

Assessment of Losses Caused By Top Borer, *Scirpophaga excerptalis* Walker on Millable Sugarcane

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ABSTRACT

The weight loss due to attack of top borer, *Scirpophaga excerptalis* Walk. was studied for 6 varieties of millable sugarcane. The changes on the length and circumference due to attack of this pest were also studied. It was found that the loss of weight ranged from 6.50 to 50.17 per cent within the varieties studied. The changes in weight due to attack of top borer were found statistically significant within the varieties, except BS-96. The length of the attacked canes were also found to be reduced significantly. The circumference of the infested canes was found to increase due to the stunted growth at the top. Canes of the variety BS-96 were more tolerant to the top borer than ISD-2/54.

INTRODUCTION

Top borer, *Scirpophaga* spp. are the most injurious insect affecting sugarcane in South and South-East Asia (Carl, 1962 ; Gupta, 1959 ; Gupta *et al.*, 1965 ; Gupta, 1962 ; Huque and Agarwala, 1955 ; Kalra and Chaudhury, 1964a ; Kalra and Sidhu, 1965 ; Pemberton, 1962 ; Rao and Chandy, 1957 ; Venkatraman, 1961). In Bangladesh this insect is the most damaging pest of sugarcane (Alam, 1967 ; Rahman, 1970, 1976 ; Rahman *et al.*, 1979). The young larvae after tunneling through the mid-rib of the leaf, travel down towards the growing point which is burrowed through (Fletcher and Ghosh, 1920 ; Gupta, 1959 ; Hazelhoff, 1932 ; Patel, 1963). Usually, though not always (Kalra and Chaudhury, 1964b), the growing point is destroyed. Young stalks die, older stalks often dies but may survive by developing side shoots. The first noticeable sign of damage is the characteristic 'deadheart' followed by damage to the base of the spindle leaves (Fletcher and Ghosh, 1920 ; Holloway *et al.*, 1928 ; Ruinard, 1958).

Loss in the weight of cane results from cane tissue being eaten, from desiccation and from impaired growth. A significant number of sugarcane plants are destroyed by the top borer. Various workers have assessed the losses caused by the top borer (Agarwala and Prasad, 1956 ; Gupta and Avasthi, 1954, 1956 ; Gupta *et al.*, 1965 ;

Kalra and Chaudhury, 1964a ; Kalra and Sidhu, 1965 ; Rajani, 1961 ; Siddiqi, 1961). But their estimates differ considerably probably due to the differences in the technique of sampling and the material contained in the samples. Efforts were, therefore, made to achieve a workable measure for loss in yield due to top borer infestation under normal conditions of cane cultivation.

MATERIAL AND METHODS

The experiments were carried out at the sugarcane fields of Rajshahi University Rural and Agricultural Development Project. During the harvesting period sample of 36 infested and 36 uninfested sugarcane plants of the same variety were randomly sampled. During sampling, the top borer affected plants which were apparently free from the attack of other pests or pathogens were taken. Similar procedures were followed in the selection of the uninfested canes. The sampled canes were cleaned and measured lengthwise and circumferencewise (one at the base, one at the middle and one at the top of the cane). Then the mean values of the circumference was calculated. Each sample of 36 canes were grouped into 6 and weighed with a spring balance (capacity 23 kg). The observations were made for 6 varieties namely, ISD-9/57, Co. 1158, Bo-67, BS-96, ISD-2/54 and I-30/60.

The average weight in Kg, average length in M (metre) and average circumference in cm with their standard error (S. E.) were calculated. The differences in weight, length and circumference between infested and uninfested canes were analysed statistically by using *t*-test. The assessment of loss in percentage were calculated by the formula :

$$\frac{\bar{X}_1 - \bar{X}_2}{\bar{X}_1} \times 100 = A, \text{ where, } A = \text{assessment of loss in percentage,}$$

$\bar{X}_1$ = the mean of the measurements for the healthy canes, and $\bar{X}_2$ = the mean of the measurements for the infested canes.

RESULTS AND DISCUSSION

The effect of infestation by *S. excerptalis* on the weight, length and circumference of different varieties of sugarcane and assessment of loss in percentage have been shown in tables 1, 2 and 3. From the tables it is found that the assessment of weight loss in percentage due to infestation of top borer was found maximum (50.17) for variety ISD-2/54 and minimum (6.50) for variety BS-96. The loss percentage in length due to infestation were also found maximum (40.74) and minimum (5.14) for the above varieties respectively. But the change in percentage of circumference between infested and uninfested canes were maximum (10.09) and minimum (1.94) for the varieties BS-96 and ISD-2/54 respectively. The *t*-test shows significant differences both in weight and length for all the treated varieties except BS-96.

In view of the severity of damage caused by top borer, *S. excerptalis* many workers observed the loss of cane in the field. Gupta and Avasthi (1954) recorded inverse

relationship between infestation and loss in yield. The overall loss in yield of millable cane was reported as high as 30 percent in years of severe attack of top borer (Kalra, 1960; Venkatraman, 1961). In Bihar, Agarwala and Prasad (1956) recorded a loss of yield 7.47 to 7.68 percent by this insect. Rajani (1961) used a sample of 30 canes for the determination of the losses in yield after comparing healthy canes with the top borer attacked ones and concluded that in severely affected canes top borer caused loss in yield upto 20 percent. Siddiqui (1961) recorded the same as 5.51 to 9.80 percent, whereas Gupta (1965) observed the top borer affected millable canes to suffer 25 percent loss in yield.

Table 1. Effect of infestation by *S. excerptalis* F. on the different varieties of sugarcane.

Variety	Category of cane sampled I= infested U= Uninfested	Average weight in Kg. of a Single cane $\pm$ S. E.	Assessment of loss in percentage	Calculated value of 't'
ISD-9/57	I	0.40 $\pm$ 0.04	31.03	4.50***
	U	0.58 $\pm$ 0.02		
Co.-1158	I	0.63 $\pm$ 0.04	18.18	4.67***
	U	0.77 $\pm$ 0.01		
BO-67	I	0.33 $\pm$ 0.03	31.58	5.00***
	U	0.48 $\pm$ 0.02		
BS-96	I	1.15 $\pm$ 0.07	6.50	1.09
	U	1.23 $\pm$ 0.05		
ISD-2/54	I	0.06 $\pm$ 0.03	50.17	17.40***
	U	1.20 $\pm$ 0.02		
I-30/60	I	0.53 $\pm$ 0.05	34.57	7.00***
	U	0.81 $\pm$ 0.01		

*p $\angle$ 0.05

**P $\angle$ 0.01

*** $\angle$ 0.001

Tabulated value of t are 2.000, 2.660 and 3.460 for 0.05, 0.01 and 0.001 Probability at 60 d. f.

Table 2. Effect of infestation by *S. excerptalis* F. on the length of different varieties of sugarcane.

Variety	Category of cane sampled I= infested U= uninfested	Average length in M. of single cane $\pm$ S. E.	Assessment of loss in percentage	Calculated value of 't'
ISD-7/57	I	1.34 $\pm$ 0.07	19.76	5.50***
	U	1.67 $\pm$ 0.01		
Co.1158	I	2.20 $\pm$ 0.10	16.18	4.30***
	U	2.41 $\pm$ 0.03		
BO-67	I	1.43 $\pm$ 0.02	22.70	8.30***
	U	1.85 $\pm$ 0.06		
BS-96	I	3.14 $\pm$ 0.13	5.14	1.41
	U	3.31 $\pm$ 0.04		
ISD-2/54	I	1.60 $\pm$ 0.60	40.74	3.06**
	U	2.70 $\pm$ 0.11		
I-30/60	I	1.94 $\pm$ 0.08	25.95	5.67***
	U	2.62 $\pm$ 0.11		

*P $\angle$ 0.05

**P $\angle$ 0.01

***P $\angle$ 0.001

Tabulated value of t are 2.000, 2.660 and 3.460 for 0.05, 0.01 and 0.001 probability at 60 d. f.

Table 3. Effect of infestation by *S. excerptalis* F. on the circumference of different varieties of sugarcane.

Varieties	Category of cane sampled I = infested U = unfested	Average circumference in cm of a single cane $\pm$ S. E.	Assessment of change in percentage	Calculated value of 't'
ISD-9/57	I	6.20 $\pm$ 0.40	9.15	0.88
	U	5.68 $\pm$ 0.43		
Co.1158	I	5.54 $\pm$ 0.27	6.42	1.24
	U	5.92 $\pm$ 0.17		
BO-67	I	5.06 $\pm$ 0.24	3.90	0.66
	U	5.37 $\mp$ 0.22		
BS-96	I	6.77 $\pm$ 0.28	10.09	1.90
	U	7.53 $\pm$ 0.28		
ISD-2/54	I	6.82 $\pm$ 0.11	1.94	0.48
	U	6.69 $\mp$ 0.27		
I-30/60	I	6.37 $\pm$ 0.16	10.20	2.68*
	U	5.78 $\pm$ 0.18		

*P $\angle$ 0.05, Tabulated value of $t = 2.000$ with 60 d.f

The present findings of weight loss due to attack of top borer was found to be similar with the findings of Rajani (1961) and Gupta (1965). No report was available on the change of length and circumference due to attack of top borer. It was found that the reduction in weight and length were significant in all the varieties under study excepting BS-96. Again the circumference was generally found to increase with the attack of top borer. But no definite correlation was found between level of infestation and the circumference change. The increase of circumference with the attack of top borer in some varieties namely, ISD-9/57, ISD-2/54 and I-30/60 (table-3) may probably be due to stunted growth at the top of the sugarcane plant.

So, from the above observation, it is assumed that the canes of the variety BS-96 was more tolerant to the top borer, whereas ISD-2/54 was more susceptible to the same pest.

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REFERENCES

- Agarwala, S. B. D. and Prasad, S. K., 1956. The status of sugarcane top borer in Bihar, *Indian Sug.* 6(1) : 60-66.
- Alam, M. Z., 1967. Insect pests of sugarcane. *Proc. seminar on Sugarcane Res. Dev. EPIDC.* Gopalpur, Rajshahi. : 79-85.
- Carl, K., 1962. Gramineous moth borer in West Pakistan. *Tech. Bull. Commonwealth Inst. Biol. Control.* 2 : 29-76.

- Fletcher, T.B. and Ghosh, C. C., 1920. Borers in sugarcane, rice etc. *Rep. Proc. ent. Meet. Pusha.* 3(1) : 354-417.
- Gupta, B. D., 1959. Insect pests of sugarcane in India III. The top borer. *Indian Sug.* 9 : 127-149.
- Gupta, B. D. and Avasthi, P. N., 1954. A resume on the behaviour of varieties towards the incidence of major pests of sugarcane in U. P. and other states in India. *Proc. 2nd Bien. Conf. Sug. Res. Dev. Workers India.* 2 : 208-228.
- Gupta, B.D. and Avasthi, P. N., 1956. Recent advances in sugarcane entomology in India. *Indian Sug.* 5 : 541-548.
- Gupta, K. M., Singh, B. and Sagar, G. E., 1965. Estimation of losses caused by top borer (*Scirpophaga nivella* Fab.) of sugarcane crop in Uttar Pradesh. *Indian Sug.* 15 : 101-106.
- Gupta, V. K., 1962. Identity and synonymy of an Ichneumonid parasite of the top borer of sugarcane, *Scirpophaga nivella* Fabricius (Hymenoptera : Ichneumonidae) *Indian J. Ent.* 23 : 7-9.
- Hazelhoff, E. H., 1932. Investigations on the white top borer. *Proc. Int. Soc. Sug. Cane Technol.* 4, Bull. - 1966, 8pp.
- Holloway, T. E. Haley, W. E., Loftin, V. C. and Heinrich, C., 1928. The Sugarcane borer in the United States. *Tech. Bull. U. S. Deptt. Agric.* 41 : 76.
- Huque, M. W. and Agarwala, S. B. D., 1955. Biological studies on top borer, *Scirpophaga nivella* Fab. *Indian Sug.* 5 : 13-20.
- Kalra, A. N., 1960. Aerial spray with endrin against sugarcane top borer. *Indian Sug.* 9 : 699-700.
- Kalra, A. N. and Chudhury, J. P. 1964a. Assessment of losses by sugarcane pests-loss caused by top borer of sugarcane. *Indian J. Sug. Cane Res. Dev.* 8(3) : 261-264.
- Kalra, A. N. and Chaudhury, J. P. 1964b. Infertuous attack of top borer of sugarcane. *Indian J. Sug. Cane Res. Dev.* 8 : 345-346.
- Kalra, A. N. and Sidhu, A. S., 1965. Studies on the biology of sugarcane top borer, *Scirpophaga nivella* Fabr. in the Punjab. *Indian Sug.* 15 : 37-43.
- Patel, R. M., 1963. Observations on the life history and control of the sugarcane top borer (*Scirpophaga nivella* F.) in South Gujarat. *Indian Sug. Cane Res. Dev.* 8(1) : 50-55.
- Pemberton, C. E., 1932. Insect pests affecting sugarcane plantation within the Pacific. *Proc. Int. Soc. Sug. Cane Technol.* 2 : 678-689.
- Rahman, M., 1970. Integrated control of the sugarcane top shoot borer, *Scirpophaga nivella* F. in Rajshahi region. *Proc. 21st & 22nd Pakistan Sci. Conf.* 58p.

- Rahman, M., 1976. Natural enemies of the top borer of sugarcane, *Scirpophaga nivella* F in Bangladesh. *Indian J. Ent.* 38(2) : 101-109.
- Rahman, M., Khalequzzaman, M. and Mannan, M. 1979. Studies on the occurrence of broods in the sugarcane top borer. *Scirpophaga excerptalis* Fabricius (Pyralidae : Lepidoptera). *Bangladesh J. Sug. Cane.* 1 : 45-49.
- Rajani, V. G., 1961. Estimation of losses caused by insect pests to sugarcane crop in Uttar Pradesh. *Proc. 4th Bien. Conf. Sug. Res. Dev. Workers, India.* : 476-487.
- Rao, P. R. N. and Chandy, K. C., 1957. Studies on the incidence of sugarcane borers. *Indian J. Sug. Cane Res. Dev.* 2 (1) : 23-30.
- Ruinard, J., 1958. *Investigations into bionomics, economic importance and possibilities of control of the sugarcane stalk borers in Java.* (In Dutch). Wageningen, Professor. Lendbouwhogesh. 222p.
- Siddiqi, Z. A., 1961. Estimation of losses due to sugarcane borers. *Proc. 4th Bien. Conf. Sug. Res. Dev. Workers, India.* : 541-546.
- Venkatraman, T., 1961. Varietal behaviour on yield and quality to top borer affected canes. *Indian J. Sug. Cane Res. Dev.* 6(1) : 43-46.