

Research Entomologist, 100% Research

USDA-ARS CMAVE, Gainesville, FL

Research focus: Integrated Pest Management of Termites. Responsibilities included research on termite detection technology and reduce risk management strategies

August 17, 1998 – August 17, 2000.

Assistant Professor and Extension Specialist, 75% Extension, 25% Research

Auburn University, Department of Entomology

Research focus: Integrated Pest Management of Termites and Other Urban Pests

Extension focus: Urban Pest Management. Extension responsibilities include developing a program to improve the educational level of homeowners, commercial pest control operators, home builders and others interested in urban pest management as well as developing a 4-H Youth Entomology Program

March 1, 1995 – August 31, 1998 (*Moved due to spousal relocation)

Graduate Assistant

Entomology and Nematology Department, University of Florida, Gainesville

August 1990 – August 1994, 1/3 time

Research Associate

Department of Biochemistry and Biophysics, Univ. of Hawai'i, Mānoa

Studied the effect of progesterone on delayed neuronal toxicity of the brain in gerbils; behavioral effects of hallucinogens on gerbils

February – August 1990 (Half-time, then full-time)

Research Associate

Department of Entomology, University of Hawai'i, Mānoa

Fruit Fly genetics project

August – November 1989 (half-time)

Graduate Assistant

Department of Entomology, University of Hawai'i, Mānoa

Tomato Spotted Wilt project and vegetable crops extension on Oahu and outer islands; field studies used to develop an IPM program for growers

January 1988 – July 1989 (half-time)

National Science Foundation Young Scholar Science Counselor

College of Tropical Agriculture and Human Resources, University of Hawai'i, Mānoa

Entailed assisting students in devising and troubleshooting their experiment proposals; learned the Harvard Business School method of teaching by case-studies. Supervisor: Sylvia Yuen

May – August 1988

Research Associate

Department of Entomology, University of Hawai'i, Mānoa

Thrips palmi project, coordinated with Waimanalo experiment station people and vegetable crops extension; field studies used to develop an IPM program

March 1987 – January 1988 (full-time)

Research Associate

Department of Entomology, University of Hawai'i, Mānoa

Diamondback moth project, coordinated with local growers and vegetable crop extension; field studies used to develop an IPM program

September 1986 – March 1987 (half-time)

Laboratory Assistant

Formosan subterranean termite project. Assisted in EPA insecticidal longevity studies; tested basaltic rock for prevention against subterranean termite infestation

Department of Entomology, University of Hawai'i, Mānoa

May 1982 – September 1986

EXTENSION PROGRAM – SPECIFIC ACCOMPLISHMENTS

I provide leadership and coordination for statewide extension educational efforts in three Extension Programs: 1) Pest Management University, 2) the Florida School IPM Statewide Program, and 3) the Community IPM program. I lead advisory committees for Pest Management University and Florida School IPM.

Pest Management University has generated >\$265,000 in revenue since 2007 – February 2014, offered 91 classes ranging from 1 to 2.5 days over 12 different curricula developed with input from a stakeholder advisory committee and subject area experts. The number of courses and hours taught is equivalent to teaching 15 credit hours per year. \$616,000 was fund-raised to build Phase I (>60 bare construction elements) and Phase II (house). PMU is a driving factor in FDACS new philosophy that “education is enforcement.” We also have successfully secured resources (people and some funds) in support of this program from the Florida Department of Agriculture and Consumer Services (FDACS) and worked with FDACS to create an alternate pathway to State certification, with 100% pass rate, for those who meet the basic statutory requirements. Our attendees come from across the U.S., Canada and the Caribbean, including regulators and extension colleagues. (Website: <https://pmu.ifas.ufl.edu/>)



Florida School IPM Statewide Program I secured \$244,372 of \$1.1M from the Environmental Protection Agency in their first round of funding for this program area and another \$87,000 to study the issue of pesticide drift around schools and to develop Good Neighbor Practices (<http://schoolipm.ifas.ufl.edu/Florida/goodneighbors.htm>). We have positively impacted close to 1 million of Florida’s 2.9 million school-aged children through training, school-district site visits, and partnership with the Florida School Plant Managers Association. We have successfully engaged our state regulators in training and enforcement, leveraging our resources from <0.30 FTE to 19 additional inspectors located throughout the state. Our partnership with FDACS provides the regulatory “teeth” behind our recommendations. Our “certified operator” model of IPM in schools and stakeholder-developed BMPs are being promoted by the Association of Structural Pest Control Regulatory Officials as a national standard. We are working directly with EPA headquarters on special projects, currently provide information that is freely available worldwide (n>100,000 visits per year, website metrics), and our logo (J. Medley, artist) has been adopted by the Southern Region IPM Work Group and others. Additional partnerships include Farm to School, Fresh Fruits and Vegetables programs; Florida Department of Health. (Website: <http://schoolipm.ifas.ufl.edu/>)



Community IPM secured industry funding to develop a solution to the tawny crazy ant problem. We were able to train pest managers to reduce ant populations by 50% using legal combinations of commercially available products. Additionally, I wrote the original grant with Fudd Graham (Auburn University) to create the “urban CoP” in eXtension which includes IPM recommendations for pests in and around structures, including schools, and remain in the leadership team (http://www.extension.org/urban_integrated_pest_management).

PEST MANAGEMENT UNIVERSITY DEVELOPMENT, OUTCOMES AND IMPACTS

Situation: Pest Management University (PMU) is a response to stakeholder requests to UF/IFAS for extension programs to support the creation and maintenance of a well-trained workforce. UF-IFAS traditionally has provided, through its on- and off-campus faculty, only a very small number of the CEUs awarded because structural pest control has been an underserved area within IFAS program priorities. Our program goal is to satisfy stakeholder needs by making IFAS information more accessible in the area of structural pest control by providing hands-on training opportunities on a regular basis. Please see our website for additional information, <http://pmu.ifas.ufl.edu/>.

We are in partnership with FDACS to offer the State Certified Operator Examination after the Master's level for each pest control category. After two years, our pass rate is 100% with the highest scores in the Wood-Destroying Organism and General Household Pest categories. Through a partnership with Deltak (<http://www.deltak-innovation.com/>), a professional online learning company specializing in higher education, we developed a course management system for continuing education units (CEU's) that can take credit cards for customer convenience and create a "transcript" for each person who enrolls in courses. The system is capable of managing online content as well as tracking registration for on-ground courses. These data are exportable to FDACS so state regulators can also track which technicians have received the required hours of training since the state does not electronically track these hours. We are beginning to see second generation pest control operators in our courses, thus partially fulfilling our goal of developing and maintaining a well-trained workforce. The course management system also is capable of administering the state certified operator examination.

Tying experiential learning with testing and CEUs is a high priority to FDACS. The pest control industry in Florida is the largest in the nation with almost 4,000 companies, over 6,100 certified operators and 31,000 identification card holders with another estimated 80,000 lawn technicians, generating >\$1B in revenue annually. Florida is also home to 14 of the top 100 revenue generating companies in the U.S. Historically, the industry has self-trained. Yet, 82% of the companies operating in Florida are small businesses with <25 employees. We believed that larger companies would be able to support their own technical training departments, while smaller companies could not. However, we are finding that even the large companies are sending their employees for training to PMU because our curricula are standardized and taught in a way employees retain the information through practical, hands-on instruction. Additionally, while there is a State examination required of certified operators, there is no technician training or certification requirement in Florida except for what is received from the pest control company. Technicians are the pesticide applicators. Training is verified by the State via affidavit. Thus, an overwhelming concern is that technicians can train other technicians improperly, which clearly becomes a consumer protection and perhaps a public and environmental health safety issue.

PMU was started through grant funds and donations, but the objectives are driven by stakeholder needs that support the program through course fees. We have also benefited from some support from the Associate VP's and Extension Dean's office for part-time help and the initial build of the website through Deltak (<http://www.deltak-innovation.com/>). Stakeholder input is organized through my standing advisory committee and as needed from construction experts including but not limited to George Seay (Vanson Enterprises, Inc., <http://www.vanson.net/>) and community sustainability experts including Kathleen Ruppert, Barbra Larson, and Pierce Jones (UF/IFAS Program for Resource Efficient Communities, <http://www.buildgreen.ufl.edu/default.htm>). The objectives below have been completed with the support and guidance of my advisory committee

whose composition has changed over the years as we have expanded our offerings. The current committee includes:

- Michael Page, FDACS Entomology and Pest Control Bureau Chief
- Paul Mitola, FDACS, Field Training Coordinator
- Allen Fugler, Florida Pest Management Association, Executive Director
- Michael Beckers, Certified Pest Control Operators of Florida, Executive Director
- Peter Quartuccio, Certified Operators of Southwest Florida, Executive Director
- Mark Ruff, Law Offices of Mark H. Ruff, pest control industry attorney
- Phil “Doc” Nichols, Massey Pest Control
- Louis Witherington, Falcon Pest Control
- Kemp Anderson, VP, Scott’s Lawn Service
- Bryan Cooksey, McCall Service
- Erica Santella, TruGreen
- Eileen Buss, UF/IFAS Landscape Entomologist
- Jennifer Gillett-Kaufman, UF/IFAS Pedagogy and Delivery Specialist
- John Capinera, UF Dept. Chair, Entomology and Nematology, *ex officio*
- Lance Osborne, UF/IFAS Apopka MREC Center Director, *ex officio*

Program Objectives, Educational Methods and Activities (where applicable), and Outcomes

Objective 1. Fund-raise, design and construct Phases I and II of the PMU training facility.

Outcome 1.1: Fund-raising successfully completed in 2011, totaling \$616,500 (see section CONTRACTS AND GRANTS, External Funding)

Outcome 1.2: Phase I completed in 2007; phase II completed in 2011

Objective 2. Be revenue generating

Outcome 2: Over \$267,000 in revenue generated since 2007 to February 2014

Educational Methods and Activities

Fund-raising. Other University-run facilities of this type received funding from the Environmental Protection Agency to develop their training facilities, but this source was depleted by the time Florida was ready to build. I wrote a grant to the FDACS Dixon Fund for \$150,000, which was approved for funding, on condition that we matched the money with private dollars. A statutory change was required to allow funding for educational activities such as PMU by the Dixon Fund. By the time the change was approved and implemented, FDACS was temporarily unable to provide funding, but my advisory committee and I had begun soliciting private donations. (See “Presentations in support of Pest Management University” below for a partial list of effort to solicit donations.) Orkin agreed to donate \$150,000 over 3 years, which would provide half of the funding for Phase I, and other donors such as BASF and Terminix had provided \$50,000 donations each in addition to several other donations of varying amounts. Orkin also donated the architectural plans which we modified for Phase I (>60 construction elements). With the assistance of Dr. John Capinera and IFAS Facilities, we were able to further leverage existing private funds through the

Cortelis building construction matching-funds from the State. Construction for Phase I was completed in 2007; phase II (The House) was completed in 2012.

Facility design. The design and construction of Phases I and II are closely tied to the learning and performance objectives in Objective 2, Curriculum Development (Objective 2). I did construction site visits, worked with attorneys, and heavily relied on my advisory committee to determine failures in pest control that led to litigation. A common reason was the failure to understand building construction and how termites and other pests exploited construction design. I also worked with FDACS to determine which complaints were most commonly received due to failures in pest control. We were also able to tie in the minimum structural requirements for the “Baseline Practices for Performing Form 13645 Wood-Destroying Organism (WDO) Inspections” as per Florida Statute 482.226 into the construction of both Phases I and II. The baseline practices were developed with input from the industry, FDACS, University of Florida and legal representatives (http://www.flaes.org/pdf/industry_baseline_final_10-07.pdf). I represent UF on the WDO Baseline Practices committee. My advisory committee and I worked closely with the builder who also had experience as an expert witness for litigation related to termite damage so that we could incorporate construction elements that led to infestations as well as construction that would exclude infestations.

Presentations in support of Pest Management University (n=5)
(Not included in list of EXTENSION PRESENTATIONS)

1. **Oi, F.M.** Apopka MREC Field Day, Vision of the Termite Training Facility and PMU. Oct 30, 2008. (>100 people)
2. **Oi, F.M.** DACS Pest Control Enforcement Advisory Council, Vision of PMU. Tallahassee, FL, Oct 7, 2008. (30 people)
3. **Oi, F.M.** Vision on PMU to DACS Pesticide Research Advisory Council. Apopka, FL, Apr 14, 2008. (20 people)
4. **Oi, F.M.**, and P. Mitola. Combat Training: The Termite Training Facility and Common Mistakes in Filling out the WDO Form. SE Pest Management Conference. Gainesville, FL, May 3, 2005. (100 people)
5. **Oi, F.M.** The Termite Training Facility and New Termiticides. SE Pest Management Conference. Gainesville, FL, May 4, 2004. (300 people).

Objective 3. Lead the development and delivery of content with a team of subject area experts relevant to the effective job performance of pest management professionals according to certification categories of Wood-Destroying Organism (WDO) and General Household Pest (GHP) Control

Educational Methods and Activities

PMU curricula are based on the task analysis for the state certified operator examinations in the categories of WDO and GHP. The task analysis was the process by which the pest control industry, FDACS and UF/IFAS vetted the learning and performance objectives which became the categories for questions on the state certified operator examinations. I was one of the UF/IFAS representatives on the task analysis committee.

Outcomes/impacts 3




1. Successfully developed 12 unique curricula ranging from 1 to 2.5 days in the categories of WDO and GHP working with an advisory committee and team of subject area experts. Each class undergoes updates and revisions no less than once a year in order to keep the material current. Curricula cover the science of the pests, including biology, behavior and control, as well as regulatory and legal requirements. Hands-on training focuses on structural inspections using the elements built into Phases I and II to determine how pests exploit building construction to provide harborage, how to prevent infestations and how to treat infestations should they occur using non-chemical and chemical methods. Each training category consists of a Basics, Foundations, Master, and Expert level, with additional training for issues of immediate need as they arise, such as school IPM, other sensitive areas, and bed bug control. We do not teach company policy, but focus on Florida laws based on enforcement action violations, trends in litigation, the biology, behavior and control of common pests, and worker protection issues associated with the industry.
2. Secured a multiple FTE commitment from FDACS to teach in every PMU class offered. I also was able to secure commitments from the pest control industry to volunteer their time to teach in our classes in partnership with IFAS and FDACS.
3. Delivered 91 classes from 1 to 2.5 days in length from 2007-2014 (Table 1).
4. Worked to brand and advertise PMU training through all structural pest control associations in the state with Dr. Eileen Buss leading the branding and marketing to landscape pest manager associations, statewide trade journal (Florida Pest Pro, distribution of 10,000) and PMU newsletter. Our newsletter now directly reaches all licensed pest control companies (n~4,000) in the State of Florida. All newsletter issues are posted at <http://pmu.ifas.ufl.edu/newsletters.shtml> .
5. Using social media to communicate with this stakeholder group, including daily posts containing information from EDIS, UF/IFAS Extension publication database:
 -  Facebook <https://www.facebook.com/PMUNews>
 -  Twitter https://twitter.com/PMU_News
 -  LinkedIn <https://www.linkedin.com/groups/Pest-Management-University-5188107>
7. We provide training to PMPs across the U.S., Canada and Caribbean Islands with daily inquiries about our program.

Table 1. Classes offered (N=91), generating >\$265,000 revenue

Class	2007, 2008 (n=12)	2009 (n=15)	2010 (n=18)	2011 (n=17)	2012 (n=15)	2013 (n=12)	2014 (n=13)
Termite Basics (1 day)	Apr 4 June 13 Aug 12	Jan 23 Jul 8 Nov 4	Mar 31 May 6 (Dupont only) Jul 30 Nov 11	Mar 30		June 14	Jul 31
Termite Foundations (2.5 days)	Oct 2007 Mar 12-14 May 21-23 Jul 16-18 Sept 17-19	Jan 14-16 Apr 15-17 Sept 23-25 Dec 2-4	Jan 20-22 Apr 14-16 Aug 11-13 Sept 8-10	Jan 26-28 Feb 28-Mar 2 (Home-Team only) Apr 13-15 Jul 20-22 Sept 7-9	Jan 18-20 Apr 11-13 May 30-Jun 1 Sept 5-7	Jan 30-Feb 1 Apr 24-26 Sept 4-6	Jan 29-31 Apr 23-25 Sept 17-19
Termite Masters (2.5 days)	Oct 15-17	Oct 21-23	Sept 29-Oct 1	Sep 21-23	Sept 26-28	Nov 13-15	Oct 15-17
Termite Expert (2.5 days)			Nov 17-19		Dec 5-7		Dec 3-5
WDO Inspections (1.5 days)	Oct 2-3	Jan 29-30 Apr 30-May 1 Nov 5-6	May 12-13	Mar 10-11	Mar 8-9	Mar 21-22	Mar 13-14
General Household Pest Basic (1 day)	Jun 12 Aug 13	Jan 22 May 14	Feb 4 Jul 29	Mar 31	Feb 3	Jul 11	Jul 30
GHP Foundations (2.5 days)		Feb 11-13 Aug 5-7	Feb 17-19 May 26-28 Sept 15-17	Feb 9-11 May 11-13 Aug 3-5	Feb 22-24 May 2-4 Jul 25-27	Feb 20-22 May 29-31 Sept 25-27	Feb 5-7 (Scott's only) Feb 26-28 April 2-4 May 28-30 Oct 1-3
GHP Master (2.5 days)			Oct 6-8	Oct 12-14	Oct 24-26	Oct 16-18	Nov 5-7

Table 1. Classes offered (N=91), generating >\$265,000 revenue (con't.)

Facilities /School IPM (1 day)			Dec 8	Feb 23 Aug 23	Mar 22 Jun 28	Sept 10-12, EPA, ASPCRO, implemeters	
Bed Bug Management (1 day)				Aug 19	Mar 16		
Special classes				EPA R4 Inspector Training Oct 31-Nov 4			
GHP Expert						Dec 4-6	

Sample of Pest Management University Hands-On Training Activities Using Phase I, Building Construction Elements



Fig. 1 Open house for Phase I, May 12, 2008. Rt: Drs. J. Cheek and L. Arrington from IFAS



Fig. 2. Practice foaming wall voids according to pesticide label directions



Fig. 3. Exercise to teach concrete patching after drilling for liquid termiticide application



Fig. 4. County faculty Pam Mattis leading discussion on treating various piers



Fig. 5. FDACS field training coordinator Paul Mitola providing instruction on how to treat around wood left in place



Fig. 6. "Spill drill" to practice the 3C's concept of "control, contain and clean-up"

Objective 4. Demonstrate gains in learning using pre- and post-test data.

Educational Methods and Activities

A short pre-test (~20 questions) to assess student knowledge is administered at the beginning of the course. Questions were developed for each learning objective and varied depending on course. A post-test was administered at the end of class test containing similar questions to the pre-test so that a paired comparison of knowledge gained could be measured.

Descriptive statistics were conducted with a simple correlation analysis to examine the relationship between years in the pest control industry and years in category versus the pre-, post- and delta scores for all attendees, regardless of category for scores collected from 2007-2010 (n=>350). I used Tukey's HSD as a means separation test where appropriate. Currently working on updating this analysis.

Outcome/Impacts 4: There were no significant differences in pre-test scores for attendees who had >1 to 30+ years of experience. The lack of significance in post-test scores and delta scores (knowledge gained) with increasing experience can be interpreted to mean that our teaching methods at PMU are effective for a wide audience. More concerning is the question of what our CEU system is doing to advance the knowledge of applicators, which has resulted in FDACS re-evaluating the content that is approved for CEUs. Whether the attendee had no experience or 30+ years of experience, they came away with an equivalent level of knowledge after the class, which I view as proof of our successful content delivery method. Additionally:

1. The average number of years in pest control for a PMU attendee was 9 years with 6.16 years practicing in the category for the class he/she was attending. The average gain in post-test score was 19.5%.
2. The average *pre-test score* for all attendees was $69.9 \pm 0.8\%$ (mean \pm SE). The overall ANOVA for all categories of pest control and experience levels was significant ($F=3.42$, $df=11,275$, $p=0.0002$), but only the pre-test scores of attendees with 0 to 1 year of experience versus 30+ years of experience were significantly different from each other. There were no significant differences between attendees who had >1 to 30+ years of experience.
3. The average *post-test score* for all attendees was $89.2 \pm 5.5\%$. The overall ANOVA for post-test scores was not significant ($F=1.66$, $df=11,274$, $p=0.0814$), indicating no difference in scores related to an operator's employment years in the pest control industry.
4. The average knowledge gained (delta) for all attendees was $19.2 \pm 0.7\%$. Based on these data, it appears that our curricula are adequately designed for new and experienced technicians in bringing them to a similar level of competency that is consistent with the learning objectives measured in the State Certified Operator Examination.

Objective 5. Increase FDACS inspector expertise and expanding training to other stakeholder groups.

Educational Methods and Activities

The pest control industry is just one stakeholder group that was identified as benefiting from the construction of the training facility during our planning meetings. Extension agents and FDACS inspectors, particularly new hires, were identified as other stakeholders. We continue to offer free in-service training to UF/IFAS Extension county faculty and do yearly FDACS inspector updates at their annual staff meeting. In providing training to FDACS inspectors, we deliver similar curricula with the same pre- and post-test that we provide to the pest control operators who attend PMU. We also hosted the EPA Region 4 Structural Pest Control Inspector training (2011), the first School IPM Partnerships Workshop sponsored by EPA and ASCPRO (2013), and will host an EPA PREP for managers (April 2014) because of our curricula, facilities and team approach.

Outcomes/impacts 5

1. Based on our pre- and post-test data, particularly for the Wood-Destroying Organisms Inspections course, FDACS inspectors do not score differently than the pest control operators they regulate.
2. FDACS is committed to sending their inspectors, particularly new hires, through PMU courses for training to provide consistency in content delivery.
3. Presentations to increase FDACS inspector expertise (n=13)
(Not included in list of presentations under EXTENSION PRESENTATIONS)

Oi, F.M. EPA Region 4 Structural Pest Control Inspector Training at PMU. Apopka, FL, Oct 31-Nov 3, 2012. Participated in agenda development and compiled notebook (526 pp.)

1. Pulling it all together: Spill drill (Nov 2, 1 hr 15 min)
2. Hot topics: Rodenticides and pyrethroid labeling (Nov 2, 45 min)
3. Monitoring exercise to reinforce “verifiable IPM” (Nov 2, 1 h)
4. Termites, mock trial video, review of slab types, calculations for full treatment exercise (Nov. 2, 4 h)
5. Bed bug IPM with canine demonstration. Oct 31, 2012 (1.5 h)

Oi, F.M. DACS staff meeting. Apopka, FL, Sept 20, 2011. (35 state regulators)

6. Bed Bugs update (1 hr)
7. School IPM update (30 min)

Oi, F.M. Florida DACS Annual Inspector Training. Apopka, FL, Sept. 21, 2010. (38 people)

8. Bed Bugs (25 min)
9. What is IPM? (45 min)
10. Caribbean, brown, hairy crazy ants (*Nylanderia pubens*) (20 min)

11. **Oi, F.M.** DACS Inspector Training, School IPM. Apopka, FL, Oct. 8, 2009 (1 hr, 35 people)
12. **Oi, F.M.** WDO Biology and behavior as a part of inspections for form 13645. DACS inspector training workshop. Teamed with Mark Ruff on legal aspects. This training was a part of information transfer after the WDO Inspection Guidelines were completed. Apopka, FL, Feb 27, 2009. (2 hr, 30 people).
13. **Oi, F.M.** DACS inspector training, termite identification and biology; building construction elements. Apopka, FL, Jul 24, 2008. (30 people, all day)

Work product summary

Curriculum guides developed with curriculum committee, ranging from 120-596 pages long

Termite Basics (1 day)

Foundations of Termite Management (2.5 days)

Master of Termite Management (2.5 days)

Expert of Termite Management (2.5 days)

WDO Inspection and form 13645 (1.5 days)

General Household Pest Basics (1 day)

Foundations of General Household Pests (2.5 days)

Master of General Household Pests (2.5 days)

Expert of General Household Pests (2.5 days)

Bed Bug Management (1 day)

Facilities IPM (1 day)

School IPM (1 day)

EPA Region 4 Structural Pest Control Inspector Training (4 days)

School IPM Partnerships Workshop (1.5 days)

Video

Mock trial video developed for use in WDO classes

Brochures and Posters

2009, Pest Management University information piece

FLORIDA SCHOOL IPM STATEWIDE DEVELOPMENT, OUTCOMES AND IMPACTS

Situation: The U.S. Environmental Protection Agency (EPA) announced its “IPM in Schools” program in the mid-1990s and Florida was an early adopter, partnering with the EPA from the start. I assumed responsibility for Florida’s IPM in Schools program in mid-2004. Florida is the fourth largest in the nation for number of school-aged children with 67 school districts, over 4,000 schools and almost 3 million school-aged children and another 1 million under the age of 5. Approximately 1 in 4 children in Florida lives in poverty, increasing the probability that even when professional pest control at home is needed, it will not or cannot be purchased, as is the case of bed bug control. The inability to control pests in the home increases the risk of pests such as bed bugs and cockroaches being brought to school, often via backpacks. Although cockroach and rodent infestations are the usual pest control concern, an emerging issue in schools is the potential to be infested with bed bugs. Bed bugs can cost schools thousands of dollars in unexpected expense. Without controlling the source of the infestation, usually home, it will be difficult for schools to prevent the introduction of this pest. A similar pest control conundrum exists for head lice, where schools are impacted because of home conditions, parental cooperation and medical privacy requirements. I branded my overall program as “Community IPM” since what we do reaches beyond pest management in schools, although we retain the program title because it is a recognized program area by granting agencies.

Integrated pest management (IPM) is an approach to the application of pest control that attempts to utilize multiple control strategies that enables the minimization of pesticide use. Unlike 38 other states in the United States, Florida does not have a law requiring IPM in schools. Thus, our program faces the challenge having schools voluntarily adopt IPM. My responsibilities range from securing funding to work with school districts to design and support IPM implementation, to providing training to IPM implementers, and working closely with Florida’s Department of Agriculture and Consumer Services (FDACS) to provide information that supports the enforcement of existing laws. I subdivided this program into two areas: 1) developing tools and providing education and training on sustainable IPM programs in and around structures, and 2) developing good neighbor practices to avoid pesticide drift around schools. In 2012, I was awarded a \$244,372 grant from the US EPA from the \$1.1M allocated to this program area. We will advance the adoption of verifiable school IPM, impacting at least one million children, by developing a consortium with Alabama and Georgia that focuses on implementation in new school districts and maintaining support for school districts with existing IPM programs. From 2013-present we began partnering with Florida Department of Education’s Office of Health Schools and Florida Green Schools Network as part of the Federal Green Ribbon School’s initiative and Florida Farm to School program. Program objectives below are largely grant driven.

Dr. Jennifer Gillett-Kaufman is this program’s co-director. My advisory committee includes:

- Michael Page, FDACS Entomology and Pest Control Bureau Chief
- Paul Mitola, FDACS, Field Training Coordinator
- Sharon Saulter, Florida Department of Health
- Robin Boxsower, Florida Department of Health

- Dan Lisenko, Manatee School District
- Eddie Flicker, Pasco School District (retired, but active)
- TBA, Orange County School District
- Garfield Rhoden, Duval School District
- Joe Jonovich, Hulett Environmental Services
- Tom Jarzynka, Massey Services
- Bryan Cooksey, McCall's Pest Control
- Paul Sugrue, Nozzle Nolen Pest Control
- Erica Santella, TruGreen
- Jim Bartley, Apex Pest Control
- Dave Schlessinger, Five-Star Pest Control
- Allen Fugler, Florida Pest Management Association, Executive Director
- Michael Beckers, Certified Pest Control Operators of Florida, Executive Director
- Peter Quartuccio, Certified Operators of Southwest Florida, Executive Director
- Mark Ruff, Law Offices of Mark H. Ruff, pest control industry attorney



Fig. 1. An example of the need to control cockroaches in a functioning school kitchen. Sticky trap was placed less than 48 hours before this picture was taken. Cockroach allergens are a potent asthma trigger.

Program Objectives, Educational Methods and Activities (where applicable), and Outcomes

Objective 1. Assess the status of IPM implementation in Florida public schools.

Educational Methods and Activities

1. From 2004 through January 2008 we facilitated IPM implementation in over 30 schools in 5 school districts (and providing training to others), with >90% of the schools receiving multiple site visits. Thus, we were able to assess practices and behaviors, not just see a snapshot in time. During the site visits, inspected “pest vulnerable areas” and provided written recommendations based on our “inspection checklist” (<http://schoolipm.ifas.ufl.edu/FloridaSIPMWelcomepackage.pdf>) and evaluated existing pest control practices. We also spoke with numerous custodial and facilities employees via requests for training by individual counties and through successive training sessions at the Florida School Plant Managers’ Association annual meeting to gather information on the

status of IPM in Schools. School districts that we targeted for intensive IPM training and implementation described met three criteria:

- 1) There was a need to control pests. (Pests are a distraction to learning.)
- 2) There was strong county faculty support to help ensure sustainability
- 3) Strong administrative support within the school district

Outcome/impacts 1

1. The most stunning result of our work was our conclusion that only 5-7% of schools practiced IPM, thus placing children at risk for the unnecessary exposure to pesticides and creating a critical need to address pest management practices in schools.
2. As a follow up, in 2013, I devised a survey tool with an on-site verification portion. Every FDACS inspector was trained in how to use the survey tool and trained on how to do on-site assessments to verify the level of pest control sample schools. Each FDACS inspector will administer the written survey as a part of their enforcement duties for their respective counties. We anticipate the surveys to be completed by the end of March 2014. It will be the most comprehensive, statewide survey of pest control practices in schools in the U.S. We began training FDACS field inspectors on school IPM since 2009.

Objective 2. Demonstrate that verifiable School IPM can be expanded from pilot schools in middle to large school districts (containing 50 to 100 schools) to a district-wide program, including high schools with daycares, as a model for the State.



Fig. 1. A Florida high school with day care employees attempting to do pest control. Insecticide was not found in the crib, but at the doorway next to the crib.

Educational Methods and Activities

The Monroe model of IPM in schools was championed by the Environmental Protection Agency who funded our first Pesticide Environmental Stewardship grant to support the implementation of verifiable IPM in pilot schools. We tested this model in Florida during our first attempt at implementing verifiable IPM. This model contains a series of 22 steps developed to ensure the recruitment and involvement of “change agents” within the school who would then carry out the communication mandates necessary for a successful program.

Model success counts on an “in-house” pest control service, meaning school district employees would be responsible for pest control. The model predicted that pest control service would be better because school district employees would be more invested. In brief, in addition to training school staff on IPM, we evaluated building construction as it related to pest control in order to provide recommendations to aid in pest prevention via excluding them from entry and conditions related to general sanitation that could provide pests a place to live and reproduce, undetected, as well as provide food and water. We provided recommendations for immediate action items, mid-term (could be completed in about 6 months) and long-term action items (could take a year or more). We followed up on whether action items were done at immediate, mid-term and long-term check points. Up until 2004-2005, the Monroe model of school IPM was successful in school districts with <50 schools, but had not been tested in larger school districts. Brevard school district was the first pilot with >85 schools to test the model.

Outcomes/impacts 2

1. In the three pilot schools, there was an average of 75% reduction of pesticide use and a 90% reduction in pest sightings.
2. By simply fixing door thresholds (exclusion), the pest problem in one of Brevard’s pilot schools decreased by 65%.
3. Custodians reported that cleaning became more efficient after clutter removal (pest harborage).
4. New storage racks were installed in cafeterias that placed the lower shelf 8” off the ground, making cleaning underneath easier. Cafeteria managers reported that the new racks and plastic bins helped keep them organized.
5. Rodent, cockroach and ant problems were almost completely eliminated due to renovations to exclude pest entry.
6. Administrators and teachers believed that complaints decreased to close to zero when compared at the start of the program. (Initially, one principal demanded that her whole school be “sprayed” at least weekly. Her complaints dropped to zero.)
7. Pest Management Company noted that pilot schools took them less time to service because of the IPM training. They were no longer getting “call-backs” for one dead ant or a cockroach at the pilot schools. However, at non-pilot schools, the time spent driving to these “call-backs” resulted in the technician spending 4 to 5 times longer per school than in the pilots.

Success story. “A good IPM program empowers the custodial staff with the tools and knowledge to communicate with the faculty, staff and administration on conditions that arise to invite and sustain pests and the ability to correct them through other avenues other than chemical application.” (Earl Lewallen, Brevard School District IPM Coordinator)

Success story. From 2004 to January 2008 we positively impacted 443,788 school-aged children in Florida from Alachua, Brevard, Duval, Manatee, Pasco, St. Lucie, Sarasota, and St. John’s Counties by either implementing programs (5 counties) or providing introductory training (3 counties) (Florida Dept. of Education 2006 Enrollment Statistics). Faculty and staff (n=50,137) also benefited from the lower risk and lower complaints associated with IPM.

Objective 3. Statewide expansion of IPM in schools on a volunteer basis or “how to run a program without funding” (2006-2012)

No funding was available to directly support IPM implementation in Florida schools from 2006 until 2012 when we received a grant from EPA; however, we were able to continue this program due to industry, school district and FDACS volunteers, listed above. This highlights a significant dilemma of being a completely grant-funded extension program. After the grant funding runs out and grant objectives are complete, the relationships that we build for UF and obligation to our stakeholders remain.

Educational Methods and Activities

We set a goal of producing a model contract for outsourced pest control services and best management practices for verifiable IPM in schools based on our observations and outcomes on different implementation methods. We also continued to provide training through the Florida School Plant Management Association annual meeting and delivered on-site assistance to school districts already engaged in our program. Finally, we developed an electronic newsletter (2010-present, <http://schoolipm.ifas.ufl.edu/Florida/newsletter.htm>) that provides tips and updates monthly. The newsletter keeps us in touch with current and new stakeholders since they simply email us back with question, concerns and comments. From 2009 – present, we provided training to FDACS inspectors on IPM in schools at Pest Management University as we began to enlist their assistance in our program through the auspices of the Bureau of Entomology and Pest Control. There are 19 FDACS regions with an inspector assigned to each region. Each inspector was charged with conducting a survey in their region on the status of IPM in schools and to determine who was performing pest control in schools. These data were shared with the advisory committee. We concluded that the Monroe model employed in Objective 1 was not appropriate for Florida in most cases since 70% of our school districts outsourced pest control services.

Outcomes/impacts 3

8. Model contract and best management practices (BMPs) completed and posted at <http://schoolipm.ifas.ufl.edu>
9. Manatee school district has become our model for a sustainable IPM program. Manatee hired a certified operator who knows how to organize the school IPM technicians as if they were a business. We are promoting that model nationally as the “certified operator model”. It is published in our “School IPM BMP” document and **Oi, F.M.** 2011. Community integrated pest management with special reference to school environments. **IN:** Urban Pest Management: An Environmental Perspective. CABI, Wallingford, Oxon, UK, pp. 83-96.

Dan Lisenko, Manatee IPM coordinator, was presented with the Southern Region IPM Center “Friends of IPM Award” in 2013.

10. Duval school district completely outsources pest control, custodial, and cafeteria staff, which makes communication and logistics difficult for sustainable IPM. We learned that the Monroe model does not apply to this situation.
11. We have had reports of cost-savings anywhere from \$60,000 to \$1M from school districts that have adopted parts or all of our IPM program.
12. The following table shows Florida School IPM Working Group Members who have, as of 2013, as a result of our expansion efforts, received support via on-site assistance, training in their county, at Pest Management University, Florida School Plant Management Association annual meeting, multiple phone calls or emails.

School District	Number of Students	Schools
Brevard	72,200	100
Hernando	23,129	23
Lake	41,100	59
Leon	33,000	48
Miami-Dade	345,000	392
Nassau	11,000	20
Orange	180,104	184
Osceola	60,069	53
Pasco	68,904	84
Polk	94,000	163
Sarasota	42,000	37
TOTAL	970,506	1,163

Objective 4. Establish stronger information exchange connections among Extension specialists in the Southern Region with interest in school IPM

Educational Methods and Activities

We convened a face-to-face meeting of representatives from states in the southern region using a facilitated ranking process similar to the one used to develop Pest Management Strategic Plans (United States Department of Agriculture Office of Pest Management Policy-National Institute of Food and Agriculture, http://www.ipmcenters.org/pmsp/PMSP_CHECKLST.pdf). Southern region priorities are aligned with the goals of the National Roadmap for IPM to 1) improve economic benefits related to the adoption of IPM practices, 2) reduce potential human health risks from pests, and 3) minimize adverse environmental risks from pests.

Outcomes/impacts 4

1. Developed regional school IPM priorities by using grant funds from the Southern Region IPM Center and United States Department of Agriculture-Extension Integrated Pest Management program (PI, Oi, F.M.), posted at: <http://www.sripmc.org/schoolIPM/>.
2. Created a Spanish-language translation of *ABCs of IPM: Making IPM Work for Your School* (collaboration with Texas AgriLife) and other training modules posted at: <https://eces.ifas.ufl.edu/elearning/study/registerlesson/listRegisterCourses-frame.faces?oid=16598840> . Qualifies for 2 FDACS Continuing Education Units.

Objective 5. Market IPM as a green school concept among school maintenance administrators and professionals.

Educational Methods and Activities

A Green Schools Workshop was co-organized by Auburn University, the University of Florida IFAS Extension and Texas AgriLife Extension personnel on behalf of the Southern Region School IPM Working group. This workshop was held on February 13-15, 2009, in Dallas, TX, and was funded by a United States Department of Agriculture-Extension IPM grant secured by the co-organizers (PI, Oi) for Marketing IPM as Green School Technology. Pest control is usually ignored in the design and building process of a school, yet preventing pest entry by building pest-proof schools is one of the most effective methods of pest control. The workshop brought together architects, engineers, builders, pest managers, city planners and school district personnel from the southern region interested in incorporating IPM as part of the building design process. Participants came from Alabama, Florida, Louisiana, North Carolina, Oklahoma, South Carolina, Texas, Washington, DC, and Wyoming.

Outcome/impacts 5

Materials developed at this meeting were presented to the Southern Association of School Business Officials at their meeting in April 2008 (www.SASBO.org) and posted at the Southern Region IPM Center website (<http://www.sripmc.org/schoolIPM/index.cfm>). SASBO membership includes those purchasing pest control services. Florida does not have a strong relationship with the organization at the state level; however, states such Texas have forged a very strong relationship with the Texas Association of School Business Officials. Information developed at this conference was used to bring awareness to purchasing agents regionally on how their purchasing decisions impact pest control.

Objective 6. Expand and reproduce existing school IPM training materials for use in training workshops, conferences, trade shows and other Extension programs and integrate new marketing and educational materials developed into a new eXtension website on school IPM:

www.extension.org.

Educational Methods and Activities

The eXtension website with school IPM content began as a grant-funded effort (PI, **Oi, F.M.**, co-PI, L.F. Graham, Auburn University, Community of school IPM practitioners, 2005-2007, \$40,000). Virtually all United States Department of Agriculture-National Institute of Food and Agriculture grants now require at least one objective dedicated to posting deliverables at the appropriate eXtension website. We hold regular face-to-face “work days” that are attached

to larger meetings that most of the Community of Practice attends, such as the Southeastern Branch of the Entomological Society, and the National Conference on Urban Entomology, as well as monthly conference calls to update action plans and discuss additional material as needed.

Outcome/impacts

Work products are posted at: http://www.extension.org/urban_integrated_pest_management, including action plans for management and control of common pests around schools. The eXtension website intends for material to be constantly updated, thus, posting dates, revisions and evolution of authorship are tracked at the website.

Program objectives related to pesticide drift around schools

(These objectives are funded by a grant from the National Association of State Departments of Agriculture, Oi. F.M., and J. Gillett-Kaufman, Good Neighbor Practices, 2010-2012, \$84,280 listed in Section 18a. CONTRACTS AND GRANTS, funded externally.)

Situation. In 2007, Pesticide Action Network of North America (PANNA) collected eight 24-hour air samples outside of a residence located 0.3 miles from the school and 63 ft. from an agricultural field in Hastings, FL, as part of a science project. They directly reported to the media the presence of pesticides in the air at low levels. This cost the school district and FDACS significant resources to collect data to counter media attacks. The School Board response was to hire a private consulting firm to collect independent air samples. FDACS responded by analyzing the methods found in both PANNA and consultant studies because of the widely varying results. They found that pesticide levels in air at and near the school did not present unacceptable health risks. Nevertheless, the media attention cost significant resources and I was asked by the UF/IFAS Associate Dean for Extension, Dr. Dusky, to write a grant in order to develop “Good Neighbor Practices” to avoid potential incidents related to pesticide drift around schools.

Our project is unique in that it strives to mitigate potential effects of pesticide drift by developing Good Neighbor Practices in cooperation with growers, Florida’s state regulatory agency (Department of Agriculture and Consumer Services, DACS), school district personnel, county personnel and the University of Florida, Extension, as well as extends the information to national partners.

Objective 7. Define the number of schools in proximity to agricultural operations in Florida.

Educational Methods and Activities

These data serve as a baseline to measure the impact of this extension project and for future risk analyses. Currently, we have no statistics to guide us in determining which school districts would have the greater risk to schools in close proximity to agricultural operations and thus would require careful monitoring and training to avoid drift incidents. A survey tool was developed with assistance from Associate Extension Dean Dusky due to the sensitive nature of potential pesticide drift and potential impacts on the agriculture industry in Florida. Schools were contacted by letter to the district superintendent, then email and phone follow-ups to appropriate school personnel as referred by the superintendent. Many districts required

submission of a separate set of approvals forms equivalent to the University Institutional Review Board (IRB) process. Broward and Dade declined participation. IRB reviews are required for any grants involving human subjects, including administering surveys. In order to receive an exemption or expedited review from IRB requirements, grant PIs must still fill out Protocol Submission Forms describing the research methodology, potential benefits, potential risks, how participants will be recruited, provide a description of the informed consent process, etc.

Outcome/impact

Of the 750 schools that answered our survey, 294 schools were within 2 miles of an agricultural operation and only 2 reported pesticide drift. These data are the first of its kind to quantify the risk of pesticide drift to schools in close proximity to agricultural operations. Follow-up surveys are being completed in 2012, but the returns have been poor. We believe that the low response rate is because of the low number of initial reports.

Objective 8. The collection and analysis of air samples from areas bordering/surrounding selected agricultural pesticide application operations during applications as a measure of risk.

Educational Methods and Activities.

Air sampling was done in cooperation with FDACS, Dec 2010. Sampling was done in Hastings, FL, where the initial concerns were publicized, with the cooperation of a concerned grower who was not involved in the initial report. Sensidyne Personal Air Sampling Systems (Model LFS-113D) coupled to a Perkin Elmer STS 25 Sequential Tube Sampler packed with XAD-2 resin or charcoal was used to collect air samples before, during and after pesticide application.

Outcomes/impacts 8

Conclusion of Florida DACS Analytical Section report: “Indications based on the available data are that 1) the maximum level of detected thiodicarb and chlorothalonil in the air are well below estimated levels of potential concern; and 2) the achieved detection limits for the non-detected analytes are significantly less than estimated levels of potential health concern. These results will be used to help growers understand the potential for drift to occur and encourage their adoption of GNPs to minimize exposures.”

Objective 9. Develop “good neighbor practices” and disseminate educational material to raise awareness and increase planning for a pesticide drift event.

Outcomes/impacts 9

1. “Good neighbor practices” brochures were developed, printed and distributed to each county at the annual meeting of Extension Professionals Association of Florida.
2. Lands, S., D. Dinkins, J. Gillett-Kaufman, and **F.M. Oi**. 2012. Good neighbor practices (GNPs): Increasing communication between school personnel and neighboring landowners. Poster presented at 2012 Central District Extension Faculty Symposium, April 26, 2012, at the UF/IFAS Sumter County Extension Office. 90 attendees. 2012 Central District Extension Faculty Symposium Poster Award. 1st Place.

Success Stories

Florida's Leadership Role

- As part of my responsibilities for the IPM in schools area, I am frequently asked for input to documents such as EPA's National Strategy for school IPM, EPA's school siting document, and am asked to work with other State Lead Agencies through the Association for Structural Pest Control Regulatory Officials subcommittee on school IPM. I also was asked to apply for and was awarded a grant on using Good Neighbor Practices to avoid pesticide drift around schools. Our research determined that pesticide drift around schools in Florida is very low and is the first of its kind to provide data to substantiate this finding, according to the National Association for State Departments of Agriculture. Finally, because I have worked with several school districts in developing policies concerning bed bugs by providing entomological guidance, I was appointed to the Statewide Bed Bug Working Group by Michael Page, Chief for the Bureau of Entomology and Pest Control, Department of Agriculture and Consumer Services. The long-term goal of the Florida School IPM Statewide program has been to reduce the risk of pests and unnecessary pesticide use near Florida's children.
- As a result of our IPM implementation strategy, Florida has been placed in a leadership position regionally and nationally. Florida was invited to be part of the Pest Management Strategic Plan (PMSP) planning and development committee. The committee was convened in October 2006. The draft of the PMSP is slated for release and review in Feb. 2008. (Faith Oi, represented) The PMSP provides the funding priorities for many granting agencies such as the USDA. The goal of the PMSP is to have IPM implemented in all schools nationally by 2015.
- Both pest management professionals and school district personnel now attend Pest Management University courses.

ADDITIONAL PROGRAMMATIC EFFORTS TOWARD SCHOOL IPM

Meetings and training sessions in support of School IPM: >100 (last 10 years)

Work group meetings were held twice a year until I suspended these meeting due to restrictions in travel budgets for school personnel. We switched information delivery to the Florida School IPM News (2010-present, <http://schoolipm.ifas.ufl.edu/Florida/newsletter.htm>)

Working Groups Related to School IPM

Florida School IPM Working Group, Director

Southern Region School IPM Working Group

- Executive Committee
- Co-organizer, Marketing IPM as Green School Technology for Southern Schools Workshop, Dallas, TX. Feb. 13-15, 2008

National School IPM Working Group, Member (2006-2009)

- First National School IPM Meeting, Reno, NV. Nov. 20, 2009. Purpose of this meeting was to unveil the PMSP and serve as the first working group meeting.

OTHER PROGRAMMATIC EFFORTS

TAWNY CRAZY ANT DEMONSTRATION PROJECT – SPECIFIC ACCOMPLISHMENTS

Situation

Problem: *Nylanderia fulva* (Mayr) infestations in urban areas annoy residents and pets by spoiling people's ability to enjoy their yards, patios and pools (Fig 1). Infestations have negatively impacted the sale of real estate. Tawny crazy ants infesting electrical equipment can cause short circuits and power outages. The ability of these ants to infest equipment is of great concern to industries such as NASA in Houston, TX, and Brevard County, FL, where the ants are known to exist.

The common method of control for this ant is the application of liquid pesticides, often exceeding what is allowable by the pesticide label because people are desperate for effective control. It is not uncommon for me (due to my Extension appointment) to receive requests for assistance from homeowners who have resorted to purchasing professional products online. The complaint is that they cannot gain satisfactory management of this ant even after applying the products in a manner that far exceeds the label application rate of what a licensed pest control professional would be legally allowed. Relying on a single control method will not solve an established infestation.

Goal: The goal of this demonstration project was to find commercially acceptable baits to manage this ant and put together an integrated pest management program that would use several methods of control. The demonstration project was intended to show homeowners and pest control operators how treatment options are site specific.



Fig. 1. Significant Caribbean crazy ant mortality after perimeter treatment using a liquid insecticide.

Program Objectives

Objective 1. Determine the distribution of *Nylanderia fulva* at the Jacksonville Zoo

Educational Methods and Activities

In 2008, I received a request from a Master Gardener who was volunteering at the Jacksonville Zoo for help in controlling a new invasive pest ant and educating zoo visitors and employees about this new pest. The zoo is on a 140-acre property that abuts the U.S. Navy fueling depot, the other site for bait testing with my Bayer Environmental Sciences cooperator. The ants were in the rhinoceros enclosure, around the man-made pond that contained fish costing

upward of \$30,000, and were putting animals giving birth at risk. We divided the zoo into 12 sampling areas and recorded ant population data over 136 points for 3 years. Signs at the zoo educate visitors about this ant. This educational material can reach up to 1,000 visitors a day.

Outcome/impacts 1

1. We determined that ants did not readily move from one area to another.
2. Populations did not increase exponentially over time, as hypothesized.
3. Decreased ant foraging over time was likely due to severe weather events (hurricanes) and cold temperatures.

Objective 2. Determine seasonal macronutrient preferences of the tawny crazy ant

Methods and Activities

Four locations were selected for macronutrient data collection: Sarasota, Jacksonville, and two sites in Gainesville, FL. Samples of a protein, carbohydrate and lipid food were placed on the ground near areas of ant activity. After 15 min, the number of ants was recorded. This test was replicated 10 times and repeated monthly for twelve months.

Outcome/impacts 2

1. The Caribbean crazy ants' overall diet preference was for protein
2. Seasonal fluctuation in diet preferences were documented ("diet switching")
3. Ants preferred sucrose to honey
4. These data correlate well with the colony census data we collected. Proteins are most preferred during periods of copious egg-laying in the spring, while during the summer ants tended to prefer liquid sugar formulations.
5. These data will aid bait selection for laboratory and field-testing.

Objective 3. Determine laboratory efficacy of insecticidal baits

Educational Methods and Activities

Laboratory bioassays testing 15 commercially available baits were repeated over spring, summer and fall with appropriate controls against small colonies that included workers, queens and brood. We measured attractancy and mortality in a "no-choice" test.

Outcome/impacts 3

1. Baits that were most attractive were not the same as the ones that produced the highest mortality.
2. Given that a combination of both attractiveness and mortality are required for a successful management program, our laboratory data suggests that granular baits Amdro Pro® and Maxforce Complete® are candidates for field testing.

Objective 4. Determine the efficacy of spray insecticidal treatments and granular bait in field tests against the Caribbean crazy ant.

Educational Methods and Activities

The Jacksonville Navy fueling depot has had significant problems with the tawny crazy ant for almost a decade. In 2010, we partnered with Bayer Environmental Sciences. Bayer recently received registration for MaxForce Complete®, a new concept in ant baiting. The matrix contained carbohydrates, lipids and proteins in different granule sizes with the hypothesis that it would appeal to ants of different sizes and was simply a PMPs decision on which bait to use during the field season due to the “diet switching” phenomenon. Our objective was to determine the efficacy of large quantities of bait, secured in a station, against a spray treatment and untreated control against the tawny crazy ant. The site around the tanks was selected to minimize the potential impact of contracted pest control services around buildings on this experiment. Treatments for this protocol included a bait-only treatment (MaxForce Complete®), Suspend® (i.e., Deltamethrin), and an untreated control, which were randomized and applied accordingly. Bait was placed into a rodent station, which was secured before placement. Four stations each with 1 lb. of bait were placed within a 100 ft. section of wall. Our observations were that granular baits became unpalatable during summer rains, so protecting the bait in secured stations would allow ants to forage and pick up the toxicant for a longer period of time. One hundred foot of wall constituted one replication. Suspend® was applied according to label directions. Population counts were taken before treatment, 2-days after treatment, and approximately weekly from June through October 2010.

Outcome/impacts 4

1. Suspend® spray treatment was effective at 2-days after treatment, but ant populations began to return within one week. By week 2 post-treatment, ant populations returned to pre-treatment levels.
2. Maxforce® granular bait in secured stations appeared to provide approximately 50% control of this ant when compared to pre-treatment levels.
3. Subsamples of bait from the secured stations were still palatable after one month in the field based on laboratory observations.
4. Toward the end of the field season, we pilot tested “Quantum dilute®” (Bayer’s MaxForce Quantum® diluted in 25% sucrose.)
5. We observed other ants besides the Caribbean crazy ant during our sampling
6. Baiting significantly reduces the amount of active ingredient introduced into the environment. While 50% reduction of millions of ants still leaves a lot of ants in an area, baiting provides an environmentally friendly option that warrants further investigation.

Objective 5. Determine the efficacy of granular and liquid bait in field tests against the Caribbean crazy ant

Methods and Activities

Field counts in 2010 indicated that CCA populations invaded the property from the fence line near refueling tank #2076. Thus, in 2011, we proposed to use the fence line as a baiting site.

Outcome/impacts 5

1. MaxForce Complete® seemed to successfully suppress populations of CCA from 7 to 10 days post-application at 1X and 2X rates when applied as a fence line broadcast and with bait protected in secure stations at the concrete wall when applied early in the field season.
2. Quantum dilute® was effective in suppressing populations at the fence line and the concrete wall during the peak of the CCA season (June to Nov.) based on pre- and post-application sampling data.
3. The combination of MaxForce® early in the season with Quantum dilute® applied during the middle of the season (June), allowing CCA constant access via protected and secured bait stations, may keep CCA populations low enough for PMPs to offer monthly service and a minimal amount of liquid spray applications, resulting in a significantly more environmentally sound approach to controlling this ant.
4. It is possible that 2010 and 2011 treatments allowed other non-invasive ants into the sampling area, and perhaps pushed CCA out of the sampling areas around tank 2076. Non-CCA ants around untreated tank 2074 seemed to significantly exclude CCA from being detected during sampling. We did not sample this area during 2010, so cannot make inferences as to the impact of non-CCA species on CCA at tank 2074 without treatment.
5. We are awaiting amended registration for Quantum dilute® from US EPA as a method to suppress Caribbean crazy ant populations

*Objective 7. Disseminate research on Caribbean crazy ant**Educational Methods and Activities*

This project is still underway; however, we have begun to disseminate information to our clientele.

Outcome/impacts 7

1. Extension pest management information for schools, homeowners and pest managers: <http://schoolipm.ifas.ufl.edu/Florida/crazyantpests.htm>
2. Educational door hanger with Caribbean crazy ant facts and tips for better control. These are available for [home printing](#) and for [commercial printing](#).
3. One year of Dawn Calibeo's assistantship was funded by a T-Star grant on which we are cooperators (PIs E. Buss and D. Oi). It allowed interdepartmental and interagency cooperation and provided us a venue to share our research with other groups with whom we would not normally interact.
4. Publications included 1 EDIS publication (Sec. 16.g., EDIS #2), 2 Florida Pest Pro articles (Sec 16.g., 1, 5) and 1 Pest Control Technology (Sec. 16.g., 56) article.
5. Presentations included 1 national submitted to the 2011 Imported Fire Ant Conference Special Session on Caribbean Crazy ants (Sec. 17.a.b.) and a Symposium organized and moderated by Dawn Calibeo at the National Conference on Urban Entomology (Sec 17, b, 1 , 2).
6. Generated more program funding to work toward a solution for managing the invasive tawny crazy ant.

EXTENSION PRESENTATIONS

Summary of Extension Presentations

All invited

TOTAL (N=319)

Presentation category	Number
International	15
National	40
Regional	21
Out-of-State	31
Statewide	47
Pest control associations (last 10 yrs)	42
Other groups (last 10 years)	15
County meetings	9
In-service training	6
Master gardeners	25
In support of PMU, listed in program description, not including courses (n=91)	18
School IPM, listed in program description	50
TOTAL	319

*Complete list of titles available upon request

Selected Extension PresentationsInternational, Invited presentations

Canadian Pest Management Association, March 20-22, 2014. Mont Tremblant, Canada. Estimated 200 PMPs.

1. Invasive ants (1 hr)
2. Practical insect ID for PMPs (1 hr)

National Pest Management Association

3. “What the World Would Look like without Pest Control,” Oct 22-25, 2013. NPMA Pest World, Phoenix, AZ (1 h, 15 min, 100 people)

PestWorld East 2012, Dubai, April 21-23, 2012. 250 PMPs from UAE, Egypt, India, Lebanon, Saudi Arabia.

4. Fredericks, J., and **F.M. Oi**. Hands-On Demonstration of Bed Bug Management Techniques (30 min)
5. **Oi, F.M.** Understanding How Pesticides Work and Why It Matters to the Pest Management Professional (1 h)

6. **Oi, F.M.** Biology Behavior and Control of German Cockroaches Using IPM Techniques (1 h)
7. **Oi, F.M.** Important Pest Ants and Options for Integrated Pest Management (1 h)

National, Invited Presentations

1. Organized and led School IPM Partnerships Workshop, sponsored by EPA and ASPCRO as a part of Florida SIPM Grant. Led 1.5 day training, 35 attendees representing EPA, ASPCRO, implementers and Extension. Sept 10-12, 2013
2. School IPM: What's the Status of National SIPM? Panel discussion including Thomas Cook (EPA Center of Excellence Director), Tom Green (IPM Institute), Don Renche (TAMU), Dan Lisenko (Manatee school district, FL), Faith Oi (Florida SIPM Director). Aug 18-21, Association for Structural Pest Control Regulatory Officials Annual Meeting, Atlanta, GA (1.5 hr, 150 people)

Purdue Conference, IN, Jan 7-8, 2013

3. "Cockroach IPM", (1 hr, 200 people)
4. "IPM in Sensitive Accounts", (1 hr, 300 people)

In-State, Invited Presentations

1. DACS staff meeting, school IPM training. Oct 8, 2013 (3 hrs, 35 people)
2. "Subterranean Termite Update: What Technician Need to Know," FPMA Region 9 (Pinellas), Oct 3, 2014. (2 hr, 30 people)

Florida School Plant Managers Annual Meeting (35-40 people)
Sept 9, 2014

3. Fire Ants & Stinging Insects (1 hr)
4. Termites & Mulch (1 hr)
5. The impact of landscaping on Indoor Pests (1 hr)

Sept 10, 2014

6. Public Pest Control & Public Health: Why sanitation is so important (1.5 hr)
7. "Invasive Ants" and "Invasive Termites" Certified Pest Control Operators Field Day, July 31, 2013 (2 hrs, 100 people)
8. McCall WDO training, endorsement and recertification for all service and sales, Marion county extension office, Jun 12, 2013 (8:30 to 4:00 pm, 35 people)
9. FPMA Region 5, Jacksonville, FL, May 14, 2014 (2 hr, 35 people)

Out-of-State, Invited Presentations

Alabama Pest Control Association joint summer meeting with Mississippi Pest Control Association

1. Invasive Termite Species and What Technicians Need to Know, Jun 3, 2013 (1 hr, 100 people)
2. Ants! Jun 4, 2013 (1 hr, 100 people)

3. “Separating the Wheat from the Chaff: A Survival Guide to Junk Science,” Alabama Vector Association Meeting, Mar 7-8, 2013 (1 hr, 125 people)

NPMA Southern Region Conference, Tunica, MS, Feb 12-13, 2013

4. “Understanding Fleas, Disease Transmission, Biology and Management”, Feb 12, 2013 (1 hr, 200 people)
5. “Subterranean Termite Update: What Technicians Need to Know”, Feb 13, 2013 (1 hr, 175 people)

TEACHING, ADVISING, AND INSTRUCTIONAL ACCOMPLISHMENTS

I do not have a formal teaching appointment, but have had the honor of mentoring highly driven undergraduate and graduate students who have worked in or have been associated with my program. I have advised these students in career placement opportunities and in selecting graduate schools, including assisting one with placement in the prestigious NIH Graduate Partnerships Program. I guest lecture yearly in the Forensic Entomology (ENY4701) and Insect Diagnostics (ENY6942) courses. I developed two courses: “Urban Pests that Invade Structures (ENY4905, Summer A 2004) and an honors colloquium on forensics (ALS4921, Spring 2008). The honors colloquium in particular relied upon my extension experience in working with attorneys and with consultants to law enforcement and regulators. I also co-lead a seminar series offered every third year (ENY6934) with Dr. Phil Kaufman, which has varied from topics in forensic entomology to urban and public health issues. I assist in the recruitment of potential students to the programming offered in the UF Department of Entomology and Nematology through Pest Management University. In 2012, I arranged tours for 3 prospective honors high school students from Pest Management University leads. Much of the Pest Management University course content was taken from “Pests that Invade Structures Course” that I developed and delivered in Summer 2004 (ENY4095/6905). My team and I deliver the approximate equivalent of 15 academic credit hours per year at Pest Management University.

Finally, as a part of my responsibilities, I have worked with graduate students and one post-doctoral research associate on 26 presentations at professional meetings, focusing on data analysis and effective communication of their findings. Presentations range in topics such as tawny crazy ant IPM strategies, seasonal population trends, distribution as well as, the status of acaricide resistance in the brown dog tick, foraging behavior of subterranean termites, the effects of three sugar-based cellulase inhibitors on feeding and mortality of *Reticulitermes flavipes* workers, the evaluation of RNA interference in *R. flavipes* through voluntary feeding, and the defaunation of *Reticulitermes flavipes* workers and its effect on cellulase gene expression.

GRADUATE COMMITTEE ACTIVITIES

Applicant's Role	Student	Home Dept.	Complete Date
Chair Ph.D.	Michael Bentley	Entomology and Nematology	Projected 2015
Chair Ph.D.	Dawn Calibeo	Entomology and Nematology	Projected 2014
Co-Chair Ph.D	Amanda Eiden	Entomology and Nematology	December 2013
Chair Master's	Marsha Wheeler	Entomology and Nematology	December 2007
Chair Masters	Gary Jonovich	Entomology and Nematology	August 2005
Member Ph.D	Susan Gruner	Entomology and Nematology	Projected 2014
Member Ph.D	Matthew Tarver	Entomology and Nematology	December 2009
Member Ph.D	Matthew Aubuchon	Entomology and Nematology	2005
Member Ph.D	Rebecca Baldwin	Entomology and Nematology	December 2005
Member Ph.D	Deanna Branscome	Entomology and Nematology	2004
Member Ph.D	Dina Richman	Entomology and Nematology	2003
Member, DPM	Jade Allen	Doctor of Plant Medicine	2004
Member Master's	Roxanne Burrus	Entomology and Nematology	2004
Member Master's	Larry Jacobs	Entomology and Nematology	Withdrew
Member Master's	Kimberly McCanless	Entomology and Nematology	August 2002
Member Master's	Cynthia Tucker	Entomology and Nematology	August 2002
Member Master's	Shawn Brooks	Entomology and Nematology	December 2001
Member Master's (non-thesis)	Robin Minor	Entomology and Nematology	2002
Member Master's	Thomas Powell	Entomology and Nematology	May 2000

TEACHING EVALUATIONS

Summary table of evaluations detailed below

Course	Term	# of students	Re-quired	Candidate Overall		Department Overall		College Overall	
				Instruct -or	Course	Instruct -or	Course	Instruct -or	Course
ENY-6 934	Spring 2010	7 out of 6	No*	4.14	.	4.55	.	4.45	.
ALS-49 21	Spring 2008	11 of 14	No	4.80	4.40	4.51	4.27	4.39	4.10
ENY-6 934	Fall 2006	5 of 6	No*	4.60	4.40	4.45	4.27	4.30	4.10

ENY-4 905	Spring 2006	3 of 7	No	4.67	4.67	4.61	4.34	4.41	4.21
ENY-6 934	Spring 2006	4 of 4	No*	4.75	4.75	4.61	4.34	4.41	4.21
ENY-4 905	Sum 2004	4 of 4	No	4.75	4.75	4.70	4.54	4.41	4.20
ENY-6 905	Sum 2004	5 of 5	No	4.40	4.60	4.70	4.54	4.41	4.20
ENY-3 225C	Sum 2003	8 of 7	No	5.00	4.75	4.55	4.38	4.47	4.25
ENY-5 226C	Sum 2003	5 of 5	No	5.00	4.40	4.55	4.38	4.47	4.25

*Seminar is a departmental requirement for graduate students, but students are not required to choose a particular seminar. This seminar series is co-led with Dr. Phil Kaufman on the topics of medical, structural and public health entomology and is currently on a 3-year rotation.

Scientific presentations made by students (n=26) which is a result of a significant investment to assist in data analysis and interpretation as well as providing guidance for effective communication of results. Occasional my data were presented by students to give them an opportunity at public speaking. “*” next to the name of the student or post-doctoral researcher

National

Invited

1. Calibeo, D.,* and **F.M. Oi**. Caribbean crazy ant IPM strategies. Symposium on Caribbean Crazy Ants. National Conference on Urban Entomology. Atlanta, GA, May 20-23, 2012.

Submitted

1. Eiden A.L., Kaufman PE, Oi FM. 2012. Acaricide resistance in Florida *Rhipicephalus sanguineus* populations. Florida Entomological Society Meeting, Jupiter Beach, FL.
2. Eiden, A.L.,* P.E. Kaufman, **F.M. Oi**, M.J. Dark, and R. Miller. 2012. Status of acaricide resistance in the brown dog tick. Livestock Insect Workers' Conference, Kalispell, MT. June 24-27 2012.
3. Calibeo, D.,* and **F.M. Oi**, Caribbean crazy ant population movement. Entomological Society of America. Nov. 13-16, 2011.
4. Calibeo-Hayes, D.,* and **F.M. Oi**. *Nylanderia pubens* in Florida: Seasonal population trends, distribution, and observations. 2010 Imported Fire Ant Conference with special session on *Nylanderia* sp. Presented by D.H. Oi. Apr. 19-22, 2010 (10 min)
5. Wheeler, M.,* X. Zhou,* **F.M. Oi**, and M. E. Scharf. 2007. Effects of three sugar-based cellulase inhibitors on feeding and mortality of *Reticulitermes flavipes* workers. Entomological Society of America Annual Meeting, San Diego, CA. Dec. 9-12, 2007 (10 min.)
6. Zhou, X.,* M. Wheeler,* **F.M. Oi**, and M. E. Scharf. 2007. Evaluation of RNA interference in *R. flavipes* through voluntary feeding. Entomological Society of America Annual Meeting, San Diego, CA. Dec. 9-12, 2007 (10 min.)

7. Wheeler, M.M.,* X. Zhou,* M.E. Scharf, and **F.M. Oi**. 2006. Defaunation of *Reticulitermes flavipes* workers and its effect on cellulase gene expression. Entomological Society of America Annual Meeting, Indianapolis, IN. Dec. 10-13, 2006. (10 min.)
8. Zhou, X.,* J.A. Smith,* P.G. Koehler, **F.M. Oi**, and M. E. Scharf. 2006. A glimpse at the cellulose digestion system of the lower termite *Reticulitermes flavipes*. IUSSI. (poster)
9. Zhou, X.,* J.A. Smith,* **F.M. Oi**, P.G. Koehler, and M.E. Scharf. 2005. Functional genomics reveals a system of collaborative cellulose digestion in the lower termite, *Reticulitermes flavipes*. Entomological Society of America Annual Meeting, Ft. Lauderdale, FL. Nov. 6-9, 2005. (10 min.)
10. Melius, D.A.,* and **F.M. Oi**. 2004. Exterior perimeter and limited interior termite treatments with Premise 75. Entomological Society of America Annual Meeting, Salt Lake City, UT. Nov. 14-17, 2004. (10 min.)
11. Smith J.A.,* P.G. Koehler, and **F.M. Oi**. 2004. Termite digestive enzymes. Entomological Society of America Annual Meeting, Salt Lake City, UT. Nov. 14-17, 2004. (10 min.)
12. Smith J.A.,* P.G. Koehler, and **F.M. Oi**. 2003. Trail following in three Florida termite species. Entomological Society of America Annual Meeting, Cincinnati, OH. Oct. 26-29, 2003. (10 min.)
13. Burrus, R.,* P.G. Koehler, D.H. Oi, E. Gerberg, and **F.M. Oi**. 2003. *Monomorium pharaonis* (L.) food preferences of patient-care fluids in hospital environments. Entomological Society of America Annual Meeting, Cincinnati, OH. Oct. 26-29, 2003. (10 min., student paper competition, placed second)
14. Branscome, D.L.,* P.G. Koehler, and **F.M. Oi**. 2003. Translocation of *Salmonella* on the cuticle of experimentally inoculated *Periplaneta americana*. Entomological Society of America Annual Meeting, Cincinnati, OH. Oct. 26-29, 2003. (10 min.)
15. Tucker, C.L.,* P.G. Koehler, and **F.M. Oi**. 2003. Susceptibility of various building materials to termite infestation and damage. Entomological Society of America Annual Meeting, Cincinnati, OH. Oct. 26-29, 2003. (10 min.)
16. Branscome, D.L.,* P.G. Koehler, and **F.M. Oi**. 2002. Prevalence of *Salmonella* spp. and *Escherichia coli* bacteria in association with insects collected from food handling and processing facilities. Entomological Society of America Annual Meeting, Ft. Lauderdale, FL. Nov. 17-21, 2002. (10 min.)
17. Baldwin, R.,* P.G. Koehler, and **F.M. Oi**. 2002. Toxicity of dishwashing soap to German cockroaches, *Blattella germanica*. Entomological Society of America Annual Meeting, Ft. Lauderdale, FL. Nov. 17-21, 2002. (10 min.)
18. Martyniak, R.,* P.G. Koehler, and **F.M. Oi**. 2002. Method to document selection of imported fire ant, *Solenopsis invicta*, hosts by the decapitating phorid fly, *Pseudacteon tricuspis*. Entomological Society of America Annual Meeting, Ft. Lauderdale, FL. Nov. 17-21, 2002. (10 min.)
19. Tucker, C.L.,* P.G. Koehler, and **F.M. Oi**. 2002. Construction of tunnel network components by eastern subterranean termites, *Reticulitermes flavipes* (Kollar) in compacted and disturbed soil. Entomological Society of America Annual Meeting, Ft. Lauderdale, FL. Nov. 17-21, 2002. (10 min.)

In-State
Submitted

1. Eiden, A.,* P. Kaufman, and **F.M. Oi**. 2012. Acaricide resistance in brown dog tick populations in Florida. 9th Arbovirus Surveillance and Mosquito Control Workshop. St. Augustine, FL. Mar. 29, 2012.
2. Tucker, C.L.,* P.G. Koehler, and **F.M. Oi**. 2003. Infestation of common building construction materials by eastern subterranean termites, *Reticulitermes flavipes* (Kollar). Florida Entomological Society Meeting Hutchinson Island, FL. July 27-30, 2003.
3. Branscome, D.L.,* P.G. Koehler, and **F.M. Oi**. 2003. Translocation of *Salmonella* on the cuticle of experimentally inoculated *Periplaneta americana*. Florida Entomological Society Meeting Hutchinson Island, FL. July 27-30, 2003.
4. Burrus, R.,* P.G. Koehler, D.H. Oi, E. Gerberg, and **F.M. Oi**. 2003. Pharaoh ant (*Monomorium pharaonis* L.) food preferences of patient-care fluids. Florida Entomological Society Meeting, Hutchinson Island, FL. July 27-30, 2003.
5. McManamy, K.,* P.G. Koehler, and **F.M. Oi**. 2002. The effect of moisture on the survival of the Eastern subterranean termite, *Reticulitermes flavipes*. Florida Entomological Society Meeting, Clearwater Beach, FL. July 28-31, 2002.
6. Martyniak, R.,* P.G. Koehler, and **F.M. Oi**. 2002. Selection of imported fire ant (*Solenopsis invicta*) host by decapitating phorid fly (*Pseudacteon tricuspis*). Florida Entomological Society Meeting, Clearwater Beach, FL. July 28-31, 2002.
7. Branscome, D.L.,* P.G. Koehler, and **F.M. Oi**. 2002. New records of *Salmonella* spp. bacteria recovered from insects. Florida Entomological Society Meeting, Clearwater, FL July 28-31, 2002.
8. Tucker, C.L.,* P.G. Koehler, and **F.M. Oi**. 2002. Effects of soil compaction on the total tunnel network by subterranean termites (*Reticulitermes flavipes*). Florida Entomological Society Meeting, Clearwater, FL. July 28-31, 2002.

CONTRIBUTION TO DISCIPLINE/RESEARCH NARRATIVE

Strong extension programs use excellent science in the implementation of a program to solve stakeholder needs and problems. While implementing practical stakeholder solutions, we often find data gaps that need to be filled; thus, while I do not have a formal research appointment, my research program is based on data needs for my stakeholder groups.

My emphasis is on developing different integrated pest management strategies for social insect control with a heavy emphasis on subterranean termites and invasive ants (See EXTENSION PROGRAM, OTHER PROGRAMMATIC EFFORTS TAWNY CRAZY ANT DEMONSTRATION PROJECT). I have collaborated with colleagues on studies investigating gene regulation as a potential method for environmentally friendly termite control. Our team, led by Dr. Michael Scharf, was recognized at the 2012 University of Florida Research Awards Ceremony for our utility patent using RNAi to validate new termiticide (i.e., insecticide for termite control) target sites or what I have called “the new mode of action” in my extension presentations.

Providing data to the Florida Department of Agriculture and Consumer Services (FDACS) and other government agencies to support their decisions directly relates to my

extension appointment. Our research has impacted the approval of at least one termite control product (Advance Termite Bait System, BASF) received in November 2011 by FDACS for use on new construction. While validating product efficacy, we demonstrated that termites in an area did not correlate with structural infestation. Five years of field data collection will likely result in the re-consideration of the current standard used to approve bait products for termite control in Florida because we were able to fill a data gap on termite foraging behavior that was largely absent at the time of the rule making.

Due to the importance of pesticide use and other forms of pest control in Florida schools, we worked closely with various state and federal agencies to generate the preliminary data that secured our current EPA grant (\$244,372, 2012-2014) to support integrated pest management (IPM) in schools. IPM is a process for balancing the risks between pests and pesticides to achieve long term pest suppression using a wide variety of technological and management practices including structural and procedural modifications that reduce the food, water, harborage, and access used by pests. There is little hard data on the efficacy of IPM in schools. My program collected data from schools implementing several different models of IPM. We used these data to define Best Management Practices (BMPs) that are currently being implemented in Florida schools. Our data also led to FDACS initiating a statewide investigation of pest control in schools and have been used in state and national discussions on policy formation regarding how pest control is performed in schools and around other sensitive populations.

My program has been funded to investigate the impact of agricultural operations around schools due to potential pesticide drift. The need arose during media coverage of an alleged pesticide drift incident that occurred in Hastings, FL. By air sampling in partnership with FDACS during a legal application, we confirmed that pesticide drift was not occurring at levels harmful to children. We also determined that only 3 schools of almost 4,000 in a statewide survey reported pesticide drift as a concern and the large majority of schools were not at risk because they were not located in agricultural areas.

Bed bugs are an emerging issue in Florida, impacting our hospitality and real estate markets, homeowners, nursing homes, hospitals, and schools. Inspection is the key to effective bed bug control. Canines use olfaction instead of vision. We found that canine-handler teams were more effective in finding bed bugs (>90%) and efficient, taking just a fraction of the time to inspect hotel rooms (1-3 minutes versus 2 technician hours). Our data have been used in national discussions on setting standards for canine-handler training.

My program also has been funded to examine the effectiveness of different training models on performance and learning objectives for pest control technicians. Our pre- and post-test data from pest management professionals (n≈350) has been used by FDACS to re-evaluate its continuing education unit (CEU) approval process. The result has been to gradually increase the standards for program content.

PATENTS AND COPYRIGHTS (TOTAL: 8)

1. M.E. Scharf, X. Zhou, M.M. Wheeler, and **F.M. Oi**. 2011. Use of RNA interference to validate new termiticide target sites and as a method of termite control, patent number 7,968,525. Awarded: June 28, 2011; filed on November 26, 2008 as application number 12/324,312. Provisional US patent application 60/991,959, filed December 2007.

Significance: RNA interference (RNAi) represents a breakthrough technology for conducting functional genomics research in non-model organisms and for the highly targeted control of insect pests. This study investigated RNAi via voluntary feeding in the economically important pest termite, *Reticulitermes flavipes*. We used a high-dose double-stranded (ds) RNA feeding approach to silence two termite genes: one encoding an endogenous digestive cellulase enzyme, and the other a caste-regulatory hexamerin storage protein. Contrary to results from previous low-dose studies that examined injection-based RNAi, high-dose silencing of either gene through dsRNA feeding led to significantly reduced group fitness and mortality. Hexamerin silencing in combination with ectopic juvenile hormone treatments additionally led to lethal molting impacts and increased differentiation of presoldier caste phenotypes (a phenotype that is not capable of feeding). These results provide the first examples of insecticidal effects from dsRNA feeding in a termite. Additionally, these results validate a bioassay approach with utility as a high-throughput methodology for use in (i) termite functional genomics research, and (ii) characterizing target sites of conventional and novel RNAi-based termiticides.

2. M.E. Scharf, X. Zhou, **F.M. Oi**, and M.M. Wheeler. 2008. Carbohydrate-based cellulase inhibitors as feeding stimulants in termites. Pending US patent 11/975,314, filed Oct 18, 2007, published May 8, 2008. Provisional application no. 60/856,964 filed Nov. 6, 2006. **Significance:** Efficacy of three prototype termite cellulase inhibitors, cellobioimidazole (CBI), fluoromethylcellobiose (FMCB) and fluoromethylglucose (FMG) was investigated using biochemical and feeding assays. Optimal conditions for measuring endoglucanase, exoglucanase and β -glucosidase activities were first determined. The three inhibitors were then tested under optimal conditions against enzyme fractions that represented endogenous (foregut/salivary gland/midgut) and symbiotic (hindgut) cellulases. *In vitro*, CBI and FMCB both inhibited exoglucanase and β -glucosidase activity (I_{50} s in nM and mM range, respectively). Feeding assays showed significant impacts on both survivorship and feeding stimulation by FMCB and CBI. Enzymatic measurements on feeding assay survivors showed impacts on all three cellulase activities by CBI and lesser impacts by FMG and FMCB. Validative bioassays with the sugars glucose, maltose and cellobiose showed no feeding stimulation or mortality as occurred in feeding bioassays. These results indicate efficacy for two cellobiose-based inhibitors, FMCB and CBI, suggesting potential for these inhibitors as novel termite feeding stimulants and control agents.

Significance of the following suite of patents is that they provide the means for a non-edible foraging matrix which greatly increases the possibility of matrices for termite baits that will not “spoil” in the field.

3. **Oi, F.M.**, and P.G. Koehler. 2004. Alternating layer non-edible foraging matrix configurations for crawling arthropods. Filed July 3, 2003; application published April 15, 2004. U. S. Patent Application Number 20040068919.
4. **Oi, F.M.**, and P.G. Koehler. 2003. Below ground non-edible foraging matrix configurations for arthropod control. Filed August 19, 2001; issued October 28, 2003. U. S. Patent Number 6,637,150.

5. **Oi, F.M.**, and P.G. Koehler. 2003. Above ground non-edible foraging matrix configurations for arthropod control. Filed March 13, 2002; issued August 19, 2003. U. S. Patent Number 6,606,817.
6. **Oi, F.M.**, and P.G. Koehler. 2003. Ground surface non-edible foraging matrix configurations for arthropod control. Filed March 13, 2002; issued August 19, 2003. U. S. Patent Number 6,606,816.
7. Koehler, P.G., and **F.M. Oi**. 2001. Non-edible foraging matrix insert for subterranean termite control. This invention claims priority of U.S. Provisional Patent Application No. 60/159,266 filed on Oct. 13, 1999. Filed March 14, 2000; issued October 9, 2001. U. S. Patent Number 6,298,597.
8. **Oi, F.M.**, and P.G. Koehler. 1999. Soil bait matrix for subterranean termite control. Docket number 0156.99. Lead Inventors Mode Code: 66-15-10-15. Major Category: Insect control or detection. Received at Area Office: April 6, 1999. Approved for patent process on July 14, 1999. Provision Patent Application No. 60/159266.

PUBLICATIONS

Summary of publications from University of Florida and Auburn University to demonstrate program continuity

Publication Type	Number at UF	Total
Patent Applications	7	8
Books, Co-authored	6	6
Books, Contributor of Chapter(s)	4	13
Refereed Publications	19	24
Non-refereed Publications	76	77
University of Florida—EDIS, peer-reviewed	25	25
Auburn University, reviewed	--	18
Auburn University, non-reviewed	--	25
Abstracts	29	29
Newsletters		
Florida School IPM, including Pest Press	75	75
Pest Management University News	40	40
Pest Management Web: Direct to You	4	4
Other Newsletter Contributions	7	7
TOTAL	292	351

Selected publications (*graduate student, co-author)

Books, Co-authored

1. **Oi, F.M.**, K.C. Ruppert, and L.E. Wetherington. 2008. Termites: A Guide for Homeowners and Building Professionals, 4th ed. University of Florida. In revision.

2. **Oi, F.M., K.C. Ruppert**, and L.E. Wetherington. 2005. Termites: A Guide for Homeowners and Building Professionals, updated. University of Florida, Gainesville, pp. 90.

Books, Contributor of Chapter(s)

1. **Oi, F.M.** 2011. Community integrated pest management with special reference to school environments. IN: Urban Pest Management: An Environmental Perspective. CABI, Wallingford, Oxon, UK, pp. 83-96.
2. Hinkle, N.C., and **F.M. Oi**. Fleas and lice. IN Mallis Handbook of Pest Control. GIE Media, Richfield, OH, pp. 514-549. (Hinkle, all of fleas; Oi all of lice section)

Refereed Publications

Senior or principal authors are underlined

* Graduate student or post-doctoral researcher

¹ corresponding author, if different than senior author

1. Zhou, X., * M.M. Wheeler, * **F.M. Oi** and M.E. Scharf¹. 2008. RNA interference in the termite *R. flavipes* through ingestion of double-stranded RNA. *Insect Biochemistry and Molecular Biology* 38: 805-815.
2. Baldwin, R., * P.G. Koehler, R. Pereira and **F.M. Oi**. 2008. Public perception of pest problems. *American Entomologist* 54: 73-79.
3. Zhou, X., * M.M. Wheeler, * **F.M. Oi** and M.E. Scharf¹. 2008. Inhibition of termite cellulases by carbohydrate-based cellulase inhibitors: Evidence from *in vitro* biochemistry and *in vivo* feeding studies. *Pesticide Biochemistry and Physiology* 90: 31-41.
4. Wheeler, M.M., * X. Zhou, M.E. Scharf¹ and **F.M. Oi**. 2007. Molecular and biochemical markers for monitoring dynamic shifts in cellulolytic protozoa in *Reticulitermes flavipes*. *Insect Biochemistry and Molecular Biology* 37: 1366-1374. [[doi:10.1016/j.ibmb.2007.09.010](https://doi.org/10.1016/j.ibmb.2007.09.010)]
5. Zhou, X., * J.A. Smith, * P.G. Koehler, **F.M. Oi**, G.W. Bennett and M.E. Scharf¹. 2007. Correlation of cellulase gene expression and cellulolytic activity throughout the gut of the termite *Reticulitermes flavipes*. *Gene* 395: 29-39. [[doi:10.1016/j.gene.2007.01.004](https://doi.org/10.1016/j.gene.2007.01.004)].
6. Zhou, X., * C. Song, T.L. Grymala, **F.M. Oi**, and M.E. Scharf¹. 2006. Juvenile hormone and colony conditions differentially include cytochrome P450 gene expression in the termite *Reticulitermes flavipes*. *Insect Molecular Biology* 15: 749-761.
7. Oi, D.H., and **F.M. Oi**. 2006. Speed of efficacy and delayed toxicity characteristics of fast-acting fire ant (Hymenoptera: Formicidae) baits. *Journal of Economic Entomology* 99: 1739-1748.
8. Zhou, X., * M.R. Tarver, * G.W. Bennett, **F.M. Oi** and M. Scharf¹. 2006. Two hexamerin genes from the termite *R. flavipes*: Sequence, expression, evolution and proposed functions in caste regulation. *Gene* 376: 47-58.
9. Zhou, X., * **F.M. Oi**, and M.E. Scharf¹. 2006. Social exploitation of hexamerin: RNAi reveals a major caste-regulatory factor in termites. *Proceedings of the National Academy of Sciences* 103:4499-4504.

10. Branscome, D.L.,* P.G. Koehler, and **F.M. Oi**. 2005. Influence of carbon dioxide gas exposure on cockroach knockdown, recovery, movement and feeding. *Physiological Entomology* 30: 144-150.
11. Tucker, C.K.,* P.G. Koehler, and **F.M. Oi**. 2005. Tunnel formation by different numbers of Eastern subterranean termites (Isoptera: Rhinotermitidae) in laboratory arenas. *Sociobiology* 45: 731-744.
12. Hu, X.P., and **F.M. Oi**. 2004. Distribution and establishment of the Formosan subterranean termite (Isoptera: Rhinotermitidae) in Alabama. *Sociobiology* 44: 35-47
13. Tucker, C.L.,* P.G. Koehler, and **F.M. Oi**. 2004. Influence of soil compaction on tunnel network construction by the Eastern subterranean termite (Isoptera: Rhinotermitidae). *Journal of Economic Entomology* 97: 89-94.
14. Brooks, S. E.,* **F.M. Oi**, and P.G. Koehler. 2003. Ability of canine termite detectors to locate live termites and discriminate them from non-termite material. *Journal of Economic Entomology* 96: 1259-1266.
15. Mankin, R.W., W.L. Osbrink, **F.M. Oi**, and J.B. Anderson. 2002. Acoustic detection of termite infestations in urban trees. *Journal of Economic Entomology* 95:981-988.
16. Valles, S.M., **F.M. Oi**, and C.A. Strong. 2001. Purification and characterization of trans-permethrin metabolizing microsomal esterases from workers of the Eastern subterranean termite, *Reticulitermes flavipes* (Kollar). *Insect Biochemistry and Molecular Biology* 21: 715-725.
17. Valles, S.M., **F.M. Oi**, T. Wagner, and R.J. Brenner. 2000. Toxicity and *in vitro* metabolism of trans-permethrin in the subterranean termite, *Reticulitermes flavipes* (Kollar). *Journal of Economic Entomology* 93: 1259-126.
18. **Oi, F.M.** 2000. Scientific note: Purple dye marker for *Reticulitermes* spp. (Isoptera: Rhinotermitidae). *Florida Entomologist* 83: 112-113.
19. Shelton, T.G.,* J.T. Vogt,* A.G. Appel, and **F.M. Oi**. 1999. Observations of *Reticulitermes* spp. in *Solenopsis invicta* mounds (Isoptera: Rhinotermitidae, Hymenoptera: Formicidae). *Sociobiology* 33(2): 1-11.
20. Valles, S.M., W. Osbrink, **F.M. Oi**, and R.J. Brenner. 1998. Cytochrome P450 monooxygenases in the dark southern subterranean termite (Isoptera: Rhinotermitidae). *Journal of Economic Entomology* 91: 1131-1135.
21. **Oi, F.M.**, and N.C. Hinkle. 1997. Biorational approaches to urban pest management: Introduction to the Symposium Proceedings. *Journal of Agricultural Entomology* 14: 227-229.
22. **Oi, F.M.**, N.-Y. Su, P.G. Koehler, and F.L. Slansky. 1996. Laboratory evaluation of food placement and food types on the feeding preference of *Reticulitermes virginicus* (Isoptera: Rhinotermitidae). *Journal of Economic Entomology* 89: 915-921.
23. **Oi, F.M.**, and N.-Y. Su. 1994. Stains tested for marking *Reticulitermes* spp. *Sociobiology* 24: 241-268.
24. Rice, D.J., R.F.L. Mau, T.L. German, and **F.M. Fujimoto (Oi)**. 1990. Dot blot detection of tomato spotted wilt virus RNA in plant and thrips tissues by cDNA clones. *Plant Disease* 7: 274-276.

Non-refereed Publications

Technical Journal articles: Peer-reviewed

First authors are underlined

* Graduate student or post-doctoral researcher

Florida Pest Pro. This periodical has a circulation of 10,000 and is provided to every pest control company in Florida and other interested stakeholders.

1. Oi, F.M. Ticks! (In press, March 2014)
2. Oi, F.M. How the Steinmetz gift to UF is helping PMPs, Nov 2013, p. 12-13
3. Oi, F.M. Practicing IPM on a continuum: sealing the building envelope, Aug 2013, p. 19-20, 22
4. Oi, F.M. The evolution of IPM, Sept 2013, p. 13-15
5. Oi, F.M. PMPs Guide to Junk Science, Part I. Jan 2013, p. 19-20
6. Oi, F.M. The Ant Formerly Known as...Again. Nov. 2012
7. Oi, F.M., J. Gillett-Kaufman, and S. Lands. Pesticide Drift around Schools, Part II. Oct. 2012
8. Oi, F.M. and J. Gillett-Kaufman. Pesticide Drift around Schools. Sept. 2012
9. Oi, F.M., and M.J. Page. Aug 2012. Voluntary school IPM BMPs
10. Oi, F.M., and J. Paige III. Mar 2012. Advances in Caribbean crazy ant management. 8(3): 19-21.
11. Oi, F.M. Jan. 2012. Cockroaches revisited. 8(1): 24-26.
12. Oi, F.M., and J.L. Gillett-Kaufman. Dec. 2011. No sleeping in class! Bed bugs make their way to school. 7(11): 54, 62.
13. Gillett-Kaufman, J.L., F.M. Oi, and E.A. Buss. Nov. 2011. Pest Management University-going the distance. 7(10): 26-27.
14. Calibeo-Hayes, D.,* D.H. Oi, and F.M. Oi. Aug 2011. Sustainable Caribbean crazy ant management. 7(8):
15. Gillett-Kaufman, J.L., and F.M. Oi. June 2011. Mold growth: Is it on the surface or something deeper? How to know you are dealing with wood-decay fungi. 7(6): 22-26.
16. Gillett, Kaufman, J.L., and F.M. Oi. May 2011. Indoor mold growth, toxic black mold and sick building syndrome. 7(5): 14, 16-17.
17. Oi, F.M. Feb. 2011. Trends in learning at Pest Management University. 7(2): 27-29.
18. Oi, F.M. Jan. 2011. Ticks by way of bed bugs. 7(1): 28, 30.
19. Oi, F.M. Oct 2010. Termidor going off patent...sort of. 6(9): 23.
20. Oi, F.M. Aug 2010. Pesticides and ADHD. 6(7): 22, 24.
21. Oi, F.M. June 2010. The original concept of IPM. 6(6): 18-20
22. Oi, F.M. Mar 2010. Profile: Pepe Peruyero. 6(3): 7-8.
23. Oi, F.M. Mar 2010. Canine bed bug detectors. 6(3): 5-6
24. Oi, F.M. Jan. 2010. Politics and policies of green. 6(1): 14-16.
25. Oi, F.M. Nov 2009. Regulatory: Did you know... 5(10):
26. Oi, F.M. Sept 2009. The other blood suckers: Fleas and ticks. 5(8): 19-21.
27. Oi, F.M. June 2009. Why IPM doesn't have traction. 5(6): 15-16, 27.
28. Oi, F.M. May 2009. Verifiable training and DACS. 5(5): 16, 18-19.
29. Oi, F.M. Apr. 2009. Why pest control matters: Part II. 5(4): 28, 30, 34.
30. Oi, F.M. Mar. 2009. Why pest control matters: Part I. 5(3): 10-11.
31. Oi, F.M. Feb. 2009. Termite swarms and other useless but interesting pieces of trivia. 5(2): 6-7.

32. **Oi, F.M.** Jan. 2009. Pesticides, children and potential industry impacts of school IPM in 2009. 5(1): 13-15.
33. **Oi, F.M.** Sept/Oct. 2008. Pests that can get you on a health report. 4(5): 22, 23, 28.
34. **Oi, F.M.** July/Aug 2008. The WDO baseline practices committee. 4(4): 20-21.
35. **Oi, F.M.** May/June 2008. My flea story: Lessons learned. 4(3): 22-25.
36. **Oi, F.M.** Mar/Apr 2008. The green movement and structural pest management. 4(2): 12, 14-16.
37. **Oi, F.M.**, and R. Baldwin. Jan/Feb. 2008. Termite training facility's first class! 4(1): 6, 8.
38. **Oi, F.M.**, and J. Gibney. Nov/Dec 2007. Winterizing your files: Are you ready for a DACS inspection? 3(6): 20-21.
39. **Oi, F.M.** Sept/Oct 2007. Acute illnesses associated with pesticide exposure at schools. 3(5):
40. **Oi, F.M.** Jul/Aug 2007. Fire ants: Are they really the bullies on the block? 3(4): 10, 12.
41. **Oi, F.M.** May/June 2007. Sanitation is pest management. 3(3): 22-23.
42. **Oi, F.M.** Mar/Apr 2007. Training and certification issues. 3(2): 8, 10.
43. **Oi, F.M.** Jan/Feb 2007. Termite – the new mode of action. 3(1): 21-23.
44. **Oi, F.M.** Nov/Dec 2006. Save a life: Know your spiders. 2(6): 13-15.
45. **Oi, F.M.** Sept/Oct. 2006. Africanized bees are defensive, not aggressive. 2(5): 22-24.
46. **Oi, F.M.**, and R. Baldwin. July/Aug 2006. Getting sucked into the vortex of school IPM. 2(4): 12-14.
47. **Oi, F.M.** May/June 2006. The facts about termites and mulch. 2(3): 25-26.
48. **Oi, F.M.** Mar/Apr 2006. Ants: Anything new? 2(2): 27-28, 32.
49. **Oi, F.M.** Mar/Apr 2006. Mosquitoes, misters and misery. 2(2): 20-21.
50. **Oi, F.M.** Jan/Feb 2006. Alert: Digging, drilling, underground utilities, fines and pest management. 2(1): 27.
51. **Oi, F.M.** Jan/Feb 2006. Termites: What happened to all that infested wood debris after hurricane season 2005? 2(1): 6, 8.
52. **Oi, F.M.** Nov/Dec 2005. Industry professionalism and the training facility. 1(6): 27-28.
53. **Oi, F.M.** Nov/Dec 2005. Spiders, arachnophobia and myths. 1(6): 22-24.
54. **Oi, F.M.** Sept/ Oct 2005. Wasps and stinging insects. 1(5): 6, 8, 10.
55. **Oi, F.M.** Sept/Oct 2005. Occasional invaders: Plague pests. 1(5): 27-28.
56. **Oi, F.M.** July/Aug 2005. Head lice: What does this have to do with me? 1(4): 10, 12.
57. **Oi, F.M.** Jul/Aug 2005. Fire ants: Stings, lawsuits, and Dr. Seuss. 1(4): 24-25.
58. **Oi, F.M.** May/June 2005. Tales from the crypt: Coffin flies and other nasties. 1(3): 28-29.
59. **Oi, F.M.**, and R. Baldwin. May/June 2005. Cockroaches voted most offensive. 1(3): 8, 10.
60. **Oi, F.M.** Mar/Apr 2005. Ants: Still #1. 1(2): 12, 14, 16.
61. **Oi, F.M.** Mar/Apr 2005. Mosquitoes. 1(2): 37-39.
62. **Oi, F.M.** Jan/Feb 2005. Pests of fabric. 1(1): 30-31.
63. **Oi, F.M.** Jan/Feb 2005. It's swarm season again! 1(1): 8, 10, 12-13.

Other technical journals

Pest Control Technology is one of the premiere trade journals for the pest control industry with an international distribution (<http://www.pctonline.com/>)

56. Calibeo-Hayes, D.,* D.H. Oi, and **F.M. Oi**. Sensitive account: Ant control at the zoo. Pest Control Technology. April 2010.
http://www.pctonline.com/Article.aspx?article_id=100304
57. **Oi, F.M.**, and P.G. Koehler. June 2004. Termiticides do not cause CPVC to rupture. Pest Control Technology, pp. 66, 68, 70, 72, 109.
58. **Oi, F.M.**, S.E. Brooks,* and P.G. Koehler. Sept. 2003. Top Dog, Part II. Pest Control Technology, pp. 68, 70-72, 74.
59. **Oi, F.M.**, S.E. Brooks,* and P. G. Koehler. Jan. 2003. Top Dog, Part I. Pest Control Technology, pp. 30, 32, 34, 84.
60. **Oi, F.M.**, D.H. Oi, S. D. Porter, and P.G. Koehler. April 2001. Fire Ants: What works, what doesn't. Pest Control Technology, pp. 48, 52-54, 56.
61. **Oi, F.M.** April 2001. What you need to know to protect your home from termites. Halifax Magazine, pp. 3.
62. **Oi, F.M.**, T.E. Powell,* and P.G. Koehler. March 2000. Subterranean termite foraging puzzle. Pest Control Technology, pp 71-75.

Extension Publications on Extension Digital Information Source (EDIS)

“The EDIS website is a comprehensive, single-source repository of all current UF/IFAS numbered peer-reviewed publications... Each year, visitors to the EDIS website access one of over 7,500 publication titles more than 25 million times.” (<http://edis.ifas.ufl.edu/about.html>)

1. **Oi, F.M.**, J. Gillett-Kaufman, E. Connor, M. Overline, B. Taggart, and L. Witherington. 2012. What not to do for bed bugs/Que No hacer contra las chinches. ENY-2026, pp. 1 pp. (English and Spanish translation.) <http://edis.ifas.ufl.edu/in925>
2. Calibeo, D.,* and **F.M. Oi**. 2011. IPM of the Caribbean crazy ant. ENY-2006, 4 pp.
<http://edis.ifas.ufl.edu/pdf/IN/IN88900.pdf>
3. **Oi, F.M.**, P. Mitola, K. C. Ruppert, M. Page, and M. Ruff. 2008. Choosing a licensed wood-destroying organism (WDO) inspector. ENY-2005, 3 pp. (Original publication 2005, reviewed and updated for changes to Florida Statutes 2008.)
<http://edis.ifas.ufl.edu/in629>
4. **Oi, F.M.**, R. Scheffrahn, W. Kern, and K.C. Ruppert. 2008. Drywood and dampwood termites. ENY-211, 6 pp. <http://edis.ifas.ufl.edu/ig098>
5. **Oi, F.M.**, and M. Wheeler.* 2007. The facts about termites and mulch. ENY-832, 1 pp. (Reviewed, 2009) <http://edis.ifas.ufl.edu/in651>
6. Baldwin, R., and **F.M. Oi**.¹ 2008. Head lice. ENY-296, 6 pp. (Revised and updated from 1997 publication.) <http://edis.ifas.ufl.edu/ig142>
7. **Oi, F.M.**, and R. Anderson.* 2003. Mosquitoes in and around the home. ENY-2004. (Voluntarily sunsetted for R. Connelly's publication and referenced in it.
<http://edis.ifas.ufl.edu/in171>)
8. Cabrera, B.J., N.-Y. Su, R.H. Scheffrahn, **F.M. Oi**, and P.G. Koehler. 2001. Formosan subterranean termite. ENY-216, 7 pp. <http://edis.ifas.ufl.edu/mg064>
9. Koehler, P.G., N.-Y. Su, R.H. Scheffrahn, and **F.M. Oi**. 2000. Baits to control subterranean termites: The Sentricon System. ENY-2000, 3 pp.
<http://edis.ifas.ufl.edu/in099>

Extension Publications on Extension Digital Information Source (EDIS), Revisions Only
(n=16)

1. Hinkle, N.C., P.G. Koehler, and **F.M. Oi**. 2003. Cat flea, *Ctenocephalides felis*. ENY-263, 5 pp.
2. Koehler, P.G., and **F.M. Oi**. 2003. Stinging or venomous insects and related pests. ENY-215, 17 pp.
3. Koehler, P.G., and **F.M. Oi**. 2003. Filth breeding flies. ENY-222, 10 pp.
4. Koehler, P.G., and **F.M. Oi**. 2003. Pillbugs, sowbugs, centipedes, millipedes, and earwigs. ENY-221, 10 pp.
5. Scherer, C., P.G. Koehler, and **F.M. Oi**. 2003. Body lice and pubic lice. ENY-208, 3 pp.
6. Koehler, P.G., and **F.M. Oi**. 2003. Clothes Moths and Plaster Bagworms. ENY-223. Feb. 2003. pp. 3.
7. Koehler, P.G., and **F.M. Oi**. 2003. Carpet Beetles. ENY-204, 5 pp.
8. Koehler, P.G., and **F.M. Oi**. 2003. Ticks. ENY-206, 6 pp.
9. Koehler, P.G., and **F.M. Oi**. 2003. Fleas. ENY-204. Feb. 2003. pp. 6.
10. Koehler, P.G., and **F.M. Oi**. 2003. Chiggers. ENY-212, 5 pp.
11. Koehler, P.G., **F.M. Oi**, and M. Aparicio. * 2003. Springtails. ENY-228, 4 pp.
12. Koehler, P.G., and **F.M. Oi**. 2003. Powderpost beetles and other wood infestation insects. ENY-266, 7 pp.
13. Scherer, C., * P.G. Koehler, and **F.M. Oi**. 2003. Head lice. ENY-263, 5 pp.
14. Koehler, P.G., D. Branscome, * and **F.M. Oi**. 2003. Booklice and silverfish. ENY-225, 10 pp.
15. Koehler, P.G., **F.M. Oi**, and D. Branscome. * 2003. Cockroaches and their management. ENY-214, 18 pp.
16. **Oi, F.M.**, P.G. Koehler, N.-Y. Su, and R.H. Scheffrahn. 1992. The Formosan subterranean termite. ENY-216.

Auburn University, Extension Publications, peer-reviewed (n=18)

1. **Oi, F.M.**, and M.A. Aubuchon. * 1998. Yellow jackets, wasps, and hornets. ANR-1134, 4 pp.
2. **Oi, F.M.** 1998. Dust mites. ANR-1127, 2 pp.
3. **Oi, F.M.** 1998 Itches, illusions, and phobias. ANR-1122, 4 pp.
4. Cobb, P., and **F.M. Oi**. 1998. Fire ants in turf and around structures. ANR-179, 4 pp.
5. **Oi, F.M.**, and B. Alverson. 1998. How to choose a pest control company. ANR-1106, 4 pp.
6. Anderson, R.R., * and **F.M. Oi**. 1998. Mosquitoes. ANR-1116, 4 pp.
7. Anderson, R.R., * and **F.M. Oi**. 1998. Chiggers. ANR-1109, 4 pp.
8. **Oi, F.M.**, and W. Foshee. 1998. The Asian lady bug. ANR-1079, 1 pp.
9. **Oi, F.M.**, and A.G. Appel. 1998. IPM tactics for millipede control. ANR-1075, 1pp.
10. **Oi, F.M.**, and J.H. Cane. 1998. Carpenter bee damage control. ANR-1057, 2 pp.
11. **Oi, F.M.**, and T.G. Shelton. * 1997. IPM tactics for termite control. ANR-1022, 6 pp.
12. **Oi, F.M.**, and R.R. Anderson. * 1997. IPM tactics for tick control. ANR-1070, 2 pp.
13. **Oi, F.M.**, and G.R. Mullen. 1997. The brown recluse, *Loxosceles reclusa*. ANR-1043, 2 pp.

14. **Oi, F.M.**, and T.G. Shelton.* 1997. The black widow, *Latrodectus mactans*. ANR-1039, 2 pp.
15. **Oi, F.M.**, and T.G. Shelton.* 1997. Formosan subterranean termites. ANR-1035, 2 pp.
16. **Oi, F.M.**, A.G. Appel, and E.P. Benson. 1997. IPM tactics for cockroach control. ANR-1016, 6 pp.
17. **Oi, F.M.**, and D.H. Oi. 1996. IPM tactics for Argentine Ant Control. ANR-999, 2 pp.
18. **Oi, F.M.** 1996. IPM tactics for flea control. ANR-997, 4 pp.

Timely Information Sheets, Auburn University, not reviewed (n=25)

Posted on the Internet and e-mailed

1. **Oi, F.M.** 1998. Phorid flies. T-25, June 3, 1998. 1 pp.
2. **Oi, F.M.** 1997. Love bugs. T-24, September 3, 1997. 1 pp.
3. R.R. Anderson,* and **F.M. Oi**. 1997. Mosquitoes. T-23, August 27, 1997. 3 pp.
4. R.R. Anderson,* and **F.M. Oi**. 1997. Biting midges. T-22, July 7, 1997. 2 pp.
5. R.R. Anderson,* and **F.M. Oi**. 1997. Chiggers. T-21, July 2, 1997. 2 pp.
6. **Oi, F.M.** 1997. FAQs and control of the Formosan subterranean termite. T-20. 2 pp.
7. **Oi, F.M.** 1997. Distribution, biology, and habits of the Formosan subterranean termite. June 6, 1997, T-19. 2 pp.
8. **Oi, F.M.** 1997. How to choose a pest control company. T-18, March 7, 1997. 2 pp.
9. **Oi, F.M.**, and W. Foshee. 1996. The Asian ladybug, *Harmonia axyridis*: Update, T-17. October 28, 1996. 2 pp.
10. **Oi, F.M.**, and G.R. Mullen. 1996. Tick biology and control. T-16, May 27, 1996. 2 pp.
11. **Oi, F.M.** 1996. New insect growth regulator for flea control. T-15, May 24, 1996. 2 pp.
12. **Oi, F.M.**, and J.H. Cane. 1996. Carpenter bee damage control. T-14, April 18, 1996. 2 pp.
13. **Oi, F.M.**, D.H. Oi, and P.P. Cobb. 1996. How to treat for fire ants in and around homes. T-13, April 11, 1996. 2 pp.
14. **Oi, F.M.** 1996. Termite swarming season has begun. T-12, April 4, 1996. 2 pp.
15. **Oi, F.M.** 1996. Suspension of fenoxycarb insecticides for consumer use. T-11, March 29, 1996. 1 pp.
16. **Oi, F.M.** 1996. Minimizing flea problems. T-10, March 8, 1996. 2 pp.
17. **Oi, F.M.** 1995. Preventing ant problems during the winter. T-9, November 22, 1995. 2 pp.
18. **Oi, F.M.**, and D.H. Oi. 1995. Common pest ants and their control with emphasis on the Argentine ant and Pharoah ant. T-8, September 25, 1995. 4 pp.
19. **Oi, F.M.** 1995. Flea control methods. T-7, August 28, 1995. 4 pp.
20. **Oi, F.M.** 1995. Spiders. T-6, July 10, 1995. 4 pp.
21. **Oi, F.M.** 1995. Stored Products Pests in Homes. T-5, July 5, 1995. 3 pp.
22. **Oi, F.M.**, and A.G. Appel. 1995. Millipedes. T-4, June 16, 1995. 2 pp.
23. **Oi, F.M.** 1995. Why are subterranean termites so difficult to control. T-3, June 15 21, 1995. 4 pp.
24. **Oi, F.M.** 1995. New technology for flea control on dogs. T-2, April 4, 1995. 2 pp.
25. **Oi, F.M.**, and W. Foshee. 1995. The Asian ladybug, *Harmonia axyridis*. T-1, March 21, 1995. 2 pp.

Newsletters:

1. Florida School IPM News (2010-present, n=75), an e-newsletter for the Florida working group to be published monthly. Posted at:
<http://schoolipm.ifas.ufl.edu/Florida/newsletter.htm>
2. Pest Management University News (n=40). Primarily to announce upcoming classes, member news interesting entomological research. Posted at
<http://pmu.ifas.ufl.edu/newsletters.shtml>

Pest Management Web: Direct to You (n=4)

Bulletins, not reviewed

1. Tucker, C.L.,* P.G. Koehler, W.G. Kern, and **F.M. Oi**. 2003. Termite Key: Alates. pp. 1.
2. Tucker, C.L.,* P.G. Koehler, W.G. Kern, and **F.M. Oi**. 2003. Termite Key: Soldiers. pp. 1.

LECTURES, SPEECHES, POSTERS, PRESENTED AT PROFESSIONAL CONFERENCES (speaker is underlined, * = graduate student)

Please see EXTENSION PROGRAM for additional presentations for an additional 300+ presentations

Summary of Presentations at Professional Conferences, 2002-2013

TOTAL (N=43)

Presentation category	Number	Number with students, post-docs ¹	Total
International, invited	2	0	2
National, invited	2	1	3
National, submitted	8	17	26
Regional, invited	1	0	1
State, submitted	0	8	8
Local	0	0	0
Other (departmental seminars)	3	0	3
TOTAL	16	26	42

¹Presentations delivered by students presented in TEACHING, ADVISING AND INSTRUCTIONAL ACCOMPLISHMENTS

a. International

Invited

1. Oi, F.M. Impacts and program sustainability in Florida. 6th International IPM Symposium, Portland, OR. March 23-26, 2009.
2. Oi, F.M., D.L. Richman, and P.G. Koehler. Impact of building code changes on termite infestations. Hawaiian Entomological Society, Honolulu, HI. Symposium on Termites and Ants. Audience from across U. S. and Pacific Basin. Feb. 17, 2003.

b. National

Invited

1. Paige, J.H., F.M. Oi, and D. Calibeo.* Combination baiting approach cuts field populations of *Nylanderia pubens* in half. Symposium on Caribbean Crazy Ants. National Conference on Urban Entomology. Atlanta, GA, May 20-23, 2012.
2. Scharf, M.E., X. Zhou, F.M. Oi, and M.M. Wheeler. Gene silencing as a tool for termite control? Section F symposium on *Novel Technology for Termite Control*. Entomological Society of America, San Diego, CA. December 2007.

Submitted

1. Baldwin, R., P. Mattis, P. Mitola, V. Morris, M. Ruff, M. Page, and F.M. Oi. Measuring the impact of training pest management professionals: An inter-agency,

- team approach. Entomological Society of America, Reno, NV. Nov. 16-19, 2008. (Poster)
2. Baldwin, R., L. Jonovich, * and **F.M. Oi**. 2007. Long-term results of school IPM in a large Florida school district. Entomological Society of America Annual Meeting, San Diego, CA. Dec. 9-12, 2007 (Poster)
 3. **Oi, F.M.**, and J. Paige III. 2006. Impact of granular imidacloprid on subterranean termites. Entomological Society of America Annual Meeting, Indianapolis, IN. Dec. 10-13, 2006. (Poster)
 4. **Baldwin, R.**, J. Kocher, and **F.M. Oi**. 2006. Using distance technologies to provide continuing education credits in IPM for industry. Entomological Society of America Annual Meeting, Indianapolis, IN. Dec. 10-13, 2006. (ESA Certificate of Excellence for Outstanding Extension/Regulatory Poster)
 5. **Oi, F.M.**, R.W. Baldwin, M.L. Lame, S. Scalera, R.E. Smith, and N.C. Leppla. 2005. Impact of a verifiable IPM model for pilot schools in Florida. Entomological Society of America Annual Meeting, Ft. Lauderdale, FL. Nov. 6-9, 2005. (Poster)
 6. **Oi, D.H.**, and **F.M. Oi**. 2005. Characteristics of a fast-acting fire ant bait. Entomological Society of America Annual Meeting, Ft. Lauderdale, FL. Nov. 6-9, 2005. (Poster)
 7. **Scharf, M.**, X. Zhou, * and **F.M. Oi**. 2005. Identification of a major caste-regulatory gene from a termite. Entomological Society of America Annual Meeting, Ft. Lauderdale, FL. Nov. 6-9, 2005. (10 min.)
 8. **Oi, F.M.**, and P.G. Koehler. 2002. Distance tunneled by and mortality of subterranean termites in soil treated with non-repellent termiticides. Entomological Society of America Annual Meeting, Ft. Lauderdale, FL. Nov. 17-21, 2002. (Poster)
- c. Regional
Invited
1. **Oi, F.M.**, and J.A. Smith.* 2004. Biology of termites. Opening session (“Ants, cockroaches and termites, oh my!”). Southeastern Branch Meeting, Charleston, SC. February 15-18, 2004. (15 min.)
- d. State: None
- e. Local: None
- f. Other – Departmental Seminars
1. **Oi, F.M.**, and M.E. Scharf. Giving termites indigestion. University of California, Davis. Jan. 23, 2008. (50 people, 1 hr)
 2. **Oi, F.M.** 2004. Urban Entomology. Seminar series for Doctor of Plant Medicine program. University of Florida, Gainesville. Jan. 14, 2004. (~20 people, 1 hr).
 3. **Oi, F.M.**, C. Tucker, * and K. McManamy. * Behavior, biology and control of subterranean termites. Department of Entomology, University of Georgia, Athens. Sept. 30, 2002. (1 hr.)

**CONTRACTS, GRANTS, GIFTS ANDD REVENUE, selected
TOTAL for ~ 10 years: \$3,186,448**

Funded Externally – TOTAL: \$1,766,239

Federal and state grants, 2004-2014			
Role	Agency	Grant Title & Dates	Amount
PI	EPA R4	Expansion of Verifiable IPM through Florida's Statewide Program (2014)	\$37,000
PI	Environmental Protection Agency	A school IPM consortium reaching one million children (2012-2014)	\$244,372
PI	Florida Department of Agriculture and Consumer Services	A proposal in support of Pest Management University, phase II (2011)	\$31,500
PI with co-PI J. Gillett-Kaufman	National Association of State Departments of Agriculture	Good neighbor practices (2010-2012)	\$88,984
Co-PI with P. Kaufman (PI)	United States Department of Agriculture-Regional Integrated Pest Management	Improving management of the brown dog tick, <i>Rhipicephalus sanguineus</i> , in Southeastern residential environments (2009-2012)	\$171,495
PI with co-PI J.A. Hurley, L. Graham, R. Baldwin, and M. Merchant	USDA-Extension Integrated Pest Management	Marketing IPM as green school technology (2009-2012)	\$57,456
PI with co-PI J.A. Hurley, L. Graham, R. Baldwin, and M. Merchant	USDA-EIPM	Marketing IPM as green school technology (2007-2008)	\$78,432
PI with co-PI R. Baldwin	USDA-Southern Region Integrated Pest Management Center	Protecting children's environmental health: verification, continued adoption, sharing resources and extension to public (2007-2008)	\$25,000

PI with co-PI Fudd Graham, Auburn University	USDA-eXtension	Community of school IPM practitioners (2005-2007)	\$40,000
PI with co-PI J. Gillett-Kaufman	US EPA Region 4	Implementation of IPM in public schools in Florida – Developing a successful model for statewide adoption by schools, state lead agencies, and the pest management industry (2005)	\$47,000,
PI	Various Industry Donors, including Orkin (\$150,000)	Matching donations from various industry sources to match funding for development of Pest Management University training facility (phase I and II) at Apopka MREC to be received over 3 to 5 years (2005-2011)	\$285,000
PI	Cortelis Matching Funds	Matching donations for industry donation to build Pest Management University, Phase I (building elements) at Apopka MREC (2006-2007)	\$150,000
PI	Florida DACS	Development of a Pest Management University, Phase II (house) for state and national use at Apopka MREC (2005-2010)	\$150,000
Co-PI with P.G. Koehle	Proctor and Gamble	Cellulase inhibitors as a method of wood destroying organism control	Patent donation and \$350,000

Funded Internally –TOTAL: \$143,400

Role	Agency	Grant Title & Dates	Amount
PI with co-PIs J. Gillett-Kaufman and E. Buss	UF	Steinmetz endowment advance (2010-2013)	\$120,000,
PI with R. Baldwin	Florida IPM	Protecting children’s environmental health. (2006-2007)	\$10,000,
PI with co-PI R. Baldwin	Florida IPM	Statewide expansion of school IPM in Florida. (2006)	\$9,600
PI with co-PIs R. Baldwin, S. Scalera, and E. Buss	Florida IPM	School IPM benchmark pilot program, Brevard County (2004)	\$3,800

UF/SHARE, unrestricted gifts

Industry donations, 2002-2013			TOTAL: \$1,012,209
(Except for Pest Management University donations, grouped above with matching funds)			
Role	Agency	Grant Title & Dates	Amount
PI (100%)	Industry donors	Applied to IPM of social insects (2013)	\$17,000
PI (100%)	Industry donors	Applied to IPM of social insects (2012)	\$11,000
PI (100%)	Industry donors	Applied to IPM of social insects (2011)	\$9,000
PI (100%)	Industry donors	Applied to IPM of social insects (2010)	\$10,000
PI (100%)	Industry donors	Applied to IPM of social insects (2009)	\$3,000
PI (100%)	Industry donors	Applied to IPM of social insects (2007)	\$18,280
PI (100%)	Industry donors	Applied to IPM of social insects (2006)	\$100,334
PI (100%)	Industry donors	Applied to IPM of social insects and IPM in schools (2005)	\$352,956
PI (100%)	Industry donors	Applied to IPM of social insects and IPM in schools (2004)	\$156,339
PI (100%)	Industry donors	Applied to IPM of social insects and IPM in schools (2003)	\$138,800
PI with co-PI P. Koehler (100%)	Industry donors	Applied to urban IPM (2002)	\$195,500

Revenue generated from Pest Management University

Revenue generating extension program, 2007-January 2014			
Role	Agency	Title & Dates	Amount
PI (100%)	PMU	Pest Management University revenue generation	\$265,000

UNIVERSITY GOVERNANCE AND SERVICE

a. University

None

b. College

2007, IFAS Web committee, appointed by Dean L. Arrington

c. Department/Center

Entomology and Nematology Department

Social committee member, 2004-2009

Laboratory Specialist (distance education) search committee member, 2004

Taxonomy Faculty search committee member, 2003

Biological Scientist search committee member, 2003

CONSULTATIONS OUTSIDE THE UNIVERSITY

1. Appointed to the Florida Department of Agriculture and Consumer Services Pest Control Enforcement Advisory Council by Commission Putnam (2011-present)
2. Appointed to the Statewide Bed Bug Working Group by Florida Department of Agriculture and Consumer Services Entomology and Pest Control Bureau Chief Michael Page (2011-present).
3. Northeastern Region IPM grants panel, 40 grants review. Corte Madera, CA, Jan 22-24, 2014
4. Western Region IPM grants panel, 36 grants reviewed. Sacramento, CA, Jan 23-25, 2008
5. Western Region IPM grants panel, 33 grants reviewed. Sacramento, CA, Feb 12-14, 2007
6. Termiticide Scientific Review Panel, 2004-present. Assist Environmental Protection Agency in product evaluation
 - a. Acting chair for one review, 2008
 - b. Two package evaluations, 2006
 - c. Acting chair for one review, 2005
 - d. Meetings attended:
Feb. 8-9, 2004, Dunn Loring, VA
 - e. Data package review. Completed Dec. 2004
7. Invited to participate in project review of United States Department of Agriculture Forest Service, July 27-28, 2004, Starkville, MS. Unable to attend meeting, but submitted comments to Project Leader Terry Wagner
8. Syngenta Corporation, label review for Xyrox termite bait. 2002

MEMBERSHIP AND ACTIVITIES IN THE PROFESSION

Entomological Society of America, member, 1989-present.

Finance Committee Member (representing SE Branch), 2008-present

MUVE Section Vice-chair, 2014 (chair, 2015)

Section Fb Chair, 2000-2001
Section Fb Secretary, 1999-2000
Appointed Nominations Chair Section, 1997
Appointed chair of the ESA Resolutions Committee by President Doug Dahlman, 1997

Southeastern Branch of the Entomological Society of America, 1990-present
Program Chair, 2008 SEB-ESA, Jacksonville, FL. Mar. 2-5, 2008
Member at Large, 1999-2002
Appointed, Resolutions Chair by President Frank Guillot, 2001
Appointed, Student Awards Committee by President Don Herzog in 1995-1998. (Chair 1997-1998.)
Appointed, Long-Range Planning Committee by President Don Herzog in 1995-1998.

Florida Entomological Society, member, 1991-present
PR Committee Chair, 2000-2002.
PR Committee Member, 1998-2000.
Student representative to the executive board 1992

Hawaiian Entomological Society, member, 1989-present

MEMBERSHIP IN INDUSTRY OR REGULATORY ORGANIZATIONS

Association for Structural Pest Control Regulatory Officials
School IPM Subcommittee member, 2011-present

National Pest Management Association, 1998-present
Technical Committee member, 1998-present
GreenPro Advisory Board, faculty member, 2009-present
Canine Insect Detection Division, faculty member, 2009-present
NPMA Woman of Excellence Award, committee member, 2009
Convention Planning Committee, 2002-until dissolution in 2006
Quality Pro Technical Committee, 2003 (completed)

Florida Wood Destroying Organisms Inspection Standards Committee

Florida Pest Management Association
Education Committee, 2004-2009

Pi Chi Omega, member. 1993-present. Director, 2000.

ACTIVITIES IN THE PROFESSION

International

1. Co-organizer for “Delivering on a Promise: Demonstration models for the successful implementation of School IPM at the state level. 5th International IPM Symposium, St. Louis, MO. April 4-6, 2006. Co-organizers: R. Baldwin, N. Leppla, M. Lame. 5th National IPM Symposium, St. Louis, MO. April 4-6, 2006. Sponsored by United States Department of Agriculture-Cooperative Research and Education and Extension Service.

National

1. Conference chair, National Conference on Urban Entomology. San Antonio, TX, May 18-21, 2014
2. Conference chair, National Conference on Urban Entomology. Atlanta, GA, May 20-23, 2012
3. Program chair, National Conference on Urban Entomology. Portland, OR, May 19-22, 2011
4. Co-organized and co-moderated the Section Fb Symposium titled: “New and Emerging Trends in Urban Insect Management.” Entomological Society of America (ESA) Annual Meeting. Atlanta, GA. Dec. 12-16, 1999
5. Co-organized with Daniel R. Suiter, (Purdue University, Director, Industrial Affiliate’s Program) the Formal Conference in Urban Entomology at the ESA Annual Meeting. Louisville, KY. Dec. 8-12, 1996
6. Co-organized with Nancy C. Hinkle (UC Riverside, Medical & Veterinary Entomologist) and moderated the Program Symposium “Biorational Approaches to Urban Pest Management.” Program Symposia are selected by the ESA for their broad-based appeal to the membership. The *Journal of Agricultural Entomology* published the proceedings of these meetings in July 1997. Received approval to publish a technical article based on these proceedings from *PCT Magazine*. ESA Annual Meeting. Louisville, KY. Dec. 8-12, 1996
7. Organized the Urban IPM Workshop for the 3rd National IPM Symposium, Washington DC. Workshop on Thursday, Feb. 29, from 1:15-5:30. Meetings: Feb. 26-March 1, 1996
8. Invited, as a PI on the National IPM Initiative to participate in the organizational meeting for the National IPM Network, sponsored by the USDA. Raleigh, NC. Nov. 8, 1995

Regional

1. Organized and moderated the SEB Student paper and display competition sessions. Chattanooga, TN. Mar. 1-4, 1998
2. Co-organized the SEB Opening Session with Ellen Thoms (DowElanco). SEB Annual Meeting. Asheville, NC. Mar. 2-5, 1997
3. Southern Regional Urban Pest Management Advisory Group Meetings. Participation by invitation of group organizers Mike Linker, NC State University; Gerrit Cuperus, Oklahoma State University
 - a. Topics for discussion: State updates, Regional and National Issues of School IPM, online handbook with regional recommendation, funding. Griffin, GA. Nov. 5, 1997.

- b. Topics: IPM Initiative, the development of a regional urban IPM handbook that will be placed in the Internet, funding. Oct. 2-3, 1996. Charlotte, NC.
- c. Topics for discussion: IPM Initiative, the development of a regional urban IPM handbook that will be placed in the Internet. Apr. 25-26, 1996. Memphis, TN.

State

University of Florida

1. Southeast Pest Management Conference, Organizational committee member, 2000-2005.
2. Subterranean Termite Treatment Study Committee, consultant to Chair Dr. Philip G. Koehler. Attended series of 5 day-long meetings. Assisted in drafting termite control recommendations that went back to Legislature.

Auburn University

3. Organizer for the educational program for the Alabama Pest Control Association Winter Meeting. Feb. 5-6, 1998.
4. Organizer for the educational program for the Alabama Pest Control Association Winter Meeting. Feb. 6-7, 1997.
5. Organizer for the educational program for the Alabama Pest Control Association Winter Meeting. Feb. 8-9, 1996.

Meetings and Symposia Moderated (n=10)

HONORS

1. Distinguished Achievement Award in Extension, Southeastern Branch of the Entomological Society of America, 2007
2. University of Florida 2012 Research Award for utility patent on the use of RNA interference to validate new termiticide target sites and as a method of termite control. Patent number 7,968,525, awarded: June 28, 2011. (Team effort with M. Scharf, lead.)