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# Management of *Odontotermes obesus* (Ramb.) through bio-control agents in preserved setts of sugarcane

**Himangshu Mishra, Badal Bhattacharyya, Dhanalakhi Gogoi, Sudhansu Bhagawati and Snigdha Bhattacharjee**

**Abstract**
An investigation was carried out during 2015-16 and 2016-17 using five biocontrol agents along with chlorpyriphos 20 EC @ 2ml/lit as insecticidal check, against *O. obesus* in preserved setts of sugarcane in Jorhat, Assam. All the treatments were significantly superior over untreated control which recorded the highest level of infestation and poor germination percentage. Among the biocontrol agents, *Metarhizium anisopliae* @ $10^{12}$ spore/lit treated setts gave promising results and recorded lowest mean number (21.25 and 19.06%) and portion of setts (22.62 and 23.59%) infestation with germination percentage of 67.86 and 67.81 during 2015-16 and 2016-17 respectively. Insecticidal check chlorpyriphos treated preserved setts maintained its superiority by registering least mean number (15.16 and 14.84%) and portion of setts (14.81 and 16.10%) infestation coupled with a marked increase in per cent germination (78.02 and 76.82%) during both the years.

**Keywords:** Sugarcane, preserved setts, biocontrol agents, termite infestation

## Introduction
Termites are small to medium size insects which are of exceptional interest to entomologists for economical, biological and social studies. Economically, they are serious pests of agricultural, horticulture, plantation crops and forest trees. The species are subterranean and produce epigeal nests (mound above the soil surface) which are of different shapes and sizes with peculiar nesting arrangement inside the mound. Feeding preferences reveal that the species is preferred to feed on many wood materials which are attached to soil in addition it also form fungal garden in core portion of the mound. The genus, Odontotermes is one of the dominant group widely distributed in tropical and subtropical regions of India. *Odontotermes obesus* is a widespread species in India, Bangladesh and Pakistan [8, 4, 3]. Termite fauna of Northeast was studied long back during 1961 by Roonwal and Chhotani [13]. They reported 34 species and 16 genera of termites and the species were belonged to mainly 3 families viz., Kalotermitidae, Rhinotermitidae and Termitidae. Further, they also conducted similar type of survey in Rajasthan in 1978 and revealed the presence of 18 species from three different zones viz., arid zone, semi-arid zone and wet zone **[14]**. Out of 18 species recorded, *Heterotermes indicola* and *Coptotermes heimi* damaged the woods, *Anacanthotermes macrocephalus* damaged grasses and stored grain while *O. obesus* and *M. obesi* caused heavy damage in sugarcane, germinating wheat, maize and millets. Sugarcane is an important cash crop of Assam cultivated in 29.9 thousand ha area with production of 10.99 lakh metric tons during 2014-15 **[5]**. Sugarcane production in Assam is very scanty and far below the national average, the state not even qualify to enter among the top ten sugarcane growing states of India **[2]**. There may be various constraints which hinders the production of sugarcane in Assam. Lack of sugarcane industry, shifting from sugarcane to tea crop, lack of marketing facilities and wide infestation of many insect pests and diseases leads to drop in productivity of this perennial crop [7]. Among the various insect pests, damages caused by termite are an emerging threat to many sugarcane growing farmers of North eastern region. Infestation of termites is noticed throughout the year particularly, *Odontotermes obesus* (Ramb.) and *Microtermes obesi* (Holgren) in sugarcane setts (preserved and planted) as well as standing crops. The sett infestation may rise up to 50 per cent, while infestation in standing crop varies from 10-20 per cent **[15]**. Furthermore, the sub-tropical climatic conditions including the soil type of Assam

favors the population builds up of termites. Termite infestation in sugarcane occurs at two stages *viz*., (i) during the pre-monsoon sowing stage when the setts are placed in the soil for germination and (ii) during the post monsoon stage when the cane is growing actively [6]. 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 [7]. Most of insecticides tested against termites under laboratory conditions gave promising results, however the situation is completely upturned when these chemicals were tested in the field which may be due to the reason that most of the chemicals did not reach the target site or organism or are lost due to various reasons. Moreover these chemicals exert many direct or indirect losses which include ill effects on many beneficial organisms, deterioration and contamination of soil, water bodies and chronic effects on human health. Pertaining to the above there is a need to explore some alternatives to chemical insecticides in order to combat the termite problems. As such, use of bio-agents is one of the promising alternatives that can reduce termite infestation. Considering, the above an attempt was made to evaluate the effectiveness of some microbial control agents along with an insecticidal check against the *O. obesus* to protect the preserved setts of sugarcane.

## 2. Materials and Methods

### 2.1 Study area

The experiment on management of termites in preserved setts of sugarcane was conducted in the Instructional Cum Research Farm, Assam Agricultural University Jorhat (26.7465° N and 94.2026° E) during 2015-16 and 2016-17. The sugarcane variety Dhansiri" (Co bln 9605) was grown by following all the recommended package and practices of Assam [1]. The trial was conducted at a site which was known to be previously infested with termites.

### 2.2 Experimental layout

The present experiment was setup in randomized block design with four replications. In each treatments, ten bundles of sugarcane with 3 budded setts were tied and treated with different bio-control agents

### 2.3 Bio-control treatments and an insecticidal check

Bio-control treatments *viz., Metarhizium anisopliae* ($10^{12}$ spores/l), *Beauveria bassiana* ($10^{12}$ spores/l), *B. brongniartii* ($10^{12}$ spores/l), *Heterorhabditis bacteriphora*, *H. indica* @ 4 billion IJs/ha and an insecticidal check (chlorpyriphos 20 EC @ 2ml/lit) were used to reduce the infestation of *O. obesus*. Desired concentration of each treatment was mixed with 15 litres of water in suitable size of buckets. Sugarcane setts were then dipped into the buckets for 15 minutes and after that the setts were turn upside down and kept for another 15 minutes. The setts were then planted by adopting "deep trench trash cover" method **[7]** in which "seed stalks" were vertically kept in narrow trenches with depth equal to the length of the stalks. However, in case of Control (farmers practice) the setts were preserved horizontally.

### 2.4 Observations

Observations in respect of mean numbers of setts attacked (%), mean portion of setts attacked (%) and mean germination (%) were taken by following the methodology mentioned below [7]

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

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

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

### 2.5 Statistical analysis

Data on per cent sett infestation and germination percentage were transformed into angular values (arcsin √x) and finally angular transformed values were analysed by using analysis of variance (ANOVA) for Randomized Block Design [9].

## 3. Results and Discussion

In view of mean number of setts infestation, all the treatments were found to be significantly superior over the untreated control. Among all the five microbial treatments, *M. anisopliae* @ $10^{12}$ spore/lit treated setts recorded 21.25 and 19.06 per cent mean number of setts infestation, 22.62 and 23.59 per cent mean portion of sett infestation with a germination percentage of 67.86 and 67.81 during 2015-16 and 2016-17 respectively, which was significantly superior over rest of the treatments. Similar types of observation were also made by Hussain *et al*. [10] where *M. anisopliae* was incorporated in combination with the diesel oil in sugarcane field. The insecticidal check *i.e*., chlorpyriphos 20EC @ 2ml/lit recorded 15.16 and 14.84, per cent of mean number of setts infestation, 14.81 and 16.10 per cent of mean portion of setts infestation during 2015-16 and 2016-17 respectively (Table 1). The remaining treatments *viz. B. bassiana* @$10^{12}$ spores/l, *B. brongniartii* @ $10^{12}$ spores/l, *H. bacteriphora* @ 4 billion IJs/ha and *H. indica* @ 4 billion IJs/ha did not show any significant difference among each other. The untreated control recorded very high levels of termite infestation in number of setts and portion of setts (82.97 and 84.22 per cent and 33.44 and 35.89 per cent) with a very low germination percentage of 37.92 and 38.33 during both the years. Considering the germination percentage of sugarcane setts, chlorpyriphos 20 EC @ 2ml/lit treated setts registered the highest germination (78.02% and 76.82%) and it was found to be significantly superior over all of the bio-agents tested against termites during both the years' *i.e* 2015-16 and 2016-17 respectively. *M. anisopliae* @ $10^{12}$ spore/lit treated setts maintained its superiority over all other tested bio agents and recorded germination of 67.86 and 67.81 per cent during 2015-16 and 2016-17 respectively. The effectiveness of chlorpyriphos in reducing termite infestation was also observed in maize **[16]** and groundnut **[11]**. Similar findings against the Formosan subterranean termites and eastern subterranean termites have also been recorded earlier by Su and Scheffrahn [17]. More or less similar study conducted by Pujari *et al.* 2017 [12]. They found that application of chlorpyriphos 20 EC @ 400 g *a.i*.ha$^{-1}$ reduced the infestation of white grubs on tubers on weight and number basis (5.55 & 6.2% and 5.25 & 5.18% respectively).

**Table 1:** Management of termite through bio-control agents during 2015-16 and 2016-17

| Treatments | Mean% infestation | | | | Mean Germination (%) | |
|---|---|---|---|---|---|---|
| | Numbers of setts | | Portion of setts | | | |
| | 2015-16 | 2016-17 | 2015-16 | 2016-17 | 2015-16 | 2016-17 |
| *Metarhizium anisopliae* ($10^{12}$ spores/l) | 21.25 (24.14) | 19.06 (25.88) | 22.62 (28.40) | 23.59 (29.05) | 67.86 (55.46) | 67.81 (55.43) |
| *Beauveria bassiana* ($10^{12}$ spores/l) | 29.53 (32.92) | 30.94 (33.79) | 25.12 (30.08) | 27.78 (31.80) | 44.90 (42.07) | 42.81 (40.86) |
| *B. brongniartii* ($10^{12}$ spores/l) | 30.47 (33.50) | 29.69 (33.01) | 25.93 (30.61) | 28.41 (32.20) | 45.36 (42.34) | 42.81 (40.86) |
| *Heterorhabditis bacteriphora* @ 4 billion IJs/ha | 31.56 (34.18) | 32.66 (34.85) | 25.26 (30.17) | 24.17 (29.45) | 45.78 (42.58) | 42.92 (40.93) |
| *H. indica* @ 4 billion IJs/ha | 31.72 (34.28) | 34.06 (35.70) | 25.84 (30.55) | 27.01 (31.31) | 44.11 (41.62) | 40.57 (39.56) |
| Chlorpyriphos 20 EC @ 2ml/lit | 15.16 (22.91) | 14.84 (22.65) | 14.81 (22.63) | 16.10 (23.65) | 78.02 (62.04) | 76.82 (61.22) |
| Control | 82.97 (65.62) | 84.22 (66.59)) | 33.44 (35.33) | 35.89 (36.80) | 37.92 (38.00) | 38.33 (38.25) |
| S. Ed (±) | 1.42 | 1.22 | 0.94 | 1.36 | 0.58 | 0.82 |
| CD (P = 0.05) | 2.98 | 2.56 | 1.97 | 2.85 | 1.22 | 1.74 |

Figures in parentheses are angular transformed values

## 4. Conclusion

The present findings revealed that sets treated with chlorpyriphos 20EC @ 2ml/lt recorded least infestation of sugarcane sets on number (15.16% and 14.84%) and portion basis (14.81% and 16.10%) during 2015-16 and 2016-17 respectively. Moreover, all the microbial treated plots were significantly superior over untreated control and it was observed that among all the biocontrol agents, *Metarhizium anisopliae* @ $10^{12}$ spore/lit treated setts effectively reduced the infestation of sugarcane on number (21.25 and 19.06%) and portion basis (22.62 and 23.59%) with better germination percentage of 67.86 and 67.81 during 2015-16 and 2016-17. However extensive studies should be carried out in preparation and application of microbial agents to this notorious pest so that farmers will rely more on organic approaches to combat the termite infestation.

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