Proceedings of the Fifth International Conference on Urban Pests
Chow-Yang Lee and William H. Robinson (editors), 2005.
Printed by Perniagaan Ph'ng @ P&Y Design Network, Malaysia.

FIELD EVALUATION OF NOVIFLUMURON FOR CONTROLLING ASIAN SUBTERRANEAN TERMITE, *COPTOTERMES GESTROI* (ISOPTERA: RHINOTERMITIDAE)

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Abstract Management of subterranean termites for past years depends mainly on cyclodiene and organophosphorous termiticides. During those years, these chemicals appeared to be the most suitable chemicals for controlling subterranean termite. However, public concern regarding environmental and health issues caused a re-examination of the widespread use of these chemicals for termite control in the 1990's. This scenario has led to the search for new techniques and chemicals that are more environmentally acceptable. Recent studies show that field colonies of *C. curvignathus* and *C. gestroi* can be eliminated effectively by using a bait matrix containing hexaflumuron. In this study, noviflumuron packaged as an above ground bait, was studied for its effectiveness in eliminating *C. gestroi* infesting different types of premises. The result of the study shows all five colonies of *C. gestroi* succumbed to the effects of the toxicant (0.5% noviflumuron). The termites ceased foraging within 42 days (35 - 56 days) after consuming an average of 83.6 g (21.7 - 162.2 g) bait matrix or 0.42 g noviflumuron (0.1 - 0.8 g). In many occasions the termites died in the bait stations The time taken to eliminate the colony was comparable to that of 0.5% hexaflumuron; the amount of treated bait consumed by those termites, however, was less than that of hexaflumuron (30.5 - 217 g).
Key Words Subterranean termites, hexaflumuron, noviflumuron

INTRODUCTION

Subterranean termites from the genus *Coptotermes* are significant wood destroying pests in the world. Despite their economic importance, methods recommended for controlling these termites have not been satisfactorily addressed. For past years, methods of controlling subterranean termites depended mainly on soil applications of cyclodiene and organophosphorous termiticides. During those years these chemicals appeared to be the most suitable chemicals for controlling subterranean termites. However, public concern regarding environmental and health issues caused a re-examination of the widespread use of these chemicals for termite control. This scenario has led to a shift from ground applications of termiticides to a more integrated approach incorporating new techniques and chemicals that are more environmentally acceptable. One of the methods of controlling subterranean termites that is widely accepted presently is baiting technique. Recent studies in Malaysia show that field colonies of *C. curvignathus* and *C. gestroi* could be eliminated effectively by using bait containing hexaflumuron (Sajap et al., 2000 and Sajap et.al. 2002). In this study, noviflumuron formulated as an above ground bait was studied for its effectiveness in eliminating *C. gestroi* infesting different types of premises.

MATERIALS AND METHODS

Several buildings and homes at different localities in the state of Selangor, Malaysia were surveyed and inspected for termite infestation. From this survey, five premises infested with *C. gestroi* were chosen for the study.

Site 1. MARDI, Jalan Kebun, Klang. Site 1 was a laboratory building of the Malaysian Agricultural Research and Development Institute (MARDI). This laboratory deals with research on vegetable production on peat soil. It is located at Jalan Kebun, Klang, about 30 km west of Kuala Lumpur. The laboratory has long history of termite infestation. Almost all wooden components in the building and furniture were heavily infested with termites. Surface and spot treatments using commercially available termiticides had been frequently applied but without success. A total of 14 AG (Above Ground) blank stations were placed on infested wood in the building between 10/7 – 10/8/2001.

Site 2. Kampong Pauh, Gombak. Site 2 was a moderately infested house located about 5 km northeast of Kuala Lumpur. Termite infestations were noticed about two years prior but no treatment was carried out. Termites were found attacking wooden door and window frames, beams and rafters. Five blank AG stations were placed in the house on 12/4/2001.

Site 3. Bukit Badong I, Kuala Selangor. Site 3 was a traditional Malay village house at Bukit Badong about 60 km northwest of Kuala Lumpur. Oil palms are planted around the house. Termite infestations were found in the wooden floor, wall and pillars. Five blank AG stations that were installed on 4/5/2001.

Site 4. Bukit Badong II, Kuala Selangor. Site 4 was part of an old house at Bukit Badong that had not been occupied for more than 10 years. The house was severely damaged by termites. Four blank AG stations were installed on 15/6/2001.

Site 5. Bukit Badong III, Kuala Selangor. Site 5 was a semi-brick village house located at Bukit Badong . The house was renovated three years prior. At that time, termites were detected infesting the bathroom, which was located outside the house, but no treatment was carried out. More recently, termite infestations were found in the house, attacking mainly the wooden wall. Two blank AG stations were placed on infested spots in a bathroom outside the house on 17/6/2001.

Experimental Procedures

The termites were allowed to feed on these blank matrices for at least one month. Depending on the number of the AG stations, at least 50% of the stations were then randomly replaced with cellulosic matrix treated with 0.5% noviflumuron (Recruit™ III AG baits) and others remained with the blanks. These blanks served as the above ground monitoring stations. To determine the connectivity of the foraging termites, one set of blank bait was dyed with Neutral Red. The connectivity of the foraging termites was verified with the presence of dyed termites in the bait stations. All bait matrices were weighed before installing in the stations. The Recruit™ III AG baits were examined biweekly. Infested units were replaced with new sets of baits. The remaining baits were taken to the laboratory and cleaned by removing soils and debris. They were then air-dried for 3 to 5 days and weighed. Monthly monitoring was continued for at least 6 months after cessation of feeding.

RESULTS

Coptotermes gestroi could be easily trapped in bait stations if the stations were placed on infested structures or over working galleries. More than 80% of the stations were infested by the termites within one to two weeks after installation. The presence of dyed termites in all bait stations indicated that the termites at each site came from a single with inter-connecting galleries. In these stations, workers voraciously fed on the cellulosic matrices and could consume all the contents within 2 to 4 weeks. After installing Recruit™ III AG containing noviflumuron, feeding activity of the termites subsided thereafter, both in the treated bait and in untreated blank matrix.

Site 1. MARDI, Jalan Kebun, Klang.

A total of 14 blank AG stations were placed on several structures such as tables, wall and window frames in the laboratory building between 10/7 to 10/8. Nine baits were infested. Six were selected for treatment and 3 for blank stations. Recruit™ III AG baits were placed on 10/8. By 5/10 the termites ceased their activity and died within 56 days. They consumed 137 g of baits containing 0.68 g noviflumuron. During the baiting program, they also consumed 225.55 g of blank matrix. It is unclear if all the termite feeding was from the same colony.

Site 2. Kampong Pauh, Gombak.

Five blank AG stations were placed in the house in 12/4/2001. Four stations became infested. On 16/5, two of these stations were replaced with Recruit™ III AG containing noviflumuron and the other 2 remained with blanks. By 6/7, 51 days after baiting, the termites ceased their feeding activity and no termites were found in any stations. The termites consumed a total of 48.48 g of baits containing 0.21 g of noviflumuron and 75.7 g blank bait.

Site 3. Bukit Badong I, Kuala Selangor.
Five blank AG stations were installed on 4/5/2001. All 5 were infested. On 18/5, 3 baits were replaced with treated baits and 2 remained with blanks. The termites ceased their feeding activities by 24/6, 36 days after baiting. The termites consumed 162.2 g treated baits containing 0.81 g of noviflumuron and 78.5 g blanks. Ants apparently invaded and disturbed the feeding activity of the termites in the blanks.

Site 4. Bukit Badong II, Kuala Selangor.
Four blank AG stations were installed on 15/6/2001. Three stations were infested and all were replaced with treated baits on 16/7. No termite activity was found as of 20/8, 34 days after baiting. The termites consumed a total of 21.7 g of baits containing about 0.1 g noviflumuron.

Site 5. Bukit Badong III, Kuala Selangor.
Two blank AG stations were placed on infested spots in a bathroom about 5 m outside the house on 17/6/2001. On 5/8 one station was replaced with treated bait and one continued with blank. As active sites were identified in the house, 5 additional stations, 3 treated and 2 blanks, were placed over the infested wood on 26/8. On this date, termites had disappeared from the Recruit™ III AG that was placed in the bathroom while the blank still harboured some termites. Of the 5 additional stations that were placed late in the baiting program, only 1 of the blanks was slightly nibbled by the termites and none of the treated baits had signs of feeding. Dead termites were found in the Recruit™ III AG and behind plywood wall in the house. By 16/9/2001, 42 days of baiting and consuming 50 g of baits containing 0.25 g noviflumuron, the termites ceased their activity. During this time, the termites consumed 101.2 g of blanks.

DISCUSSION

Coptotermes gestroi, like many other termites can be controlled using baits. In this trial, all five colonies treated rapidly succumbed to the effects of the toxicant (0.5% noviflumuron). The termites ceased foraging within 42 days (35 - 56 days) after consuming an average of 83.6 g (21.7 - 162.2 g) bait matrix or 0.42 g of noviflumuron (0.1 - 0.8 g). On many occasions, dead termites were observed in both the treated and blank baits. Even though the time taken to eliminate the colony was comparable to that of 0.1% hexaflumuron, the amount of treated bait consumed by these termites was less than that of hexaflumuron (30.5 - 217 g).

In addition to rapid mortality accompanying reduced feeding, another interesting observation that came from the trials was noted, particularly on the feeding pattern of the termites on treated baits. The termites generally fed on the outer surface of treated baits and seldom tunneled into the rolls. This pattern of feeding was markedly different from the pattern of termites feeding on blank baits. The termites usually fed from outside and also inside of the rolls of blank baits. It is possible that this species of termite is able to detect the active ingredient in the bait matrix, resulting in the different pattern of feeding. This possibility is supported by the fact that the termites overall consumed a greater quantity of blank bait than bait treated with noviflumuron, although the noviflumuron bait was obviously effective in eliminating the termites.

In summary, results of this study indicate that noviflumuron is an effective bait active ingredient for *C. gestroi* when applied in above-ground stations.

ACKNOWLEDGMENTS

We thank Mr. Yaacob Abdul Wahab for his assistance and Dow AgroSciences LLC (Indianapolis, IN) for providing the test materials and partial funding for this study.

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