STATUS OF THE SUGAR CANE SPOTTED BORER, *Chilo saccharifagus* BOJER (LEPIDOPTERA : PYRALIDAE: CRAMBINAE), IN MAURITIUS

AG Soma and S Ganeshan

Mauritius Sugar Industry Research Institute

ABSTRACT

In 1996 and 1997, infestation by the spotted borer, Chilo saccharifagus, in the most commonly cultivated sugar cane varieties in Mauritius was assessed in the different climatic regions. Compared to surveys conducted in 1964, 1965, 1984 and 1985 fields with higher levels of infestations were recorded. The highest infestations were in the subhumid non-irrigated zone in 1996 and in the humid non-irrigated zone in 1997. Data showed that a particular variety reacts differently to borers in different climatic regions and plant canes tend to be more susceptible than ratoons. There appears to be a relationship between percent canes bored and percent internodes bored.

Keywords: *Chilo saccharifagus*, spotted borer, infestation, sugar cane, *Saccharum officinaru*m, Mauritius.

INTRODUCTION

Chilo saccharifagus Bojer (Lepidoptera : Pyralidae) is the most important sugar cane borer in Mauritius, while *Sesamia calamistis* Hmps. (Lepidoptera : Noctuidae), the pink borer, and *Tetramoera* (= *Argyroploce*) *schistaceana* (Sn.) (Lepidoptera : Eucosmidae), the white borer, are of lesser importance. The first serious attacks by *C. saccharifagus* were reported in 1850 (Moutia, 1934). However, its origin is still uncertain although Vinson (1941) assumed that it originated from Java. *C. saccharifagus* attacks mainly the soft joints within the leaf sheath.

In attempts at biocontrol, 31 species of parasitoids have been introduced (Greathead 1971; Williams 1983) but only two became established bringing the total number of primary parasitoids of *C. saccharifagus* to six (Williams, 1983). *Cotesia flavipes* Cameron, a larval endoparasitoid, and *Trichogramma australicum* Girault, an egg parasitoid, are the most common (Ganeshan and Rajabalee, 1997). Even in cases of serious attacks by *C. saccharifagus* insecticides are never recommended for its control. In fact, the concealed habit of the pest, the difficulty in hitting the target, and concern for the general sugar cane environment make the use of insecticides undesirable (Williams, 1983; Rajabalee, 1990). The use of sex pheromones for control by mating disruption has been explored (Nesbitt *et al*, 1980) but does not seem to be practicable.

Damage by the spotted borer, while not a constraint to sugar production island-wide, can at times be severe, causing both loss of cane weight and cane quality. Degree of infestation by the borer can be expressed as percent canes bored (% CB) and/or percent internodes bored (% IB) (Williams 1983). Bangdiwala and Martorell (1954) claimed that % IB is a more exact expression and found a linear relationship to exist between % CB and % IB during an assessment of infestation by the borer *Diatraea saccharalis* in Puerto Rico. Different sampling procedures for assessment of infestation by sugar cane borers have been proposed. Bates (1954) divided fields of six hectares into two halves and calculated the mean infestation of five samples of cane, each sample consisting of 100 stalks. Bangdiwala and Martorell (1954) assessed 100 canes at random in fields of ten acres and increased the sample size in larger fields. Hall (1986) stratified fields into 0.4 ha and assessed samples of 25 stalks each, each field being assessed more than once. In 1979 and 1982 fields of about 2.25 ha in Mauritius were intensively sampled for *Chilo* damage and Lim Shin Chong and Rajabalee (1988) proposed a sampling method for local use. Rajabalee *et al*. (1990) showed a positive correlation between the % internodes damage and sugar loss.

In Mauritius, the first exhaustive assessment of field-to-field incidence by *C. sacchariphagus* was carried out in 1964-1965 (Williams, 1983). Fields in different areas were surveyed and results showed that infestation was higher in plant canes than ratoon canes. Most of the fields surveyed had less than 20 % canes bored. A relationship between % CB and % IB was mentioned. In 1984 and 1985 (MSIRI, 1985, 1986), surveys were performed in fields of 1.5-3.5 ha, each field being divided into eight strata and data collected from four samples in each stratum, each sample consisting of 10-20 canes. In both years, infestation was highest in the sub humid unirrigated zone. Irrigated fields in the subhumid zone were less infested than unirrigated fields thereby showing the effect of humidity on the levels of borer damage. In 1985 borer infestation was compared in plant and ratoon canes and the former were found to be more infested in all zones except the superhumid zone. Since 1985, changes have occurred in the varieties cultivated as well as in cultural practices. This paper presents the results of surveys conducted in 1996 and 1997 to assess the intensity of borer damage in the different climatic regions.

MATERIALS AND METHODS

Several fields of the most commonly cultivated sugar cane varieties were surveyed for damage by the spotted borer in 1996 and 1997. Fields selected were those of mature canes near harvest. Each field was divided into eight equal strata and from each stratum four random samples were examined. Each sample consisted of 10 consecutive canes. The number of internodes and number of internodes bored per cane were recorded. The survey was conducted in all the climatic zones, i.e., subhumid (less than 1500 mm rainfall / annum); humid irrigated and unirrigated, (1500 - 2500 mm), and superhumid (> 2500 mm). The following data were also recorded : soil type, field area, date of planting for plant cane or date of previous harvest for ratoon fields, type of irrigation.

RESULTS AND DISCUSSION

The number of fields and areas surveyed for each year in the different climatic zones are given in **Table 1**, and levels of stem borer damage for 1996 and 1997 in **Figures 1& 2.** In both years the highest proportion of fields surveyed (31.9% in 1996 and 29.1% in 1997) were found to have 40-60% canes bored. For both years the highest proportion of fields had less than 5% internodes bored.

Table 1. Areas surveyed

Climatic zone	Year	No. of fields	Area *ha*		
			Plant cane	Ratoon	Total
Subhumid irrigated	1996	14	36	51	87
	1997	15	11	54	65
Subhumid unirrigated	1996	10	-	38	38
	1997	9	15	16	31
Humid irrigated	1996	21	17	61	78
	1997	13	19	35	54
Humid unirrigated	1996	38	38	134	172
	1997	27	39	74	113
Superhumid	1996	55	13	206	219
	1997	39	38	99	137
Total	1996	138	104	489	593
	1997	103	122	279	401

Figure 1 Stem borer damage (% canes bored)

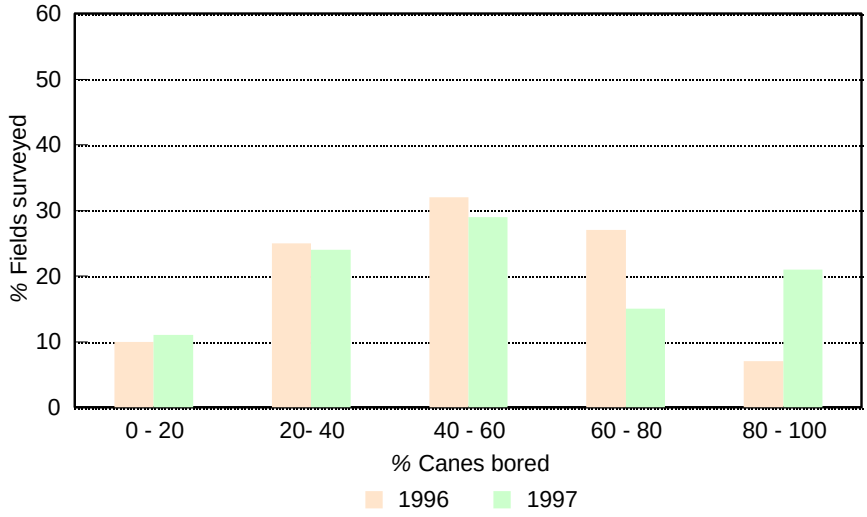
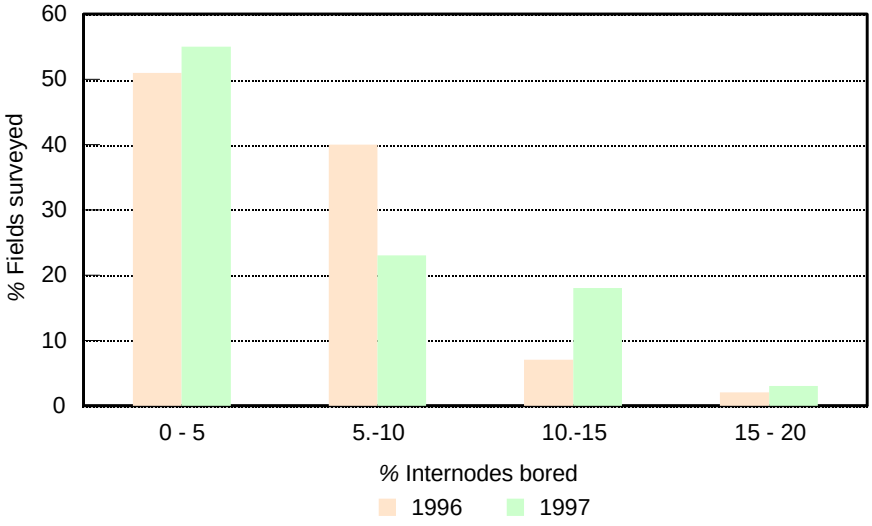


Figure 2 Stem borer damage (% internodes bored)



Tables 2 to 4 give the infestation in the different climatic regions.

Borer infestation seems to be more important in plant cane than in ratoons, with 5.87 and 5.30 % IB respectively in 1996, and 7.48 and 5.45 % IB respectively in 1997 (**Table 5)**. The same tendency was observed in surveys of 1964-65 (Williams, 1983) and 1985 (MSIRI, 1986). The biochemical composition of plant canes and the disturbed environment caused by replanting might be the causes of this higher borer incidence in these fields.

Table 2 Infestation by *Chilo sacchariphagus* in the subhumid zone

Varieties	Irrigated								Unirrigated							
	1996				1997				1996				1997			
	No of fields	Area *ha*	% CB	% IB	No of fields	Area *ha*	% CB	% IB	No of fields	Area *ha*	% CB	% IB	No of fields	Area *ha*	% CB	% IB
M 555/60	2	6	59	7.0	2	4	82	10.2								
M 3035/66	2	22	37	4.7	-	-	-	-								
M 695/69	-	-	-	-	1	3	99	13.3	2	6	82	13.7	1	3	74	8.1
M 1557/70									-	-	-	-	1	2	74	9.5
M1176/77	-	-	-	-	1	4	97	12.1	-	-	-	-	1	3	92	11.8
M 261/78									-	-	-	-	2	7	20	1.8
M 1658/78	-	-	-	-	1	2	89	13.6								
R 570	10	59	54	6.0	10	53	43	4.8	8	31	56	6.9	4	16	39	5.9
Totals	14	88			15	65			10	38			9	31		
Averages			52	6.0			59	7.1			61	8.2			49	6.7

Table 3 Infestation by *Chilo sacchariphagus* in the humid zone

Varieties	Irrigated								Unirrigated							
	1996				1997				1996				1997			
	No of fields	Area *ha*	% CB	% IB	No of fields	Area *ha*	% CB	% IB	No of fields	Area *ha*	% CB	% IB	No of fields	Area *ha*	% CB	% IB
M 555/60	2	6	69	7.5	-	-	-	-	1	2	47	5.3	-	-	-	-
M 3035/66									10	40	57	5.7	5	22	72	9.1
M 695/69	2	11	30	2.8	-	-	-	-								
M 1557/70									1	2	76	9.6	1	2	93	10.9
M 1658/78	11	38	50	5.0	8	35	59	6.8	2	8	55	8.0	7	40	80	9.5
M 2350/79	-	-	-	-	1	3	88	9.9								
R 570	6	22	45	5.8	4	16	31	2.8	24	120	46	4.6	14	48	52	6.8
Totals	21	78			13	54			38	172			27	113		
Averages			49	5.3			53	5.9			50	5.2			64	8.1

Figure 3 shows the relationship between % CB and % IB from data obtained in surveys of 1996 and 1997. In both cases the relationship is a power curve of $y = 0.041x^{1.2325}$ for 1996 and $y = 0.0352x^{1.2701}$ for 1997. Thus, given the % CB of a certain field, an indication of its % IB can be obtained. As stated by Williams (1983), the amount of work in the sampling procedure could be reduced for it would only be necessary to obtain the number of canes bored in a particular field. However, more surveys will have to be performed to compare the curves of different years to confirm these results.

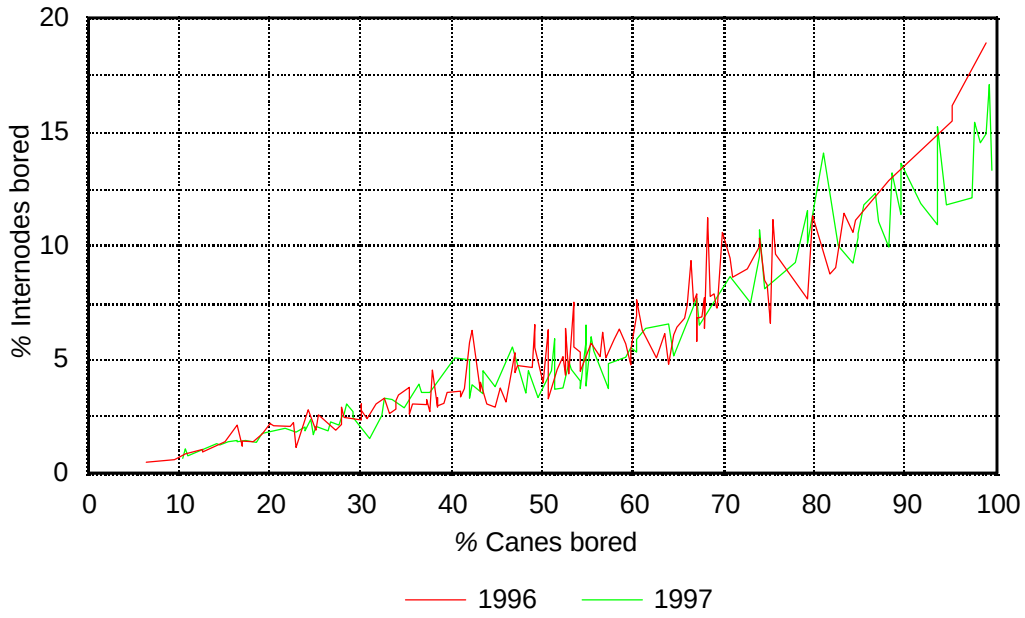
Table 4 . Infestation by *Chilo sacchariphagus* in the superhumid zone

Variety	1996				1997			
	No. of fields	Area *ha*	*% CB*	*% IB*	No. of fields	Area *ha*	*% CB*	*% IB*
M 3035/66	28	100	57	6.0	21	73	49	4.3
M 292/70	1	2	53	5.5	-	-	-	-
M 1658/78	11	58	46	4.6	14	51	39	3.9
R 570	15	60	39	2.8	4	13	33	3.2
Totals	55	220			39	137		
Averages			47	5.0			44	4.1

Table 5. Sugar cane borer infestation in plant canes and ratoons in different climatic zones in1996 and 1997

Climatic zone	Year	Plant cane				Ratoon			
		No of fields	Area	% CB	% IB	No of fields	Area	% CB	% IB
Subhumid Irrigated	1996	7	36	56	6.0	7	51	48	5.9
	1997	4	11	89	12.1	11	54	48	5.5
Subhumid Unirrigated	1996	-	-	-	-	10	38	61	8.2
	1997	4	15	57	8.5	5	16	42	5.4
Humid Irrigated	1996	6	17	58	7.0	15	61	45	4.6
	1997	5	19	42	4.5	8	35	59	6.8
Humid Unirrigated	1996	10	38	54	5.8	28	134	48	5.0
	1997	10	39	66	9.2	17	74	63	7.5
Superhumid	1996	4	13	46	4.0	51	205	47	5.0
	1997	10	34	52	4.8	29	104	41	3.8
Totals / Averages	1996	27	104	54	5.9	111	489	48	5.3
	1997	33	118	60	7.5	70	283	50	5.4

Figure 3. Relationship between % canes bored and % internodes bored



CONCLUSION

The surveys have shown that different varieties respond differently to borer infestation in different parts of the island. The climatic conditions prevailing in a particular zone influence the borer population in that region. Humidity has been found to be one of the most important factors in limiting infestations. This fact has been confirmed not only in the subhumid zone but also in the humid zone where unirrigated fields were found to be more infested than irrigated ones. Irrigation would therefore help to reduce infestation by borers in regions of inadequate rainfall. A higher percentage of the total area under sugar cane cultivation could be assessed for borer infestation if a definite equation for the relationship between % CB and % IB could be formulated. Further studies are required to determine the loss sustained due to borer damage in varieties currently under cultivation in the different agroclimatic areas.

ACKNOWLEDGMENTS

The authors are grateful to the Director of the Mauritius Sugar Industry Research Institute for granting them permission to present this paper, and to Dr. J R Williams for valuable comments on the manuscript.

REFERENCES

BANGDIWALA, I.S. and MARTORELL, L. F. (1954). Correlation between stalk and joint infestation by sugar cane moth borer, *Diatraea saccharalis (F.). Proceedings of the international Society of Sugar Cane Technologists*, **8** : 593-601.

BATES, J. F. (1954). The status of moth borer in British Guiana. *Proceedings of the British West Indies Sugar Technologists* 1954 : 126-136.

GANESHAN, S. and RAJABALEE, A. (1997). Parasitoids of the sugar cane spotted borer, *Chilo sacchariphagus* (Lepidoptera : Pyralidae), in Mauritius. *Proceedings of the South African Sugar Cane Technologists' Association* 1997 : 87-90.

GREATHEAD, D. J. (1971). A review of biological control in the Ethiopian Region. Technical Communication No. 5, Commonwealth Institute of Biological Control. 162 p.

HALL, D.J. (1986). Sampling for the sugar cane borer (Lepidoptera : Pyralidae) in sugar cane. *Journal of Economic Entomology*, **79** : 813-816.

LIM SHIN CHONG, L. C. Y. and RAJABALEE, A. (1988). Sampling method for estimating stem borer infestation in sugar cane fields. *Sugar cane - Autumn 1988 supplement* : 15-16.

MOUTIA, L. A. (1934). The sugar cane moth borers in Mauritius. *Bulletin of Entomological Research*, **25 :** 33-45.

MSIRI (1985) . *Mauritius Sugar Industry Research Institute. Annual Report* 1984 : 43-45.

MSIRI (1986) . *Mauritius Sugar Industry Research Institute. Annual Report* 1985 : 44-45.

NESBITT, B. F., BEEVOR, P. S., HALL, D. R., LESTER, R., and WILLIAMS, J. R. (1980). Components of the sex pheromone of the female sugar cane borer, *Chilo sacchariphagus* (Bojer) (Lepidoptera : Pyralidae). *Journal of Chemical Ecology*, **6** (2) : 385-394.

RAJABALEE, A. (1990). Management of *Chilo* spp. on sugar cane with notes on mating disruption studies with the synthetic sex pheromone of *Chilo sacchariphagus*. *Insect Science Application*, **11** (4/5) : 825-836.

RAJABALEE, A., LIM SHIN CHONG, L. C. Y. and GANESHAN, S. (1990). Estimation of sugar loss due to infestation by the stem borer, *Chilo sacchariphagus*, in Mauritius. *Proceedings of the South African Sugar Technologists' Association* 1990 : 120-123.

VINSON, J. (1941). Rectification d'une erreur courante relative à l'èspece de *Diatraea* (borer ponctué), s'attaquant à la canne à sucre à Maurice. *Revue Agricole de l'Ile Maurice*, **20 :** 148-153.

WILLIAMS, J.R. (1983) The sugar cane stem borer (*Chilo sacchariphagus*) in Mauritius. *Revue Agricole et Sucière de l'Ile Maurice*, 1983, **62** : 5-23.