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EVALUATING A TERMITE INTERCEPTION AND BAITING SYSTEM IN AUSTRALIA, THAILAND AND THE PHILIPPINES

BRENTON C. PETERS[1] AND STEVEN BROADBENT[2]

[1]Department of Primary Industries and Fisheries, Indooroopilly, Queensland 4068, Australia

[2]Ensystex Australasia, 2/47 Day Street North, Silverwater, NSW 2180, Australia

EVALUATING THE EXTERRA™ TERMITE INTERCEPTION AND BAITING SYSTEM IN AUSTRALIA, THAILAND AND THE PHILIPPINES

BRENTON C. PETERS[1] AND STEVE BROADBENT[2]

[1]Department of Primary Industries and Fisheries, Indooroopilly, Queensland 4068, Australia

email address: brenton.peters@dpi.qld.gov.au

[2]Ensystex Australasia, 2/47 Day Street North, Silverwater, NSW 2180, Australia

email address: sbroadbent@ensystex.com

Abstract The Exterra Termite Interception and Baiting System (Ensystex Inc., Fayetteville, NC) was evaluated in field experiments in Australia, Thailand and the Philippines. Cellulose-acetate powder containing chlorfluazuron (Requiem™) was tested for its efficacy in eliminating colonies of various mound-building subterranean termite species. Using 0.05% and 0.1% weight/weight chlorfluazuron there was no evidence of repellence and all colonies were eliminated. Colony elimination was confirmed by destructive sampling. Indicators used to monitor colony health were reliable. A suite of urban trials, demonstrating the effectiveness of Exterra Requiem Termite Bait in controlling a wide range of subterranean termite species, is also presented and discussed.

Key words: bait technology, chlorfluazuron, *Coptotermes acinaciformis*, *Globitermes sulphureus*, *Macrotermes gilvus*

INTRODUCTION

Some economically important subterranean termite species build mounds (epigeous nests). These mounds provide an opportunity to test the effectiveness of bait toxicants, under field conditions (Peters and Fitzgerald 1999). The use of mounds avoids the need to use multiple mark-release schemes (see Su et al. 1991) to verify the effects of the bait toxicant on the termite colonies. Problems with multiple mark-release schemes are discussed by Evans et al. (1998, 1999) and by Evans (2001).

Ensystex Inc. (Fayetteville, North Carolina, USA) has developed the Exterra Termite Interception and Baiting System, which utilises a toxicant incorporated into an edible bait matrix. The toxicant used in Australia and South East (SE) Asia is chlorfluazuron (a chitin synthesis inhibitor) and the bait matrix is a cellulose-acetate compound. Both the system and bait toxicant required testing under conditions prevalent in Australia and SE Asia, against economically important species of termite present in the region, to facilitate product registration.

Evaluation of the susceptibility of the bait matrix and the efficacy of chlorfluazuron in eliminating colonies of *Coptotermes acinaciformis* (Froggatt), *Globitermes sulphureus* (Haviland) and *Macrotermes gilvus* (Hagen) took place in Australia, Thailand and the Philippines, respectively. Results from a suite of urban trials, conducted throughout Australia, Thailand and the Philippines, are also presented and discussed. The Australian data were sourced from Peters and Broadbent (2003) and from Peters and Fitzgerald (2003) and are presented for comparison purposes.

MATERIALS AND METHODS

Field Trials

The work in Australia was conducted in a state forest about 45 km north-west of Townsville, North Queensland, where *C. acinaciformis* occurs commonly in mounds. Eight *C. acinaciformis* mounds were located and five were treated. In Thailand, the trial was located at Nong Ta You Forest Plantation in the Sriracha District about 60 km from Bangkok. Six mounds of *G. sulphureus* were located and five were treated. In the Philippines the trials were established at a property in Antipolo, 55 km from Manila City. The fruit property is one hectare of rural land containing fifteen *M. gilvus* mounds of various sizes and three were treated.

In Australia and Thailand, at each mound, a trench (about 50 × 100 × 1000 mm long) was dug radially to the mound. One end of the trench was extended into the outer crust of the mound until live termites were encountered. 'Feeder' material, 35 × 70 × 1000 mm long, was placed in each trench with one end inserted into the mound. In Australia radiata pine *Pinus radiata* D.Don was used and in Thailand rubberwood *Hevea brasiliensis* (Willd.) Muell.-Arg. was used. Five Exterra Quarterra Stations were then placed into the ground along each stud. In the Philippines no timber 'feeder' material was used. Four Exterra Quarterra Stations were located at opposite points of the quadrant about one metre from the centre of the colony. The Exterra Quarterra Station is a round plastic bait Station consisting of inter-locking halves with horizontal slots, to allow the entry of termites, and a lockable plastic lid. Inside the Station are a series of vertical slots, which house timber interceptors. These are billets of untreated timber *Eucalyptus delegatensis* R.T.Baker used to intercept foraging termites. Each Station

holds about 250 g of dry bait matrix. In Australia and Thailand, Station 1 was proximal, and Station 5 was distal to the mound. Once the devices were in place the trenches were backfilled with soil to the level of the Station lid.

Ensystex Australasia supplied the bait matrix (cellulose-acetate powder with chlorfluazuron) and control matrix. Approximately 250 g of bait matrix was mixed with 1.5 litres of clean water and added to each Station. In Australia 0.05% weight/weight (w/w) chlorfluazuron was used and in Thailand and the Philippines 0.1% w/w chlorfluazuron was employed. Mounds were inspected at regular intervals after the initial treatment and an estimate made of the quantity of bait matrix eaten at each Station. Bait matrix was generally replenished at each inspection as required.

A 400-mm-long timber dowel was placed into a conduit in each mound and used as a ‘dip-stick’ to measure colony health. The presence of termites, faecal mottling and feeding on the dowel was used to indicate an active colony. Commencing at the third inspection, a small section of the mound was separated from the main structure and the presence of live termites noted. The section was replaced and repairs noted at the next inspection. Colonies showing decline were destructively sampled, when it appeared evident that no further activity was present at the colony, using a pick and shovel, and a search made for live termites in the mound.

Urban Trials

Over 175 urban trials were conducted throughout Australia, Thailand and the Philippines, as remedial treatments, on a range of termite species, to evaluate the effectiveness of the Exterra Termite Interception and Baiting System using 0.05% and 0.1% w/w chlorfluazuron. A range of high profile sites with termite infestations was

included in the urban trials. These were often sites where control had not been achieved despite many attempts using a variety of traditional chemical methods over many years.

RESULTS AND DISCUSSION

Australian Field Trial (0.05% w/w chlorfluazuron)

The following observations were made during four monthly inspections:

- Termites 'muddied' the inside of most Stations.
- Bait matrix consumption was greatest in Station 1 (400 g) and least in Station 5 (0-80 g), with some variation between mounds.
- Ants, principally *Iridomyrmex purpureus* (F. Smith) group and *Papyrius nitidus* (Mayr) group, were present in Stations where bait matrix consumption was least.
- Replenished bait matrix was generally not consumed.
- At the third inspection, termites and feeding were absent from dowels inserted into all test mounds, suggesting the colonies were in decline. Termites were also absent when small sections of the mounds were removed, and in some of the Stations the ant activity had increased.
- All five *C. acinaciformis* colonies were confirmed dead due to the effects of the 0.05% chlorfluazuron bait toxicant.
- One mound was occupied by *Microcerotermes* sp.

The results of the four-month experiment indicated that 440 g of 0.05% w/w chlorfluazuron caused colony elimination. The bait matrix was readily consumed, with no evidence of repellence, supporting work by Rojas and Morales-Ramos (2001). Replenished bait matrix was seldom consumed and was unnecessary for colony elimination. Indicators used to monitor colony health were reliable.

Thailand Field Trial (0.1% w/w chlorfluazuron)

All five treated *G. sulphureus* colonies were eliminated within four months. Results were similar to those in Australia except that:

- Total bait matrix consumption was greater (5,800 g to 10,000 g per mound).
- Replenished bait matrix was generally consumed.
- In addition to the *G. sulphureus*, *Macrotermes* sp., *Coptotermes* sp., *Bulbitermes prabhae* Krishna and *Hypotermes* sp. were recorded feeding on the matrix.

Philippines Field Trial (0.1% w/w chlorfluazuron)

All three treated *M. gilvus* colonies were eliminated within four months.

Results were similar to those in Australia except that:

- Total bait matrix consumption was greater (2,600 g to 3,150 g per mound).
- Replenished bait matrix was generally consumed.

Bait consumption per Station was higher in both Thailand and the Philippines, due to the use of an improved moister matrix. The exceptionally high rates of consumption in Thailand are also attributed to the presence of other termite species feeding on the matrix.

Urban Trials

Termite species and corresponding number of buildings successfully treated during registration trials in Australia, Thailand and the Philippines are presented in Table 1. Presumed colony elimination was achieved at all sites. In about 15% of these urban sites, the colony was located and elimination confirmed by destructive sampling, the use

of temperature probes or borescopic investigation. The average consumption of Exterra Requiem Termite Bait was about 1,000 g per colony, with one colony of *Schedorhinotermes* sp. consuming 2,900 g of bait matrix. Using a formulation with 0.1% w/w chlorfluazuron, colony elimination during summer months was less than 50 days, and for all trials was less than 63 days.

Table 1: Termite species and corresponding number of buildings successfully treated with the Exterra Termite Interception and Baiting System in Australia, Thailand and the Philippines

Termite species	Number of buildings
Coptotermes acinaciformis (Froggatt) [A]	85+
C. a. raffrayi Wasmann [A]	5+
C. frenchi Hill [A]	21+
C. michaelseni Silvestri [A]	10+
Nasutitermes exitiosus (Hill) [A]	6+
N. walkeri (Hill) [A]	3+
Schedorhinotermes spp. [A]	17+
Heterotermes ferox (Froggatt) [A]	5+
Coptotermes gestroi Wasmann [T]	4
Coptotermes vastator Light [P]	15
Microcerotermes spp. [P]	6
Total	177+

A = Australia; T = Thailand; P= Philippines

Some interesting aspects of termite behaviour were observed during urban trials. For example, the rate of bait removal was greatest when large amounts of bait matrix were provided, as demonstrated by Waller and La Fage (1987). Shortly before colony elimination, thousands of soldier termites were often found aggregated in the baited Stations. On some occasions nymphs and alates were also found (see Lenz and Evans, 2002). The bait matrix was seen incorporated into the walls of the royal chamber of the nest (see Evans, 2001). On other occasions, termites produced large amounts of 'muddy' material external to the Above-ground Stations, with worker and soldier termites observed outside of this material. Further timber damage was not noted after termites commenced feeding on the Exterra Requiem Termite Bait. On several occasions in all countries where termite activity in the building was minimal, high levels of termites were quickly aggregated in the Exterra Above-ground Stations indicating the preference of these termites for feeding on the bait matrix.

Observable changes in termite behaviour and physiology were recorded and provided reliable indicators to colony vigour and projected time to colony elimination. Such features included the build-up of uric acid, colour changes and the presence of *Pscocids* in termite workings. These indicators corresponded to physiological changes observed using electron microscopy to reveal damage to the peritrophic membrane, malpighian tubules and mandibles. In Australia, a moister bait matrix was more successful during summer months.

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