Ann. Entomol., 28(2) : 83-87 (2010) ISSN 0970-3721

STUDIES ON CHLORFLUAZURON 0.1% BASED BAITING SYSTEM FOR TERMITE MANAGEMENT IN BUILDINGS IN INDIA

by

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Abstract

Termite baiting system is an alternative approach and newly emerged termite management tool for buildings. Small amount of less-toxic bait material is deployed to eliminate the whole termite colony attacking buildings. Foraging termites consume the bait material and share it with their nest-mates, resulting decline in numbers leading to colony elimination. In the present study, a baiting system containing Chlorfluazuron 0.1% as the active constituent was studied in different climatic and soil conditions in India. Three experiments viz. (i) Elimination of termite colonies from termite infested buildings (ii) Elimination of termite colonies from active termite mounds and (iii) Study on leaching effect of Chlorfluazuron 0.1% were performed. Based on the results and observations of these tests; it can be concluded that this bait material is 100% effective for termite management in buildings in India.

Keywords : Termite control, baiting, Building, Pest, Chlorfluazuron, I.G.R.

Introduction

Termite is considered a major pest of buildings worldwide. Tiny termites become very much dangerous, when it starts entering into costly buildings and damaging them. Huge damage is reported to cellulosic materials as well as non-cellulosic materials every year. Among all, subterranean termites are most destructive to buildings and account for 95% damage. Currently in India, anti-termite treatment to buildings is totally dependent on the use of highly toxic pesticides. A typical "anti-termite treatment" may involve application of thousands of litres of toxic pesticidal solution, which introduces toxins in the home environment and soil also. In contrast, bait material containing "Chlorfluazuron" as an active constituent is a low toxic benzoyl phenyl urea, requiring ingestion by target pests to be efficacious.(Fig.1) It disrupts the formation of chitin at the time of moulting, resulting in the failure of the termite to complete the moulting process, eventually killing the affected termites (Rojas *et al.*, 2001). About, 50% of the insect cuticle is comprised of chitin, a polysaccharide of N-acetyiglucosamine. This polymerization is blocked by the bait material. (Peters and Fitzgerald, 2003, Garcia *et. al.*, 2007) The bait material itself contains a pure alpha-cellulose that termites readily consume. Additionally, the bait material is not applied directly to the soil, it is instead contained within tamper –resistant stations, which further increases the environmental benefits for this method of termite management.

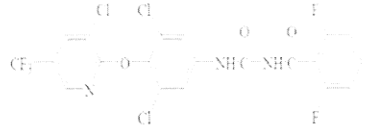


Fig.1: Chemical structure of Chlorfluazuron

Materials and Methods: Two types of bait stations are used in the study, which are as follows-

(a) **In Ground Bait Station (I.G.B.S.):** IGBS is designed to enhance termite transition to and

consumption of bait material. It consists of a hollow plastic body with perforations in its sides and bottom, which allow termites to enter the station freely. The cover of IGBS is temper resistant and removable. Each bait station contains six wooden interceptors of *Eucalyptus regnans* measuring 175mm (+/-3.0mm) x 36.5mm (+/-1.0mm) x 5mm (+/-0.5mm), which are positioned around the edge of station and accessible to termite through the perforations in the sides. Interceptors provide a food source for termites that establishes termite's activity within the station. After interception of a termite colony, the bait is made continuously available for consumption by placing in the vacant centre cavity of the station and replenishing it for as long as termite activity is present in the station.

(b) **Above Ground Bait Station (AGBS):** Timber interceptors are not used in AGBS. Instead the termites are intercepted directly with the bait material itself. An AGBS measure 180mm x 80mm x 80mm with an approximate capacity of 0.5kg bait material. The cover is held in place with six tamper – resistant screws. Perforations on the back of station allow termites to enter the station and feed on the bait material. They are installed on termite infested timbers, dry walls, pillars or other areas of termite activity. (Peters and Fitzgerald, 2003)

(c) **The bait material:** The bait material is light, cream colored powder with appearance similar to flour. One part of bait material is mixed with six parts of water (w/w) or one part of bait material with 1.5 parts of water (v/v). The bait and water are mixed gently to form dough like mixture.

(i) **Elimination of termite colonies from termite infested buildings:**

Eight infested buildings were selected for experiment in each site (Roorkee, Dehradun and Mysore). The predominant termite species present were *Heterotermes indicola* (Wasmann), *Odontotermes bellahunisensis* (Holmgren & Holmgreen), *Odontotermes feae* (Wasmann) and *Odontotermes obesus* (Rambur) etc.

(a) **Installation and monitoring of bait stations**:

IGBS were installed strategically around each structure at a distance of about 0.50 - 0.75mt from perimeter walls and the distance between one IGBS to another IGBS was 1.5 mt. AGBS were installed only on points of termite activity. Each station was inspected regularly throughout the experimental period. They were continuously replenished to ensure bait material was always present. During inspection, the interceptors were visually inspected. If termites were present and sufficient consumption of bait material had occurred, re-baiting was carried out. Bait material inside all stations was kept moist to keep it attractive to termites. (Potter *et al.*, 2001, Su *et al.*,1995, 2000)

(b) **Observations**:

In Roorkee, 121 IGBS and 65 AGBS were placed, while in Dehradun 100 IGBS and 37 AGBS, in Mysore site 95 IGBS and 34 AGBS were installed. The average consumption of bait material was 0.2247 kg / station in Roorkee, 0.2613 kg /station in Dehradun and 0.2891 kg / station in Mysore. Nearly 58% of the stations were attacked within one week. Only 26% of bait stations remained un-attacked at the end of the test period. The rate of consumption was highest during the first month. All termite infested buildings were observed free from termites within fifteen to seventeen weeks. The observations were recorded periodically for one year and are tabulated in Table -1, Fig.2. (Evans, 2001; Su *et al.*, 2000).

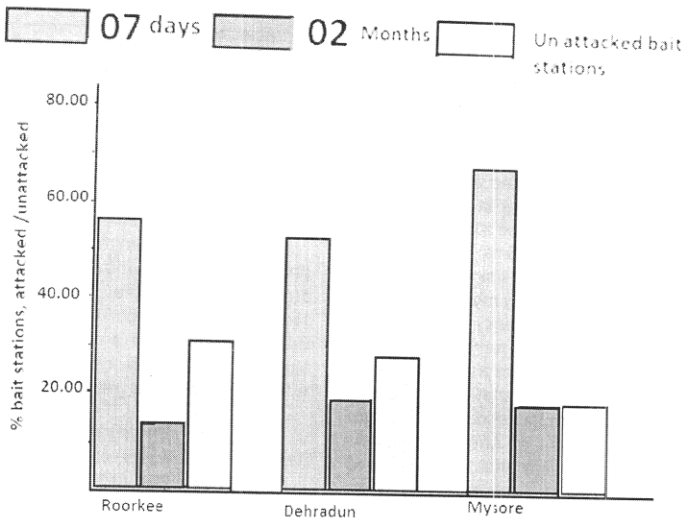
(ii) **Elimination of termite colonies from active termite mounds:**

Eradication of a termite colony in the field provides conclusive evidence of effectiveness of material. Ten active mounds were selected in each experimental site. Eight mounds at each site were treated and two were left as untreated (control). Mounds were selected on the basis of their physical proximity, easy to access, and other subjective attributes. The minimum height and diameter of selected mounds was 1.1

Table 1. Showing total number of bait stations installed in buildings and summary of results.

Name of Site	Total building treated	Total bait station installed			Number and % of bait station attacked				Number and % of bait station not attacked
		IGBS	AGBS	Total	Months				
					0M	02M	04M	06M	
RKE	08	121	65	186	(105) 56.0%	(24) 13.0%	00	00	(57) 31.0%
DDN	08	100	37	137	(73) 53.2%	(27) 19.7%	00	00	(37) 27.0%
MYE	08	95	34	129	(82) 63.5%	(23) 17.8%	00	00	(24) 18.6%
TOTAL	24	316	136	452	(260) 57.5%	(74) 16.3%	00	00	(118) 26.1%

Abbreviations: RKE-Roorkee, **DDN**-Dehradun, **MYE**-Mysore, **NR**-Not Required



Graphic Representation of Results

Fig.2: Percentage of attacked and un-attacked bait stations during first two months of experiment

mt and 2.5 mt; with a maximum height and diameter of 2.0 mt and 3.50 mt respectively.

(a) Installation and monitoring of bait stations:

Four IGBS were placed in each mound. 0.20 kg of bait material was initially placed in each station. Bait was replenished as required, depending upon the number of termites present and quantity of bait material consumed. At each observation, a small section of mound was separated from the main structure and termite activity, as well as the presence of live termites was noted. This served as an indicator of colony health.

(b) Observations:

Mounds were inspected periodically. An increase in the ratio of soldier to worker termites was recorded after two months and a slight mottled discoloration to the termites was noted. No live termites were found in any of the treated mounds after four months. All the treated mounds destructively sampled after four months and found to have been eliminated. Treated mounds were compared with untreated (control) mounds at the end of trial. All control mounds were recorded as healthy with the termite queen present.

(iii) Study on leaching effect of Chlorfluazuron 0.1% :

0.10 kg soil was collected from the bottom of distantly placed IGBS to study leaching effect of bait material. The soil samples were collected from 0 - 0.15mt, 0.15 - 0.30 mt and 0.30 - 0.45mt depth using augur. All the samples were thoroughly mixed, ground and sieved. Distilled water was mixed in the soil so that the moisture content should be around 20%. 0.025 kg soil was used in three separate glass petri- dishes (90 mm dia) in the form of 3-4mm thin bed. Active termite workers (10 Nos.) of *Microcerotermes beesoni* species were released over these beds and their rate of mortality were determined. It was compared with the rate of mortality on untreated soil and Chlorpyrifos 1.0% treated soil. The soil was collected from the buildings having pH range 7.7 to 8.2, when it was diluted with water (at the ratio 1:2.5 water) and minimum percentage of organic carbon was 0.74 and maximum 1.75. (Grace *et al.*, 1996, Su 1994, Su and Scheffrahn 1996, Su *et al.*, 1995 b, Tsunoda *et al.*, 1998)

(a) Observations:

The observations of termite mortality test were recorded after every two hours interval up to 72 hrs. It was compared with the observations of soil treated with Chlorpyrifos 20 E.C. at 1.0% one year ago and untreated soil. There was no difference in mortality rate of termites on the soil collected under the IGBS and untreated soil. However, mortality rate was very high on soil treated with Chlorpyrifos 20 E.C. at 1.0% one year ago.

RESULTS AND DISCUSSIONS:

Based on the findings of above experiments; it can be concluded that 100% protection from termites was achieved, through colony elimination, within fifteen to seventeen weeks from the date of installation of bait stations in all the treated buildings at all experimental sites from three different regions of India. Bait material was also found equally effective in active mounds of *Odontotermes obesus* species in all the sites. However, no contact toxicity with bait material was observed as in case of soil treated with Chlorpyrifos 20 E.C. at 1.0%.

ACKNOWLEDGEMENTS:

The author is thankful to M/S Pest Control (India), Pvt. Ltd. Mumbai; for sponsoring the project to this institute. The assistance of all persons of C.B.R.I. Roorkee, P.C.I. Mumbai, and B.C.R.L. Bangalore (a research unit of PCI, Mumbai), who were directly or indirectly involved in the project are also gratefully acknowledged.

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Published by : Surya International Publications, 4-B, Nashville Road, Dehra Dun (Uttarakhand), India