

# Fiona L. Goggin



## Section I. Background Information

### Contact Information

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(479) 575-6751

**Current Title:** Professor

**Affiliation:** Department of Entomology, University of Arkansas

**Appointment Split:** ~85% research, ~10% service, ~5% teaching

### Educational Background

B.S. with honors.	Cornell University, Ithaca, NY.	Plant Science
Ph.D.	University of California, Davis, California.	Entomology

### Relevant Employment

University of Arkansas, Fayetteville, Department of Entomology	
Assistant Professor	December 2001-March 2007
Associate Professor	April 2007-present

### Awards and Honors

- *Gamma Sigma Delta* honor society, inducted 2007
- Outstanding Mentor Award, 2005. University of Arkansas. (An award for excellence in mentoring undergraduate research projects)
- ESA Plant Resistance to Insects Research Award, 2001
- Jastro Shields Graduate student research grant, 7/01, University of California, \$1,000
- 1998 President's Prize 1<sup>st</sup> Place Award, ESA Student Paper Competition
- Jastro Shields Graduate student research grant, 7/98, University of California, \$2,000
- Frank & Grace Benedix Fellowship, University of California, 1997-2001
- Jesse D. Carr Fellowship, University of California, 1997-2001
- Charles A. Ring Memorial Award in Plant Science, Cornell University, 1997
- *Phi Kappa Phi* Honor Society, inducted 1997
- Golden Key Honor Society, inducted 1997
- Hughes Undergraduate Research Fellowship, Cornell University, 1996

## Section II. Research

**AREA OF FOCUS:** The long-term goal of my research is to facilitate the use of host plant resistance in ecologically-sound integrated pest management strategies. The focus of my research program is the molecular and physiological basis of plant defenses against herbivory, including broad-spectrum resistance as well highly-specific responses that target particular pest biotypes. I am particularly interested in examining what determines the specificity of plant defenses, as well as how plants balance the need to defend against divergent stresses. My laboratory is currently studying potential tradeoffs between aphid and caterpillar resistance in plants, as well as the effects of foliar vitamin C content on herbivore susceptibility and abiotic stress tolerance. I am also interested in the impact of plant defenses on multi-trophic interactions; for example, I have examined the impact of host plant resistance on aphid endosymbionts and natural enemies.

## IIAi. Peer-Reviewed Publications (20 in print, 1 in press)

### Invited Reviews (2)

- **Goggin F. L.**, Avila, C. A.<sup>1</sup>, and Lorence, A. 2010. Vitamin C content in plants is modified by insects and influences susceptibility to herbivory. *BioEssays*, 32:777-790. BioEssays publishes reviews and commentaries in the areas of cellular and molecular biology, genetics, and physiology, with an emphasis on transdisciplinary and integrative biology (Impact Factor: 5.3).
- **Goggin, F. L.** 2007. Plant-aphid interactions: molecular and ecological perspectives. *Current Opinion in Plant Biology* 10: 399-408. COPB publishes reviews on all aspects of plant biology and biotic interactions (Impact Factor: 10.3).

### Other Peer-reviewed Research Articles (19)

- Wu, C.<sup>1</sup>, Jia, L.<sup>1</sup>, and Goggin, F.L. The reliability of TRV-based VIGS experiments in tomato is influenced by the size of the vector control. *Molecular Plant Pathology*, in press (accepted 9/20/2010).
- Palliparrambil, R.<sup>2</sup>, Reese, J., Avila, C.<sup>1</sup>, Louis, J., & **Goggin, F. L.** 2010. *Mi*-mediated aphid resistance in tomato: tissue localization and impact on the feeding behavior of two potato aphid clones with differing levels of virulence. *Entomologia Experimentalis et Applicata* 135: 295-307.
- Francis, F., Guillonneau, F., Leprince, P., De Pauw, E., Haubruge, E., Jia, L.<sup>1</sup>, and **Goggin, F. L.** 2010. Tritrophic interactions among *Macrosiphum euphorbiae* aphids, their host plants and endosymbionts: investigation by a proteomic approach. *Journal of Insect Physiology* 56: 575-585.
- Suza, W. P., Avila, C.A.<sup>1</sup>, Carruthers, K.<sup>2</sup>, Kulkarni, S., **Goggin, F. L.**, and Lorence, A. 2010. Exploring the impact of wounding and jasmonates on ascorbate metabolism. *Plant Physiology and Biochemistry* 48: 337-350.
- Anstead, J., Samuel, P., Song, N., Wu, C.<sup>1</sup>, Thompson G. A., and **Goggin F. L.** 2010. Activation of ethylene-related genes in response to aphid feeding on resistant and susceptible melon and tomato plants. *Entomologia Experimentalis et Applicata* 134: 170-181.
- Muilenburg, V. L.<sup>3</sup>, **Goggin, F. L.**, Hebert, S.<sup>2</sup>, Jia, L.<sup>3</sup>, and Stephen, F. M. 2008. Ant predation on red oak borer confirmed by field observation and DNA analysis. *Agricultural and Forest Entomology* 10: 205-213.
- Hebert, S.<sup>2</sup>, Jia, L.<sup>1</sup>, and **Goggin, F. L.** 2007. Quantitative differences in aphid virulence and foliar symptom development on tomato plants carrying the *Mi* resistance gene. *Environmental Entomology* 36: 458-467.
- Sagers, C. L., and **Goggin, F. L.** 2007. Isotopic enrichment in a phloem-feeding insect: influences of nutrient and water availability. *Oecologia* 151: 464-472.
- **Goggin, F. L.**, Jia, L.<sup>1</sup>, Shah, G., Hebert, S.<sup>2</sup>, Williamson, V. M., and Ullman, D. E. 2006. The tomato *Mi-1.2* herbivore resistance gene functions to confer nematode resistance but not aphid resistance in eggplant. *Molecular Plant-Microbe Interactions* 19: 383-388.
- Thompson, G. T., and **Goggin, F. L.** 2006. Transcriptomics and functional genomics of plant defense induction by phloem-feeding insects. *Journal of Experimental Botany* 57: 755-766.
- Korth, K. L., Doege, S. J., Park S., **Goggin, F. L.**, Wang, Q., Gomez, S. K., Liu, G., Jia, L.<sup>1</sup>, and Nakata, P. A. 2006. *Medicago truncatula* mutants demonstrate the role of plant

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<sup>1</sup> Postdoctoral associate or other research associate in my laboratory.

<sup>2</sup> Graduate student in my laboratory.

<sup>3</sup> Graduate student co-advised in my laboratory.

calcium oxalate crystals as an effective defense against chewing insects. *Plant Physiology* 141: 188-195.

- Cooper, W. R.<sup>2</sup>, Jia, L.<sup>1</sup>, and **Goggin, F. L.** 2005. Effects of jasmonate-induced defenses on root-knot nematode infection of resistant and susceptible tomato cultivars. *Journal of Chemical Ecology* 31: 1953-1967.
- Cooper, W. R.<sup>2</sup>, and **Goggin, F. L.** 2005. The impact of jasmonate-dependent defenses on the feeding behavior, fecundity, and mortality of the potato aphid, *Macrosiphum euphorbiae*. *Entomologia Experimentalis et Applicata* 115: 107-115.
- Cooper, W. R.<sup>2</sup>, Jia, L.<sup>1</sup>, and **Goggin, F. L.** 2004. Acquired and R-gene-mediated resistance against the potato aphid in tomato. *Journal of Chemical Ecology* 30: 2527-2542.
- **Goggin, F. L.**, Shah, G., Williamson, V. M., and Ullman, D. E. 2004. Instability of *Mi*-mediated nematode resistance in transgenic tomato plants. *Molecular Breeding* 13: 391-394.
- **Goggin, F.L.**, Shah, G., Williamson, V. M., and Ullman, D. E. 2004. Developmental regulation of *Mi*-mediated aphid resistance is independent of *Mi-1.2* transcript levels. *Molecular Plant-Microbe Interactions* 17: 532-536.
- **Goggin, F.L.**, Williamson, V. M., and Ullman, D. E. 2001. Variability in the response of *Macrosiphum euphorbiae* and *Myzus persicae* (Hemiptera: Aphididae) to the tomato resistance gene *Mi*. *Environmental Entomology* 30: 101-106.
- **Goggin, F. L.**, Medville R., and Turgeon, R. 2001. Phloem loading in the tulip tree. Mechanisms and evolutionary implications. *Plant Physiology* 124: 891-899.
- Rossi, M., **Goggin, F. L.**, Milligan, S. B., Kaloshian, I., Ullman, D. E., and Williamson, V. M. 1998. The nematode resistance gene *Mi* of tomato confers resistance against the potato aphid. *Proceedings of the National Academy of Science, U.S.A.* 95: 9750-9754.

#### Manuscripts in Review or Revision (2)

- Corbett, B. P.<sup>4</sup>, Jia, L.<sup>1</sup>, and **Goggin, F. L.** The effects of nematode infection and *Mi*-mediated resistance in tomato on plant fitness. Submitted to *Journal of Nematology*; in review.
- Avila, C.A.<sup>1</sup>, Arevalo-Soliz<sup>2</sup>, L. M., Navarre, D., Howe, G.A., and **Goggin, F. L.** 2010. Loss of function of FATTY ACID DESATURASE 7 enhances aphid resistance in a salicylate-dependent manner. Submitted to *Plant Journal*; in revision.

#### IIAii. Other Research Publications (1)

- Corbett, B. P.<sup>4</sup>, and **Goggin, F. L.** 2007. The effects of nematode infection and *Mi*-mediated resistance in tomato (*Solanum lycopersicum*) on plant fitness. *Inquiry* 8:3-9. (the University of Arkansas undergraduate research journal).

#### IIB. Research Support (>\$1.9 million in competitive funding since 2003)

- **NSF. Total: \$637,448.** 4/2010-3/2013. Influence of fatty acid desaturation on plant defenses against aphids. My Role: sole investigator.
- **NSF-EPSCoR. Total: \$249,978. My share: \$124,268.** 5/08-3/10. Intersection of Ascorbate regulation, jasmonate signaling and defense against herbivory in plants. My role: This grant is shared equally between two co-principal investigators (co-PIs), myself and Argelia Lorence (Arkansas State University).

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<sup>4</sup> Undergraduate Honors student

- **NSF-EPSCoR: Total: \$249,952. My share: \$132,557.** 10/08-3/10. Role of oxylipins in plant defenses against aphids. My Role: principal investigator. Co-PI = Robyn Hannigan (Arkansas State University).
- **USDA-NRI. \$346,193.** 11/05-11/08. Comparative analysis of aphid resistance in tomato & melon. My role: principal investigator. Collaborator = Gary Thompson, Oklahoma State University.
- **USDA-NRI. \$99,967.** 11/04-11/07. Transcriptional responses to aphid feeding in tomato. My role: sole investigator.
- **Arkansas Biotechnology Institute, \$317,937** (\$147,200 in research support; \$170,737 in support for my salary). 7/05-7/08. Regulation of antioxidants in tomato by the jasmonate pathway. My role: sole investigator.
- **California Tomato Commission, \$41,407.** 5/04-5/06. Integrated aphid and nematode management in tomato. My role: sole investigator.
- **Arkansas Experiment Station, \$10,000.** 4/05-4/06. Role of Spr2, a fatty acid desaturase in tomato, in regulating plant defenses against herbivores. My role: sole investigator.
- **Arkansas Experiment Station, \$20,000.** 4/03-4/05. Mechanisms of aphid and nematode resistance in tomato. My role: sole investigator.

#### **IIC. Graduate students and postdoctoral associates trained**

- Masters students: 2 (1 graduated)
- PhD students: 4 (2 graduated)
- Postdoctoral associates: 3 (2 previous; 1 current)

#### **IIDI. Invited Research Talks (>30 since 2000, including 11 at international meetings).**

##### **Venues include:**

- International Conference on Plant Vascular Biology, 2010.
- Keynote Address, Aphid Research Symposium, Iowa State University, Ames, IA, 2009.
- Keynote Address, Central States (Kansas) Entomological Society Annual Meeting, Manhattan, KS 2003.
- Annual ESA Meeting Symposia, 2010, 2004, 2000
- Joint Annual Meeting of the ESA and the Entomological Society of Canada, 2000
- Southeastern Branch ESA meeting, 2002, 2005, 2009
- Southwestern Branch ESA meeting, 2009
- Northeastern Branch ESA meeting, 2009
- Biennial International Workshop on Plant Resistance to Insects, 2010, 2006, 2002.
- Plant Interactions with Aphids Symposium. Wageningen, the Netherlands, 2008.
- USDA-NRI Workshop, Reno, NV, 2007.
- 5th International Symposium on Molecular Insect Science, Tucson AZ, 2006.
- Society of Experimental Biology Annual Meeting, Barcelona, Spain, 2005.
- International Symposium on Insect-Plant Interactions, Berlin, Germany, 2004.
- International Plant and Animal Genomes (PAG) Workshop, San Diego, CA, 2004, 2003.
- Departmental seminar series: University of Arkansas Little Rock (2009), Gembloux Agricultural University, Gembloux, Belgium (2008), Arkansas State University (2008), University of Florida (2007, students' choice invited speaker), University of Arkansas Fayetteville (2007), Northeastern State University, Tahlequah, OK (2007), University of Nebraska (2006), Texas A&M University (2006).

#### **IIDIi. Other talks and posters (>50 since 1998)**

- ~20 oral presentations
- >30 posters

- Of these presentations, ~40% were given at national or regional meetings of the Entomological Society of America. Other venues included the Gordon Research Conference in Plant-Herbivore Interactions, the Biennial International Plant Resistance to Insects Workshop (IPRI), the American Society of Plant Biology (ASPB) National Meeting, the Society of Experimental Biology (SEB) International Meeting and many others.

## Section III: Teaching

### IIIA. Formal Courses

- **Insect Physiology** (ENTO 6113 +6110L), SPR 2010, 2008, 2006, 2004, & 2002. University of Arkansas. I teach a graduate-level lecture and laboratory class in insect physiology that is a required course for all graduate students in the department. In developing the curriculum for this class, I have sought to introduce students to key concepts and common techniques of molecular insect biology, which are not represented in any other aspect of the students' required curriculum. In addition to covering up-to-date information on insect physiology, I also strive to provide students with opportunities to develop their analytical skills in areas such as experimental design, interpretation of data, and critical evaluation of primary literature. Average enrollment ~9 graduate students.
- **Special Topics in Entomology**, (ENTO 4003) SPR 2006, FA 2005, SPR 2003. U. Arkansas. Through the special topics option, I have offered a program of laboratory training and directed readings to four undergraduate students. Enrollment 1-2.
- **Seminar in Insect Ecology**, SPR 2001. University of California, Davis. As a graduate student, I organized a cross-disciplinary graduate seminar on gall-forming insects. Enrollment ~5.

### IIIB. Other Teaching Activities

- **Internship Sponsorships:** In Summer 2010 I supervised one student from the George Washington Carver program and one student from the NIH-funded IDeA Networks of Biomedical Research Excellence (INBRE) program (May-July 2010). The goal of both of these programs is to provide research opportunities for undergraduates from colleges with limited research facilities. These students are receiving training in DNA extraction, real-time PCR, and spectrophotometric analysis of vitamin C content, and they each have independent research projects on which they will present posters in July.
- **Other Undergraduate Research Training:** I have supervised 3 undergraduate research projects at the University of Arkansas, including 1 honors thesis project. Two of my students received competitive funding for their projects (one NSF-funded State Undergraduate Research Fellowship, and one Honors College research grant), and one student authored a publication on his research. This publication won the university's 2007 student paper competition (\$1,000 prize). Furthermore, this student presented his work at an SEB-ESA meeting and won 1st-place in the Masters-level poster competition there. I received an Outstanding Mentor award from the university for my involvement in undergraduate research. In addition, according to undergraduate student exit surveys conducted by the Registrar's Office, I was cited twice by students as a faculty member with the most positive influence on their college careers.
- **Graduate Student Advising:** I have supervised six graduate students at the University of Arkansas, in addition to serving on student guidance committees in Entomology, Biology, Plant Pathology, and Crop Soil and Environmental Science. The quality of the training in my laboratory is reflected in the students' productivity. Highlights of their achievements include:

- 2005-2006 Conference of Southern Graduate Schools Masters thesis award for life sciences (William R. Cooper. Applicants were solicited from over 250 schools in the area of biological & medical sciences.)
- USDA-SARE student research grant (\$10,000, William R. Cooper)
- Two University of Arkansas Doctoral Academy fellowships (Stephanie Hebert and Godshen Pallipparambil)
- John S. Heiss Fellowship in Entomology, University of Arkansas (Godshen R. Pallipparambil, William R. Cooper)
- Lloyd and Ruby Warren Scholarship in Entomology, University of Arkansas (William R. Cooper)
- Dwight Isely Scholarship in Entomology, University of Arkansas (Godshen R. Pallipparambil, Kelly Carruthers)
- 8 student authorships on publications, and four manuscripts in preparation
- >30 student presentations at scientific conferences

### **IIIC. Teaching Improvement Grants.**

PI: Danielle Julie Carrier (UAF)

CoPIs: Fiona L. Goggin (UAF) & Vibha Srivastava (UAF)

Agency: Arkansas Science and Technology Authority STEM program

Project Title: From field to table: the science behind plants as food and fuel.

Amount: \$12,000.

This grant supported the development of a two-day training workshop for Arkansas K12 teachers which was held in June, 2010. I taught a half-day module on the role of biotechnology in crop protection, and developed two new classroom activities for high school biology classes.

### **IIID. Publications relevant to teaching. None.**

### **IIIE. Teaching Evaluations**

Students at the University of Arkansas fill out standard Purdue course evaluation questionnaires, and are also given the opportunity to provide written comments on the class.

The following is a summary of my evaluations for Insect Physiology:

- Most recent teaching evaluation (2010): 4.8/5.0
- Average teaching evaluation (for 2002, 2004, 2006, 2008, & 2010): 4.6/5.0
- Samples of written comments (from 8 students over 5 years):
  - (2010) "No area[s] of physiological research methods are safe from the instructor's grasp and course content, whether they involve microinstrumentation, genetic work, or chemical analysis."
  - (2008) "This is the best class I have ever had. This is the best instructor I have ever had."
  - (2008) "By far this class was one of the best courses I have taken at the university."
  - (2006) "The teaching strategy used in this course was excellent...The course content was very concise, relevant, and up-to-date....Good combination of insect molecular biology and physiology...The course was thought-provoking."
  - (2006) "[Dr. Goggin] made a point to incorporate up-to-date research in specific areas of insect physiology that made the class interesting. I feel that her enthusiasm and prepared[ness] made her class...the best one taught in this department. She clearly wanted everyone to understand and was helpful if you had questions."

- (2004) "I appreciate [Dr. Goggin's] concern when my grades were low. This helped me to improve not only in this class but with my study skills in general."
- (2004) "This was one of the best courses I have ever taken. The lecture was excellent!"
- (2002) "I really believed that [the instructor] cares about the students and was trying to help us understand the materials at hand."

**Section IV: Extension** N/A (no extension appointment)

## **Section V: Service**

### **VA. Professional Societies**

#### **Memberships**

- Entomological Society of America
- American Society of Plant Biologists

#### **Committees**

- Member of the editorial board of the *Journal of Chemical Ecology*, 2009-present. JEC is the official journal of the International Society of Chemical Ecology.
- Member of the Entomological Foundation, 2008-present.
- Member of the SEB-ESA member awards committee, 2008-present.
- Member of the judging committee for the ESA Starks Plant Resistance to Insects Research Award, 2007-2010 (appointed)
- Member of the SEB-ESA membership committee 2004-2006 (appointed)

#### **Symposia**

- Invited to serve as a co-chair of a session on biotic plant interactions at the International Conference on Plant Vascular Biology, held in Columbus, Ohio, in July, 2010.
- Volunteered to organize and moderate a symposium entitled "Molecular Analyses of Host Plant Resistance to Insect Herbivores," ESA 2004 annual meeting, Salt Lake City, 2004. The symposium had an international panel of speakers and over 100 attendees. Many participants and audience members commented that the symposium was the highlight of the meeting for them, and was a unique and much-needed forum for research on the molecular basis of host-plant defense.
- Invited to speak in symposia at seven regional and national ESA meetings, including the upcoming 2010 national meeting.

#### **Other Service**

- Judge, Section F student paper competition, 2007 ESA national meeting
- Manuscript reviewer for the *Annals of the Entomological Society of America*, the *Journal of Economic Entomology*, *Entomologia Experimentalis et Applicata*, *Archives of Insect Biochemistry and Physiology*, *Insect Molecular Biology*, *Physiological Entomology*, *Proceedings of the National Academy of Sciences*, *Oikos*, *BMC Ecology*, *BMC Plant Biology*, *Journal of Chemical Ecology*, *Plant Physiology*, *Plant Journal*, *Plant Science*, *Molecular Plant-Microbe Interactions*, *Plant Cell Reports*, *Physiologia Plantarum*, *Crop Science*, and *Bioessays*. In addition, I have reviewed a book proposal on insect resistance for the publisher John Wiley and Sons, and a proposal for a new journal for Kluwer Academic Publishers.

### **VB. Other Organizations**

- Provided materials and protocols to fellow scientists at the University of Arizona, Kansas State University, Louisiana State University, & the Volcani Institute (Israel).

#### **VC. Public and/or Private Sector**

- I have been funded to perform research on pest control for a fresh-market tomato commodity group, the California Tomato Commission, and I have given presentations at their 2004, 2005, and 2006 annual board meetings.

#### **VD. State, National, and International Agencies**

- Panelist, USDA-NRI Suborganismal Biology of Arthropods & Nematodes (2006)
- Panelist for the NSF Integrative Biology Cluster (2007; scheduled to serve again in November 2010)
- External grant reviewer for numerous proposals submitted to the USDA-NRI and NSF, as well as for proposals to the Israel Science Foundation and the Academy of Sciences of the Czech Republic.

#### **VE. Nominee's institution (The University of Arkansas)**

- **Service to the University/College**
  - **Standing Committees:** I have served on eight college committees: the undergraduate scholarship committee (1 yr; current), the promotion committee for non-classified support personnel (1 year; current); the student award committee (1 year; current), the alumni society faculty advising award committee (1 yr; current), the oversight committee for the college's shared greenhouse and growth chamber facility (7 years; current), the Faculty Council (2 years), the Undergraduate Honors Committee (2 years), and the Plant Biotechnology Committee (1 year).
  - **Other service:** I was a member of the search committee charged with recruiting a director for the college's shared greenhouse facility. I also served as a reviewer for an internal granting program, the Arkansas Biosciences Institute.
- **Departmental Service**
  - **Chair, Awards Committee.** 7/09-present. As chair, I administer the selection process for departmental student awards, and also serve as the departmental representative on several college committees that distribute student scholarships, alumni and faculty awards.
  - **Member, Medical/veterinary entomology search committee,** 1/2010-present. As a member of this committee, I helped draft a position announcement, and will be involved in the advertising, screening, and selection process to recruit a new faculty member.
  - **Chair, Insect Systematics Search Committee.** In Spring/Summer 2007, I chaired a departmental selection committee to recruit an assistant professor.
  - **Chair, Graduate Admissions Committee.** 7/03-7/05 (& member, 1/02-7/03). As chair, I worked to standardize the admissions process, clarify departmental requirements, & develop a written policy approved by a majority vote of the department's faculty.
  - **Other Committee Service.** I have served 2-year appointments on four additional standing committees (the curriculum, promotion & tenure, seminar, and social committees), and one *ad-hoc* committee charged with organizing an external departmental review.

#### **VF. Community and other:**

- Offered a workshop for K12 teachers (see section on teaching grants, above)

- Participated in the Gifted and Talented Scholars program for Arkansas high school students, targeted to stimulate students' interest in science.
- Developed a display on aphid biology for the department's biennial Insect Festival, an outreach event attended by hundreds of local schoolchildren. Participated in the festival in 2006, 2008, and 2010.