Final Report

A Comparison of baiting and Perimeter Spray Programs for Urban Pest Management of Argentine Ants: A Demonstration and Costs

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Introduction

The proposed research for this grant has been completed and the final report will be presented in three parts: (1 and 2) efficacy evaluation of various spraying and baiting strategies, and (3) cost analysis of a baiting program versus an application of sprays and granules. The efficacy studies have been published in the journal *Sociobiology* (see attached pdf's). The cost analysis was conducted in collaboration with Herb Field, Chief Operating Officer, Lloyd Pest Control.

Methods

Parts 1 and 2: The protocols for the efficacy studies were based on estimations of ant numbers around homes in Riverside, CA, before and after treatments were made. The ant numbers were estimated using 20 vials of 25% sugar water, 10 placed near the house and 10 placed away in the yard. After 24 hours the vials were collected and the amount of sugar water consumed was measured. It has been determined that on average, an Argentine ant consumes 0.3 mg of sugar water per visit. Using this figure along with the total amount of sugar water consumed, the total number of ant visits to a vial over 24 hours can be calculated. Thus, pretreatment numbers of ants were compared with post-treatment numbers to determine percent reduction of ants in each treatment.

Part 3: The cost analysis with Lloyd Pest Control was conducted over the most active season of the year for controlling Argentine ants in San Diego (June – September). The most effective bait and spray treatments from the efficacy studies (years 1 and 2) were selected to be included in the analysis, namely Vitis and Termidor + Talstar granules. Bait and combination treatments were compared by tracking the amount of time (labor costs) and materials (insecticide costs) that were allocated to each account (6 homes treated with bait and 6 homes sprayed and treated with granules).

Results

Parts 1 and 2: Tables 1 and 2 summarize the treatments and their efficacies based on percent reductions in ant numbers from the pre-treatment levels.

Part 3: See attached Excel file for cost analysis.

Conclusions

Parts 1 and 2: The most effective strategy overall was the combination treatment with Termidor spray and Talstar granules. Noteworthy was the performance of the spot application with one gallon of Termidor, which resulted in a 90% reduction of ants near the house two months after treatment. This result demonstrates the efficacy of fipronil

when applied directly to trailing ants thereby exploiting its horizontal transfer. In regard to baiting, Vitis provided about 10% more control than Gourmet. These baiting programs are designed to be used year-round, not for only 8 weeks, so their long-term efficacy was not addressed in this study.

Part 3: The quarterly cost analysis showed that the combination treatment cost 39% less than baiting. However, we intend to continue the cost analysis for one year so this may change particularly during the winter months when there is less bait being consumed by the ants and fewer visits made by the technician.

Low Impact Directed Sprays and Liquid Baits to Control Argentine Ants (Hymenoptera: Formicidae)

by

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ABSTRACT

Insecticide treatments were evaluated for efficacy in reducing outdoor infestations of Argentine ants around homes in southern California. Treatments were applied with the goal of reducing the amount of insecticides applied to control ants. Most effective was an experimental liquid bait formulated with 0.003% thiamethoxam as the toxicant. It reduced the ant numbers near the house by 84% and in the yard by 80%. Similar levels of control were obtained near the house with the same bait containing a lower concentration of AI (0.001%), and two other treatments using low volume applications of fipronil sprays. In the yard, though, these treatments were less effective. The results show that less insecticide and more target specific applications can be used effectively to control Argentine ants outdoors. A cost analysis indicated that a standard industry treatment cost 40% less than baiting.

Key Words: *Linepithema humile*, ant control, ant baits, insecticide spray

INTRODUCTION

The Argentine ant, *Linepithema humile* Mayr, is a significant urban pest in the Southeast and along the West Coast of the United States. In California, surveys indicate that Argentine ants are the most common ant pest encountered by pest management professionals (Knight & Rust 1990), and make up 85% of the ants collected at service accounts of the largest pest control firm in San Diego (Field *et al*. 2007). Infestations around homes in southern California can attain tremendous levels with averages of around 0.5 million ant visits to bait stations daily (Reierson *et al*. 1998).

To control these massive infestations around homes Pest Management Professionals (PMPs) typically apply perimeter sprays of Termidor (0.06%

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fipronil) or synthetic pyrethroids such as Talstar (0.06% bifenthrin). In previous studies we determined that these products and various others can significantly reduce ant numbers, but that various modifications of the standard perimeter treatment could be made in order to reduce the volume of insecticide used and improve efficacy (Klotz *et al*. 2007, 2008). For example, using Termidor sprays we achieved the same level of ant control with 25% the amount of insecticide as in a perimeter treatment by spraying only active ant trails, thereby facilitating horizontal transfer of fipronil (Soeprono & Rust 2004a,b; Choe & Rust 2008). This kind of approach with directed sprays is more target-specific, minimizes waste, and may potentially reduce insecticide runoff, all important factors to be considered given the increasing environmental concerns with pesticide use.

In this study we continued our evaluation of directed sprays and liquid baits with the objective of reducing the amount of insecticide applied and developing more effective Argentine ant control strategies with even lower environmental impact. We also include a cost analysis comparing a baiting program to a standard industry treatment.

MATERIALS AND METHODS

The experimental design and monitoring procedure are the same as used in two previous field studies on the efficacy of various treatment strategies to control Argentine ants around homes in Riverside, California (for details see Klotz *et al*. 2007, 2008). Briefly, Argentine ant numbers around homes in Riverside, California, were monitored before and at various dates after treatment (1, 2, 4, and 8 wks) to determine their percent reduction. Each treatment was repeated at five homes. Untreated control sites were also included in the study and monitored along with treated sites. Control sites provide information concerning the levels of ant activity and colony development during the study period.

Monitoring

Ant numbers around homes were monitored using vials of sucrose water, 10 placed equidistant from one another around the exterior foundation (near), and 10 additional vials placed out in the yard about 5 m from the structure (away). Each vial contained 13 ml of sucrose water and was covered with a clay

flowerpot to minimize disturbance and ambient light and protect the vials from irrigation. The vials were left in place for 24 hours and then collected to measure the amount of sucrose water consumed by the ants. Reierson *et al.* (1998) determined that on average an Argentine ant consumes 0.3 mg of sucrose water per visit, which along with the total consumption can be used to calculate the number of ant visits per vial over the 24-hour monitoring period.

Treatments

Five treatments to control Argentine ants were evaluated for efficacy:

(1) A perimeter treatment using 3.8 liters of Termidor (0.06% fipronil, BASF, Florham Park, NJ) applied in a pin-stream with a 15-liter backpack sprayer (Birchmeier Co., Switzerland). A 5 cm band of insecticide was applied to the base of the foundation, along the edges of doors and windows, around utility line points of entry, and along the underside edge of the eaves.

(2) A spot treatment with 3.8 liters of Termidor (0.06% fipronil) applied as a fan spray with a backpack sprayer. Only active ant trails were treated including any that were found on the house or in the yard.

(3) A perimeter and spot treatment using 11.4 liters of Talstar One (0.06% bifenthrin, FMC Corp., Philadelphia, PA) applied as a fan spray with a backpack sprayer. The perimeter spray was applied 30 cm up and 30 cm out from the foundation. The spot spray was applied along the edges of the sidewalks, and driveway, and any other area where ants were found trailing.

(4+5) An experimental sweetened liquid bait containing thiamethoxam (Syngenta Corp.) formulated at two different concentrations (0.001% and 0.003%). The KM AntPro liquid bait dispenser (KM AntPro, Nokomis, FL) was used for bait delivery (300 ml of 0.001% and 90 ml of 0.003% thiamethoxam per station). Depending on the size of the home, three to five stations were placed equidistant from one another around the exterior foundation.

Cost Analysis

A nine month cost comparison was made between a baiting program and a traditional industry treatment. Twelve homes were included in the analysis: six that were treated with bait, and six that received the traditional treatment. In the baiting program, the KM AntPro liquid bait dispenser was used to deliver 473 ml of Vitis (0.001% imidacloprid, Bayer Corporation) per

station. Depending on the size of the house, four to six stations were placed around the outside perimeter and in the yard. In the traditional treatment, two separate applications using a backpack sprayer was used to apply 7.6 liters of Termidor (0.06% fipronil) as a perimeter and spot spray around the outside of each home, and 0.9 kg of Talstar G were broadcasted in foliage outside the spray zone. Two other applications were made using a power sprayer to apply CyKick CS (0.25% cypermethrin) to turf, hardscape, and ant trails away from the structure. Cypermethrin was not applied in areas where previous fipronil applications had been made. The time it took to make each of these applications was recorded along with the amount of material used.

Statistical Analysis

A Wilcoxon-Signed Rank Test ($P<0.05$) (Systat 2007) was used to analyze for differences between pre- and post-treatment ant numbers. The number of ants visiting each vial before treatment was compared with counts at the same vial after treatment.

RESULTS AND DISCUSSION

All treatments achieved significant reductions of ant numbers, however, the level of control varied (see Table 1). Least effective was treatment 3 (bifenthrin perimeter + spot spray), which reduced ant numbers after 8 wks by only 54% near the house and no reduction in the yard. In a previous study this same treatment provided somewhat better control at 8 wks with 71% reduction near the house and 24% reduction in the yard, and this result despite the higher pre-treatment ant numbers relative to the current study (Klotz *et al*. 2008). When compared with similar treatments using fipronil, the bifenthrin treatment is about 10 to 20% less effective, probably due to the fast-acting contact activity and minimal to no horizontal transfer of the active ingredient (Soeprono and Rust 2004a,b). As more PMPs convert their residential routes to every other month service, the treatments will need to be able to control ants for at least 8 wks.

The other treatments resulted in approximately 80% reduction of ants near the house after 8 wks, but with varying degrees of control in the yard. Most effective in the yard was the liquid bait with 0.003% thiamethoxam, which reduced the ant numbers by 80% after 8 wks. The other treatments provided only marginal (54% and 57% reductions with the fipronil spot treatment,

Table 1. The average performance of five different treatments for Argentine ants around homes in Riverside, CA (N = 5 homes/treatment). Residences treated in July 2008. Untreated controls (#6) are shown for comparison.

Treatment, %AI[a]	Avg. ant visits per tube before	Monitoring Site[a]	Avg. ant visits per tube (% reduction) at week after treatment[b] 1	2	4	8
(1) Perimeter, 0.06 fipronil	22,281	Near	2,832 (87)***	3,357 (85)***	1,984 (91)***	4,372 (80)***
pin-stream	23,861	Away	16,016 (33)**	10,929 (54)***	9,945 (58)***	17,962 (25)
(2) Spot, 0.06 fipronil	22,468	Near	4,439 (80)***	1,541 (93)***	3,100 (86)***	4,144 (82)***
	26,019	Away	9,286 (64)***	10,508 (60)***	11,325 (57)***	11,721 (55)***
(3) Perimeter, 0.06	21,209	Near	2,404 (87)***	6,263 (70)***	7,269 (66)***	10,732 (54)***
bifenthrin + Spot	24,221	Away	9,896 (59)***	18,124 (25)*	13,909 (43)***	30,417 (0)
(4) Bait, 0.001	28,338	Near	6,131 (78)***	12,225 (57)***	3,879 (86)***	5,308 (81)***
thiamethoxam	26,183	Away	12,647 (52)***	20,231 (5)	14,076 (46)**	11,185 (57)***
(5) Bait, 0.003	27,751	Near	8,766 (68)***	8,184 (71)***	9,640 (65)***	4,423 (84)***
thiamethoxam	31,414	Away	18,941 (40)***	15,347 (51)***	16,649 (47)***	6,604 (80)***
(6) Untreated[c]	5,827	Near	4,494 (23)	5,469 (6)	5,711 (2)	---
	5,301	Away	4218 (20)	4,336 (18)	4,337 (18)	---

[a]Each residence monitored with 10 conical vials containing 13 ml 25% sucrose near the structure and away from the structure.
[b]Percent reductions adjusted for missing or spilled vials; Wilcoxon-Signed Rank Test, * = P<0.05, ** = P<0.01, *** = P<0.001;
[c]Due to sporadic feeding at monitoring sites and low number of ants, a Wilcoxon-Signed Rank Test was not performed on controls; ---, indicates no monitoring on this date.

and 0.001% thiamethoxam bait, respectively) to little control (24% with the pin-stream perimeter treatment) in the yard.

The most effective treatment overall was the 0.003% thiamethoxam bait (84% and 80% reductions near the house and in the yard, respectively). Given the ultra-low dose of active ingredient plus its point source application, achiev-

ing this level of control represents a significant breakthrough in controlling Argentine ants with liquid baits. In previous bait trials with Gourmet (1% borate) and Vitis (0.001% imidacloprid), the levels of control were lower both near the house and in the yard: reductions of 73% and 66% with Gourmet and 83% and 64% with Vitis, respectively (Klotz *et al*. 2007, 2008).

Remarkably, the bait efficacy reported here is comparable to a Termidor treatment. Nevertheless, the cost of a baiting program (Table 2) presents a serious drawback to its incorporation into commercial pest control programs. In order to offset the additional costs, a company would need to charge 40% more than a traditional treatment program (Table 2), which would be prohibitively high for all but a few customers to afford.

It should be noted that initial setup costs for Vitis baiting were higher than expected due to the thorough inspection and mapping of each property. These additional costs would likely be reduced as the PMP gains more experience with the baiting program, resulting in about a 20% decrease in costs. Furthermore, the frequency of service for the two treatments was different. The traditional treatment was performed on a quarterly basis and the baiting on an as needed basis due to the ants consuming the bait. Future advances in baiting technology and application techniques may reduce costs. Growing environmental concerns about broadcast applications of insecticides and increasing regulations on urban water runoff could make baiting a more competitive and attractive option in future marketplaces.

The treatments with low volumes of fipronil demonstrate the efficacy of targeted sprays. The spot spray on active ant trails is a limited application but it probably maximizes horizontal transfer, resulting in reductions of 82% near the house and 55% in the yard. The pin-stream application around the foundation and at various points on the structure resulted in an 80% reduction of ants near the house. In both cases, the insecticide is placed strategically in order to maximize efficacy, minimize waste, and reduce the amount of insecticide applied. Another potential advantage of strategic applications is reduction of pesticide runoff by irrigation and rain events.

Years ago, crack and crevice treatments became the industry standard for interior treatments in structural pest control replacing baseboard spraying with a more strategic placement of insecticides. Using a similar approach on

Table 2. Cost analysis comparing a "traditional" ant treatment consisting of applications of fipronil, bifenthrin granules, and micro-encapsulated cypermethrin with a baiting program using sweetened liquid baits containing imidacloprid in KM AntPro bait stations.

		Cost over time (days) comparing both treatment methods[c]				
Treatment, %AI[a]	Callbacks[b]	30	31-90	91-180	181-270	Total Cost
Traditional; 0.06 fipronil 0.2 bifenthrin granules, 0.005 cypermethrin	0	$122.70	$93.60	$93.60	$93.60	$403.50
Liquid ant bait; 0.001 imidacloprid	3	$243.20	$164.31	$125.13	$141.60	$674.24

[a]Traditional treatments were performed using a 15-l Birchmeier backpack sprayer, 189.2 liter power sprayer, and granular spreader on a quarterly frequency. Liquid bait treatments were performed using KM AntPro liquid ant bait stations on a frequency dictated by bait consumption. Six sites were evaluated and averaged.
[b]Callbacks are defined as the client initiating a request for service when ants have gained access to the interior of the structure. Six sites were evaluated and averaged.
[c]Initial service included an inspection of the property. Traditional treatments were more encompassing and more areas on the property were treated. Liquid Bait Treatments included determining initial bait station locations and area mapping of the property using GoogleEarth maps.

exterior treatments can also provide the added benefits of both efficacy and reduced environmental impact.

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