

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

R. K. NATH¹ AND D. K. SAIKIA²

¹Department of Entomology, SCS college of Agriculture, Assam Agricultural University, Rangamati, Dhubri-783376, Assam, INDIA

²Department of Entomology, Assam Agricultural University, Jorhat-785013, Assam, INDIA
e-mail: rupaknath09@gmail.com

KEYWORDS

Sugarcane plassey borer
EIL
Internode damage
Secondary infestation

Received on :
04.07.2020

Accepted on :
11.08.2020

***Corresponding author**

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 borer, *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 quadrat, 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.

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

The percentage incidence was calculated as follows

$$\text{Percentage incidence}(\%) = \frac{\text{Number of infested canes}}{\text{Total number of canes}} \times 100$$

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 quadrat

Table 2: EIL of sugarcane plassey borer

Observation	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 $900 \times 4 = \text{Rs. } 3600$

Labour cost = $(200 \times 2) \times 4 = \text{Rs } 1600$

Market value of cane = Rs. 8/kg

GT = $4500/8 = 562.50$

Loss per insect = 0.064

EIL = $562.50/0.064 = 8789.0625$

PI population = $5n/m^2 = 5 \times 10000 = 50,000/\text{ha}$

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).

REFERENCES

- Anonymous 2014.** Economic Survey of Assam. Directorate of Economics and Statistics, Assam Planning and Development Department, Government of Assam. P. 71.
- Box, H.E. 1953.** List of sugarcane insects. London. Commonw Inst. Ent., pp. 101.
- Butani, D.K. 1961.** Insect pest of sugarcane in Bihar. *Indian Sugar*. **11:** 649-54.
- David, H., Easwaramoorthy, S. and Jayanthi, R. 1986.** Sugarcane Entomology in India (Eds). Sugarcane Breeding Institute, ICAR, Coimbatore, pp. 564.
- Khanna, K.L., Nigam, L.N. and Puri, V.D. 1957.** *Chilo tumidicostalis* Hmps, serious stem borer pests of sugarcane in Bihar. *Proc. Indian Acad. Sci. (B)*. **46:**75-95.
- Leslie, G.W. 2008.** Estimating the economic injury level and the economic threshold for the use of a-cypermethrin against the sugarcane borer, *Eldana saccharina* Walker (Lepidoptera: Pyralidae). *Intern. J. Pest Mngt.* **55(1):** 37-44.
- Murugesan, S. and Chelliah, S. 1986.** Yield loss and economic injury by rice leaf folder. *Indian J. Ent.* **56(4):** 282-285.
- Phukan, E. 1978.** Comparative resistance of certain sugarcane varieties to *Ceratovacuna lanigera* (Zehntner) (Aphididae: Homoptera) and effect of meteorological factors on the natural population build up of this pest. M.Sc. Thesis. Assam Agricultural University, Jorhat.
- Rajmedhi, J. 1992.** Biology of sugarcane plassey borer *C. tumidicostalis* Hmps (Pyralidae: Lepidoptera). M.Sc. Thesis, Assam Agril. Univ., Jorhat.
- Rajani, V.G. 1960.** Estimation of losses caused by insect pest to sugarcane crop in Uttar Pradesh. *Proc. 4th All India Conf. Sug. Res. Dev. Wrks.*, pp. 476-478.
- Stern, V.M., Smith, R.F., Bosch, V.D.R. and Hagen, K.S. 1959.** The integrated control concept. *Hilgardia*. **29:** 81-10.
- Sone, J.D. and Pedigo, L. 1972.** Development of economic injury level of the green clover worm on soybean in Iowa. *J. Econ. Entomol.* **65(1):** 197-201.
- Way, M.O.; Grigarick, A.A.; Litsinger, J.; Palis, F. and Pingali, P. 1991.** Economic thresholds and injury levels for insect pests of rice. In: Rice Insects: Management Strategies. Heinrichs, E.A. and Miller, T.A. (eds.), Springer, pp. 67-105.



**NATIONAL ENVIRONMENTALISTS
ASSOCIATION**

The National Environmentalists Association is chartered in Ranchi as a nonprofit scientific and educational association of like minded academician, researchers, scientists from all over the nation for the furtherance and diffusion of knowledge of Life Sciences in general and Environmental Science in particular.

The association not only honours its members but also provides FELLOWSHIP to outstanding contributors to the subject and the society.

Contact :

For Editorial Information

Prof. M. P. Sinha
Vice Chancellor
Sido Kanhu Murmu University
Dumka - 814 110
Jharkhand, INDIA

For information regarding Association :

SECRETARY,
National Environmentalists Association,
D-13, Sai Roofs, 1st Floor,
H. H. Colony,
Ranchi - 834002
Jharkhand, India

E-mails : editor.bioscan@gmail.com
dr.mp.sinha@gmail.com
nat.env.assoc@gmail.com

Cell : 94313-60645; 9572649448

Ph. : 0651-2244071

Website : www.thebioscan.com
: www.neaindia.org

NAAS Rating : 5.26

U.S.A. Office

2827 Videre Dr.,
Wilmington,
DE 19808 We, USA

Type setter 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

CONTENTS

Page

A. RESEARCH PAPER

1. Comparison and molecular profiling of Begomovirus infecting chilli (*Capsicum annum*) in gangetic alluvial zone of West Bengal
Uday Bikash Oraono, Lourembam Sanajaoba Singh and Jayanta Tarafdar—275 - 280
2. Assessment of probiotic characteristics of *L.plantarum*
Sravani Kandula And Rita Narayanan—281 - 286
3. Effect of rate and frequency of micronutrient on growth attributes and dry matter yield of Banana Cv. grand naine under south Gujarat condition
Narendra Singh, Sonal Tripathi, Patel V. A., Jaimin Naik and Chauhan Aditi—287 - 290
4. Character association and path analysis for seed yield and its components in Grass pea (*Lathyrus sativus* L.)
Gangishetti Ranjithkumar, Sandip Debnath and Duddukur Rajasekhar—291 - 295
5. Determination of physical and biometric properties of onion bulbs in relation to design of digger cum windrower
Shiddanagouda Yadachi and Kiran Nagajjanavar—297 - 301
6. Polygenic variation for morphological and biochemical traits of brinjal genotypes (*Solanum melongena* L.) and its wild relatives
Nisha Sharma, K. D. Bhutia, Rajesh Kumar, Sita Kumari Prasad, Ankita Debnath and Malay Marut Sharma—303 - 309
7. Effect of different sources of horizontal transmission of bacterial flacherie on Et_{50} for symptom expression and mortality of PM X CSR₂
B. L. Kavyashree., R. N. Bhaskar and C. Doreswamy—311 - 314
8. Comparative biology of *Goniozus nephantidis* (Muesbeck) on *Galleria mellonella* L. and *Corcyra cephalonica* (Stainton)
A. V. Desai, M. R. Siddhapara and N. P. Trivedi—315 - 321
9. Efficiency of ovatide on mass seed production of climbing perch (*Anabas testudineus*, Bloch, 1972) in Nalbari district, Assam
Ankur Rajbongshi, A. Ali, M. Chakravarty, M. Deka, H. Mazumdar, Pranab Kr Das and S. Baishya—323 - 326
10. Study of combining ability and gene action for yield and yield component characters in interspecific hybrids of cotton (*Gossypium hirsutum* L. X *Gossypium barbadense* L.)
S. B. Gohil., M. B. Parmar., M. P. Patel and D. A. Patel—327 - 333
11. Per oral inoculation of *Lysinibacillus sphaericus* with pathogenic microbes on rearing and cocoon parameters of silkworm, *Bombyx mori* L.
H. G. Anusha, R. N. Bhaskar and K. V. Anitharani—335 - 338
12. Effect of fungicides, plant extracts and bioagents on spore germination of *Colletotrichum lindemuthianum* causing field bean anthracnose

The Journal is Currently Abstracted / Indexed in

- Paryavarn Abstract, INDIA
- Indian Science Abstract, INDIA
- Cambridge Science Abstract, U.S.A.
- Zoological Record, U.K.
- Directory of Open Access Journal (DOAJ)
- Chemical Abstract, U. S. A.
- Research BIB
- Indian Science
- Journal Seek
- Scientific Indexing Service (SIS)
- Journal is currently rated by
- Index Copernicus
- Universal Impact Factor
- NAAS

DISCLAIMER

The Publisher and Editors cannot be held responsible for errors or any consequences arising from the use of information in this journal; the views and opinions expressed do not necessarily reflect those of the Publisher/ Association and Editors, neither does the publication of advertisements constitute any endorsement by the Publisher / Association and Editors of the products advertised.

- S. Narasimha Rao, S.L. Bhattiprolu, A. Vijaya Gopal and V. Sekhar— 339-344
13. Evaluation in vitro different fungicides for growth of *Rhizoctonia bataticola*
A.M. Kadam, S.S. Chavan and A.H. Kendre — 345- 349
 14. Evaluation of gladiolus varieties for flowering and cut flower traits under indo-gangetic plains
Girish, P. M., Anjana Sisodia and Anil K. Singh— 351- 355
 15. Effect of land configuration and different organic sources on growth, yield and quality of carrot under organic farming
B. Solanki, A. R. Kaswala, P.K. Dubey and A.P. Italiya— 357- 362
 16. Verification and usability analysis of medium range weather forecast for the Kokrajhar district of lower Brahmaputra valley zone of Assam
Kuldip Medhi, Kushal Sarmah, Vinod Upadhyay, Sunil Kumar Paul, Athar N. Islam and Bikash J. Gharphalia— 363 - 370
 17. Canonical root analysis and clustering for characterization and evaluation of aromatic rice germplasm based on morphological characters
G. Parimala, Ch. Damodhar Raju, L.V. Subba Rao and K. Uma Maheswari— 371 - 374
 18. Genetic divergence analysis of sesame genotypes (*Sesamum indicum* L.)
Dasari Rajitha, T. Srikanth, D. Padmaja and T. Kiran Babu— 375 - 379
 19. Nutrient uptake and chemical properties of soil after harvest of baby corn (*Zea mays* L.) as influenced by organic manures and fertilizers
D.H. Roopashree, S. Kamal Bai, Nagaraju and S. Raghavendra— 381 - 384
 20. Genotypic response on growth and yield in papaya
D. K. Varu., K. D. Patel and Sandip Makhmale— 385 - 389
 21. Studies on frequency distribution of yield and yield related traits in F_2M_2 generation of sesame (*Sesamum indicum* L.)
Rajesh Kumar Kar, Tapash Kumar Mishra and Banshidhar Pradhan — 391 - 395
 22. Correlation and path analysis in cowpea (*Vigna unguiculata* (L.) Walp)
R.M. Nagalakshmi, R. Usha Kumari and R. Ananda Kumar— 397 - 401
 23. A simple and efficient method for DNA extraction from rabi sorghum [*Sorghum bicolor* (L.) Moench]"
S. S. Gadakh, G. D. Khalekar, U. S. Dalvi, A. A. Kale and P.L. Kulwal— 403 - 406
 24. Determination of economic injury level (EIL) of sugarcane planthopper borer *Chilo tumidicostalis* Hampson (Lepidoptera: pyralidae)
R. K. Nath and D. K. Saikia— 407- 409
 25. Performance of different summer mung (*Vigna radiata* L.) varieties sown at different dates under Manipur valley condition
Meghna Gogoi, Jamkhogin Lhungdim, Kamal Kant, Urjashi Bhattacharya and Gauri Mohan — 411 - 414



ZONAL CO-ORDINATORS OF THE ASSOCIATION

- Prof. N. Behera
School of Life Science,
Sambalpur University
- Dr. Nirmal Kumar
ISTAR, Vallabh Vidyanagar,
Anand, Gujarat
- Dr. P. N. Sudha
D. K. M. College for Women,
Vellore
- Prof. S. P. S. Dutta
Dept. of Environmental Science,
Jammu University, Jammu
- Dr. V. Salom Gnana Thanga
Dept. of Env. Scs.,
University of Kerala, Kariavattom
Tiruvananthapuram, Kerala

Publications of the Association

The Bioscan

An International Quarterly Journal of Life Sciences

The Ecoscan

An International Quarterly Journal of
Environmental Sciences

**Both the Journals are
online**

**Both the Journals are
available on Google.com**

Websites of the Journals are
www.theecoscan.in
www.thebioscan.in

FEATURES OF ASSOCIATION

- Association is registered under 80G of I.T.
- Prestigious fellowship of the Association (F. N. E. A.) to academicians of the nation.
- Regular annual conference of national and international levels organized by the Association.
- Young Scientist and Senior Scientist award during the conference of the Association.



_____ 062 & 082

_____ 000 & 000

THE BIOSCAN : SUBSCRIPTION RATES				
		India (Rs.)	SAARC Countries	Other Countries
Individuals	One Year	1,000	2,000(I:C)	US \$200
	Life Member*	10,000		
Institutions	One Year	3,000	6,000(I:C)	US \$400
	Life Member*	30,000		

*Life Member will receive the journal for 15 years while other benefits will continue whole life

THE BIOSCAN : MEMBERSHIP FORM

Please enter my subscription for the above journal for the year / life member.

Name:

Address:

E-mail:

Payment Rs. : by DD / MD in favour of
National Environmentalists Association payable at Ranchi, No. Dated
..... is enclosed.

NOTE: FOR MEMBERSHIP THE ABOVE INFORMATION CAN BE SENT ON SEPARATE SHEET