The Bioscan 15(3): 407-409, 2020
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

DETERMINATION OF ECONOMIC INJURY LEVEL (EIL) OF SUGARCANE PLASSEY BORER *CHILO TUMIDICOSTALIS* HAMPSON (LEPIDOPTERA: PYRALIDAE)

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KEYWORDS
Sugarcane plassey borer
EIL
Internode damage Secondary infestation

Received on :
04.07.2020

Accepted on :
11.08.2020

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ABSTRACT
Field experiment was conducted at Krishi Vigyan Kendra, Assam Agricultural University, Tinsukia during 2016 to determine the economic injury level of sugarcane plassey borer *Chilo tumidicostalis* Hampson (Lepidoptera: Pyralidae). The EIL was determined by using the method given by Stone and Pedigo (1972). From the investigation, it was observed that the per cent loss in yield of sugarcane due to secondary infestation by the plassey borer varied from 2.84 to 11.15 per cent.The intensity of borer attack in terms of number of internodes damaged due to secondary infestation varied from 15.38 to 58.33 per cent. The economic injury level of sugarcane plassey borer was determined in case of per cent internode infestation and was 17.6 per cent. However, the economic injury level is the dynamic parameter with the variety, the management practices in a particular area, the stage of the crop at infestation, the market price of the produce and the cost of insect control.

INTRODUCTION

Sugarcane *Saccharum officinarum* L. is an important food cum cash crop grown extensively throughout India, with an area and production of 49.44 lakh hectares and 3391.70 lakh metric tonnes, respectively. In Assam, sugarcane is the important commercial crop grown in all the districts next to tea and jute with an area and production of 0.30 lakh ha and 10.76 lakh metric tonnes, respectively (Anon., 2014).

In view of the low yield and importance of sugarcane in Indian economy, various efforts have been made to increase the production per unit area. The insect pest problem is one of the important limiting factors in the production of sugarcane crop. The number of insect pests associated with sugarcane crop in India had been listed by many workers. About 125 insect species are reported to attack sugarcane in India (Box, 1953). Butani (1961) considered 32 insects as major pests, out of a total 50 insects found on sugarcane in Bihar. Phukan (1978) mentioned about 6 insect species which are major importance of sugarcane crop in Assam. Among the different internode borers associated with sugarcane, the plassey broer, *Chilo tumidicostalis* has assumed the status of a very serious endemic pest in recent years causing 8.2 to 12.6 per cent loss in cane yield and 1.25 to 7.85 per cent loss in sucrose output in endemic areas of India (Butani, 1961). Though its occurrence is also reported in some parts of Bihar, West Bengal and Nagaland, but the pest is of economic importance only in Assam. Even after seven decades of its first report from Jorhat, Assam, the insect still remains a menace to sugarcane growers (David *et al*., 1986).

Moreover, the estimation of crop loss helps to determine the economic status of the insect pest and to establish the economic injury level and economic threshold level of the pest. In view of the importance of this pest, the knowledge of EIL is essential for establishment of an integrated management program to minimize the use of chemical and biological insecticides, with the first applications made only when the insect population exceeds a given economic threshold (Stern *et al*., 1959). Development and implementation of economic thresholds is a rational approach to pest management designed to aid farmers in making pest control decisions (Way *et al*., 1991). In view of the above factors, the present study was undertaken to determine the loss in cane yield of sugarcane and economic injury level of sugarcane plassey borer.

MATERIALS AND METHODS

For determining EIL of plassey borer, *C. tumidicostalis* an experiment was conducted using the variety 'Barak' applying all the recommended package of practices. For this investigation, plant population was counted in 10 quadrates (1 m x 1 m). Per cent infestation was calculated from the healthy and infested cane and the sampling was done randomly in the plot for determining the different levels of infestation from 10 quadrates along with a protected plot where no insecticide was applied and considered as control plot. The plassey borer

infestation was effectively controlled with 4 spray of Monocrotophos 36WSC @ 1.5 l/ha at 15 days intervals. Per cent infestation and cane yield per plant was recorded and compared the yield at different per cent infestation level with the control plot. Percentage yield loss was also calculated.

For determining the per cent loss in cane yield, the reduction in weight of canes was worked out. To determine the reduction in weight, a sample of 10 canes of infested and healthy was drawn from each quadrate, and then the canes were weighed. With the help of comparative weights for infested as well as healthy canes, the percentage reduction in weight in infested canes was worked out. For this purpose, the canes were examined by cutting the canes at ground level from the observational plot. The canes was cut open longitudinally and grouped into two categories *viz*., healthy and bored. The number of healthy and bored internodes in each cane was also recorded. For this observation, the secondary infested canes were observed.

The percentage incidence of canes and the percentage reduction in weight of bored canes as compared to those in healthy canes, the actual loss in cane yield in terms of total yield was determined with the help of formula given by Rajani, 1960.

$$\% \text{ loss in cane yield}(\%) = \frac{\% \text{ incidence} X \% \text{ reduction in weight}}{100}$$

The percentage incidence was calculated as follows

$$\text{Percentage incidence}(\%) = \frac{\text{Number of infested canes}}{\text{Total number of canes}} X100$$

Subsequently, the regression equation was computed between the different levels of per cent infestation and reduction in yield to calculate the regression coefficient.

Following procedure was used for computation of EIL

Yield- infestation relationship established by regression analysis and EIL was worked out by the method given by Stone and Pedigo (1972) as

$$\text{Grain threshold} = \frac{\text{Cost of plane protection measures}(Rs/ha)}{\text{Market price of the produce}(Rs/kg)}$$

$$\text{EIL} = \frac{\text{Grain threshold}}{\text{Regression coefficient}}$$

RESULTS AND DISCUSSION

Loss in cane yield

The extent of damage caused by *C. tumidicostalis* larvae was assessed in terms of per cent internode damaged and losses in cane yield at the time of harvesting of the crop are presented in Table 1. In the present investigation, it was observed that the per cent loss in yield of sugarcane due to secondary infestation by the insect varied from 2.84 to 11.15 per cent in different quadrates (Table 1).

The loss in yield of sugarcane due to secondary infestation of *C. tumidicostalis* also reported by Khanna *et al*. (1957). According to them, the per cent loss in cane yield in different varieties of sugarcane due to *C. tumidicostalis* was 6.07 to 34.82. The reduction in percentage loss in cane yield might be attributed to the varietal susceptibility of the cane and the intensity of pest attack. The findings of the present investigation was also in conformity with the findings of Rajmedhi (1992) who reported that the loss in cane yield varied from 1.24 to 7.85 per cent and 0.23 to 2.82 per cent due to primary and secondary infestation, respectively.

Moreover, the intensity of borer attack was estimated on the basis of the number of the internodes damaged out of the total internodes due to secondary infestation varied from 15.38 to 58.33 per cent (Table 2). Rajmedhi (1992) reported 10.16 to 19.79 per cent internode damage due to secondary infestation. He also reported the variety 'Co8112' was preferred more by

Table 1: Loss in cane yield due to attack by plassey borer

Sl. No.	State of the cane	Average wt per cane (kg)	Loss in wt per cane (kg)	Percentage reduction in wt (%)	Percent incidence (%)	Percent loss in yield (%)
1	Healthy	1.01	0.55	54.45	5.22	2.84
	Bored	0.46				
2	Healthy	1.25	0.72	57.6	5.34	3.07
	Bored	0.53				
3	Healthy	1.38	0.73	52.89	5.88	3.12
	Bored	0.65				
4	Healthy	1.36	0.71	52.2	6.23	3.25
	Bored	0.65				
5	Healthy	1.46	0.72	49.31	6.75	3.33
	Bored	0.74				
6	Healthy	1.2	0.75	62.5	7.06	4.41
	Bored	0.45				
7	Healthy	0.95	0.66	69.47	7.12	4.94
	Bored	0.29				
8	Healthy	1.55	0.77	49.67	10.56	5.24
	Bored	0.78				
9	Healthy	1.52	0.87	57.23	11.02	6.3
	Bored	0.65				
10	Healthy	1.25	0.98	78.4	14.23	11.15
	Bored	0.27				

Data based on total canes of each quadrate

Table 2: EIL of sugarcane plassey borer

Obser vation	Per cent Infestation	Average wt per cane (kg)	Reduction in yield (kg)	Per cent yield loss
1	0	1.56	0	0
2	9.77	1.32	0.24	15.38
3	10.14	1.25	0.31	19.87
4	11.56	1.08	0.48	30.76
5	12.21	0.92	0.64	41.02
6	12.45	0.84	0.72	46.15
7	13.04	0.74	0.82	52.56
8	14.56	0.7	0.86	55.12
9	15.32	0.67	0.89	57.05
10	16.04	0.65	0.91	58.33

plassey borer. The variations in the intensity of attack might be due to the characteristics of the cane varieties and the density of the pest population.

Determination of Economic Injury Level of plassey borer

EIL was determined by using the method given by Stone and Pedigo (1972). The regression equation between per cent cane infestation and per cent reduction in yield was Y = .0.064x-0.161

$$\text{Grain threshold} = \frac{\text{Cost of plane protection measures(Rs / ha)}}{\text{Market price of the produce(Rs / kg)}}$$

$$\text{EIL} = \frac{\text{Grain threshold}}{\text{Regression coefficient}}$$

Altogether, four spray of Monocrotophos 36WSC @ 1.5 l/ha at 15 days an interval was the most effective in suppressing the C. tumidicostalis infestation in the respective sugarcane fields.

Management cost

Monocrotophos 36 WSC = Rs 600/lit, need 1.5 lt/ha = Rs 900/ha

4spraying was done, so total cost 900X4 = Rs. 3600

Labour cost = (200X2)X4 = Rs 1600

Market value of cane = Rs. 8/kg

GT = 4500/8 = 562.50

Loss per insect = 0.064

EIL = 562.50/0.064 = 8789.0625

Pl population = 5no/m2 = 5X10000 = 50,000/ha

So, EIL = 8789.0625/50,000 = 0.1758 = 17.6%

The economic injury level of sugarcane C. tumidicostalis was determined in case of per cent internode infestation. The present investigation established that the economic injury level of sugarcane *C. tumidicostalis* was 17.6 per cent as internode damage. However, the economic injury level is the dynamic parameter with the variety, the management practices in a particular area, the stage of the crop at infestation, the market price of the produce and the cost of insect control (Murugesan and Chelliah, 1986). However, the economic injury level of *Eldana saccharina*, a serious pest of sugarcane in South Africa was calculated based on internode damage was reported as 5.8 per cent Internode Borer (IB) and 7.2 per cent IB at treatment efficacy levels of 50 per cent and 40 per cent, respectively (Leslie, 2008).

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NAAS Rating : 5.26

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Type seter Bandana Solutions Facility Management LLP
Published by Aditi Publications, Patliputra, Patna

The Bioscan
An International Quarterly Journal of Life Sciences
ISSN : 0973-7049
Volume 15(3) : 2020
Published as an official organ by
NATIONAL ENVIRONMENTALISTS ASSOCIATION

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