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Sudhansu Bhagawati
Junior Scientist, Department of Entomology, Assam Agricultural University, Jorhat, Assam, India

Badal Bhattacharyya
All India Network Project on Soil Arthropod Pests, Department of Entomology, Assam Agricultural University, Jorhat, Assam, India

Himangshu Mishra
All India Network Project on Soil Arthropod Pests, Department of Entomology, Assam Agricultural University, Jorhat, Assam, India

Himangshu Mishra
All India Network Project on Soil Arthropod Pests, Department of Entomology, Assam Agricultural University, Jorhat, Assam, India

Correspondence
Sudhansu Bhagawati
Junior Scientist, Department of Entomology, Assam Agricultural University, Jorhat, Assam, India

Chemical management of termites (*Odontotermes obesus*) in preserved setts of sugarcane (*Saccharum officinarum*)

Sudhansu Bhagawati, Badal Bhattacharyya, Himangshu Mishra and Dhanalakhi Gogoi

Abstract
Field efficacy of some newer insecticides was evaluated against *Odontotermes obesus* in preserved setts of sugarcane at Assam Agricultural University, Jorhat during 2014-15. Three budded setts were treated with insecticides for one hour and were preserved by adopting "deep trench trash cover" method, in which seed stalks were vertically kept in narrow trenches with depth equal to the length of the stalks. In case of untreated control the setts were preserved horizontally. Experimental results indicated that all the insecticidal treatments were significantly superior over the untreated control in reducing termite infestation. The setts treated with clothianidin 50 WDG at concentration of 1ml/ lit registered the lowest infestation of termites (5.55 and 6.18% as number and portion infested respectively) and this treatment showed statistical parity with the combined application of acephate 50 per cent and imidacloprid 1.8 per cent at concentration 1ml/ lit treated setts (7.49 and 8.59%). Highest mean germination of eye buds was recorded in clothianidin 50 WDG treated setts (79.41%) followed by acephate 50% + imidacloprid 1.8% SP (72.49%) and imidacloprid 17.8 SL (71.94%) treated setts. The untreated control setts showed very high levels of termite infestation (82.93 and 78.37% based on number and portion of sett infested respectively) with 46.94 per cent sett germination exhibiting the impact of termite infestation when the setts were preserved before planting.

Keywords: Termite, efficacy, insecticides, sugarcane

1. Introduction

Sugarcane (*Saccharum officinarum* L.) is one of the most important sugar crops grown in India occupying an area of 5.03 million hectares with an average productivity of 70.86 tonnes per hectare [1]. It is also regarded as one of the major cash crops of Assam with an area of 0.30 lakh hectares and annual production and productivity of 10.99 lakh tonnes and 36.76 tonnes per hectare respectively [2]. As compared to the national average, one of the causes of low cane yield in Assam is due to the heavy infestation of several species of insect pests. More than 280 species of insects have been associated with sugarcane in India, of which nearly 24 species cause heavy losses to the quality as well as quantity of the crop [3]. Different species of lepidopterans borers and termites are the pests of major economic significance in Assam. Favourable climatic condition as well as different soil types of Assam favours the population build-up of termites which makes them one of the most abundant and problematic pest in almost all sugarcane growing areas of Assam. The most important species of termite infesting both preserved and planted sugarcane setts is *Odontotermes obesus*. The sett infestation may be up to 50 per cent, while infestation in standing crop may vary from 10-20 per cent [4]. Termite infestation in sugarcane occurs at two stages, *viz.*, (i) in the pre-monsoon sett sowing stage when the seed setts are placed in the soil for germination, and (ii) in the post monsoon stage when the cane is growing actively [5]. At the sowing stage, termites enter the buds through some abrasion or injury or directly through the cut ends. The infestation during the germination of eye buds results in complete destruction of the mother shoot and tillers. A number of physical, biological as well as chemical methods were extensively studied by Rust and Saran (2006) [6], Ahmed *et al.* (2006) [7] and Monica *et al.* (2009) [8] for the effective management of these subterranean termites. However, the growers preferred synthetic insecticides as compared to other methods because of their high efficiency to prevent the sett damage caused by the termites.

Pertinent to above, an attempt was made to evaluate some newer insecticide molecules at different concentrations in reducing the termite infestation in case of preserved sugarcane setts.

2. Materials and Methods

2.1 Study area

The experiment was conducted in the Instructional cum Research Farm, Assam Agricultural University, Jorhat (26.7465° N and 94.2026° E) during 2014-15. The experimental site was known to be previously infested by the termites in preserved sugarcane setts.

2.2 Experimental layout

The experiment was conducted as 3RBD (Randomized Block Design) and the size of individual plot was 4 x 3 sq. m. The variety "Dhansiri" (Co bln 9605) was selected for the experiment.

2.3 Treatments

Six insecticidal treatments *viz*., thiamethoxam 25 WG, imidacloprid 17.8 SL, acephate 50% + imidacloprid 1.8% SP, thiamethoxam 35 FS, imidacloprid 600 FS and clothianidin 50 WDG were applied @ 1 ml/ lit, whereas fipronil 5 SC was applied at three different concentrations (0.5, 1 and 1.5 ml/ lit). Three budded setts were treated with required amount of insecticides for one hour and then ten numbers of treated three budded setts were packed with a rope to make one bundle and this was treated as one replication. Treated setts were preserved by following the "deep trench trash cover" method in which "seed stalks" were vertically kept in narrow trenches with depth equal to the length of the stalks. However, in case of untreated control the setts were preserved horizontally.

2.4 Observations

Observations were recorded as per cent sett infestation and germination percentage by following the methodology [9] as delineated below:

$$\text{(i) Mean numbers of setts infested (\%)} = \frac{\text{Number of infested setts}}{\text{Total number of setts in each treatment}} \times 100$$

$$\text{ii) Mean portion of setts infested (\%)} = \frac{\text{Length of infested setts}}{\text{Total length of setts in each treatment}} \times 100$$

$$\text{(iii) Mean germination (\%)} = \frac{\text{Number of germinated buds}}{\text{Total number of buds in each treatment}} \times 100$$

2.5 Statistical analysis

Data on per cent sett infestation and germination percentage were transformed into angular values (arcsin $\sqrt{x}$) and finally angular transformed values were analysed by using analysis of variance (ANOVA) for Randomized Block Design [10].

3. Results and Discussion

The effect of insecticidal treatment on preserved sugarcane setts based on per cent termite infestation and germination of eye buds is presented in Table 1. Experimental results indicate that all the insecticidal treatments were significantly superior over the untreated control in reducing termite infestation. Out of all, clothianidin 50 WDG @ 1ml/ lit treated setts registered least termite infestation (5.55 and 6.18% based on number and portion of setts infested) and it was found to be at par with the combined application of acephate 50 per cent and imidacloprid 1.8 per cent treated setts (7.49 and 8.59%) (Table 1). The mean number of infestation of setts in fipronil 5 SC @ 0.5 and 1.5 ml/lit, imidacloprid 17.8 SL, fipronil 5 SC, thiamethoxam 25 WG, thiamethoxam 35 FS and imidacloprid 600 FS @ 1ml/ lit treated setts recorded 18.61, 12.55, 15.79, 14.60, 19.33, 21.08 and 22.46 per cent respectively. While considering the sett infestation (portion wise) by the termites, imidacloprid 17.8 SL @ 1 ml/lit and fipronil 5 SC @ 1.5 ml/ lit registered 9.62 and 12.04 per cent respectively and these treatments showed statistical parity with each other. The setts treated with the fipronil 5 SC @ 0.5 and 1 ml/ lit, thiamethoxam 25 WG, thiamethoxam 35 FS and imidacloprid 600 FS @ 1 ml/ lit did not found to be effective as compared to the above insecticides and registered 17.35, 16.20, 15.49, 19.04 and 19.89 per cent of sett infestation respectively (Table 1).

Treatment of preserved setts of sugarcane with synthetic insecticides must be able to suppress the termite infestation leading to considerable improvement in germination percentage of setts. The present study showed highest germination of eye buds in clothianidin 50 WDG @ 1ml/ lit (79.41%) treated setts which was significantly superior over rest of the treatments and it was followed by acephate 50% + imidacloprid 1.8% SP @ 1 ml/ lit (72.49%) and imidacloprid 17.8 SL @1 ml/ lit (71.94%). Barring these three insecticidal treatments, rest of the treatments registered low levels of germination percentage of setts (54.61-68.29). The untreated control setts showed a very high level of termite infestation (82.93 and 78.37% based on both number and portion of setts infested respectively) and registered only 46.94 per cent of germination depicting the effect of termite infestation when the setts were preserved without taking any insecticidal treatment (Table 1).

Superiority of clothianidin in suppressing the subterranean termites even at a very low concentration was earlier observed by Charoenkrun (2014) [11] who reported that when the dosage of clothianidin was increased to 0.10 or 0.15 per cent, the wood damage caused by the termites was reduced up to 5 per cent. Being an insecticidal mixture, the sett treated with acephate 50% + imidacloprid 1.8% SP also proved promising in preventing termite infestation. The present findings corroborate the findings of Smith *et al.* (2008) [12] who reported that the combination of acetamiprid and bifenthrin was more toxic to termites as compared to their lone application. Furthermore, due to the enhanced toxicity of insecticidal mixtures, they could also be used as a potential insecticide resistance management tool [13]. The less effectiveness of fipronil, imidacloprid and thiamethoxam as compared to clothianidin and acephate + imidacloprid treated setts might be attributed to their slow action against the

workers of termites. The slow action of fipronil and imidacloprid, which required more time to interact and kill the workers of termites was also reported earlier by Osbrink (2001) [14] and Manzoor *et al.* (2012) [15]. Moreover, considering the ill effects of fipronil to fish and aquatic invertebrates as reported by Li *et al.* (2010) [16] there is every possibility of contamination of water bodies if fipronil is used extensively for the management of termites.

Table 1: Management of termites through chemicals in preserved sets of sugarcane during 2014-15

Treatment	Dose (ml/ lit)	No. of infestation (%)			Portion of infestation (%)			Germination (%)		
		2014	2015	Pooled (2014 and 15)	2014	2015	Pooled (2014 and 15)	2014	2015	Pooled (2014 and 15)
T_1 : Thiamethoxam 25 WG	1	13.33 (21.43)	25.37 (30.01)	19.33	8.11 (16.55)	22.22 (28.00)	15.49	67.78 (55.45)	65.45 (54.08)	66.64
T_2 : Imidacloprid 17.8 SL	1	11.11 (19.28)	20.55 (26.87)	15.79	5.11 (12.69)	13.16 (21.26)	9.62	72.78 (58.72)	70.69 (57.85)	71.94
T_3 : Acephate 50% + Imidacloprid 1.8% SP	1	6.67 (12.13)	8.25 (16.68)	7.49	4.44 (7.14)	12.82 (20.73)	8.59	72.22 (58.35)	72.94 (58.57)	72.49
T_4 : Fipronil 5 SC	0.5	20.00 (26.37)	17.17 (24.38)	18.61	13.34 (20.35)	21.52 (27.44)	17.35	63.33 (52.78)	62.03 (51.98)	62.66
T_5 : Fipronil 5 SC	1	15.55 (23.14)	13.68 (21.69)	14.60	15.44 (18.83)	16.87 (24.28)	16.20	66.11 (55.16)	67.47 (55.18)	66.69
T_6 : Fipronil 5 SC	1.5	13.88 (21.88)	11.20 (19.40)	12.55	8.89 (17.12)	15.20 (22.94)	12.04	67.22 (55.20)	68.67 (56.81)	68.29
T_7 : Thiamethoxam 35 FS	1	17.78 (24.86)	24.72 (29.55)	21.08	15.56 (21.74)	22.62 (28.29)	19.04	60.00 (50.83)	60.61 (51.07)	60.21
T_8 : Imidacloprid 600 FS	1	24.44 (29.60)	19.80 (26.49)	22.46	22.22 (27.76)	17.72 (24.63)	19.89	53.33 (46.95)	55.70 (48.49)	54.61
T_9 : Clothianidin 50 WDG	1	4.44 (7.14)	6.67 (14.91)	5.55	2.22 (4.99)	10.10 (18.52)	6.18	80.00 (63.96)	78.79 (62.83)	79.41
T_{10} : Control		88.89 (73.11)	76.56 (61.73)	82.93	86.67 (68.18)	70.24 (56.89)	78.37	44.44 (41.25)	49.06 (44.71)	46.94
SED ±		3.50	2.11	1.16	4.29	1.20	1.63	2.97	2.50	1.69
CD (P=0.05)		7.35	4.43	2.43	9.01	2.51	3.43	6.24	5.26	3.54

4. Conclusion

The present study indicates that out of all insecticidal treatments, clothianidin 50 WDG registered a significantly lower incidence of termites coupled with a marked increase in per cent germination of preserved setts. The insecticidal mixture *i.e.* acephate 50% + imidacloprid 1.8% SP also could supress the termite infestation. Earlier in Assam, some old insecticides were recommended for protecting the sugarcane setts from the ravages of termites of late, clorpyriphos has also been recommended in preserved sugarcane setts to reduce termite infestation. However, considering the present scenario towards the development and use of newer insecticide molecules with better efficacy and safety records compared to old molecules, clothianidin can be explored as an alternative insecticide to clorpyriphos in reducing the termite infestation in preserved setts of sugarcane. However, proper analysis on residual toxicity of this chemical on soil health is required.

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6. References

1. Current Data on Sugarcane Production in India. 2016. http://www.gktoday.in/blog/current-data-on-sugarcane-production-in-india/.
2. District wise area, production and average yield of sugarcane. 2016. http://ecostatassam.nic.in/agri38_sugarcane_frm.html.
3. Gupta MK. *Chilo tumidicostalis* Hampson (Crambidae: Lepidoptera) - a serious pest of Sugarcane in Eastern India. Proceedings of National Symposium on Entomology as a Science and IPM as a Technology-the Way Forward, Arunachal Pradesh, India. 2014, 138-154.
4. Bhattacharyya B, Baruah AALH, Bhuyan U, Das P. Management of termites in preserved setts of sugarcane in Assam. Pesticide Research Journal. 2007; 19:45-46.
5. Roonwal ML. Termite injurious crops plantation and fruits and forest trees and their control: In "Termite life and termite control in tropical South Asia". Scientific publisher, Jodhpur. 1979, 27-30.
6. Rust MK, Saran RK. Toxicity, repellency and transfer of chlorfenapyr against western subterranean termites (Isoptera: Rhinotermitidae). Journal of Economic Entomology. 2006; 99:864-872.
7. Ahmed S, Mustafa Y, Riaz MA, Hussain A. Efficacy of insecticide against subterranean termites in sugarcane. International Journal of Agriculture and Biology. 2006; 8:508-510.
8. Monica V, Satyawati S, Rajendra P. Biological alternatives for termite control: a review. International Biodeterioration and Biodegradation. 2009; 63:959-972.
9. Sharma SK. Effect of cutworm population and shoot damage in potato on the tuber yield. Potato Journal. 2013; 40:114-121.
10. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research, Edn 2, Wiley-Interscience, John Wiley & Sons, New York. 1984, 680.
11. Charoenkrun K. A field trial in Thailand to evaluate the efficacy of a new non–repellent termiticide (clothianidin: Neonicotinoid) in preventing structural damages caused by subterranean termite. Proceedings of the 10th Pacific Termite Research Group Conference (B. T. Forschler, Ed.), Kuala Lumpur, Malaysia. 2014, 7-11.

12. Smith JA, Pereira RM, Koehler PG. Relative repellency and lethality of the neonicotinoids thiamethoxam and acetamiprid and an acetamiprid/bifenthrin combination to *Reticulitermes flavipes* termites. Journal of Economic Entomology. 2008; 101:1881-1887.
13. Khan HAA, Akram W, Shad SA, Lee JJ. Insecticide mixtures could enhance the toxicity of insecticides in a resistant dairy population of *Musca domestica* L. PLOS One. 2013; 8. e60929.
14. Osbrink WL, Lax AR. Effect of tolerance to insecticides on substrate penetration by Formosan subterranean termites (Isoptera: Rhinotermitidae). Journal of Economic Entomology. 2001; 95:989-1000.
15. Manzoor F, Sayyed AH, Rafique T, Malik SA. Toxicity and repellency of different insecticides against *Heterotermes indicola* (Isoptera: Rhinotermitidae). Journal of Animal and Plant Sciences. 2012; 22:65-71.
16. Li X, Bao C, Yang D, Zheng M, Li X, Tao S. Toxicities of fipronil enantiomers to the honeybee *Apis mellifera* L. and enantiomeric compositions of fipronil in honey plant flowers. Environmental Toxicology and Chemistry. 2010; 29:127-132.