recorded in Passara area in the Badulla district of the Uva Province (670-690 m above sea level). The reasons for the high to moderate SWA infestations throughout the year in Passara area may be the favourable weather conditions and the cultivation of highly susceptible varieties.

Of the natural predators of SWA considered in this study, the highest number of *Dipha aphidivora* was recorded in the month of June (49 per ten plants) and the highest number of *Micromus* sp. and *Eupeodes* sp were recorded in the month of September (54 and 17 larvae per ten plants respectively). The number of

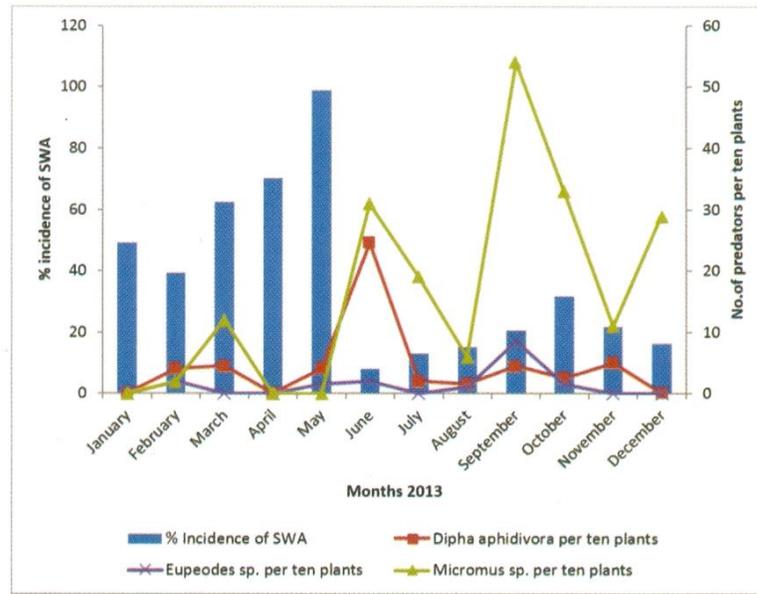


Figure 4 Population densities of SWA and its common predators in Passara sugarcane plantations recorded during 2013

coccinellid beetles was not considered in this analysis as those coccinellid beetles showed an uneven distribution pattern with low relative abundance during the study period. Peak populations of predators were detected during the periods with low population levels of SWA. Accordingly, natural enemies have helped to reduce SWA populations, but the efficiency of the predators was not sufficient to control the high SWA populations throughout the year. However, in other sugarcane-growing areas, SWA can be successfully controlled with the predators (Unpublished data from field experiments). Therefore, augmentation and conservation programmes should be continued to increase the population levels of the predators of SWA in Passara area.

Conclusions

Severe damages of INB, shoot borers and termites were not recorded during the year 2013 in commercial sugarcane plantations in Sri Lanka, and sugarcane was more prone to these pest attacks during the dry months of the year.

Infestations of SWA were detected in farmer fields at Passara throughout the year with peak levels from March to May. The identified natural predators of SWA were observed in the sampling locations, and they have helped to reduce SWA populations, but their efficiency was not sufficient to control the high populations of SWA throughout the year.

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