Journal of Scientific Research and Reports

Volume 31, Issue 7, Page 747-752, 2025; Article no.JSRR.130235
ISSN: 2320-0227

Impact of Bio Intensive IPM Components on Borer Complex in Sugarcane for Sustained Cane Production

Sheeba Jasmine R [a*] and C. Raja Babu [a]

[a] *ICAR-Krishi Vigyan Kendra, Sirugamani-639 115, Tiruchirappalli, Tamil Nadu, India.*

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/jsrr/2025/v31i73294

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://pr.sdiarticle5.com/review-history/130235

Short Research Article

Received: 22/11/2024
Accepted: 24/01/2025
Published: 12/07/2025

ABSTRACT

Bio intensive IPM is the potential option to tackle the borers in sugarcane crop, since the practices are not only effective and economical but also ecologically safe. In order to find out the effect of various BIPM components to sugarcane borer complex, an investigation was undertaken at Sugarcane Research Station, Sirugamani during 2020-2022. The treatments were T_1-Carbofuran 3G @ 1 kg ai ha^{-1} at basal and 105 DAP (days after planting), T_2-Rynaxypyr 20 SC @ 75 g $aiha^{-1}$ (sett treatment) + soil drenching at 105 DAP @ 75 g a i ha^{-1}, T_3-Intercropping of blackgram+ mechanical removal of top borer infested shoots and egg masses of internode and top borers, T_4-Neemcake @ 125 kg ha^{-1} at basal and 105 DAP, T_5- Release of *T.chilonis* @ 2.5 cc ha^{-1} $release^{-1}$ starting from 30 to 180 DAP at 15 days interval (11 releases), T_6-Combination of T_4 + T_5, T_7-

**Corresponding author: E-mail: sheebajasmine@tnau.ac.in;*

Cite as: *R, Sheeba Jasmine, and C. Raja Babu. 2025. "Impact of Bio Intensive IPM Components on Borer Complex in Sugarcane for Sustained Cane Production". Journal of Scientific Research and Reports 31 (7):747-52. https://doi.org/10.9734/jsrr/2025/v31i73294.*

Intercropping of blackgram + Detrashing at 150, 180 and 210 DAP+ T_6 and T_8-Untreated Check. Rynaxypyr 20 SC @ 75 g a.i./ha as sett treatment as well as drenching on 105 DAP recorded lowest mean incidence of ESB (20.41%) and INB (16.32%) as well as top borer (2.01%) and registered highest mean yield (104.82 tonnes/ha).

Keywords: Sugarcane; borers; rynaxypyr; Trichogramma chilonis; neem cake; cane yield.

1. INTRODUCTION

"Sugarcane (*Saccharum officinarum* L.) is not only high-valued crop of India but also one of the important cash crops and the second largest producer (405.4 million tons) in the world. (www.fao.org/faostat, 2022-23). In India, 21% of the agricultural land is used for sugarcane production and yields 22% of the total sugarcane in the world" (Abdullah et al., 2006). "Sugarcane is known to be attacked by as many as 212 insect pests and 76 non-insect pests in India right from germination to harvest" (Patil et al., 2004). "However, 15 pests are reported to cause considerable losses in yield" (Kumar, 2009; Ram et al., 2017). "Sugarcane shoot borers are the major destructive pests that cause 8 to 10% cane yield losses at the farmer's level and 10 to 15% sugar recovery losses in sugar industries" (Kumarasinghe, 1999; Ahad et al., 2016). "About 45% of yield losses in sugarcane are due to infestation by borer pests in different stages in sugarcane cultivation includes germination, tillering, early growth, active growth and elongation" (Rao et al., 2009; Rossato et al., 2013). "Among them, Early shoot borer, *Chilo infuscatellus*, inter nodal borer *Chilo sacchariphagus indicus* and top shoot borer *Scirpophaga incertulus* and *Scirpophaga excerptalis* are the major shoot borer pests distributed in all the sugarcane growing regions of India" (Chavan et al., 2021).

"Statistically the borers are causing losses of 25.5 million tonnes at national level. Developing Bio Intensive Integrated Pest Management (BIPM) package involves bio agents and safer insecticides to reduce borer infestation and facilitates sustainable yield, quality, monetary benefits to farmers and sugar mills to bring out green environment" (Ao-Mei et al., 2024). Keeping the above facts, this experiment was formulated with bio agents, botanicals, a new class insecticide (Rynaxypyr (Coragen) 20 SC) anthranilic diamide) and combination of mechanical, botanical and bio agent for the control of early shoot borer, internode borer and the top borer of sugarcane at Sugarcane Research Station, Sirugamani during 2020-2022.

2. MATERIALS AND METHODS

The field-testing of insecticides was undertaken at Sugarcane Research Station, Sirugamani during 2020-2022 to find out the effect of various BIPM components against sugarcane borer complex. The variety Si8 was planted in a randomized block design during March 2020 and March 2021 with 8 treatments replicated thrice. The size of each block was 10x8m. The treatments imposed were T1-Carbofuran 3G @ 1 kg a i ha^{-1} at basal and 105 DAP (days after planting), T2-Rynaxypyr 20 SC @ 75 g $aiha^{-1}$ (sett treatment) + soil drenching at 105 DAP @ 75 $gaiha^{-1}$, T3-Intercropping of blackgram+ mechanical removal of top borer infested shoots and egg masses of internode and top borers, T4- Neemcake @ 125 kg ha^{-1} at basal and 105 DAP, T5- Release of *Trichogramma chilonis* @ 2.5 cc ha^{-1} $release^{-1}$ starting from 30 to 180 DAP at 15 days interval (11 releases), T6-Combination of T4 + T5, T7- Intercropping of blackgram + Detrashing at 150, 180 and 210 DAP+ T6 and T8-Untreated Check. Observations on the incidence of shoot borer were recorded on 30, 45, 60 and 90th days after planting and percentage of shoot borer incidence was recorded and pooled incidence were worked out.

The internode borer incidence was recorded at the time of harvest based on number of canes affected with respect to total number of canes in a randomly selected row in each plot and percentage incidence of internode borer was worked out. Further, healthy and internode borer affected canes were recorded from 10 randomly selected canes in each plot for internode borer incidence and intensity to arrive infestation index as per formula.

$$Per\ cent\ incidence = \frac{No.of\ affected\ canes}{Total\ no.of\ canes}\ X\ 100$$

$$Per\ cent\ intensity = \frac{No.of\ internodes\ affected}{Total\ no.of\ internodes}\ X\ 100$$

$$Infestation\ index = \frac{Per\ cent\ incidence\ X\ Per\ cent\ intensity}{100}$$

The yield parameters like cane yield, commercial cane sugar (%) was recorded along with cane population and sugar yield were worked out. The data were statistically analyzed following the ANOVA technique (Panse & Sukhatme, 1985)

3. RESULTS AND DISCUSSION

Rynaxypyr 20 SC @ 75 g a i ha^{-1} recorded lowest mean incidence of early shoot borer (15.43% and 24.12%) in first plant and second plant crop respectively, followed by combination of Neemcake, *T.chilonis* and intercropping as well as detrashing. (T7) (Tables 1 & 2). Of the eight treatments, Rynaxypyr (Coragen®) 20 SC @ 75 g a.i. ha^{-1} seem to offer a good control and was found to be significantly superior to Carbofuran 3G@ 1 kg a.i. ha^{-1}. The plots receiving Rynaxypyr 20 SC recorded minimum mean population build up of internode borer (16.50% and 18.18%) in first plant and second plant crop respectively, thereby proving the most effective treatment of all treatments followed by T7 and also proved most effective against top borer (2.01% incidence) followed by T3. Rynaxypyr 20 SC @ 75 g ai ha^{-1} recorded highest mean yield of 102.50 tonnes/ha and 104.83 tonnes/ha in first plant and second plant crop respectively, followed by T7 (combination of Neem cake, *T.chilonis* and intercropping as well as detrashing). (Tables 3 & 4). The commercial cane sugar (CCS %) did not vary significantly among the treatments.

Table 1. Effect of BIPM components on early shoot borer incidence in first plant crop

Treatment		Early Shoot borer incidence (%)				
		30 DAP	45 DAP	60 DAP	90 DAP	Pooled
T1	Carbofuran 3G @ 1 kg a.i ha^{-1} at basal and 105 DAP (days after planting)	0.69	5.36	3.53	13.61	23.19
T2	Coragen 20SC @ 75 g a.i ha^{-1} (sett treatment) +soil drenching at 105 DAP@ 75 g a.i ha^{-1}	0.35	4.00	0.94	10.14	15.43
T3	Inter cropping of blackgram + Mechanical removal of top borer infested shoots and egg masses of internode and top borers	1.37	7.11	3.89	24.31	36.67
T4	Neem cake @ 125 kg ha^{-1} at basal and 105 DAP	4.43	10.53	4.24	18.91	38.12
T5	Release of *T. chilonis @ 2.5* CC ha^{-1} (11 releases)	1.46	12.37	6.00	18.73	38.56
T6	T4+T5	4.77	9.56	3.13	13.79	31.25
T7	Inter cropping of blackgram + Detrashing at 150, 180 and 210 DAP + T6	1.74	11.61	1.88	6.96	22.18
T8	Untreated Check	4.17	9.85	2.95	22.01	38.98
	SE(M) ±	0.11	0.06	0.10	0.28	0.22
	CD(p=0.05)	0.33	0.18	0.31	0.86	0.68

Mean of three observations; DAP-days after planting

Table. 2 Effect of IPM components on early shoot borer incidence in second plant crop

Treatments	Early Shoot borer incidence (%)				
	30 DAP	45 DAP	60 DAP	90 DAP	Pooled
T1	2.13	9.63	4.05	16.93	32.74
T2	1.25	5.67	1.78	15.42	24.12
T3	2.89	8.97	2.81	24.03	38.7
T4	4.12	10.21	2.83	22.68	39.84
T5	2.43	9.59	3.75	21.22	36.99
T6	2.58	10.44	3.29	18.32	34.63
T7	2.35	9.11	2.23	16.56	30.25
T8	5.21	14.24	4.93	27.36	51.74
SE(M) ±	0.11	0.07	0.12	0.25	0.24
CD(p=0.05)	0.34	0.20	0.38	0.78	0.72

Mean of three observations; DAP-days after planting

Table 3. Effect of BIPM components on Internode borer incidence and Yield Parameters in first plant crop

Treatment		% of INB incidence	% intensity	Infestation Index	CCS%	Cane yield (t/ha)	Sugar yield (t/ha)
T1	Carbofuran 3G @ 1 kg a.i ha^{-1} at basal and 105 DAP (days after planting)	30.36	11.08	3.36	12.97	88.33	11.46
T2	Coragen 20SC @ 75 g a.i ha^{-1} (sett treatment) +soil drenching at 105 DAP@ 75 g a.i ha^{-1}	16.50	3.84	0.63	13.05	102.50	13.38
T3	Inter cropping of blackgram + Mechanical removal of top borer infested shoots and egg masses of internode and top borers	38.00	12.00	4.56	12.92	80.83	10.44
T4	Neem cake @ 125 kg ha^{-1} at basal and 105 DAP	48.50	9.20	4.46	13.03	81.67	10.64
T5	Release of *T. chilonis @ 2.5* CC ha^{-1} (11 releases)	38.78	10.69	4.14	12.95	83.75	10.85
T6	T4+T5	34.33	10.33	3.55	13.00	87.50	11.38
T7	Inter cropping of blackgram + Detrashing at 150, 180 and 210 DAP + T6	29.00	8.21	2.38	13.03	93.75	12.22
T8	Untreated Check	58.33	16.09	9.38	12.67	70.33	8.91
	SE(M) ±	0.20	0.27	0.03	0.00	0.09	0.03
	CD(p=0.05)	0.59	0.82	0.08	NS	0.26	0.09

Mean of three observations; CCS- Commercial Cane sugar

Table 4. Effect of IPM components on INB and top borer incidence as well as Yield Parameters in second plant crop

Treatments	% of INB incidence	% intensity	Infestation Index	Top borer incidence (%)	CCS%	Cane yield (t/ha)	Sugar yield (t/ha)
T1	34.67	11.82	4.10	7.50	12.96	94.59	12.26
T2	18.18	4.77	0.87	2.14	13.00	104.83	13.63
T3	38.04	7.82	2.98	5.71	13.00	90.3	11.74
T4	43.48	13.88	6.03	11.67	12.93	90.85	11.75
T5	39.19	10.95	4.29	8.75	13.01	91.73	11.93
T6	37.21	10.54	3.92	7.08	12.88	93.49	12.04
T7	30.34	7.02	2.13	7.50	13.08	98.44	12.88
T8	59.68	18.67	11.14	16.25	12.78	83.90	10.72
SE(M) ±	0.20	0.27	0.03	0.00	0.09	0.03	SE(M) ±
CD(p=0.05)	0.69	0.92	0.13	0.32	NS	0.31	0.11

Rao et al., (2010) reported that cumulative incidence of early shoot borer varied from 26.57% in neemazole 0.5% to 41.77% in untreated control. The intensity of internode borer varied from 1.50% in *Ageratum conyzoides* 1.0% to 4.23% in Neem cake application @ 2t/ha. The cane yield varied from 72.58 t/ha in the plot where neem cake is applied @ 2t/ha to 92.58t/ha in neemazole 0.5% applied plot. Among all the treatments imposed neemazole 0.5% was proved to be effective in reducing the incidence of early shoot borer and internode borer and also registered more cane yield among botanical pesticides. Ao-Mei et al., (2024) stated that Bt sugarcane serves as an additional tool to complement conventional sugarcane borers control resistance programs.

The present findings are in agreement with the observations of Singh et al., (2009) who reported

that Rynaxypyr 20SC @ 100g a.i./ha was found to be best with minimum 0.12% infestation by early shoot borer as well as gave maximum yield of 77.13 MT/ha. Jaipal et al., (2010) recorded the similar observations and reported that the mean incidence of shoot borer was lowered by about 60 per cent due to Rynaxypyr 20 SC treatments given as root drench that registered significantly increased cane yield over the untreated control as well as the standard recommended insecticide carbofuran 3G. Likewise, Misra, (2008) reported that Rynaxypyr @ 50g a.s./ha gave a 87–90% reduction in eggplant fruit damage and combination of rynaxypyr @ 50g a.s./ha and NSKE @ 7 ml a.s./l recorded only 3.74% shoot and 2.12% fruit infestation in eggplant.(Sudarshan & Pijush, 2011) Thus, the insecticide Rynaxypyr could be selectively used in the management of sugarcane borers for higher yield.

4. CONCLUSION

Rynaxypyr 20 SC @ 75 g a.i./ha as sett treatment recorded lowest mean incidence of Early Shoot Borer (19.78%) and Internode borer (17.34%) as well as top borer incidence in second plant crop (2.01%) and registered highest mean yield (103.67 tonnes/ha). Thus, the insecticide Rynaxypyr could be selectively used in the management of sugarcane borer.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Abdullah, M., Begum, M. M., Rahman, M. A., & Biswas, M. M. (2006). Incidence of major insect pests to some promising sugarcane clones in Bangladesh. *Plants, 82*(965), 533–543.

Ahad, M. A., Ferdaus, R. R., Ahsan, M. R., Hoque, M. M., Islam, N., & A. N. M. S. (2016). Survey of major insect pests, uses of management practices and other related information of sugarcane (*Saccharum officinarum* L.) growers of the Northern Region of Bangladesh. *American Journal of Life Sciences, 3*(6), 408-411.

Ao-Mei, L., Zhong-Liang, C., Fen, L., Yong, Z., Cui-Xian, Q., Miao, W., You-Qiang, P., Shao-Long, W., & Dong-Liang, H. (2024). Sugarcane borers: Species, distribution, damage, and management options. *Journal of Pest Science, 97*, 1171-1201.

Chavan, S. M., Modi, P. K., & Pandya, C. D. (2021). Species composition of sugarcane shoot borers in South Gujarat. *Indian Journal of Entomology, 84*(4), 937-938.

FAO. (2022-23). *FAOSTAT*. https://www.fao.org/faostat/ (Accessed on 25.06.2024).

Jaipal, S., Chaudhary, O. P., & Prasad, R. (2010). Evaluation of rynaxypyr (Coragen) 20 SC for the management of early shoot borer and top borer in sugarcane. *Indian Journal of Sugarcane Technology, 25*(1&2), 47-50.

Kumar, A. (2009). Study on efficacy of different novel insecticides against sugarcane borer complex. (Ph.D. thesis, S.V.P. University of Agriculture and Technology, Meerut, U.P.)

Kumarasinghe, N. C. (1999). Insect fauna associated with sugarcane plantations in Sri Lanka. Division of Pest Management, Sugarcane Research Institute, Uda Walawe, Sri Lanka, 70190.

Misra, H. P. (2008). New promising insecticides for the management of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee. *Pest Management in Horticultural Ecosystem, 14*(2), 140–147.

Panse, V. G., & Sukhatme, P. K. (1985). *Statistical methods for Agricultural Workers*. ICAR.

Patil, A. S., Shinde, V. D., Magar, S. B., Yadav, R. G., & Nerkar, Y. S. (2004). Sugarcane woolly aphid (*Ceratovacuna lanigera* Zehnt) its history and control measures. *Proceedings of the 66th Annual Convention of the Sugar Technologists Association of India*, New Delhi, 133-155.

Ram, M., Singh, G., & Singh, H. (2017). Survey and surveillance of major sugarcane borers in Western Plain Zone of Uttar Pradesh. *Journal of Experimental Zoology India, 20*(2), 1261-1264.

Rao, C. V. V., Rao, N. V., Bhavani, B., & Naidu, N. V. (2009). Survey and surveillance of sugarcane insect pests in Andhra Pradesh. *Indian Journal of Plant Protection, 37*(1/2), 24-28.

Rao, N. V., Rao, C. V. N., Bhavani, B., & Naidu, N. V. (2010). Evaluation of botanical pesticides against early shoot borer and internode borer, *Chilo infuscatellus* Snellen, in sugarcane. *Journal of Entomological Research, 34*(3), 54-59.

Rossato, D. S. Jr., Costa, G. H., Madaleno, L. L., Mutton, M. J., Higley, L. G., & Fernandes, O. A. (2013). Characterization and impact of the sugarcane borer on sugarcane yield and quality. *Journal of Agronomy, 105*(3), 643-648.

Singh, G., Prasad, C. S., Sirohi, A., Kumar, A., & Ali, N. (2009). Field evaluation of rynaxypyr 20 SC against insect pests of sugarcane. *Annals of Plant Protection Sciences, 17*(1), 75-79.

Sudarshan, C., & Pijush, K. S. (2011). Management of *Leucinodes orbonalis* Guenee on eggplants during the rainy season in India. *Journal of Plant Protection Research, 51*(4), 326-328.

Peer-review history:
The peer review history for this paper can be accessed here:
https://pr.sdiarticle5.com/review-history/130235