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SUPPRESSION OF TERMITE ATTACK IN TEA ECOSYSTEM WITH BIOPESTICIDES

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ABSTRACT

A field study was conducted during 2016-17 to evaluate the effectiveness of some biopesticides against *Odontotermes obesus* (Rambur) in tea ecosystem. The study revealed that the plants treated with *Metarhizium anisopliae* (Metchnikoff and Sorokin) showed lowest number and portion of termite infestation (stem) (13.86% and 12.04% and 14.11% and 12.04%) which was significantly superior over other treatments but statistically at par with *Heterorhabditis indica* (Poinar, Karunakar and David) treated plant (14.49% and 13.73% and 15.60% and 14.26%) after 30 and 60 days of treatment. The plants treated with AAU Jatropha oil 50 EC exhibited termite infestation of 15.52% and 16.56% on number basis and 14.60% and 15.36% on portion basis while neem oil treated plant recorded 16.01% and 17.09% of number of infestation and 15.17% and 16.44% of portion of infestation after 30 and 60 days of treatment respectively. The untreated control plots recorded 38.44% and 37.35% and 40.32% and 39.48% of infestation on number and portion (stem) basis after 30 and 60 days of treatment respectively.

Key words: *Odontotermes obesus*, tea gardens, *Metarhizium anisopliae*, *Heterorhabditis indica*, *Steinernema abbasi,* jatropha oil, neem oil

Tea, *Camellia sinensis* (L.) Kuntze is considered as one of the important commercial crop grown hugely in North Eastern regions of India The perennial nature of the crop and monocropping make it amenable for many pests and diseases. Every part of the tea plants are subjected to attack by many insect pests and diseases. There were many arthropod pests and nematodes reported to infest the tea plants (Muraleedharan, 1983; Chen and Chen, 1989). Among them termites are considered as serious pests, infected on both below and above ground portion of tea plant. It was estimated that about 15% of the total crop loss in tea, only because of termite attack (Das, 1962). Sometimes the infestation was more than 90% in old tea plantation at Barak Valley Region of Assam (Choudhury, 1999).

Management of termite is one of the difficult tasks because most of the termites are found within confined environment and exist in very large population. Most of the termites have their unique nest characteristics and qualified them to adopt any new environments. Holistic approach is necessary to manage the termites, as chemical control is ineffective. Moreover, management of termite through chemicals need specially designed equipment's to reach the target sites. Many biocontrol agents and botanicals give promising results against this destructive and notorious pest. Considering this, in the present study, biopesticides have been evaluated against termites in the tea ecosystem.

MATERIALS AND METHODS

The field experiment was conducted in 10 years old experimental plot for plantation crops, Department of Tea Husbandry and Technology, Assam Agricultural University, Jorhat (26.7465° N and 94.2026° E). The experiment was laid out in a Randomized Block Design with seven treatments and five replications. Before application of treatments, termites were counted from each plant and basal portion of tea plants. Infested stem portion of the tea plants were injected with water through syringe, as water enters into the infested stem, termites were come out as soon as it was collected and counted. Infestation of termites on tea plants in number and portion basis (stem) were calculated out on % basis. Six biopesticides treatments were tested for their effectiveness against termite. Among the six, four biopesticides viz., *Metarhizium anisopliae* (Metchnikoff and Sorokin), *Beauveria bassiana (Bals.-Criv.* and Vuill.) *Heterorhabditis indica* (Poinar, Karunakar and David), *and Steinernema abbassi (Travassos) were microbial origin whereas two viz.,* AAU jatropha oil 50 EC and neem oil 30 EC were of plant origin. These biopesticides were applied @ 10g/ m^2 in trench

prepared around the basal portion of the tea plants and the plant origin biopesticides *viz.,* AAU jatropha oil 50 EC (5%) and neem oil 30 EC (3%) were mixed with sticker (Tween 25) and smeared on the trunk region of the plants.

RESULTS AND DISCUSSION

Evaluation of the biopesticides against *O. obesus* in tea ecosystem revealed that all the treatments were found to be significantly superior (Table 1). However, the plants treated with *M. anisopliae* registered least number (13.86% and 14.11%) and portion of infestation (12.04% and 12.04%) in the stem and showed statistical parity with *H. indica* treated plants, where the infestation on number basis were 14.49% and 15.60% and portion basis were 13.73% and 14.26% after 30 and 60 days of treatment respectively. The *M. anisopliae* and *H. indica* exhibited significant difference compared to *B. bassiana treated tea plants, where* the infestation on number basis after 30 and 60 days of treatment were 23.26% and 25.72% and infestation on portion of the stem after 30 and 60 days of treatment were *22.56%* and 24.33%. The tea plants treated with AAU *Jatropha* oil 50 EC exhibited number of infestation (15.52% and 16.56%) and portion of infestation (stem) (14.60% and 15.36%), and this treatment showed statistical parity with neem oil 30 EC, where the infestation after 30 and 60 days of treatments on number basis were 16.01% and 17.09% and portion basis were 15.17% and 16.44%. The untreated control plants recorded 38.44% and 37.35% and 40.32% and 39.48% of infestation on number and portion basis after 30 and 60 days of treatment, respectively.

Logan et al. (1990) reported that direct application of entomopathogenic nematodes on infested portion of tea bushes were effective in reducing the termite infestation. Evaluation of some botanicals viz. *Andrographis paniculata* (Burm. F) Nees, *Allium sativum* (L), *Lantana camara* (L) and *Curcurna* sp. against termite infestation in tea ecosystem revealed that *A. paniculata* contributed lowest % of termite infestation in treated tea plants (Choudhury *et al.*, 2005**)**. In a study conducted by Bhattacharyya et al. (2014) revealed that rapid decrease of termite infestation in terms of % infestation (21.25% and 19.06% and 22.62% and 23.59%) as numbers and portions basis in sugarcane crops, when the sugarcane setts were treated with *M. anisopliae* @ 10^{12} spore $litre^{-1}$. Shapiro-Ilan et al. (2004) reported that combined application of *H. indica* and *M. anisopliae* showed most potentiality in management of pecan weevil, grubs, *Curculio caryae* (G. H. Horn). The present findings on management of termites through application of biopesticides can help tea growers to formulate suitable management strategies.

Table 1. Evaluation of biopesticides against *O. obesus* in tea ecosystem

Treatments	Dose	Pretreatment count	30 DAT		Pretreatment count	60 DAT	
			No. of infestation (%)	Portion of infestation (%)		No. of infestation (%)	Portion of infestation (%)
Metarhizium anisopliae	10 g/m^2	27.03	13.86 (21.32)	12.04 (20.01)	28.52	14.11 (21.79)	12.04 (20.03)
Beauveria bassiana	10 g/m^2	28.25	23.26 (28.83)	22.56 (28.31)	29.71	25.72 (30.43)	24.33 (29.24)
Heterorhabditis indica	10 g/m^2	27.32	14.49 (22.31)	13.73 (19.74)	28.41	15.60 (23.24)	14.26 (22.06)
Steinernema abbassi	10 g/m^2	29.78	20.89 (27.11)	19.63 (23.97)	30.77	21.35 (27.50)	20.48 (26.52)
AAU Jatropha oil 50 EC	5 %	28.31	15.52 (23.13)	14.60 (22.18)	29.50	16.56 (23.94)	15.36 (22.06)
Neem oil 30 EC	3 %	29.67	16.01 (23.53)	15.17 (21.02)	30.21	17.09 (24.32)	16.44 (23.73)
Untreated Control	-	31.44	38.44 (38.31)	37.35 (37.59)	32.05	40.32 (39.43)	39.48 (38.92)
SEd (±)			0.60	1.68		0.45	1.02
CD (P=0.05)		NS	1.27	3.57	NS	0.95	2.16

*Data in parentheses angular transformed values; *DAT: Days after treatment; *NS: Non-significant

REFERENCES

Bhattacharyya B, Mishra H, Gogoi D, Bhagawati S. 2014. Management of termites through biocontrol agents in Assam. Current Advances in Agricultural Science 6(2): 176-179.

Chen Z, Chen X. 1989. An analysis of the world tea pest fauna. Journal of Tea Science 9(1): 13-22.

Choudhury P. 1999. Studies on the pests of *Camellia sinensis* (L) Kuntze and their control in the tea agro-ecosystem in Barak Valley, Assam. Ph.D thesis, Gauhati University. 65 pp.

Choudhury P, Dutta B K, Bhattacharjee P C. 2005. Control of termites in tea (*Camellia sinensis* L) Plantations of Barak Valley, ASSAM. International Journal of Tea Science 4(1): 9-17.

Das G M. 1962. Termites in tea, termites in humid tropics. Humid Tropics Research UNESCO: 229-231. Proceedings. New Delhi Symposium

Das G M. 1965. Pests of tea in north-east India and their control. Memorandum No. 27: 75-76.

Das S C, Mukherjee S, Gope B, Satyanarayana G. 1982. Termites in Cachar- An ecological study. Tea Research Association. Two and A Bud 29(1): 3-4.

Eggleton P. 2000. Global patterns of termite diversity. Termites: evolution, sociality, symbiosis, ecology. Kluwer Academic Publications, Dordrecht, Netherlands. pp. 25-51.

Krishna K, *Grimaldi D A, Krishna V, Engel M S. 2013. Treatise on the Isoptera of the World. Bulletin of the American Museum of Natural History 377(7): 1-200.*

Harler E R. 1966. Tea growing, Oxford University Press, London, pp. viii+ 162.

Logans J W M, Cowie R H, Wood T G. 1990. Termite (Isoptera) control in agriculture and forestry by non-chemical methods - a review. Bulletin of Entomological Research 80(1): 309- 330

Muraleedharan N. 1983. Tea entomology: an overview. UPASI TRI, Cinchona, India. Occasional publication 4(1): 1-11.

Muraleedharan N. 1992. Bioecology and management of tea pests in southern India. Journal of Plantation Crops 20(1): 1-21.

Sands W A. 1977. The role of termites in tropical agriculture. In: Termites and soils Academic Press, Outlook on Agriculture 9(3): 136-143.

Shapiro-Ilan D I, Jackson M, Reilly C C, Hotchkiss M W. 2004. Effects of combining an entomopathogenic fungi or bacterium with entomopathogenic nematodes on mortality of *Curculio caryae* (Coleoptera: Curculionidae). BioControl 30: 119-126.

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