

**Highlights and Impacts of FY '05 Projects Funded by the Texas Imported Fire Ant Research and Management Project**

**Project Investigator's Name:** Forrest L. Mitchell

**Project Title:** Development of *Thelohania solenopsae* as a Management Tool for the Red Imported Fire Ant through Augmentation

<b>Significant Accomplishment</b>	<b>Impact on Imported Fire Ant Management</b>
<p>Training of a graduate student, Amy Waits, in fire ant biology and insect pathology. Her thesis: "Intracolony transmission of <i>Thelohania solenopsae</i> in red imported fire ants via trophylaxis of the meconium" has been submitted to the graduate college at Tarleton State University and she will begin PhD studies on fire ant biology at TAMU this summer.</p>	<p>Developing research skills in capable people ensures that studies on fire ants will continue and increases the chances for new and innovative approaches to management.</p>
<p>Discovered that in the absence of a reproductive queen, fire ant workers would not feed particulate matter in their buccal pouches to 4<sup>th</sup> instar ant larvae.</p>	<p>Protozoan spores are particulate and one route into the colony is hypothesized to be via trophylaxis from workers who acquire spores via foraging to larvae. If the influence of the queen is needed to feed the workers, then perhaps one reason monogyne colonies are not as affected by disease is that the influence of the single queen may be distant, as opposed to the influence of multiple queens spread throughout polygyne colonies. This discovery will also have bearing on bait formulations in the future.</p>
<p>Support of Elizabeth Ashbaugh, a student in the lab of co-PI Karen Snowden. Ms Ashbaugh has been analyzing DNA of samples archived from the statewide survey of <i>T. solenopsae</i> conducted by this lab. Her results on the genetics of the fire ants will be overlaid on the distribution of <i>T. solenopsae</i> in the survey.</p>	<p>Details on the genetics are being presented by Dr. Snowden. Support of Ms Ashbaugh constitutes training of a researcher who will contribute ideas and solutions to the fire ant problem in Texas.</p>
<p align="center"><b>Source and Amount of Funds Leveraging Current Fire Ant Project</b></p> <p>USDA Regional Grant to Bart Drees and Charles Barr - \$30,000 in 2004/2005</p>	

## **Presentations:**

**Mitchell, Forrest L.** Distribution of *Thelohania solenopsae* in Texas. Entomology Science Conference, College Station, TX October 2004.

**Waits, Amy and Forrest L. Mitchell.** "Intracolony transmission of *Thelohania solenopsae* in red imported fire ants via trophylaxis of the meconium". Presented to the Tarleton State University Chapter of the Sigma Xi Society, April 2005. Paper judged first place in the graduate student competition for Amy Waits.

Other presentations where I appear as a co-author are reported by my colleagues.

## **Publications:**

**Chen JSC, K Snowden, F Mitchell, J Sokolova, J Fuxa and SB Vinson. 2004.** Sources of spores for the possible horizontal transmission of *Thelohania solenopsae* (Microspora: Thelohaniidae) in the red imported fire ant, *Solenopsis invicta*. *J Invert Path.* 85: 139-145.

**Milks ML, YY Sokolova, IA Isakova, JR Fuxa, F Mitchell, KF Snowden and SB Vinson. 2004.** Comparative Effectiveness of Light-Microscopic Techniques and PCR in Detecting *Thelohania solenopsae* (Microsporida) Infections in Red Imported Fire Ants (*Solenopsis invicta*). *J. Euk. Microbiol.* 51: 187-191.

**Waits, Amy, Forrest L. Mitchell and S. B. Vinson.** Queen presence is required for red imported fire ant (*Solenopsis invicta*) workers to feed infrabuccal pouch contents to fourth instar larvae. MS submitted to Southwestern Entomologist July 2005.

Dr. Chen was a PhD student working with Dr. Vinson. Dr. Milks is a post-doctoral associate working in the lab of Dr. Fuxa. Ms Waits conducted her thesis research in Dr. Mitchell's lab and is now a PhD student for Dr. Vinson.

## Highlights and Impacts of FY '05 Projects Funded by the Texas Imported Fire Ant Research and Management Project

**Project Investigator's Name:** S. Bradleigh Vinson Co-PI: Fernando Consoli (replaced by Togahara Azizi-Barbane)

**Project Title:** Development of *Thelohania solenopsae* as a Management Tool for the Red Imported Fire Ant through Augmentation

Significant Accomplishment	Impact on Imported Fire Ant Management
<p>A). We initiated some studies to:</p> <ol style="list-style-type: none"> <li>1. Measure the effects of <i>Thelohania solenopsae</i> on field populations of <i>Solenopsis invicta</i>. RESULTS: There are more queens in infected polygynous mounds than uninfected colonies. There was less brood per queen in infected colonies and less brood regardless of queen status, no difference in worker morphometrics, or polymorphism. No difference in ratios of inseminated vrs un-inseminated queens when comparing healthy and infected colonies.</li> <li>2. We measured intercolonial adoption rates of infected and uninfected sub colonies of <i>S. invicta</i>. RESULTS: The infected colonies kept introduced queens alive at a significantly different (higher rate) than uninfected colonies, and may explain the differences found in field for the queen number differences.</li> <li>3. We measured the effect of infection on the mating flight (those that flew early vrs late) of colonies with a moderate infection (30 to 60%). RESULTS: We found that the queens flying first tended to not be infected while significantly more of the infected queens flew later.</li> <li>4. We examined the weight and determined the lipid and protein content of infected and non-infected alates. RESULTS: Found that infected queens weighed less and contained a significantly smaller amount of lipid needed for flight, suggesting that they may be less likely to fly as far as non-infected alates.</li> </ol>	<p>A). Although this disease is spread vertically, it can also spread horizontally, but this appears to be very inefficient. If the disease level can be increased this disease could become a major management tool. The over all <b>goal</b> of this project is to develop bait that can be used to: increase the infection level of polygyne colonies, infect monogyne colonies and spread the infection to uninfected areas. We know that heavily infected colonies die and the data suggests that the disease has a negative effect on the colony. This suggested that we examine the effects of infection on competition with other ants.</p>
<p>B). We determined if <i>Monomorium minimum</i> (the little black ant) would invade various sizes of IFA colonies. We found that the <i>M. minimum</i> would invade small healthy IFA colonies, but would not invade colonies of 300 or more workers while <i>M. minimum</i> would readily</p>	<p>B). These results point out the importance of protecting the native ants and that infected IFA colonies are less able to defend themselves. This indicates that <i>Thelohania</i> can have a greater impact then just slowly killing colonies.</p>

invade infected IFA colonies even as large as 1000 workers.	
C). We evaluated the effects of several controlled temperatures on the development of the disease. We looked at spore growth and spore type, estimated infection levels, examined worker ant interactions such as feeding, egg laying by the queen and brood tending. RESULTS: We found no difference at the higher temperatures for <i>T. solenopsae</i> single spore production, but binucleate spore production increased, and more binucleate spores could be harvested in worker ants.	C). These results suggest that the difference we see in the infection level from a high in the northwest to a low in the southeast is probably not a temperature response. The effect of temperature on the production of binucleate spores is interesting and whether it is important will depend on determining which of the 4 spore types is the infective one (octospore, magaspore, binucleate spore or monospores).
D). We have been evaluating spore storage, effects of different pH and effect of different foods used by the IFA on spore viability based on filament extrusion. . Overall, spore storage did not alter the spores and no decrease in viability was indicated, food class also did not have an effect on spore storage. Interestingly at pH 4 there was a higher % of viable spore in comparison to the other pHs.	D). The results suggest that viable spores may be able to be stored in several different baits for some period with out serious problems.
E). We initiated a study using archived ants that I began to archive in 1984 when the IFA program was funded by TDA. The data is based on 10 colonies from each year selected at random. The graph is based on a rating system (% of colonies infected x a rating as to the level of infection [1 or 2 spores.02, 3 to 10 spores 0.04, 11 to 30 spores 0.06, more than 31 spores 0.09]. RESULTS. (See graph at end). First spores detected in 1985, but the infection was low until 1996 when it increased dramatically. It has decreased some from 2000 to 2003but is increasing again.	The disease is influenced by some factors and drought may be one. We plan to compare the graph to weather patterns over this time period and develop a test to evaluate the effects of water availability.

**Source and  
Amount of Funds Leveraging Current Fire Ant Project**

USDA Formula Animal Health - "Development of an in vitro culture system for the production of *Thelohania solenopsae* (Microspora) as a biological control agent" K Snowden & SB Vinson; AH8975; \$43,600, Jan '03- Sep '04

Planning submitting an ARP this summer.

**Publications:**

Snowden, Logan, Vinson, Milks and Fuxa. (submitted, under revision) Molecular Comparisons of Ribosomal RNA Genes from Geographically Diverse Isolates of *Thelohania solenopsae* (Phylum Microspora) from Red Imported Fire Ants (*Solenopsis invicta*). *J Parasitol*

Keck, ME, RE Gold and SB Vinson. 2005. Invasive interactions of *Monomorium minimum* (Hymenoptera: Formicidae) and *Solenopsis invicta* (Hymenoptera: Formicidae) infected with *Thelohania solenopsae* (Microsporida: Thelohaniidae) in the laboratory. (Accepted in Sociobiology).

Chen JSC, K Snowden, F Mitchell, J Sokolova, J Fuxa and SB Vinson. 2004. Sources of spores for the possible horizontal transmission of *Thelohania solenopsae* (Microspora: Thelohaniidae) in the red imported fire ant, *Solenopsis invicta*. *J Invert Path.* 85: 139-145.

Milks ML, YY Sokolova, IA Isakova, JR Fuxa, F Mitchell, KF Snowden and SB Vinson. 2004. Comparative Effectiveness of Light-Microscopic Techniques and PCR in Detecting *Thelohania solenopsae* (Microsporida) Infections in Red Imported Fire Ants (*Solenopsis invicta*). *J. Euk. Microbiol.* 51: 187-191

#### **Dissertations directed.**

Johnny Shou-chung Chen. Spring 2004. Biology of *Thelohania* in the IFA. (Directed by S. B. Vinson).

#### **Presentations & Abstracts:**

Invited Symposium: Vinson, SB. Invasion of *Solenopsis invicta*, a discussion of some events that appear to having an impact on local populations in Texas. In; Section 2 "Invasions of social insects" (C. Van der Woude and C. Allen, Organizers). XXII International Congress of Entomology. Brisbane, Queensland, Australia, August 15-21, 2004.

Hale, M. W. and S. B. Vinson. 2005. The host/parasite relationship between a microsporidian parasite *Thelohania solenopsae* and *Solenopsis invicta*. Annual Red Imported Fire Ant Conference, March 22-24, Gulfport MS.

Keck, M., S. B. Vinson and R. Gold. 2005. Invasive interactions of *Monomorium minimum* and *Solenopsis invicta* infected with *Thelohania solenopsae*. Annual Red Imported Fire Ant Conference, March 22-24, Gulfport MS.

Vinson, S. B., A. Rao and P. Mokkarala. 2005. Effect of red imported fire ant baits on some of the non-target ants. Annual Red Imported Fire Ant Conference, March 22-24, Gulfport MS.

Gold, R. E.; K. Overton and S. B. Vinson 2004. Mating flight initiation and nutritional status of *Solenopsis invicta* (Hymenoptera: Formicidae) alates infected with *Thelohania solenopsae* (Microsporidae: Thelohaniidae). Entomological Society of America, November 14 – 17, Salt Lake City, Utah.

Snowden, Logan, Mitchell, Fuxa & Vinson, "Molecular comparisons of ribosomal RNA genes from geographically diverse isolates of *Thelohania solenopsae* (phylum Microspora) from red imported fire ants (*Solenopsis invicta*), invited presentation at NATO Advanced Research Workshop on Microsporidia from Invertebrate and Vertebrate Hosts, Ceske Budejovice, Czech Republic, July 12-15, 2004.

Ashbaugh, Logan, Mitchell, Vinson and Snowden. "Correlation of colony social behavior and infection with *Thelohania solenopsae* (Phylum Microspora) in Red Imported Fire Ants in Texas" poster presented at the Imported Fire conference (Publicity and awareness of research program at TAMU and the state of Texas)

Ashbaugh, Logan, Mitchell, Vinson and Snowden. "Correlation of colony social behavior and

infection with *Thelohania solenopsae* in Red Imported Fire Ants" poster competition, TAMU Student Research Week, College Station, TX Apr., 2005

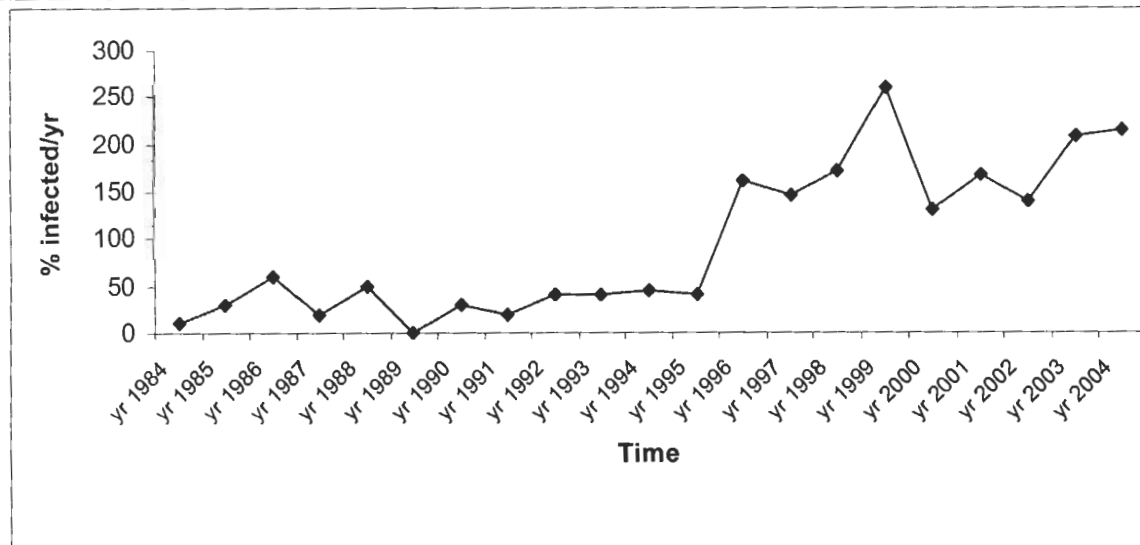
Ashbaugh, Logan, Mitchell, Vinson and Snowden. "Biological Control of Fire Ants in Texas" oral presentation at annual meeting of the American Society of Parasitologists, Mobile, AL. July 8-11, 2005 (Publicity and awareness of research program at TAMU and the state of Texas).

Azizi, T. and S. B. Vinson. 2004. Initiation of flight muscle histolysis in Red Imported Fire Ant, *Solenopsis invicta*. (Poster). Annual Imported Fire Ant Conference. Baton Rouge, La. March 21-23

Hale, M. W. and S. B. Vinson. 2004. Host and parasite interactions between the Red Imported Fire Ant and a Microsporidian parasite. (Poster). Annual Imported Fire Ant Conference. Baton Rouge, La. March 21-23

Vinson, S. B. and S. Ellison. 2004. Rearing new colonies of Imported Fire Ants using newly mated queens. Annual Imported Fire Ant Conference. Baton Rouge, La. March 21-23

Chen, J. S.; K. Snowden, C. Coates, and S. B. Vinson. 2004. *Thelohania solenopsae* parasitism and apoptosis of infected tissues and cells in inseminated queens of the red imported fire ant, *Solenopsis invicta*. Entomological Society of America, November 14 – 17, Salt Lake City, Utah.



***Thelohania* infection of IFA colonies collected on indicated date ( % Infection is an arbitrary figure based on the % colonies infected X a multiplier based on the number of spores seen in the sample.)**

**Highlights and Impacts of FY '05 Projects Funded by the Texas Imported Fire Ant Research and Management Project**

**Project Investigator's Name:** Karen Snowden

**Project Title:** Development of *Thelohania solenopsae* as a Management Tool for the Red Imported Fire Ant through Augmentation

Significant Accomplishment	Impact on Imported Fire Ant Management
A purification scheme was developed to purify and enrich various <i>T. solenopsae</i> spore forms from infected ants	Characterization and purification of spores is essential in trying to develop an in vitro culture method to produce large number of spores in preparation for development of a bait formulation
Molecular methodology was optimized to determine the polygyne/monogyne social behavioral characteristics of ant colonies using the GP-9 gene alleles (BB and Bb). The method was applied to archived colonies from fire ant infected counties in Texas. Approx. equal distribution was found since 54% of the colonies (n=313) were polygyne, and 46% were monogyne. Parasite infection rates were markedly different since 45% of polygyne colonies (76/169) were parasite positive while only 18% of monogyne colonies (26/143) were infected.	Knowledge of host-parasites biological interactions is important when evaluating the potential of <i>T. solenopsae</i> as a biological control agent.
Using molecular methodology, the GP-9 B allele, variations were noted in the gene amplicon size of 5 of 313 isolates. These colonies came from Cameron, Jim Hogg, Kennedy and Kinney counties, all of which are in south Texas along the Gulf coast or the Rio Grande. DNA sequencing of this gene region showed that all 5 variant colonies were identical. A Genbank blast search indicates that these variant colonies have the highest homology with the fire ant species, <i>Solenopsis geminata</i> . We suggest that these variant colonies might be <i>S. geminata</i> hybrids. All 5 colonies were classified as monogyne and were not infected with <i>T. solenopsae</i>	Knowledge of fire ant species distributions and the development of hybrids is important in trying to develop <i>T. solenopsae</i> as a biological control agent. It is important to know the host range infectivity of the parasite.
Molecular methodology was used to identify a new gene region called the internal transcribed spacer region (ITS) in <i>T. solenopsae</i> . The ITS region of the ribosomal RNA gene complex is useful in taxonomic identification of parasites species and genotypes.	Molecular characterization of this region in numerous parasite isolates can indicate whether there is species diversity in the parasite.
Using molecular methodology, the ITS region	The molecular differences in this gene

of 17 parasite isolates were sequenced. Thirteen isolates were identical, 2 isolates varied by 1 nucleotide base, and 2 isolates from Cameron County, TX, were significantly different from other isolates.

region in several isolates suggest molecular diversity or a new species/genotype of the parasite. These variants may have different biological characteristics such as increased/decreased pathogenicity for the fire ant.

### Source and Amount of Funds Leveraging Current Fire Ant Project

Merck-Merial Summer Veterinary Student Research Program. Summer, 2004. EA Ashbaugh, 3VM veterinary student, participated in 10 week summer research program, Snowden lab. Funding support: approx. \$1,800 in salary support/travel

USDA Formula Animal Health - "Development of an in vitro culture system for the production of *Thelohania solenopsae* (Microspora) as a biological control agent" K Snowden & SB Vinson; AH8975; \$43,600, Jan '03- Sep '04

#### **Publications:**

Feature article about K Snowden research:

TVMA Research Report: "Microsporidia: Parasites of Mammals, Fish, Birds and Arthropods" *Newsletter of the Texas Veterinary Medical Association*. Jun 2005 (Publicity and awareness of research program at TAMU and the state of Texas)

Snowden, Logan, Vinson, Milks and Fuxa. (submitted, under revision) Molecular Comparisons of Ribosomal RNA Genes from Geographically Diverse Isolates of *Thelohania solenopsae* (Phylum Microspora) from Red Imported Fire Ants (*Solenopsis invicta*). *J Parasitol*

Chen JSC, K Snowden, F Mitchell, J Sokolova, J Fuxa and SB Vinson. 2004. Sources of spores for the possible horizontal transmission of *Thelohania solenopsae* (Microspora: Thelohaniidae) in the red imported fire ant, *Solenopsis invicta*. *J Invert Path.* 85: 139-145.

Milks ML, YY Sokolova, IA Isakova, JR Fuxa, F Mitchell, KF Snowden and SB Vinson. 2004. Comparative Effectiveness of Light-Microscopic Techniques and PCR in Detecting *Thelohania solenopsae* (Microsporidia) Infections in Red Imported Fire Ants (*Solenopsis invicta*). *J. Euk. Microbiol.* 51: 187-191.

#### **Presentations & Abstracts:**

Snowden, Logan, Mitchell, Fuxa & Vinson, "Molecular comparisons of ribosomal RNA genes from geographically diverse isolates of *Thelohania solenopsae* (phylum Microspora) from red imported fire ants (*Solenopsis invicta*), invited presentation at NATO Advanced Research Workshop on Microsporidia from Invertebrate and Vertebrate Hosts, Ceske Budejovice, Czech Republic, July 12-15, 2004.

Ashbaugh, Mitchell, Logan & Snowden, "Correlation of colony social behavior and infection with *Thelohania solenopsae* (Phylum Microspora) in Red Imported Fire Ants in Texas" presented at Merck-Merial Veterinary Scholars National Symposium, Auburn University, Auburn, AL, July 29-31, 2004 (Publicity and awareness of research program at TAMU and the state of Texas)



Ashbaugh, Logan, Mitchell, Vinson and Snowden. "Correlation of colony social behavior and infection with *Thelohania solenopsae* (Phylum Microspora) in Red Imported Fire Ants in Texas" poster presented at the Imported Fire conference (Publicity and awareness of research program at TAMU and the state of Texas)

Ashbaugh, Logan, Mitchell, Vinson and Snowden. "Correlation of colony social behavior and infection with *Thelohania solenopsae* in Red Imported Fire Ants" poster competition, TAMU Student Research Week, College Station, TX Apr., 2005

Ashbaugh, Logan, Mitchell, Vinson and Snowden. "Biological Control of Fire Ants in Texas" oral presentation at annual meeting of the American Society of Parasitologists, Mobile, AL. July 8-11, 2005 (Publicity and awareness of research program at TAMU and the state of Texas)

### Appendix

Summary of the data correlating *Solenopsis invicta* colony social status (monogyne/polygyne) and parasite infection rates with *Thelohania solenopsae*.

		Parasite Infection Status	
		positive	negative
Colony Social Status	monogyne	26	118
	polygyne	76	93

total colonies analyzed (n = 313)

monogyne = 46%

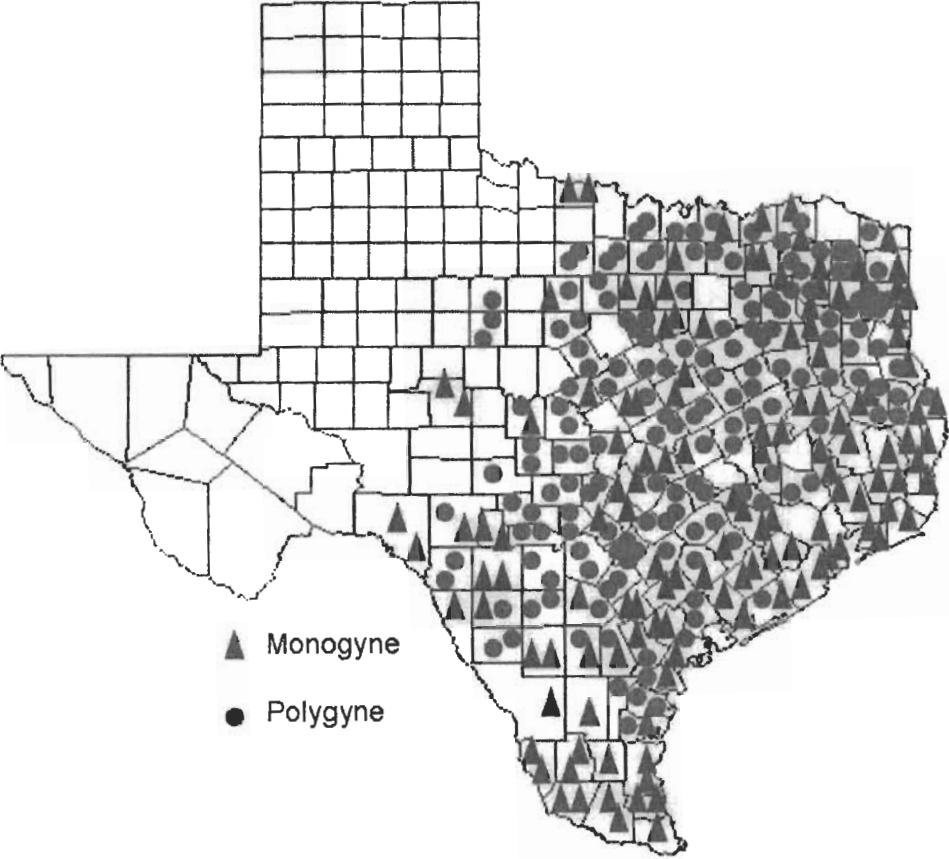
polygyne = 54 %

% of total colonies that were parasite infected = 33%

% of monogyne colonies that were parasite infected = 18%

% of polygyne colonies that were parasite infected = 45%

County Map of Texas indicating the distribution of monogyne and polygyne type *Solenopsis invicta* colonies.



**Highlights and Impacts of FY '05 Projects Funded by the Texas Imported Fire Ant Research and Management Project**

**Project Investigator's Name: Jim Fuxa (Louisiana Team)**

**Project Title:**

Significant Accomplishment	Impact on Imported Fire Ant Management
<p>A combination of applied and basic research contributed toward potential biological suppression of the red imported fire ant, <i>Solenopsis invicta</i>, with the microsporidium <i>Thelohania solenopsae</i>.</p> <p>Impact of the microsporidium on fire ants was examined in field studies. In a field survey of 1328 <i>S. invicta</i> colonies at 165 sites, infected colonies were 40% less likely to have brood than uninfected ones, but the pathogen did not affect colony size. In field experiments lasting 4-7 years, the number of colonies per unit area decreased as prevalence of the disease increased, and areas treated with the microsporidium had fewer foragers than control plots. The pathogen also caused sporadic decreases in brood and in the size of ant colonies in these experiments.</p> <p>The first two epizootics of <i>T. solenopsae</i> in single-queen, or monogyne, colonies of <i>S. invicta</i> were reported, with prevalence peaking at 63% of colonies infected in one case. One epizootic was natural, and the other resulted from introduction of the pathogen, which is the first report of artificial infection of monogyne ants in the field. However, monogyne ants alone apparently cannot sustain the pathogen, and both epizootics died out within two years.</p> <p>In contrast to monogyne hosts, <i>Thelohania</i> released in field trials in predominantly polygyne (multiple-queen) populations is still spreading in massive epizootics after 4-7 years.</p> <p>Studies of the life cycle of <i>T. solenopsae</i> were continued in order to learn how to improve its transmission. There were indications that the megaspores, discovered previously in LSU AgCenter Insect Pathology, may function in vertical</p>	<p>This microsporidium is intended to become a natural mortality agent of this important pest, not requiring further public funding after it spreads and is permanently established. The field studies are establishing the degree of impact on ant populations that can be expected as well as identifying factors to examine experimentally for improving the microsporidium's efficacy. The <i>Thelohania</i> life-cycle studies will help researchers learn how to infect ants by feeding them spores, which, in turn, will greatly simplify infecting ants in the field if augmentation becomes necessary, for example, against monogyne ants.</p>

(parent-to-offspring) transmission. Detailed light and electron microscopic analyses indicated that cysts produced by this pathogen result from a single hypertrophied host cell and may aid horizontal transmission.

**Source and  
Amount of Funds Leveraging Current Fire Ant Project**

Louisiana Fire Ant Research and Management Legislative Grant. 2004-2005. \$103,942 (J. R. Fuxa)

**Publications**

Milks, M. L., Y. Y. Sokolova, I. A. Isakova, J. R. Fuxa, F. Mitchell, K. F. Snowden, and S. B. Vinson. 2004. Comparative effectiveness of light-microscopic techniques and PCR in detecting *Thelohania solenopsae* (Microsporidia) infections in red imported fire ants (*Solenopsis invicta*). J. Eukaryot. Microbiol. 51: 187-191.

Sokolova, Y. Y., L. R. McNally, J. R. Fuxa, and S. B. Vinson. 2004. Spore morphotypes of *Thelohania solenopsae* (Microsporidia) described microscopically and confirmed by PCR of individual spores microdissected from smears by position ablative laser microbeam microscopy. Microbiology 150: 1261-1270.

Chen, J. S. C., K. Snowden, F. Mitchell, J. Sokolova, J. Fuxa, and S. B. Vinson. 2004. Sources of spores for the possible horizontal transmission of *Thelohania solenopsae* (Microspora: Thelohaniidae) in the red imported fire ants, *Solenopsis invicta*. J. Invertebr. Pathol. 85: 139-145.

Fuxa, J. R., and A. R. Richter. 2004. Effects of soil moisture and composition and fungal isolate on prevalence of *Beauveria bassiana* in laboratory colonies of red imported fire ant (Hymenoptera: Formicidae). Environ. Entomol. 33: 975-981.

Sokolova, Y. Y., I. M. Sokolova, and J. R. Fuxa. 2004. Identification of Microsporidia infections in nature: light microscopy or PCR? Protistology 3: 273-281.

Sokolova, Y. Y., R. L. Bossard, J. R. Fuxa, D. W. Sanson, and L. D. Foil. 2004. The microsporidium *Thelohania solenopsae* in red imported fire ants (Hymenoptera: Formicidae) from Louisiana pastures. Southwestern Entomol. 29:271-276.

Fuxa, J. R., M. L. Milks, Y. Y. Sokolova, and A. R. Richter. 2005. Interaction of an entomopathogen with an insect social form: an epizootic of *Thelohania solenopsae* (Microsporidia) in a population of the red imported fire ant, *Solenopsis invicta*. J. Invertebr. Pathol. 88: 79-82.

Sokolova, Y. Y., J. R. Fuxa, and O. N. Borkhsenius. 2005. The nature of *Thelohania solenopsae* (Microsporidia) cysts in abdomens of red imported fire ants, *Solenopsis invicta*. J. Invertebr. Pathol. (In Press).

Fuxa, J. R. 2004. Germ warfare against the red imported fire ant. LSU AgCenter impact reports. <http://www.lsuagcenter.com/impacts/public.asp?id=538>

## Presentations

### Invitational

Fuxa, J. R., Y. Y. Sokolova, M. L. Milks, A. R. Richter, J. S. C. Chen, and S. B. Vinson. 15 July 2004. Epizootiology of microsporidia in insect populations, with particular reference to *Thelohania solenopsae* in fire ants. Emergent Pathogens in the 21<sup>st</sup> Century: First United Workshop on Microsporidia from Invertebrate and Vertebrate Hosts. Academy of Sciences of the Czech Republic, Pěeské Budějovice, 12-15 July 2004. (Fuxa's Air fare paid by NATO, hotel paid by organizers).

### Research Papers

Milks, M. L., J. R. Fuxa, and A. R. Richter. 22 March 2004. Occurrence and distribution of *Thelohania solenopsae* in Louisiana red imported fire ant (*Solenopsis invicta*) populations. 2004 Red Imported Fire Ant Conf., Baton Rouge, LA

Sokolova, Y. Y., L. R. McNally, and J. R. Fuxa. 22 March 2004. PCR-based analysis of spores isolated from smears by laser pressure catapult (LPC) microdissection techniques confirms genetic identity of three spore morphotypes of *Thelohania solenopsae*. 2004 Red Imported Fire Ant Conf., Baton Rouge, LA (Poster).

Snowden, K. F., Logan, K. S., Mitchell, F., Fuxa, J. R., and Vinson, S. B. 12 July 2004. Molecular comparisons of ribosomal RNA genes from geographically diverse isolates of *Thelohania solenopsae* (phylum Microspora) from red imported fire ants (*Solenopsis invicta*). Emergent Pathogens in the 21<sup>st</sup> Century: First United Workshop on Microsporidia from Invertebrate and Vertebrate Hosts. Academy of Sciences of the Czech Republic, Pěeské Budějovice, 12-15 July 2004.

Sokolova, Y. Y., and J. R. Fuxa. 12 July 2004. Fine structure of *Thelohania solenopsae* from *Solenopsis invicta* with reference to the microsporidian life cycle. Emergent Pathogens in the 21<sup>st</sup> Century: First United Workshop on Microsporidia from Invertebrate and Vertebrate Hosts. Academy of Sciences of the Czech Republic, Pěeské Budějovice, 12-15 July 2004 (Poster).

Sokolova, Y. Y., and J. R. Fuxa. 4 August 2004. Structure and development of *Thelohania solenopsae* in fire ants. Annu. Mtg. Soc. Invertebr. Pathol., Helsinki, Finland, 1-6 Aug. 2004.

Fuxa, J. R., A. R. Richter, Y. Y. Sokolova, and M. Milks. 15 November 2004. Epizootics of *Thelohania solenopsae* in red imported fire ants (*Solenopsis invicta*): natural infections in a monogyne population and biocontrol releases in polygyne populations. Annu. Mtg. Entomol. Soc. Amer., Salt Lake City, Utah, 14-17 Nov. 2004.

Milks, M. L., J. R. Fuxa, and A. R. Richter. 15 November 2004. Occurrence and distribution of *Thelohania solenopsae* in red imported fire ant (*Solenopsis invicta*) populations in Louisiana. Annu. Mtg. Entomol. Soc. Amer., Salt Lake City, Utah, 14-17 Nov. 2004.

Sokolova, Y. Y., J. R. Fuxa, and O. N. Borkchsenius. 16 November 2004. The nature of *Thelohania solenopsae* cysts produced in abdomens of red imported fire ants, *Solenopsis invicta*. Annu. Mtg. Entomol. Soc. Amer., Salt Lake City, Utah, 14-17 Nov. 2004 (Poster).

#### Media Interviews

Bogren, R. 11 Aug. 2004. Parasite offers hope for controlling fire ants. LSU AgCenter news. [www.lsuagcenter.com/news/August2004/Headlines/default.html](http://www.lsuagcenter.com/news/August2004/Headlines/default.html)

Anonymous. 15 Aug. 2004. AgCenter researchers targeting fire ant pest. The Advocate, Baton Rouge, Sect. I, p. 3.

Fuxa, J. R. 20 Aug. 2004. Mid-day guest on the Noon News, KALB TV, Alexandria, LA.

Wold, A. 23 Aug. 2004. Of ants and men. The Advocate, Baton Rouge, Sect. B, pp. 1-2. (Also same author and title, front page of The Advocate web site 14 day archive, [www.2theadvocate.com](http://www.2theadvocate.com), main story at [www.2theadvocate.com/stories/082304/new\\_ants001.shtml](http://www.2theadvocate.com/stories/082304/new_ants001.shtml)).

Fuxa, J. R. 23 Aug. 2004. Interview with Jeff Palermo, Louisiana Statewide Radio News Network.

Sutherland, E. 23 Aug. 2004. Fire-ant control tips offered. The Town Talk, Alexandria, LA, p. A4.

Magill, K. 11 Sept. 2004. Researchers from LSU out to kill fire ants. The Times-Picayune, New Orleans (page unknown). (Also same author and title, [www.nola.com/newsflash/louisiana/index.ssf?/base/news-11/1094926139250030.xml&storylist=louisiana](http://www.nola.com/newsflash/louisiana/index.ssf?/base/news-11/1094926139250030.xml&storylist=louisiana)