



Texas Imported Fire Ant Research Ant Management Project

Final Report 2006-2007

Title of project:

“The Interaction of Broadcast Baits and Native Ants on the Control and Re-invasion of Fire Ants”

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Summary of work done:

Higher densities of *S. invicta* in the US relative to South America are explained by the absence of natural enemies and lack of strong interspecific competition (IC). Despite advances in *S. invicta* management using biological control agents, broadcast baits remain as the primary tool for effective control. Determining effects of baits on native ants (the primary goal of this study) is critical for *S. invicta* management, since native ant competition may enhance the effect of introduced biological control agents. In a pilot study, we documented that the impact of baits was greater on *S. invicta*, and that the majority of ant species had positive responses to the reduction of *S. invicta*. This showed for the first time that baits and native ants are not always incompatible. The general goal of this project was to explore strategies that combine the use of baits with IC for the management of *S. invicta*. Specific goals were to determine if different types of *S. invicta* management procedures affect native ants and to determine how unaffected species contributed to slow re-invasion of *S. invicta* via IC. We estimated Effect Sizes (ES) based on previous studies and proposed four research hypotheses to be addressed. 1) Density of native ants exhibit increase $\geq 25\%$ (Effect Size= 0.6) in bait treated areas compared

to untreated, 2) Successful establishment of new *S. invicta* colonies decreases $\leq 10\%$ (Effect Size= -0.2) in bait treated areas and with restored native ants compared to untreated, 3) Foraging by *S. invicta* decreases $\leq 10\%$ (Effect Size= -0.2) in bait treated areas and with restored native ants compared to untreated, and 4) Reinvasion of *S. invicta* decreases $\leq 10\%$ (Effect Size= -0.2) in bait treated areas and with restored native ants compared to untreated. Manipulative experiments were conducted on three sites in Central Texas with different densities of native ants (low, medium, high), but with similar densities of *S. invicta*. A BACI-P (Before/After-Control/Impact-Paired) design was used. Experimental units consisted of 0.4 ha plots. Three treatments were randomly assigned to units and replicated four times; 1) Slow acting bait, 2) Fast acting bait, 3) Untreated Control. Samples and observations were collected for several weeks before/after the treatments to account for seasonal variation and to determine rates of reinvasion. To determine effects on abundance and reinvasion, ants were monitored using pitfall traps and fatty food lures. To determine IC for baits, blank bait was applied and species collecting bait were then recorded. Preliminary results indicate that different management methods did not impact native ants when they are at low and medium densities and that *S. invicta* is greatly affected; at high native ant density, competition for these baits is observed affecting both natives and *S. invicta*. Reinvasion of *S. invicta* was observed reduced in areas of low and medium native ant densities previously treated with baits and native ant abundance increased by $\sim 25\%$. At high native ant densities, reinvasion of *S. invicta* was similar to Control sites; this may be due to IC at baits by natives and *S. invicta*, impacting natives and failing to reduce *S. invicta*. We conclude: 1) from the conservation perspective, properly used, baits can help in recovery of native ant species that compete with *S. invicta* reestablishment; however, rote re-treatments may have a negative impact on restored populations. 2) from the *S. invicta* management perspective, we found that "bait failures" may be due to interspecific competition when initial native ant densities are high (work in progress and see below).

A short term experiment (6 weeks) evaluating the impact of several *S. invicta* products on native ants using two bait products (Hydramethylnon and Indoxacarb) and two granular contact insecticides (Fipronil and Bifenthrin), were conducted in two sites in Central Texas. Results indicate granular baits (containing non- contact insecticides) did not adversely affect native ants when *S. invicta* were abundant. We expect other baits to perform similarly. It is important though, for conservation and restoration purposes, to have an initial estimate of *S. invicta* density before applying any bait treatment. Work is ongoing to develop a simple, fast method to detect *S. invicta* densities that would contraindicate treating minimally infested areas that also harbor native ant species. Products containing Fipronil and Bifenthrin (contact granular insecticides) negatively impacted *S. invicta* and devastated native ants, as the mode of action is quite different from granular baits. Any ant contacting these granules is expected to die after translocating the active compound into the colony. These materials are contraindicated for use in environmentally sensitive areas or in areas with high densities of native ants.

Major accomplishments to date (September 2005 – May 2007):

- Establishment of three permanent study sites in Texas that were permanently monitored for ant changes 5 weeks in 2005, 23 weeks 2006 and 6 weeks in 2007.
- Two of the study sites belong to the Leon River Restoration Program that intends to restore populations of two threatened species (Golden-cheeked Warbler and the Black-capped Vireo).
- We were able to demonstrate that native ants at low and medium densities are compatible with bait treatments, they exhibit increases in density, increasing interspecific competition

towards *S. invicta* and resulting in possible reduction of successful establishment of new colonies and reinvasion.

- At high native ant densities, successful reduction of *S. invicta* is not warranted; we observed that at this level both natives and *S. invicta* compete for baits and treatment has more significant impact on the native ant community.

Goals achieved

1- Large-plot experiments (Re-invasion of *S. invicta* on large bait-treated plots that also contain native ants)

September - December 2005 Site Evaluations

- Preliminary sampling was conducted to determine natural densities of *Solenopsis invicta* and native ants in different sites in Central Texas using lures (hot dogs) and pitfall traps

January – March 2006 Site Selection and Implementation of Experimentation

- Research sites in Burleson Co. (1) and Coryell Co. (2) were selected based on preliminary data

- The Burleson Co. site is a private ranch and the two sites in Coryell Co. are part of a large state project -Leon River Restoration Project (LRRP) – to restore the habitat for several endangered species such as the Golden-cheeked Warbler and the Black-capped Vireo; both species are severely affected by fire ants. Our projects mutually cooperate in assisting students and providing input on sustainable fire ant management commensurate with our mutual objectives.

- Preliminary sampling was conducted to determine the natural densities of *S. invicta* and native ants in the spring in selected sites to determine and establish the location of experimental plots

- Establishment of twelve experimental plots (1 acre each) on the three selected sites

March 2006 - November 2006

- Pre-treatment data collected weekly (Mar,- May 2006) using lures, pitfalls and quadrat samples

- Experimental plots treated in mid-May 2006

- Weekly monitoring of experimental plots through November 2006 (lures, pitfalls & quadrats)

December 2006 - March 2007

- Post processing of pitfall traps (3600+) ongoing with completion expected by Sept. 2007

March – May 2007

- Assessment of plots in process. Ant activity delayed by snow during mid April 2007

- Triggers for re-treatments expected in mid May after >6 weeks of pre-treatment evaluation.

2- Small-plot experiments (Effect of insecticide baits/granules on native ants)

March 2006-August 2006

- Selection of two sites from lure and trap data collected in winter/spring of 2005-06

- Sites are located in Gatesville and also are part of the LRRP

- Preliminary sampling conducted to determine the natural densities of *S. invicta* and native ants in the spring in selected sites to determine and establish the location of small experimental plots

- Establishment of twenty small experimental plots (1/8 acre) on the two selected sites

- Experimental plots were sampled for ants early in May 2006 with lures and pitfall traps

- Treatments using different insecticide baits/granules (four products; 1) Hydramethylnon, 2) Indoxacarb, 3) Fipronil, 4) Bifenthrin) were applied in May 2006
- Post-treatment data were collected for four consecutive weeks following original treatment dates, and a fifth sample was collected in mid-August 2006
- Post processing of samples collected in pitfall traps (1000+) completed during the winter.

3- Estimation of *S. invicta* densities based on recruitment response time to lures

May 2006-August 2006

- Additional experiments were done in a site in Caldwell, Burleson Co to investigate efficiency of hot dogs to estimate fire ant densities based on response time and hits per sampling unit
- Colonies were mapped on a 20 acre area using submeter accuracy GPS and colonies were rated from 1-5 according to colony size and reproductive condition in May 2006
- Twenty plots were established based on fire ant density (low, medium, high) and colony size and reproductive stage condition, larger colonies were left intact, others were removed using a broadcast bait (individual mound treatment), buffer areas were treated with baits in June 2006
- Experimental plots were monitored using hot dog lures deployed using a grid design on each experimental plot and inspected every 10 minutes for an hour, colony counts repeated Aug.-06
- Experiments are ongoing to investigate diurnal recruitment using lures and other methods to calibrate this sampling technique as a decision aid for stakeholders (completion expected 2007)

Publication citations, Paper Presentation Citations and other Citable Products:

Peer reviewed publications

- Calixto, A., M. K. Harris, A. Knutson and C. Barr. 2007. (*In Press*). Responses of Native Ants to *Solenopsis invicta* Buren Reduction with Broadcast Baits. *Env. Entomol.* 36: 000-000.
- Calixto, A., M. K. Harris and C. L. Barr. 2007. (*In Press*). Resurgence and Persistence of *Dorymyrmex flavus* Mc Cook Following Reduction of *Solenopsis invicta* Buren with a Broadcast Bait. *Env. Entomol.* 36: 000-000.
- Calixto, A., A. Dean and M. K. Harris. 2007. (*In Press*). Sampling ants with pitfall traps: propylene glycol vs water as kill/preservative agent. (*Southwest. Entomol.*)
- Calixto, A., A. Dean, A. Knutson and M. K. Harris. 2006. Density Changes of Two Earwigs, *Labidura riparia* (Pallas) And *Euborellia annulipes* (Lucas) Following Fire Ant Reduction in Mumford, Texas. *Southwest. Entomol.* 31: 97-101.

Oral presentations

- Calixto, A., M. K. Harris and C. L. Barr. 2007. Adaptive management of *Solenopsis invicta* using broadcast baits and native ants: implications for management of *S. invicta* and restoration of native ants. International Pacific Ant Conference, Kailua-Kona, Hawaii.
- Calixto, A., M. K. Harris and C. L. Barr. 2007. Interference competition by *Solenopsis invicta* displaces native ants at broadcast baits: implications for management of *S. invicta* and restoration of native ants. Annual Red Imported Fire Ant Research Conference. Gainesville, Florida.
- Calixto, A., M. K. Harris and C. L. Barr. 2007. Interference competition by *Solenopsis invicta* displaces native ants at broadcast baits: implications for management of *S. invicta* and restoration of native ants. 10th Student Research Week, Texas A&M University, Texas.
- Calixto, A., M. K. Harris and C. L. Barr. 2007. Interference competition by *Solenopsis invicta* displaces native ants at broadcast baits: implications for management of *S. invicta* and

restoration of native ants. 55th meeting of the Southwestern Branch of the Entomological Society of America and annual imported fire ant research conference. Corpus Christi, Texas.

- Calixto, A., M. K. Harris and C. L. Barr. 2007. Interaction of broadcast baits and native ants for the control and re-invasion of *Solenopsis invicta*. 54th Annual Meeting of the Entomological Society of America. Indianapolis, Indiana.
- Calixto, A., M. K. Harris, C. L. Barr, A. Knutson and B. Ree. 2006. Influence of fire ants and their control on native ant diversity. 54th Annual Meeting of the Southwestern Branch of the Entomological Society of America. Austin, Texas.
- Calixto, A., M. K. Harris, C. L. Barr, A. Knutson and K. Winemiller. 2005. Species turnover in local ant assemblages following fire ant reduction in Mumford, TX. 53^d Annual Meeting of the Entomological Society of America. Fort Lauderdale, Florida.