RESPONSE OF *RETICULITERMES HESPERUS* COLONIES TO BAITING WITH LUFENURON IN NORTHERN CALIFORNIA

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Background

Baits are important tools for control of subterranean termites, as they can eliminate entire colonies. To test baits, we established a 4-ha field site near Placerville, CA. We chose this wildland location for bait evaluation because of prior studies on the ecology and biology of *Reticulitermes*, high colony density, and simplification of logistics.

We installed wooden stakes on a 2-m grid. Once fed upon by termites, independent monitoring stations (IMs) were installed adjacent to the stakes. We monitored IMs monthly for termite activity and wood consumption. We then selected 12 disparate sites that served as foci for testing baits. One or two additional IMs were installed near each occupied IM. Eight monitoring stations (MSs) were then installed at 1-m intervals in a 90º, radial pattern around the original IMs.

Methods

We collected termite samples from all IMs and MSs to establish laboratory colonies, to determine species of termites in each IM or MS, to conduct agonism studies and establish a genetic data base for future use. From these data we identified at least one IM and one MS, that were occupied by the same colony of *R. hesperus* for all 12 sites. Half of the sites were randomly assigned to the bait treatment and the other half assigned as untreated checks (unbaited). We used SecureChoice monitoring stations to deliver 1500 ppm lufenuron termite bait. After baiting we monitored the IMs for termite activity and wood consumption to evaluate the bait impact on the colonies.

Field

What we did in the field:

- Estimated the number of termites in each station using a rating scale
- Estimated the amount of wood consumed using a rating scale
- Recorded mold, and other arthropods found in each station
- Collected termites for use in laboratory studies
- Determined colony relatedness using mark/recapture
- Baited six colonies from July 2004 to July 2005
- Baits were removed before July 2005 if ants entered the station

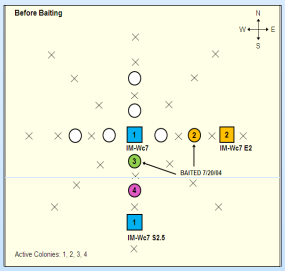
Laboratory

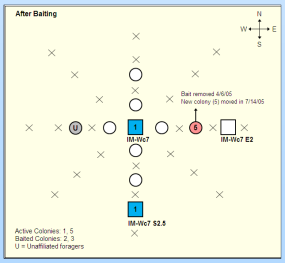
What we did in the laboratory:

- Established laboratory colonies for nearly all IM's
- Conducted cuticular hydrocarbon analyses [1]
- Conducted agonism bioassays [1]
- Prepared samples for microsatellite analyses [1]
- Determined wood consumption with monthly bundle weighing

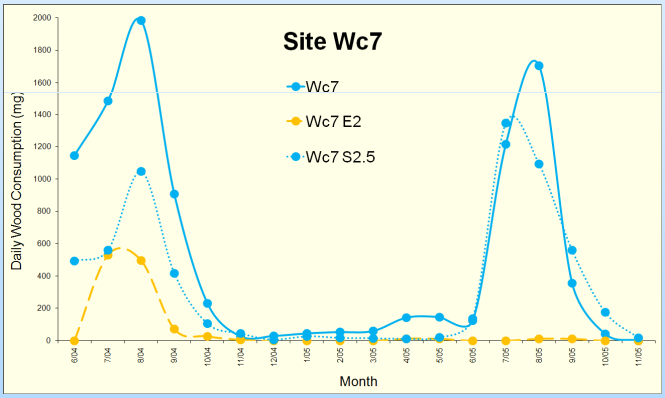
[1] used to determine species and colony designation.

Results

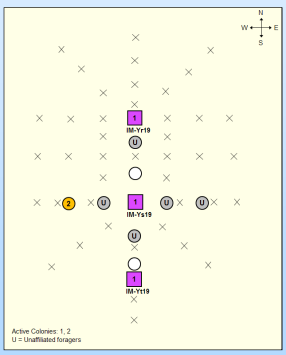


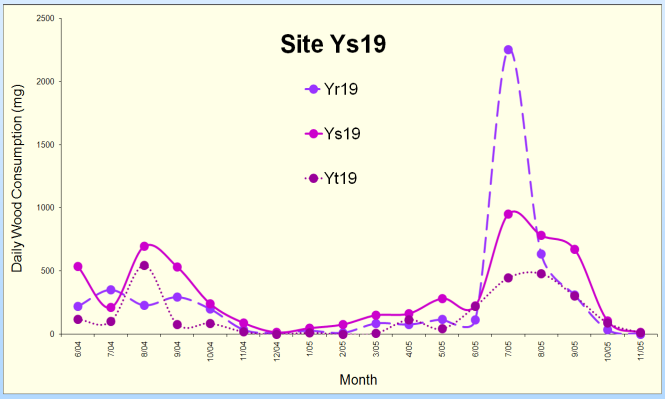


BAITED



UNBAITED





- Additional colonies were found at each baited site but did not feed on the bait.
- Decline in termite activity was closely correlated with soil temperature for the first few months of baiting. When the soil temperatures started to warm, consumption in the baited stations did not increase.
- Factors causing the decline of a termite colony include climate, colony age or health, an invading termite or ant colony, and **an effective bait**.
- Two of the unbaited colonies were displaced by carpenter ants or simply abandoned the IM's.
- The bait was evaluated based on the disappearance of termites and the cessation of wood consumption in the IM's that were occupied by baited termites.

Wood consumption (mg/day) before and after baiting for five baited and twelve unbaited colonies at the Institute of Forest Genetics in Placerville, California, USA

Colony treatment	Wood consumption (mg/day) Before baiting [a]	Post baiting I [a]	Doldrums [a]	Post baiting II [a]
Baited (n=5)				
Mean	281.4 a,α	112.5 b,α	4.3	7.9 c,α
95% Confidence interval	146.2 – 972.9	40.2 – 271.2	--	4.2 – 33.4
Unbaited (n=12)				
Mean	590.5 a,α	436.8 a,α	46.2	488.1 a,β
95% Confidence interval	456.7 – 2,842.4	245.6 – 1,531.0	--	352.3 – 2,345.9

Means in the same row, followed by the same letter, are not significantly different ($p \geq 0.05$); means in the same column, followed by the same Greek letter, are not significantly different ($p \geq 0.05$). Values for the doldrums time period were not tested in the repeated measures analysis of variance.

[a] Before baiting = June 3, 2004 – August 10, 2004, Post baiting I = August 10, 2004 – November 5, 2004, Doldrums = November 5, 2004 – May 3, 2005, Post baiting II = May 3, 2005 – November 15, 2005.

Number of bait tubes used, amount of bait consumed and days required to eliminate *R. hesperus* colonies at the Institute of Forest Genetics near Placerville, California, USA

Site	Bait tubes used	Total bait consumed (g)	Days from baiting to colony elimination [a]
Wc7	1	9.15	93
YK20	3	16	51
Yw23	1	4.45	93
Yr23	1	8.33	65
Yr34 [b]	1	2.18	52
Mean		8.03	70.8

[a] Based on the absence of termites or cessation of wood consumption in the independent monitor(s) and/or appearance of toxic effects in workers.

[b] No definitive connection was ever made between the monitoring station and independent monitor for this colony.

Conclusion

We discovered that eight of the 12 sites had two or more colonies operating within an area of 13 to 48 m^2. In total, we found at least 32 colonies operating at the 12 sites. At least five colonies were completely controlled by lufenuron. Determination of the amount of time required for colony destruction was confounded by the reduction in feeding in the fall. We estimate that it required 2 to 3 months to deliver an amount of active material required to kill all members of a colony. The complexity and dynamic nature of the termite community at this location, and probably around wooden structures as well, could mask the efficacy of the product. The IMs occupied by one colony that was destroyed as a result of feeding on a bait, could be occupied by a different or second colony after the baits are removed from the MSs. Therefore, baiting and monitoring need to be a continual process. The MSs should be installed early in the spring and the bait placed in the MSs early in the feeding cycle, late spring or early summer. Through our analyses and assays we were able to provide detailed and unequivocal "cause-and-effect" data which link the deployment of the lufenuron termite bait to the cessation of termite activity associated with a given colony.