

***Sirex* Science Advisory Panel**

Report

**January 9 & 10, 2006
Annapolis, MD**

Members¹

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¹ See Appendix 2 for C.V.s of SAP members

***Sirex* Science Advisory Panel**

10 January, 2006

Panel Recommendations to Sirex Management Team

A *Sirex noctilio* female was found in a trap placed for exotic bark beetle in Fulton, NJ on September 7 of 2004 and identified in February of 2005. Since that time, through visual and trap-based surveys, an established population has been found in the area around Oswego and Fulton, NY. Trap catches indicate that the population may extend at least 46 miles southeast of Oswego. A total of 85 females were captured in NY. In addition, trap surveys in Canada, along the north shore of Lake Ontario and the St. Lawrence River, captured five additional females. One of these was captured as far east as the town of Prescott (Proviens).

Sirex noctilio is native to EurAsian and only has become a primary pest of *Pinus* species when it was accidentally introduced into areas where pines are being commercially grown. It is now known to occur in New Zealand, Australia, South Africa, Brazil, Chili, and Argentina. In these areas of the world, most of the damage has been reported on North American species of pine, which have been cultivated for fiber and lumber production. Risk assessments and economic analysis predict that direct *S. noctilio* impacts in the United States would amount to billions of dollars (appendix 1).

To address the discovery of established populations in New York, APHIS requested the formation of a science advisory panel to formulate an appropriate response and to respond to specific questions posed by federal and state officials and by stakeholders. The following report is the result of the initial meeting of the *Sirex* Science Advisory Panel (SSAP) in Annapolis, Maryland on January 9 & 10, 2006. These recommendations are based on the best available information at the time of the meeting and are subject to change as new information becomes available.

Survey

The Science Panel believes that the actual area infested by *Sirex* in the U.S. likely extends beyond the current area that is known to be infested, and that proper delimitation of the population should be given high priority. Accurate delimitation will allow us to: (1) refine boundaries of regulatory zones, (2) make better decisions regarding possible program options and allocation of resources, and (3) identify locations for various program actions (control, future survey, etc.).

Trapping

Trapping should be the primary delimitation method. Traps should be spaced on a grid system; within areas delineated by the grid. Sites containing pine (giving preference to sites with hard pines in poor condition) should be selected for trapping. The delimitation grid should extend to areas within 150 miles of Oswego. The trapping area should also include a band on the U.S. side of the St. Lawrence Seaway to cover *Sirex* captures in Canada. Overall trap density should ideally be one trap per 5 square miles in this area, however, if resources are limiting this area, it

should be covered, but at a lower trapping density. Trapping efforts can be substantially reduced within 50 miles of Oswego, as the bulk of that area is already known to be infested. Statisticians with experience in detection trapping systems should be consulted on survey design. Coordinate this delimitation program with CAPS and the FS-ED/APHIS programs to ensure adequate detection survey for *S. noctilio* beyond the scope of the delimitation trapping effort. Also, coordinate this with Canada so that a clear picture of *Sirex noctilio* distribution emerges.

Semiochemical-baited traps (synthetic lures) still need developmental work, but these are the least expensive and logistically simplest of the currently available trapping tools and technology which can be used for delimiting surveys.

Log-baited traps appear at this time to be more efficient than traps baited with synthetic lures, but are relatively more complicated logistically. The mesh cylinders used for these traps are not commercially available and trappers must coat them with sticky substances in the field. For optimal attraction, logs must be freshly cut and changed frequently (every 2-3 wks).

Trap trees are thought, under most circumstances, to be the most effective trapping system that is currently available. Trap trees should be used in the U.S. for *S. noctilio* programs, but that use should be limited, due primarily to logistical issues. Trap trees for survey and for establishing nematodes are killed using herbicides. The optimal time for applying herbicides may fall into a relatively narrow window (as short as several weeks) in order to minimize attack from other bark and wood feeding insects. Beetle-attacked trees are thought not to support *Sirex*. USFS and APHIS-PPQ-CPHST will cooperatively develop the best technique and timing for creating effective trap trees and provide recommendations for timing these treatments for the 2006/2007 field season. Another consideration is that trap trees must be felled for evaluation. Felling and peeling/splitting to detect *Sirex* life stages is time consuming.

Trap-tree methodology, however, needs to be developed for U.S. climate and tree species because trap trees will be used for inoculating areas with nematodes (see control section below). The SSAP's recommendation is to depend on semiochemical-baited traps for most of the delimiting effort, but include trap trees throughout (perhaps in an array radiating from Oswego) to: (1) give the program experience with trap trees, (2) get information on relative effectiveness of traps and trap trees under different conditions (e.g., different densities of *Sirex*, hole tree density, etc.), and (3) enhance the sensitivity of the overall survey effort.

Aerial survey

Aerial survey may be able to be used to identify high-risk areas for selecting trap sites and perhaps for locating infested trees. If aerial survey techniques are used, the survey results should be ground-truthed so that results are confirmed. Information should be collected on tree species and host condition to determine if this technique can be utilized for a survey site location. It is unknown at this point if *Pinus* species in the U.S. will display the same needle symptoms as on *Pinus radiata*, etc. in New Zealand, Australia, etc. These surveys can be most effective if conducted when leaves are not present on deciduous trees. The utility of this technique will have to be evaluated on different species of North American pines.

Softwood mills

Mills should be surveyed for *Sirex* damage. Ends of logs can be examined periodically (as inventory turns over) for signs of larvae or larval damage. If infested material is found, it should be traced back to the point of origin. An effort should be made to educate mill personnel to conduct these surveys, even though conflict-of-interest issues could arise. This relates to the next area of discussion.

Outreach

Initiate an outreach program to educate the public, and especially forestry professionals, non-industrial woodlot owners, arborist, and the timber industry about *S. noctilio*. This outreach effort should be national in scope as the public is often our primary detection method in areas remote from known infested areas and because almost all of the U.S. is susceptible to infestation. Also, silvicultural guidelines should be developed to describe best stand management practices to minimize impacts of *Sirex* infestations. Known infested areas, such as Oswego, should be used for on-site training of program personnel and to show the impact to the stakeholders.

Regulatory Actions

Movement of logs and green lumber of hard (2- and 3-needle) pines from infested areas (currently the five NY counties) should be regulated. These logs go for such uses as utility poles, pulp, and firewood. Movement of *S. noctilio* in logs or lumber is a concern, as it could create infestations in areas remote from the known infested area(s). Chipped wood may also be a concern, depending on the size of the chips and how they are processed. Chipping or grinding to 1" or less results in no emergence of the emerald ash borer (EAB) from infested wood, but it will be necessary to verify this treatment on *Sirex*. Compliance agreements can be used to allow movement of these commodities during periods when emergence of adults is not a risk

Control

New York Population

The Science Advisory Panel believes that eradication of *S. noctilio* is not a feasible option at this point in time. Tree removal also does not appear to be feasible as an overall control method, and generalized use of pesticides is problematic from a number of viewpoints, including a lack of known effective compounds, expense of application over large areas, and environmental impacts. Comprehensive biological/cultural control programs have been effective against introduced populations of *S. noctilio* in New Zealand, Australia, and South America. These programs consist of three basic parts, all of which are complimentary and critical for success: 1) dissemination of parasitoids and parasitic nematodes, 2) silvicultural practices that promote tree health and vigor, and 3) systematic survey and surveillance. We believe that this approach should be initiated in North America. This approach will require adjustments when applied in North America because of difference in host species, abundance, distribution, and forest composition. Other facts that must be considered are climate effects and land management patterns.

The parasitoid species that have been most effective in classical biological control programs in other areas where *S. noctilio* has been introduced are North American species and some have already been found parasitizing *Sirex* in New York (Mastro unpublished). The effectiveness of these agents in New York should be assessed; however, they have not, in themselves, provided sufficient control in other areas, and preliminary data suggest that this will not be the case in North America either. A program to deploy the nematode, *Beddingia siricidicola*, is imperative and should be initiated as quickly as possible if we are to minimize impacts of *S. noctilio* in North America. Cooperation with other countries, including Australia, South Africa, Brazil (or other South American countries with *Sirex* infestations), and Canada, may be desirable. For the overall nematode program, the successful Australian program should be used as a model. The critical steps that must be taken include:

- Possible regulatory barriers to the release of this nematode should be identified and addressed. The nematode is highly host-specific – the non-infective stage of the nematode requires the wasp’s symbiotic fungus (*Amylostereum areolatum*) for development, and this fungus species is not used by North American siricids. Regardless, assessments of possible effects on non-target species may be required and should be completed as soon as possible. A survey should also be conducted to determine if the nematode, *B. siricidicola*, was, by chance, introduced along with the wasp. Note that the presence of the nematode associated with the introduced North American *S. noctilio* population(s) would not preclude a nematode release program and could even complicate it if the strain present here has less-than-desirable virulence (defective strains).
- Sources of nematode cultures should be identified or developed. Longer-term, will require that the U.S. and Canada develop the capacity to produce the nematode. Both the production of the nematode and management of the strain require care in order to ensure an effective product. A dedicated facility that is equipped to handle sterile media and maintain sterile technique (comparable to a microbiology laboratory) will be required.
- Trap trees and/or infested pine bolts are used for propagation and dissemination of the nematode in the field. The capability to conduct this work, and the design of the program to meet these needs, has to be carefully considered and developed. The capacity to monitor the effectiveness and distribution of the nematodes also needs to be developed as an integral part of the program.

Prior to the deployment of the nematodes, trees that are found to be infested, and are well within the known infested area, do not need to be controlled for program purposes. Landowners, though, could be encouraged to remove and destroy infested trees. In addition, outreach activities should include information on, and encouragement of, steps to improve overall health of pine stands. Sites where trees are known to be infested can also be viewed as opportunities to obtain insects for purposes of research and for inoculating trap trees that will be used as part of the nematode distribution program.

Outside the infested area

If populations of *S. noctilio* are discovered long distances from the area that is known to be infested and are not well established, eradication should be considered if the population is sufficiently small and spatially contained. Successful spot eradications of *Sirex* have been achieved in South America when they were detected early and the discoveries acted on

aggressively. Public education, outreach, and focused surveys should aid in discovery of these outliers.

Overall

An electronic data management system should be used to record and document all of the program's activities, regardless of jurisdiction, including survey, control, and regulatory activities. All survey, biocontrol release, and evaluation locations should be geo referenced to facilitate mapping and data interpretation. Ideally, field personnel will be equipped with hand-held electronic units for data collection and geo-referencing.

As quickly as possible, an integral evaluation component should be integrated into the program activities. This will aid the program in tracking and analysis of its information, improving its delivery and providing documentation for planning purposes, and demonstrate the program's impacts.

Research Priorities

(not necessarily in order of priority)

1. Develop improved semiochemical lures for *S. noctilio* and improved trapping devices.
2. Determine optimal methods, tree species, types and doses of herbicide, and timing for creating trap trees for survey and biological control.
3. Assess host potential of various North American conifers, including commercially and ecologically important species of *Pinus* that exist outside of the infested areas.
4. Evaluate ecology of *S. noctilio* in North America as it relates to the effectiveness of native biological control agents (and other mortality agents) and pest risks.
5. Develop better methods for identification of the various life stages of *S. noctilio* and related organisms.
6. Transfer the technology for nematode rearing from Australia to the U.S.
7. Describe adult *Sirex* behavior as it relates to mating and to oviposition-site selection.
8. Develop/verify regulatory treatments relevant to *Sirex*-infested materials (methyl bromide, chipping, heat treatments, phosphine, etc.).
9. Confirm specificity of the nematode, *B. siricidicola*, to *Sirex noctilio*.
10. Conduct surveys for nematodes, which are already present in U.S., for *S. noctilio* populations.
11. Conduct an economic analyses of possible impacts of *S. noctilio* in U.S. and in North America.
12. Develop a phenological prediction model for vulnerable areas in the U.S.
13. Evaluate aerial detection/remote as survey tools and compare with other potential methods.
14. Assess effectiveness of silvicultural methods for reducing stand susceptibility to *S. noctilio*.
15. Develop a better understanding of the interactions of the nematode fungus and wasp.
16. Determine nematode spread rates and evaluate how site characteristics impact these.

Priority should be given to items that are likely to lead to the successful use and establishment of the nematode system as quickly as possible. Other priorities should be dictated by the needs of the program. The science panel members suggest that after two years, any research progress be evaluated. Both the research and program priorities should be evaluated yearly as the program progresses and new findings become available.

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January 9, 2006**

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RESULTS OF A SURVEY FOR THE EUROPEAN WOOD WASP, *SIREX NOCTILIO*, IN SOUTHEASTERN ONTARIO.

Introduction

On 5 July 2005, the Systematic Entomology Laboratory in Beltsville Maryland confirmed that the European wood wasp, *Sirex noctilio* Fabricus, had established a reproducing population in pine trees collected from Fulton, New York, which is less than 100 km south of Kingston, Ontario. This is the first report of an established population in North America and represents a very significant and disturbing finding. This work followed the find of a single female adult captured in a trap on 7 September 2004 near Fulton. The European wood wasp feeds on many species of pine and is a serious pest of plantations in Australia, South America and South Africa. Based on the climatic conditions its native range (Europe, Asia and northern Africa), the wood wasp could establish in any climate zone of North America where pine grows. The wasp is rated as a “very high risk” in a risk assessment for North America.

Survey results reported on 5 August 2005 by US authorities confirmed that the wasp had been caught at a 30 km radius from the initial find. In response to this finding, the Canadian Forest Service and the Ontario Ministry of Natural Resources in collaboration with the Canadian Food Inspection Agency established a rapid trap survey of sites along the Canada-US border extending west from Cornwall to Prince Edward County south of Belleville, Ontario. As of 14 November 2005, US authorities reported finding 85 female *S. noctilio* in delimiting trap surveys, including six females between the 20-70 mile radius trap circles from Fulton NY.

Results from the surveys in Ontario indicated the presence of *S. noctilio* in four locations. This report, presents a brief description of the survey methods and of the locations found positive for this insect. It should be noted that the trap results only indicate that these wasps were captured in the area and does not necessarily mean that we have established reproducing populations at these sites.

Survey methods

A total of 36 sites were located from Sandbanks Provincial Park southeast of Wellington, Ontario to Cornwall (Figure 1). This area and corridor was chosen as it was closest to the known area of *S. noctilio* infestation in New York. Sites contained either two or three needle hard pine, and ranged from small residential and roadside plantings, small plantations, and natural forests. Thirteen sites contained Scots pine (*Pinus sylvestris*), followed by 12 Austrian pine (*P. nigra*), four red pine (*P. resinosa*), four jack pine (*P. banksiana*), two pitch pine (*P. rigida*) and one Mugho pine (*P. mugo*) sites. Tree height ranged from 4 to 20 m. 12-unit Lindgren funnel traps were in pine approximately 1 m away from the tree trunk and the bottom of the trap at least 0.5 m above ground. Each trap was baited with alpha-pinene, beta-pinene, both, or a formulation of both. Traps were deployed between 23 August and 2 September 2005. All insects were collected

from the traps between 19-23 September, and again on 10-13 October 2005, when the traps were taken down. Traps were deployed late in the season, but as quickly as possible after the 5th August disclosure, and 16th August *Sirex* update and training session in Oswego, New York.

Insect collections were submitted to the Insect Identification Lab at the Great Lakes Forest Centre, Canadian Forest Service for processing and identification. The collections were submitted on 3 November 2005 to the Centre for Plant Quarantine Pests, Canadian Food Inspection Agency for confirmation. Species were confirmed by CFIA on 17 November 2005.

In addition to five adult females of *Sirex noctilio*, adults of *Sirex behrensii*, *S. edwardsii*, *S. j. juvencus* and *S. nigricornis* were collected, as well as *Tremex columba*, and *Urocerus cressoni*.

Description of sites where *Sirex noctilio* was found

- Site 28:** Sandbanks Provincial Park, Prince Edward County; Scots pine plantation, 18 m tall, semi-mature, west aspect, full stocked stand in decline; two adult females captured with alpha-pinene.
- Site 29:** Simpson Road, Milford, Prince Edward County; Private land, Scots pine plantation, 15 m tall, semi-mature, flat, full stocked stand; one adult female captured with alpha-pinene.
- Site 30:** Morrison Point Road, Black River, Prince Edward County; Private land, Predominately red pine with some Austrian and Scots pine, 15 m tall, young to semi-mature, flat, partially stocked stand (front lawn planting); one adult female captured with alpha-pinene.
- Site 36:** Hwy 416, 4.2 km north of Hwy 401, near Prescott, Ontario; Provincial Crown land, Scots pine, 9 m tall, young to semi-mature, flat, partially stocked stand (road side planting); one adult female captured with alpha-pinene.

CFS and OMNR staff involved with this survey

OMNR: Taylor Scarr, Wayne Ingram, Ed Czerwinski.

CFS: Peter de Groot, Hugh Evans, Kathryn Nystrom, Ron Fournier, Tony Hopkin,.

Report prepared 23 November 2005 by: Peter de Groot, Hugh Evans, Kathryn Nystrom and Ron Fournier.

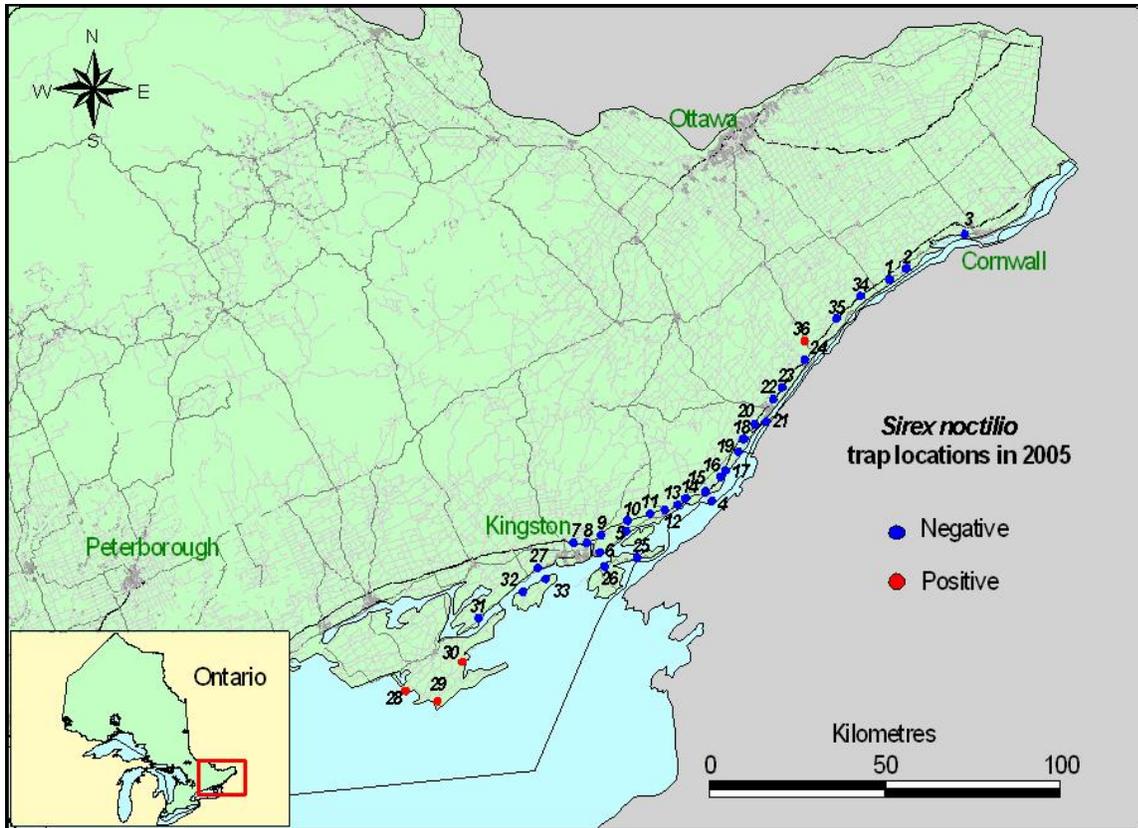


Figure 1. Location of *Sirex noctilio* trap sites in southeastern Ontario (23 August -13 October 2005). Locations where *S. noctilio* were found are indicated in red.

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1959-1962 The Royal College of Science,
Imperial College of Science and
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1962 Bachelor of Science, (BSc Hons)
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1962-1965 Imperial College of Science and
Technology, London University
Essex County Scholarship
ARC Scholarship
Marshal Prize for Biological
Research at Imperial College.
Demonstrator in Zoology (2yrs)
University of London colours (Judo).
Doctor of Philosophy (PhD)
Diploma of Imperial College
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1965-1969 Employed by Australian High
Commission to work for CSIRO on
nematode parasites of *Sirex*
at Silwood Park, UK

1969 Indefinite appointment to CSIRO.
Division of Entomology
Transferred to Hobart, Tasmania
to work on nematodes of *Sirex*.

1969-1971 Research Scientist

1971-1976 Senior Research Scientist,

1976-1985 Principal Research Scientist

1985-1989	Senior Principal Research Scientist
1974-present	Group Leader, Nematodes to Control Insects
1981-1988	Officer-in-Charge, Division of Entomology, Tas.Reg.Laboratory.
1985	Best Economic Paper Award Society of Nematology (International)
1986-1988	Chairman, CSIRO Tas. Reg. Laboratory. Acting Chief Research Scientist
1988	Transferred to Canberra to head new laboratory for nematode control of insects
1989	Chief Research Scientist Consultant to EMBRAPA, Brazil Urrbrae Award for Agricultural Research
1992	Consultant to FAO on sirex .
1993	CSIRO medal Sir Ian McLennan Award Commendation
1994	Plaque from Academia Sinica, Guangzhou for sign. contribution to entomopath. nematode research in China Chief Research Scientist 2 Scientific Auditor of Horticulture Research International
1995	International Plant Protection Congr. award of distinction to Entomology Division for nematode research Clunies Ross National Science and Technology Award Consultant to South Africa on Sirex
1997	Elected Fellow of the Australian Academy of Science Sir Ian McLennan Achievement for Industry Award
1998	Elected Fellow of the Society of Nematologists (International)
1975-Present	Convenor & Chairman of Sessions at 8 International Congresses
2002	CSIRO Honorary Fellow
2003	Australian Centenary Medal
2005	Consultant to Homegrown/Dudutech in Kenya on entomopathogenic nematodes for vegetables

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- Forest health surveillance
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- Pest and disease diagnosis
- Pest and disease damage assessment
- Pest and disease management

QUALIFICATIONS:

PhD, The University of Melbourne, School of Forestry, Australia, 2000.

Thesis title: A study of the species of *Mycosphaerella* on eucalypts in Australia and the impact of *Mycosphaerella* leaf diseases on *Eucalyptus globulus* Labill.

Bachelor of Science Honours, La Trobe University, School of Botany, Australia, 1991. Thesis title:

The susceptibility of certain *Eucalyptus* species and provenances to infection by *Mycosphaerella* spp. and other leaf parasites.

I have extensive experience in forest health surveillance being with the Forest Health Survey Unit (FHSU) since 1996, and prior to that with post-graduate study in forest pathology. My expertise lies in forest health surveillance, pest and disease diagnosis, fungal taxonomy and tree breeding. During my time with the FHSU I have significantly improved forest health surveillance methodology, including the use of GIS-GPS interface during aerial and ground surveys, training of field staff, and being involved in a national team to improve and standardise eucalypt tree crown assessment. I have made, and continue to make, original contributions to the national and international field of forest health research.

I am a recognised national authority within the field of forest health. Evidence for this is provided by my contribution to external reports and workshops, being a member of Forestry and Forest Products Committee's Research Working Group 7 (Forest Health) and being called to review scientific manuscripts and research dissertations. I have also been invited to participate in three World Congresses, as a convenor and a speaker, and I am a regular guest lecturer on forest health for Southern Cross University. I was recently invited to assist with South Africa's Sirex Management Program.

My current research results are assisting in the selection of improved planting stock for both hardwood and softwood plantations, a major corporate objective of Forests NSW/NSW DPI. Work I have conducted since joining Forests NSW/NSW DPI has identified significant pests and diseases that impact on our planted forest estate, with follow-up research on quantifying and managing the impact of these. Research I am currently working on will further quantify the impact of pests and diseases in softwood and hardwood plantations and provide spatial, GIS-based models for pest risk management.

I have developed influence among the broader scientific community through my national and international collaborative research programs and my supervision of post-graduate students.

EMPLOYMENT:

2003-current: Research Scientist & Team Leader of Forest Health Survey Unit, Forest Resources Research, NSW Department of Primary Industries (formerly State Forests of NSW). *Duties:* Manage and conduct forest health surveys in softwood and hardwood plantations in NSW. Conduct research on tree improvement and the impact and management of insect pests, fungal diseases, parasites, invertebrate pests and nutritional disorders in plantations.

1998-2003: Research Officer & Team Leader of Forest Health Survey Unit, State Forests of NSW. *Duties:* Manage and conduct forest health surveys in softwood and hardwood plantations in NSW. Conduct research on tree improvement and the impact and management of insect pests, fungal diseases, parasites, invertebrate pests and nutritional disorders in plantations.

1996-1998: Project Officer / Forest Health Survey Officer, Forest Health Survey Unit, State Forests of NSW. *Duties:* Conduct forest health surveys in softwood and hardwood plantations in NSW.

1992-1995: Full time student, PhD studies, The University of Melbourne

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National Geographic Society

PUBLICATIONS:**Books**

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- Kent, D.S. and **Carnegie, A. J.** (2001). Three bugs and a maggot in the limelight for forest health in NSW. Australian Entomological Society 32nd
- Carnegie, A. J.** (2000). State and company overviews of eucalypt plantation estates and pest problems – New South Wales. 15-25. Proceedings of a Workshop on managing pests of eucalypt plantations. 10-11 February 2000, Department of Forestry, ANU, Canberra. 84pp.

CURRICULUM VITAE

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EDUCATION

Simon Fraser University, Burnaby, British Columbia (Entomology) Ph.D. (1991)
Lakehead University, Thunder Bay, Ontario HBSc Forestry (1981)
Sault College, Sault Ste. Marie, Ontario Forest Technology (1975)
Pauline Johnson High School, Brantford, Ontario (1972)

AWARDS/HONOURS

Ontario Federal Council Leadership Through Collaboration Award (2004)
Canadian Forest Service, Excellence in Technology Transfer (1993)
Gold Medal, Canadian Institute of Forestry, (1981)
First Class Honours, B. Sc. Forestry (1981)
Presidents Award, Lakehead University, (1981)
First Class Honours, Forest Technician Diploma (1975)

EMPLOYMENT

1992- Research Scientist, Applied Insect Ecology, Canadian Forest Service
1982-1992 Research Forester, Insect Pest Management, Canadian Forest Service
1981-1982 Research Forester, Field Efficacy Section, Canadian Forest Service
1975-1981 Research Technician, Virology Section, Canadian Forest Service
1974-1974 Field Technician, Ontario Ministry of Natural Resources

TEACHING

1999- Adjunct Professor, Faculty of Forestry, University of Toronto
1997-1999 Lecturer, Alberta Environmental Training Centre
1997- Graduate student supervisor, Committee member for graduate students, University of Toronto
1994-2004 Adjunct Professor, Faculty of Forestry, Lakehead University, Thunder Bay
1994-1998 Course Instructor, Advanced Forest Pest Management Courses.
1992-1993 Guest Lecturer and co-instructor of forest entomology courses, Lakehead University, Thunder Bay
1990- Guest Lecturer at the Faculties of Forestry at the University of Toronto, Lakehead University and Sault College

ACTIVITIES AND SERVICES FOR PROFESSIONAL SOCIETIES OR ORGANIZATIONS (Selected)

- Guest Editor, Special issue of the Canadian Entomologist, Volume 132(6), 2000
- Scientific reviewer for USDA, Small Business and Innovations Group, 2000
- Scientific reviewer for the Canadian Innovation Centre
- Director, Entomological Society of Canada 1999 to 2002
- Associate editor for *The Canadian Entomologist*, 1995-2001
- Associate editor for The Forestry Chronicle, 1999-
- Director, Entomological Society of Ontario, 1996 to 1999 and 1992-1994
- Program committee member, Entomological Society of Ontario, Sault Ste. Marie, 2000
- Steering committee member, North American Forest Insect and Disease Work Conference, Edmonton, Alberta, 2000-2001
- Steering committee member, North American Forest Insect and Disease Work Conference, San Antonio, Texas, 1995-1996
- Technical committee member, Forest Sustainability Conference, 1994-1995.
- Chair, Cone and Seed Pest Working Party, Canadian Tree Improvement Association, 1985- 2000
- Chair, Integrated Pest Management in Seed Orchards Network. 1991-1994
- Symposium chairman, Recent Advances in Pest Management, Canadian Institute of Forestry, 1989-1990.
- Member of the editorial board for, and contributor to the book, Trees in Canada. 1988-1992
- Chair, Pest Control Working Group, Canadian Institute of Forestry, 1985-1988

PUBLICATIONS

Refereed journals

- Sweeney, J., J.M. Gutowsky, J. Price, P. de Groot. 2006. Effect of semiochemical release rate, killing agent, and trap design on capture of *Tetropium fuscum* (F.) and other longhorn beetles (Coleoptera: Cerambycidae) *Environmental Entomology* **34** (in press).
- Rodriguez-Saona, C. T.M Poland, J. R Miller, L. L Stelinski, G.G. Grant, P. de Groot, L. Buchan, and L. MacDonald. 2006. Behavioral and electrophysiological responses of the emerald ash borer, *Agilus planipennis*, to induced plant volatiles. *Chemoecology* (in press)
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- Morgan, R.E., P. de Groot and S.M. Smith. 2004. Susceptibility of pine plantations to attack by the pine shoot beetle (*Tomicus piniperda*) in Southern Ontario. *Canadian Journal of Forest Research* **34**: 2528-2540
- Poland, T.M., P. de Groot, R. A. Haack, and D. Czokajlo. 2004. Semiochemical attractants for the pine shoot beetle, *Tomicus piniperda* (Coleoptera: Scolytidae) *Journal of Applied Entomology* **128**: 639-644.
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- de Groot and R. Nott. 2004. Response of the whitespotted sawyer beetle, *Monochamus s. scutellatus*, and associated woodborers to pheromones of some *Ips* and *Dendroctonus* bark beetles. *Journal of Applied Entomology* **128**: 483-487
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- Trudel, R., C. Guertin and P. de Groot. 2004. Use of pityol to reduce damage by the white pine cone beetle, *Conophthorus coniperda* (Coleoptera: Scolytidae) in seed orchards. *Journal of Applied Entomology* **128**: 403-406.

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- de Groot, P. and R. Nott. 2003. Response of *Monochamus* (Col., Cerambycidae) and some Buprestidae to flight intercept traps. *Journal of Applied Entomology* **127**: 548-552.
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- Peddle, S., P. de Groot, and S. Smith. 2002. Oviposition behaviour and response of *Monochamus scutellatus* (Coleoptera: Cerambycidae) to conspecific eggs and larvae. *Agricultural and Forest Entomology* **4**: 217-222.
- Grant, G.G., P. de Groot, D. Langevin, S.A. Katovich, K.N. Slessor and W.E. Miller. 2002. Sex attractant and seasonal flight patterns for three *Eucosma* (Lepidoptera: Tortricidae) species sympatric in eastern pine seed orchards and plantations. *The Canadian Entomologist* **134** : 391-401.
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- Rapport, N.G., J.D. Stein, A.A. Del Rio Mora, G. DeBarr, P. de Groot and S. Mori. 2000. Responses of *Conophthorus* spp. (Coleoptera: Scolytidae) to behavioral chemicals in field trials: a transcontinental perspective. *The Canadian Entomologist* **132** : 925-938.
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- de Groot, P., J.J. Turgeon and G.E. Miller. 1994. Management of cone and seed insects in Canada. *The Forestry Chronicle* **70**: 745-761.
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- de Groot, P., and J.H. Borden. 1992. Host acceptance behaviour of *Conophthorus resinosae* and *C. banksianae* (Coleoptera: Scolytidae). *Entomologica Experimentalis et Applicata* **65**: 149-155.
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- de Groot, P. 1991. Cone beetles in the boreal forest: At the cutting edge. *Proceedings of the Entomological Society of Ontario* **122**: 87-100
- de Groot, P., G.L. DeBarr, G.O. Birgersson, H.D. Pierce, J.H. Borden, Y.C. Berisford, C.W. Berisford. 1991. Evidence for a female-produced pheromone in the white pine cone beetle, *Conophthorus coniperda* and in the red pine cone beetle, *C. resinosae* (Coleoptera: Scolytidae). *The Canadian Entomologist* **123**: 1057-1064.
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- de Groot, P. and T.J. Ennis. 1990. Cytotaxonomy of *Conophthorus* (Coleoptera: Scolytidae) in eastern North America. *The Canadian Entomologist* **122**: 1131-1135.
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- Cunningham, J.C., P. de Groot and W.J. Kaupp. 1986. A review of aerial spray trials with Lecontvirus for control of redheaded pine sawfly, *Neodiprion lecontei* (Hymenoptera: Diprionidae), in Ontario. *Proceedings of the Entomological Society of Ontario* **117**: 65-72.
- de Groot, P. 1985. Chemical control of insect pests of white pine. *Proceedings of the Entomological Society of Ontario* **116**: 67-71.

Books

- de Groot, P., A. A. Hopkin and R.J. Sagan. 2005. *Silvicultural Techniques and Guidelines for the Management of Major Insects and Diseases of Spruce, Pine and Aspen in Eastern Canada*. Natural Resources Canada, 65 p.
- Turgeon, J.J., P. de Groot and J. Sweeney. 2004. *Insects of Seed Cones in Eastern Canada: Field Guide*. Natural Resources Canada/ Ontario Ministry of Natural Resources. 127 p.
- Turgeon, J.J. and P. de Groot. 1993. *Guide de Terrain- Vergers à Graines de Confères: Identification des Ravageurs et Protection des Récoltes*. OMNR/NRCan, CFS/NODA, 115p.
- Turgeon, J.J. and P. de Groot. 1992. *Field Guide to the Management of Insect Pests of Cones in Seed Orchards*. 95 p.

Book Chapters

- Sweeney, J., de Groot, P., Turgeon, J.J., and Smith, R.F. 2003. Management of pests and other factors. Chapter 6 *In* Smith, R.F., and Adams, C. 2003. *A manual for managing conifer seed orchards in eastern Canada*. Joint publ. Forest Genetics Ontario, Forest Ecosystem Science Coop, Living Legacy Trust, Ontario Ministry of Natural Resources, and Natural Resources Canada, 125p + appendices.
- Abou-Zaid, M.H., G.G. Grant, B.V. Helson, C.W. Benniger and P. de Groot. 2000. Phenolics from deciduous leaves and coniferous needles as sources of novel control agents for Lepidopteran forest pests. Chapter 36, pp. 398-416 *In*. *Phytochemicals and Phytopharmaceuticals*. F. Shahidi and Chi-Tang Ho. AOCS Press, Champaign, Illinois. 431 p.
- Helson, B., B. Lyons and P. de Groot. 1999. Evaluation of neem EC formulations containing azadirachtin for forest insect pest management in Canada. pp. 79-89 *In*. RP Singh, RC Saxena (Eds.), *Azadirachta indica* A. Juss. Oxford & IBH Publishing Co. PVT. Ltd. New Delhi. 322pp.
- de Groot, P. and J.J. Turgeon. 1998. Insect-pine interactions. pp. 354-380. *In*. *Ecology and Biogeography of Pinus*. D. M. Richardson (ed.). Cambridge University Press . 527 p.
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- de Groot, P. Mortality factors of jack pine, *Pinus banksiana* Lamb., strobili. Presentation to the 2nd conference of the Cone and Seed Insect Working Party (IUFRO S2.07-01), Briancon, France, September 1986.
- de Groot, P. Lecontivirus: an example of successful technology transfer in forest pest management. Annual meeting of the Canadian Institute of Forestry, Winnipeg, MB, October 1985.
- Helson, B.V., J.J. Turgeon, and P. de Groot. Selection of insecticides for control of a new pest, the spruce budmoth. Annual meeting of the Entomological Society of Canada, Ottawa, ON, September 1985.
- Helson, B.V., P.D. Kingsbury and P. de Groot. The use of two bioassay methods with *Aedes aegypti* larvae to assess the aquatic impact of insecticide drift. Annual meeting of the American Mosquito Control Association, Toronto, ON, March 1984.
- de Groot, P. and J.J. Turgeon. The Canadian Forestry Service's role in cone and seed insect research. Annual Northeastern Forest Insect Work Conference, Providence, Rhode Island, March 1984.
- Turgeon, J.J., P. de Groot, and B.V. Helson. Spruce budmoth, *Zeiraphera canadensis*: Biology and control. Annual Northeastern Forest Insect Work Conference, Providence, Rhode Island, March 1984.
- de Groot, P. Potential control methods for the spruce budmoth, *Zeiraphera canadensis*. Annual New Brunswick Forest Pest Review Meeting, Fredericton, New Brunswick, November 1983.

Kevin J. Dodds

USDA Forest Service, Forest Health Protection
271 Mast Road
Durham, NH 03824
603-868-7743
kdodds@fs.fed.us

Experience

Forest Entomologist

January 2005 to present, USDA Forest Service, Durham, NH

- Exotic and native insect surveys
- Extension responsibilities to federal, state, and tribal partners
- Develop management plans for damaging insects

Research Associate

January 2004-January 2005, University of Minnesota, Grand Rapids, MN

- Researched an introduction of Douglas-fir beetle into northern MN
- Developed large-scale monitoring program for bark beetles
- Developed ecological risk assessments for indigenous exotic insects

Graduate Research Assistant

January 2000 to December 2003, Oregon State University, Corvallis, OR

- Developed and validated Douglas-fir beetle hazard and risk ratings
- Improved knowledge on Douglas-fir beetle pheromone-baited traps
- Conducted basic biological studies on Douglas-fir beetle

Research Technician – Forest Entomology

May 1999 to September 1999, University of Arkansas, Fayetteville, AR

- Biological control of southern pine beetle
- Large scale surveys and monitoring of southern pine beetle infestations
- Evaluation of biological control efficacy

Education

Oregon State University, Department of Forest Science, Corvallis, OR

January 2000 to December 2003

- Ph.D., Forest Science, emphasis Forest Ecology

University of Arkansas, Department of Entomology, Fayetteville, AR

August 1997 to December 1999

- M.S. in Entomology

Frostburg State University, Frostburg, MD

August 1990 to December 1996

- B.S., Wildlife Biology

Interests

Bark beetle biology and management, invasive species management, Cerambycidae, Buprestidae, chemical ecology, trapping, survey methods

CURRICULUM VITAE

René H. Germain, Associate Professor, State University of New York
College of Environmental Science and Forestry, 1998 - present
Syracuse, NY 13210
Phone: (315) 470-6698 Email: rhgermai@mailbox.syr.edu

Education: **Ph. D. in Forest Resources Management**
STATE UNIVERSITY OF NEW YORK
COLLEGE OF ENVIRONMENTAL SCIENCE & FORESTRY
Syracuse, New York. May 1997.

Master of Science in Business Administration.
BOSTON UNIVERSITY
Boston, MA January 1988.

Bachelor of Science. Major: Forestry.
UNIVERSITY OF VERMONT.
Burlington, Vermont. December 1983.

Current Responsibilities:

- Teaching: undergraduate and graduate courses in Principles of Management, Forestry Consulting and Wood Procurement and Integrated Resources Management;
- Research: sustainable forestry systems, parcelization/fragmentation of private forestlands, wood supply issues and projects associated with the New York City Watershed Model Forest program, continuing education, environmental dispute resolution;
- Continuing education/outreach: develop and conduct workshops for natural resource professionals; coordinate New York City Watershed Model Forest Program
 - Developed and administered over 40 workshops since 1998

Past Work Experience:

Vice President, Resource Management.
Ward Lumber Company, Inc. Jay, New York.
March 1987 through August 1994.

Responsibilities:

- forest management of company's 4500 acres.
- initiated landowner assistance program as well as an easement and lease program.
- conducted company financial planning and budget analysis.
- supplied logs to sawmill with an annual production level of 8 million board feet.
- managed log yard and coordinated scaling and grading of incoming logs.

Professional Service:

Member – Board of Directors - New York Logger Training, Inc., 1994 – present
Chair – New York Logger Training Curriculum Committee, 1995 – present
Member – Watershed Forestry Program Committee, 1997 – present
Chair – Watershed Forestry Model Forest Program, 1997 – present
Member – New York State Green Certification Advisory Committee, 1999
Member – New York State Best Management Practices Committee, 1997-2000
Member – New York Sustainable Forestry Initiative Committee, 1996 – 1998
Executive Committee Member - New York Society of American Foresters, 1993 - 1997

Selected Refereed Publications:

Germain, R.H. and J. Munsell. 2005. How much land is needed for the harvest access system on NIPF dominated by northern hardwoods? *Northern Journal of Applied Forestry* (in press).

Lapierre, S. and **R.H. Germain** 2005. Forestland parcelization in the New York City Watershed. *Journal of Forestry*, 104(3).

Munsell, J.F., **R.H. Germain**, E. Bevilacqua, and R.M. Schuster. 2005. Voluntary BMP implementation by NIPF owners in New York City's water supply system. *Northern Journal of Applied Forestry*. (in press).

Munsell, J. and **R.H. Germain**. 2004. Forestry extension participation and written forest management plan use in New York City's Water Supply System. *Journal of Extension* 43 (2).

Germain, R.H. and S. Harris. 2003. Logger training leads to improved market access but no price premium. *Journal Of Extension* 41(5).

Harris, S., **R.H. Germain** and L. Zhang. 2003. Assessing Wood Procurement Management Systems in the Forest Products Industry. *Forest Products Journal* 53(2) 1-10.

Germain, R.H., S. Harris and V. Luzadis. 2002. Assessing Environmental Management Systems for Implementing Sustainable Forestry on Industrial Forestlands. *Journal of Forestry* 100(2) 12-18.

Capozzi, S., C. Dawson, and **R.H. Germain**. 2003. Satisfaction with recreational leasing of industrial forestlands in the State of New York. *Northern Journal Of Applied Forestry* 20(1) 27- 33.

Germain, R.H., S. Harris and V. Luzadis. 2002. Assessing Environmental Management Systems for Implementing Sustainable Forestry on Industrial Forestlands. *Journal of Forestry* 100(2) 12-18.

Malmsheimer, R. and **R.H. Germain**. 2002. Ability of continuing education needs assessments to predict client behavior. *Jo. Of Extension* 40 (4).

Germain, R.H., Floyd D. and S. Stehman. 2001. Participant perceptions of the Forest Service's public participation process. *Jo. Of Forest Policy and Economics* (3) 113-124.

Germain, R.H., J. Schwartz and J. Parrish. 2001. The New York City Watershed Model Forests: Working laboratories to study and demonstrate sustainable forestry. *Jo. Of Extension* 39(2).

Germain, R.H. and D.W. Floyd. 1999. Models for Examining Forest Resource Conflicts. *Forest Science*, 45(3) 394-406.

Awards:

2001 New York Society of American Foresters Outreach Forester of the Year

RESUME: FRED P. HAIN

ACADEMIC RANK

Professor of Entomology
Full Member Graduate Faculty

BIRTH DATE/PLACE

November 21, 1944
Milwaukee, Wisconsin

DISTRIBUTION OF EFFORT

76% Research 24% Academic Affairs

SPECIALIZATION AND AREAS OF INTEREST

Research: Biology and management of balsam woolly adelgid and other arthropod pests of Fraser fir and Fraser fir Christmas trees. Investigations of meteorological and predatory factors that regulate populations of the spruce spider mite. Dynamics of low-level populations of southern pine beetles. Evaluating host tree reaction to southern pine beetle attack. Population dynamics of gypsy moths at the leading edge of the generally infested area. Impact of *Entomophaga maimaiga* on non-targets. Biological control of the hemlock woolly adelgid. Integrated pest management of the Nantucket pine tip moth in Virginia pine Christmas tree plantations.

Teaching: ENT 402 (FOR) Forest Entomology (offered every spring), ENT (FOR) 565 Advanced Forest Entomology (offered every other spring), ENT 604/804 Insect Natural History and Field Ecology (offered every fall).

EDUCATION

B.S. - Stetson University, DeLand, FL. 1969. Biology
M.F. - Duke University, Durham, NC. 1969. Forestry
Ph.D. - Michigan State University, East Lansing, MI. 1972. Entomology

PROFESSIONAL EXPERIENCE

1972-74 Postdoctoral Fellow, Texas A&M University
1974-76 Research Associate, Department of Entomology, NCSU
1976-78 Assistant Professor, Department of Entomology, NCSU
1978-85 Associate Professor, Department of Entomology, NCSU
1985- Full Professor, Department of Entomology, NCSU
1989-94 Chairman, Ecology Program, NCSU
2005- Director of Graduate Programs, Dept. of Entomology, NCSU

GRADUATE STUDENT ADVISEMENT

Total Career Graduate Student Committees: 28; Chairman or Co-Chairman: 14 M.S., 2 M.A., 12 Ph.D.

POSTDOCTORAL ADVISEMENT

Total Career Postdoctorates: 5

PUBLICATIONS: Total Career Books/Chapters: 32; Refereed Articles: 82; Extension and Other: 21.
Pertinent Articles:

Wallace, M.S. and F.P. Hain. 2000. Field surveys and evaluation of native and established predators of the hemlock woolly adelgid (Homoptera: Adelgidae) in the southeastern United States. *Environ. Entomol.* 29: 638-644.

Wallace, M.S. and F.P. Hain. 2002. Summary of native and established predators of the hemlock woolly adelgid and the balsam woolly adelgid (Homoptera: Adelgidae) in the southeastern United States. Pp. 141-149. *In* Onken, B., R. Reardon and J. Lashomb. *Proceedings: Hemlock Woolly Adelgid in The Eastern United States Symposium*. Rutgers. 403 pp.

Jetton, R.M. and F.P. Hain. 2003. The hemlock woolly adelgid. *Conifer Quarterly* 20: 6-11.

Dr. DENNIS A. HAUGEN
USDA Forest Service
FOREST ENTOMOLOGIST

Dennis has been working on sirex woodwasp for 18 years. In Australia, he implemented a biological control program for a sirex outbreak during 1987-1991. Also, he was the lead author on the National Sirex Management Strategy for Australia. After returning to the US, he was a consultant to the US Forest Service on the Pest Risk Assessment for pine from New Zealand. He has been working in Brazil with the National Forest Research agency (Embrapa) on a sirex biological control program since 1997.

Dennis has been with the USDA Forest Service, St. Paul Field Office, Forest Health Protection unit since February 1993. He works with the states of Indiana, Iowa and Missouri on issues concerning forest insects. He has assisted with the Asian longhorned beetle project in Chicago since it was detected in July 1998. He has been on the Pest Risk Assessment team for projects on eucalypts from South America and from Australia, and for solid wood packing material.

Post-doc – University of California-Davis – 1992-1993

Post-doc – Waite Agricultural Research Institute, University of Adelaide – 1987-1991

Post-doc – Clemson University – 1985-1987

Ph.D. -- Iowa State University (Entomology and Forest Biology) -- 1985

M.S. -- University of Arkansas-Fayetteville (Entomology) -- 1982

B.S. -- Iowa State University (Forestry and Entomology) -- 1979

Selected publications on sirex woodwasp:

Haugen, D.A. 1990. Control procedures for *Sirex noctilio* in the Green Triangle: review from detection to severe outbreak (1977-1987). *Australian Forestry* 53:24-32.

Haugen, D.A.; Underdown, M.G. 1990. *Sirex noctilio* control program in response to the 1987 Green Triangle outbreak. *Australian Forestry* 53: 33-40.

Haugen, D.A.; Underdown, M.G. 1990. Release of parasitoids for *Sirex noctilio* control by transporting infested logs. *Australian Forestry* 53: 266-270.

Haugen, D.A.; Bedding, R.A.; Underdown, M.G.; Neumann, F.G. 1990. National strategy for control of *Sirex noctilio* in Australia. *Australian Forest Grower* 13(2): special liftout section No. 13. 8pp.

Haugen, D.A.; Underdown, M.G. 1991. Woodchip sampling for the nematode *Deladenus siricidicola* and the relationship with the percentage of *Sirex noctilio* infected. *Australian Forestry* 54: 3-8.

Haugen, D.A. 1991. *Sirex noctilio*. pp. 2-18 to 2-23. In Pest Risk Assessment of the Importation of *Pinus radiata* and Douglas-fir Logs from New Zealand. USDA Forest Service Miscellaneous Publication No. 1508.

Haugen, D.A.; Underdown, M.G. 1993. Reduced parasitism of *Sirex noctilio* in radiata pines inoculated with the nematode *Beddingia siricidicola* during 1974-1989. *Australian Forestry* 56:45-48.

Haugen, D.A. 1999. *Sirex noctilio*. Record in the Exotic Forest Pest Information System, published by North American Forest Commission. www.spfnic.fs.fed.us/exfor/.

Haugen, D.A. 2000. Sirex woodwasp. pp.172-174. In Pest Risk Assessment for Importation of Solid Wood Packing Materials into the United States. Draft August 2000, unpublished report.

www.aphis.usda.gov/ppq/praswpm/

Haugen, D.A.; Hoebeke, E.R. 2005. Pest Alert: Sirex woodwasp – *Sirex noctilio* F. (Hymenoptera: Siricidae). USDA Forest Service NA-PR-07-05.

Hoebeke, E.R.; Haugen, D.A.; Haack, R.A. 2005. *Sirex noctilio*: Discovery of a Palearctic siricid woodwasp in New York. Newsletter of the Michigan Entomological Society 50(1&2):24-25.

Carnegie, A.J.; Matsuki, M.; Haugen, D.A.; Hurley, B.P.; Ahumada, R.; Klasmer, P.; Sun, J.; Iede, E.T. 2005. Predicting the potential distribution of *Sirex noctilio* (Hymenoptera: Siricidae), a significant exotic pest of *Pinus* plantations. Annals of Forest Science 63:1-9.

Curriculum vitae-Edson Tadeu Iede

PERSONAL INFORMATION

Surname: Iede
Name: Edson Tadeu
Nationality: Brazilian.
Date of Birth: December 18th, 1954.
Address: Rua Pamphilo d'Assumpção, 1446
CEP 80.220-041, Curitiba, Paraná, Brazil.
Phone: 55(41)-332-7355
e-mail: iedeet@cnpf.embrapa.br

PROFESSIONAL ADDRESS

Empresa Brasileira de Pesquisa Agropecuária-EMBRAPA
Centro Nacional de Pesquisa de Florestas
Address: Estrada da Ribeira Km 111
83.411-000, Colombo, Paraná, , Brazil
Phone/fax: 55(41)- 666-1313

GRADUATION AND POS-GRADUATION

Biologist. Faculty of Biology, Federal University of Paraná. Curitiba, Brazil 1977.
Master in Entomology, Federal University of Paraná. Curitiba, Brazil 1980.
Specialization Course, "International Training Program In Biological Control", 160 hours- International Center for Integrated and Biological Control- University of California at Berkeley – USA-March to April, 1982
Doctor in Entomology, Federal University of Paraná. Curitiba, Brazil 2003.

LANGUAGES AND COMPRENSION

Portuguese – Very good speaking, writing and reading.
English – Regular speaking and reading, regular writing.
Spanish – Good speaking and reading, regular writing.

PROFESSIONAL EXPERIENCE

- Technical Coordinator of the Woodwasp Integrated Pest Management Program from the National Fund for Woodwasp Control-1989-2006
- Brazilian Government Representative for the Working Group of Forest Health from the Southern Cone Committee of Plant Health - COSAVE-1992-2006
- Editorial group member of the Forest Research Society– SIF- Árvore Magazine-1993-2006
- Counterpart of the Cooperative Project USDA-Forest Service/ EMBRAPA “Development of an integrated pest management program for the woodwasp *Sirex noctilio* (HYmenoptera: Siricidae) a serious pest of exotic pines in Brazil, 1997-2000”
- Counterpart of the Cooperative Project CSIRO_Austrália/ Embrapa/ National Council of Technology and Cientific Development (CNPq) –Biological Control of Weeds-1979/1981
- Administrative Chief of the National Center of Forest Research – EMBRAPA-1985/1987
- Coordinator of the Ecology and Forest Protection Technical Area of the National Center of Forest Research EMBRAPA 1990/1991
- Technical Chief of the National Center of Forest Research – EMBRAPA-1990/1992
- Member of the Technical Cientific Committee of the National Center of Forest Research- 1985 and 2003-2006.
- Member of the Technical Panel on Forest Quarantine- FAO-2005/2006.
- Member of the Expert Workingo Group on Debarking and Bark Freedom- FAO-2005.

PARTICIPATION IN CONGRESSES AND MEETINGS FROM 2000 TO 2003

- 03/2000- Lecture presentation in the 1o Symposium of the Southern Cone about Integrated Pest Management in pine plantation. Curitiba-PR
- 06/2000- Lecture presentation in the XIV Silvotecna -Plagas Cuarentenarias. Riesgos para el sector forestal y efectos em el comercio internacional. Concepción, Chile
- 07/2000- Lecture presentation in the Workshop Plant Health Quarantine-Brasília-DF
- 07/2000- Lecture presentation in the Technical Meeting about Pine Plantation Silviculture. Ipumirim.
- 08/2000- Lecture presentation and coordinator of the I Seminar about Introduction Risks of Quarantine Forest Pests. Curitiba .
- 08/2000- Lecture (2) and coordinator of Symposium in the section 10- XXI International Congress of Entomology. Foz do Iguaçu.
- 08/2000- Lecture presentation in the IX National Meeting of Phitosanitary Experts. Foz do Iguaçu
- 11/2000- Lecture presentation in the Forest Protection Seminary. Curitiba
- 11/2000- Panel member of the 31. National Fund of Woodwasp Control (FUNCEMA) Technical Meeting. Florianópolis.
- 10/2000- Lecture presentation in the Woodwasp Control Technical Meeting. Mafra.
- 02/2001- Lecture presentation in the Remote Sensing Woodwasp Monitoring Technical Meeting. Embrapa Florestas/Associação Gaúcha de Empresas Florestais/USDA Forest Service
Porto Alegre/Lages/ Colombo
- 04/2001- Paper presentation in the Workshop The Risks of Exotic Forest Pests and Their Impact on Trade. Online at <http://exoticpests.apsnet.org> American Phytopathological Society (APS)
- 05/2001- Lecture presentation in the 1o Latin América Symposium about Forest Pests. Poços de Caldas
- 06/2001- Lecture presentation and pôster presentation in the VII Biological Control Symposium. Poços de Caldas.
- 07/2001- Lecture presentation in the I. Pine Plantations New Pests Technical Meeting. Itapeva.
- 07/2001- Lecture presentation in the I Forest Pests Seminary. Curitiba
- 9/2001- Panel member of the XV Technical meeting of Working Group in Forest Health of the COSAVE. Canela.
- 09/2001- Lecture presentation in the Regional meeting about the Woodwasp. Ponta Grossa.
- 10/2001- Lecture presentation in the XV Agropecuary and Forest Studies Week of Botucatu. Botucatu.
- 11/2001- Lecture presentation in the IV Finep Award - Technologies News - National Step. Rio de Janeiro
- 03/2002- Lecture presentation in the Reforestation Technical Meeting in Palmas Region- Palmas.
- 04/2002- Lecture presentation in the Woodwasp Technical Meeting/Klabin, Telêmaco Borba.
- 04/2002- Lecture presentation in the 12^a. State Committee of Agropecuary Sanity(CONESA) Technical Meeting
- 05/2002- Lecture presentation in the First Forest Technical Meeting of Rivera-Uruguay
- 05/2002- Panel member of the XVI Meeting of the Working Group of Forest Plant Health of the COSAVE. Montevideo, Uruguai
- 06/2002- Poster presentation in the Brazilian National Congress of Entomology. Manaus.
- 07/2002- Panel member of the 36^a National Fund of Woodwasp Control (FUNCEMA) Technical Meeting. Florianópolis.
- 08/2002- Lecture presentation in the I Lecture Cicle- "Association of Insects to Forest Species: Interaction and Biodiversity"-Universidade Federal do Rio de Janeiro-Seropédica-RJ
- 10/2002- Lecture presentation in the Seminary about Integration - Forest Management X Industry in the Pinus spp plantations. Rio Negrinho.
- 11/2002- Lecture presentation and coordinator of the Workshop About Development and Research Program to aphids monitoring and Control. Contestado University-Canoinhas.
- 07/2003- Lecture presentation in the Brazilian Nematology Congress. Petrolina.

07/2003- Panel member of the 38^a National Fund of Woodwasp Control (FUNCEMA) Technical Meeting. Florianópolis.

10/2003- Lecture presentation in the CAMCORE Technical Meeting. Curitiba.

10/2003- Lecture presentation in the Council of the Forest Development of the Cone Sul.1 -CEDEFOR. Curitiba

10/2003- Lecture presentation and coordinator of the Symposium about Armilariose in Pine Plantation. Curitiba.

10/2003- Lecture presentation and coordinator of the Symposium about Cinara spp. in Pine Plantation. Curitiba.

Special Courses Participation

06/1998- Professor, Control Quarentenary Control of Solid Wood Packing Material Course- COSAVE Embrapa Florestas / Servicio Agrícola y Ganadero Chile. Colombo

08/2000- Professor, Plant Health Certificate- State System Course. Pato Branco.

08/2000- Professor, Plant Health Certificate- State System Course. Curitiba.

08/2000- Professor, Plant Health Certificate- State System Course. Londrina.

08/2000- Professor, Plant Health Certificate- State System Course. Maringá.

10/2000- Professor, Plant Health Certificate- State System Course /Disciplina de Proteção Florestal-UFPR- Curitiba.

10/2000- Professor, the Plant Health Certificate- State System Course. Ponta Grossa.

10/2000- Professor, Plant Health Certificate- State System Course. UFPR-Curitiba.

11/2000-Fellow, Pest Risk Assessment Course. Brasília.

11/2000- Professor, Disciplina of Forest Ecophysiology(AS 705)-Forestry School-UFPR.

12/2000- Professor, Plant Health Certificate- State System Course. Cascavel.

03/2001- Professor, Plant Health Certificate- State System Course. UFPR-Curitiba.

05/2001- Professor, Plant Health Certificate- State System Course. Maringá..

07/2001- Professor, Field Day about Sirex Monitoring and Control . Telêmaco Borba.

11/2001- Professor, Quarentenary Pests of Wood Course. Curitiba.

04/2002- Professor, course of Plant Health Capacitation for the Technical Staff of the Rio de Janeiro State Agriculture Secretary . Araruamã.

07/2002- Professor, Origen Phytosanitary Certificate Course. Canoinhas.

07/2002- Professor, Origen Phytosanitary Certificate Course. Ponta Grossa.

07/2002- Professor, Origen Phytosanitary Certificate Course. Escola de Florestas-UFPR -Curitiba.

09/2002- Professor, Origen Phytosanitary Certificate Course – Agronomy School-UFPR-Curitiba.

10/2002- Professor, Sirex-Monitoring and Control Course. Arapoti.

11/2002- Professor, Training in Seed Technology and Forestry Nursery. Colombo.

08/2003- Professor, Forestry Pests Course for Agronomy students of Catholic University. Curitiba.

08/2003- Professor, Woodwasp Monitoring and Control Course- UNICENTRO- Irati

09/2003- Professor, Applied Technology and Pest Management Course- XIX Agronomy Studies- UNESP- Ilha Solteira.

AWARD

2001 - IV FINEP AWARD - TECHNOLOGIES NEWS - CASE "Sirex noctilio Integrated Pesp Management Program in Brazil". Regional Step- First Place in the Process Category.

2004 – PRÊMIO MÉRITO FLORESTAL DO ESTADO DO RIO GRANDE DO SUL- FOREST AWARD
MERIT FROM RIO GRANDE DO SUL STATE.

CURITIBA, 23/02//2006.

Edson Tadeu Iede

CURRICULUM VITAE
DAVID R. LANCE

Entomologist (1999 - present)
USDA-APHIS-PPQ-CPHST
Otis Plant Protection Center
Bldg. 1398
Otis ANG Base, MA 02542

Voice: 508-563-9303
Facsimile: 508-564-4398
Email: david.r.lance@aphis.usda.gov

EXPERIENCE:

- 1996-1999 Director, USDA-APHIS-PPQ, Hawaii Plant Protection Center, P.O. Box 1040, Waimanalo, HI 96795
- 1991-1996 Entomologist, USDA-APHIS-PPQ, Hawaii Methods Development Station, 41-650 Ahiki Street, Waimanalo, HI 96795 (sterile insect technique and detection trapping for tephritid fruit flies, esp. Mediterranean fruit fly).
- 1985-1991 Research Entomologist, USDA-ARS, Northern Grain Insects Research Laboratory, R.R. #3, Brookings, SD 57006 (development of semiochemical-based tools for management of corn rootworm beetles).
- 1981-1985 Research Assistant, Dept. of Entomology, Univ. of Mass., Amherst, MA 01003 (Stationed at the USDA-APHIS Otis Methods Development Center).
- 1979-1981 Research Associate, Dept. of Entomology, Univ. of Mass., Amherst, MA 01003 (Stationed at the USDA-APHIS Otis Methods Development Center).
- 1976-1979 Research Assistant, Dept. of Entomology, Univ. of Mass., Amherst, MA 01003.

ACADEMIC TRAINING:

- 1970-1974 Univ. of Connecticut, Storrs; B.A. in Biology, May 1974.
- 1976-1979 Univ. of Massachusetts, Amherst; M.S. in Entomology, September 1979.
Thesis title: The relationship between the host tree and larval dispersal in the gypsy moth, *Lymantria dispar* (L.).
- 1981-1985 Univ. of Massachusetts, Amherst; Ph.D. in Entomology, May 1985.
Dissertation title: Density-related factors affecting population quality in the gypsy moth, *Lymantria dispar* (L.) (Lepidoptera: Lymantriidae).

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

American Society for Testing and Materials
Entomological Society of America
Hawaiian Entomological Society

PROFESSIONAL INTERESTS AND ACTIVITIES:

Insect behavior and ecology, especially as it pertains to applied use of semiochemicals in pest management and to the production, delivery, and quality control testing of insects for use in Sterile Insect Technique (SIT) programs. Development of biorational tactics for detecting, monitoring, and suppressing populations of pest insects. Current program responsibilities include projects in detection and/or semiochemical-based management of a variety of exotic invasive insect pests, Asian longhorned beetle control, detection, and rearing, and emerald ash borer detection.

Additional activities and responsibilities (current): Chair of an ASTM task group (E10.01-cc) that developed and is responsible for the maintenance of a standard (ISO/ASTM Standard 51940:2004) entitled "Standard guide for irradiation of insects for sterile release programs". Member of science advisory panels for programs to manage or eradicate following exotic insect pests: Citrus longhorned beetle (Tukwila, WA [Chair]), emerald ash borer (Michigan & surrounding states), Asian longhorned beetle (2: Toronto, ON and Sacramento, CA).

PUBLICATIONS AND PRESENTATIONS:

Numerous manuscripts in refereed scientific journals, including 27 as senior author; four chapters in books and co-editor of a multi-paper ARS technical publication. Numerous presentations at professional meetings, workshops, symposia, and seminars; organizer and/or co-organizer of several symposia, workshops, etc.

Selected publications:

- Lance, D.R., J.S. Elkinton & C.P. Schwalbe. 1986. Feeding rhythms of gypsy moth larvae: effect of food quality during outbreaks. *Ecology* 67: 1650-1654.
- Lance, D.R., J.S. Elkinton & C.P. Schwalbe. 1987. Microhabitat and temperature effects explain accelerated development during outbreaks of the gypsy moth (Lepidoptera: Lymantriidae). *Environ. Entomol.* 16: 202-205.
- Lance, D.R., T.M. ODell, V.C. Mastro & C.P. Schwalbe. 1988. Temperature-mediated programming of activity rhythms in male gypsy moths (Lepidoptera: Lymantriidae): implications for the sterile male technique. *Environ. Entomol.* 17: 649-653.
- Lance, D.R. & G.R. Sutter. 1990. Field-cage and laboratory evaluations of semiochemical-based baits for managing western corn rootworm beetles (Coleoptera: Chrysomelidae). *J. Econ. Entomol.* 83: 1085-1090..
- Sutter, G.R. & D.R. Lance. 1991. New strategies for reducing insecticide use in the corn belt. Pp. 231-249 in: *Sustainable agriculture: research and education in the field*. National Academy of Sciences Press, Washington.
- Lance, D.R. & G.R. Sutter. 1992. Field tests of a semiochemical-based toxic bait for suppression of corn rootworm beetles (Coleoptera: Chrysomelidae). *J. Econ. Entomol.* 85: 967-973.
- Lance, D.R. 1993. Effects of a non-pheromonal attractant on movement and distribution of adult *Diabrotica virgifera virgifera* (Coleoptera: Chrysomelidae). *Environ. Entomol.* 22: 654-662.
- Lance, D.R. & D.B. Gates. 1994. Sensitivity of detection trapping systems for Mediterranean fruit flies (Diptera: Tephritidae) in southern California. *J. Econ. Entomol.* 87: 1377-1383.
- McInnis, D.O., D.R. Lance & C.G. Jackson. 1996. Behavioral resistance to the sterile insect technique by Mediterranean fruit fly (Diptera: Tephritidae) in Hawaii. *Ann. Entomol. Soc. Am.* 89: 739-744.
- Lance, D.R., D.O. McInnis, P. Rendon & C.G. Jackson. 2000. Courtship among sterile and wild *Ceratitidis capitata* (Diptera: Tephritidae) in field cages in Hawaii and Guatemala. *Ann. Entomol. Soc. Am.* 93: 1179-1185 (2000).
- Lance, D.R. & D.O. McInnis. 2005. Biological basis of the Sterile Insect Technique. Pp. 69-94 in: V.A. Dyck, J. Hendrichs & A.S. Robinson (eds.), *The Sterile Insect Technique. Principles and Practice in Areawide Integrated Pest Management*, Springer, Dordrecht, The Netherlands.

Curriculum Vitae

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EDUCATION

M.S., Entomology, 1973. Texas A&M University, College Station, Texas
B.S., Forestry, 1970. Stephen F. University, Nacogdoches, Texas
Associate in Forestry, 1968. The Pennsylvania State University, Mont Alto Campus, Mont Alto, PA.

EXPERIENCE

2002 – 2006 Laboratory Director, Otis Pest Survey Detection and Exclusion Laboratory

Mission Arcar Director. Responsible for technical support for APHIS pest exclusion, pest surevy and detection, point-of-origin, risk mitigation and pathway identification and analysis.

February 1998-2002: The mission areas for the laboratory include the following. Under this structure, I supervised three laboratories including Oxford, North Carolina; Beltsville, Maryland and the Otis Plant Protection Center, Otis ANGB, Massachusetts.

July 1992-February 1998: Center Director, Otis Plant Protection Center (formerly Otis Methods Development Center).

June 1990- July 1992: Supervisory Entomologist for the Otis Methods Development Center.

March 1977, April 1979, and October 1983: Entomologist at Otis Methods Development Center.

April 1974-March 1977: Research Assistant, Department of Entomology, The Pennsylvania State University, State College, PA.

January 1970-April 1973: Graduate Research Assistant, Department of Entomology, Texas A&M University, College Station , TX.

PROFESSIONAL MEMBERSHIP AND ACTIVITIES

Entomological Society of America: 1972 – present

Editorial Board Entomological Techniques

National Gypsy Moth Management Board

Board of Directors: 1992 – 2002

Annual Program Committee: 1995 – 2002.

Chair of the Program Committee 1998

Program Committee Annual Gypsy Moth Interagency Research Forum 1992-present

Sigma Xi

Phi Kappa Phi

IAEA International Working Group on SIT: 1998 – 2001

HONORS AND AWARDS

Certificate of Merit for the Development of the Gypsy Moth Sterile Male Technique, 1985. Controlled Release Society, Outstanding Paper Award in the Agrochemical Field, 1993.

USDA Group Award for Excellence, For Outstanding Performance in the Development and Implementation of an Exotic Pest Survey Program in the Northeast Region PPQ, APHIS, 1994.

Forest Service Chief's International Forestry Award for Development of the Russian Far Eastern Port Monitoring Program, 1995.

Entomological Society of America Distinguished Achievement Award for Regulatory Entomology, 1996.

USDA Group Award for Excellence, Asian Long-horned Beetle Program, 1998.

PROFESSIONAL TRAINING

Risk Analysis, a USDA, APHIS Course.

Epidemiology, a USDA, AHPIS, Veterinary Service Course

Biological Control, a USDA Course

Certified Pesticide Applicator

SELECTION OF INVITED LECTURES

Numerous Invited Lectures

PUBLICATIONS

Authored or coauthored publications.

CV

Name and Address:

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Education Background:

1. B.S. – Wildlife/Fisheries Management – Utah State Univ. – 1966
2. M.S. – Forestry/Entomology – Univ. of Michigan – 1968
3. Ph.D – Forestry/Entomology – Univ. of Michigan – 1975

Professional Experience:

1969-1970 – Teaching Fellow and Teaching Assistant, School of Natural Resources,
University of Michigan

1970-1972 – Entomologist, USDA APHIS, Otis ANG, MA and Niles, MI

1972-1975 – Research Entomologist, USDA Northeastern Forest Experiment Station,
Hamden, CT

1975-1978 – Entomologist, USDA-Gypsy Moth Program, Northeastern Area, State and
Private Forestry, Forest Service, Hamden, CT

1978-1983 – Research Entomologist, USDA Pacific Southwest Forest and Range
Experiment Station, Davis, CA

1983-1988 – Entomologist and Project Coordinator for Maryland Gypsy Moth IPM Pilot
Project, Northeastern Area, State and Private Forestry, USDA Forest Service,
Morgantown, WV

1988-1993 – Entomologist and Project Leader for Appalachian Gypsy Moth IPM Project,
Northeastern Area, State and Private Forestry, USDA Forest Service,
Morgantown, WV

1993-1995 – Program Manager for National Center of Forest Health Management,
Northeastern Area, State and Private Forestry, USDA Forest Service,
Morgantown, WV

1995-Present – Program Manger (Biopesticide and Biological Control Programs) for
Forest Health Technology Enterprise Team, State and Private Forestry, USDA
Forest Service, Morgantown, WV

Publications:

Over 80 authored publications

Don Rogers
NC Division of Forest Resources

Born Johnson City, Tn 1946 (casualty of the war)
Grew up in Asheville, NC (Grad. HS 1964)
Attended Western Carolina College ('64-'67)
BS Forestry Univ. of GA 1969
Fla. Div of Forestry-FIA and Co. Forester '69-'73
NC DFR-Field Forester-Lenoir '74-'76
NC DFR-Service Forester-Elizabeth City-'77
NC DFR-Pest Control Forester - Morganton-'78-'97
NC DFR-Forest Health Monitoring Coord.- Clayton '98
NC DFR-Program Head, Pest Control -Raleigh - '99 to present

CURRICULUM VITAE

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SOCIAL SECURITY NUMBER: U.S.CITIZEN

EDUCATION:

- University of Illinois: 1983-1988: Ph.D. Entomology. Dissertation title: Dietary self-selection by the corn earworm, *Heliothis zea*: testing the malaise hypothesis. Advisors G. P. Waldbauer and S. Friedman.
- University of Arizona: 1981-1983: M.S. Entomology. Thesis title: Seasonal fecundity dynamics of the pink bollworm, *Pectinophora gossypiella* (Saunders). Advisor R.T. Huber.
- University of California at Berkeley Extension: 1980-1981, Entomology, non-degree program.
- University of California at Los Angeles: 1975-1979: B.A., Biology

PROFESSIONAL EXPERIENCE:

- 2004-present. Adjunct Faculty, Dept. of Biology, University of Mississippi, Oxford, MS.
- 1997-present. Research Entomologist. GS 13 Step 06. USDA Forest Service, Southern Hardwoods Laboratory. Biology of woodwasps and their symbiotic fungi. Ecology and conservation of pondberry, *Lindera melissifolia*. Insects associated with forest fires. Project Leader Ted Leinger.
- 1996 Postdoctoral Fellow, Western Regional Research Center. With B. Campbell. Population genetics/genetic characterization of lepidopteran vectors of *Aspergillus flavus* in nut crops.
- 1995: Instructor, Biotechnology Workshop in: Recombinant DNA Methodologies and Applications. 17-28 July 1995. University of Maryland, Baltimore County, Dept. Biological Sciences, Continuing Education Program. (Lecture and laboratory, 8 hours per day)
- 1991-1995: Kinney Postdoctoral Fellow, USDA ARS Bee Research Lab. With W. S. Sheppard. Molecular genetics of feral and commercial U. S. honey bees.
- 1989-1991: Rehabilitation and curation of the Vanderbilt arthropod teaching collection.
- 1988-1991: Postdoctoral Researcher, Department of Molecular Biology, Vanderbilt University. With D.R. Cavener. Evolution of transcriptional regulation of glucose dehydrogenase.
- 1987-1988: Teaching Assistant, University of Illinois. Introductory Biology for biology majors, and Honors Biology (population biology and ecology).

- 1984-1987: Research Assistant, University of Illinois. Dietary self-selection by the corn earworm, *Heliothis zea* (Boddie). With G. P. Waldbauer and S. Friedman.
- 1981-1983: Research Assistant, University of Arizona: Effect of black-margined aphid on pecan yields. Effectiveness of trap design and pheromone composition on capture of the pink bollworm in cotton. Monitored population growth of the pink bollworm and cotton development using a heat unit simulation model. With R. T. Huber.

GRANTS:

- 1993-1995 NRICGP CSRS USDA awarded to Sheppard and Schiff co-PI's. Project title "Genetic diversity of feral and commercial honey bee populations in the U.S."
- 1999-2000 Arkansas Natural Heritage Commission Grant (33-C-99-650) to Devall and Schiff co-PI's, Project title "Ecology of pondberry."
- 1999-2000 USDA Forest Service Challenge Cost Share Award to Devall and Schiff co-PI's, Project title "Ecology of pondberry."
- 2000-2002. Boise Cascade Research Travel Grant awarded to Leininger, Schiff and Wilson. Project title "Bacterial leaf scorch, *Xylella fastidiosa*, of Sycamore."
- 2001-2002 National Wildlife Federation "Keep the wild alive species recovery fund" Project title "Pondberry Conservation". To the Leland and Greenville Garden Clubs and the U.S. Forest Service. M. Devall and N. Schiff co-PI's.
- 2001-7 Army Corps of Engineers Grant to Devall, Schiff, Gardiner, Leininger, Hamel, Connor and Wilson. Pondberry ecology: flooding, light availability, competition, population genetics and disease. .
- 2002-2003 USFWS Grant to Devall and Schiff. Pondberry assessment at the Hester site, Bolivar Co., MS.
- 2005 Australian Biological Resources Study Participatory Grant to John Jennings and Nathan Schiff. Taxonomy of Australian woodwasps (Hymenoptera: Siricoidea: Xiphydriidae).
- 2005-6 Forest Health Protection Grant to Schiff and Wilson. Develop DNA methods for identification of immature stages of *Sirex noctilio*.
- 2005-6 Forest Health Protection Grant to Schiff and Wilson. Determine potential impacts of releasing the nematode, *Deladenus siricidicola*, on the North American flora and fauna.
- 2005-6 Forest Health Protection Grant to Schiff, Wilson and Leininger. Determine the potential impacts of the exotic fungus, *Amylostereum areolatum*, on selected North American flora.

PUBLICATIONS:

- Smith, D.R. and N.M. Schiff. 2005. A new western nearctic species of *Calameuta* (Hymenoptera: Cephidae). Proc. Entomol. Soc. Wash. 107:864-868.
- Smith, C.G., P.B. Hamel, M.S. Devall and N.M. Schiff. 2004. Hermit thrush is the first observed dispersal agent for pondberry (*Lindera melissifolia*). Castanea 69:1-8
- Smith, D.R. & N.M. Schiff. 2002. A review of the siricid woodwasps and their ibaliid parasitoids (Hymenoptera: Siricidae, Ibalidae) in the eastern United States, with emphasis on the mid-Atlantic region. Proc. Entomol. Soc. Wash. 104:174-194.

- Devall, M., C. Meier, E. Gardiner, P. Hamel, T. Leininger, N. Schiff and J. Stanturf. 2001. The restoration of functions and values in bottomland hardwood forests of the lower Mississippi alluvial valley. *Wetland Journal* 13: 24-38.
- Smith, D.R. and N. M. Schiff. 2001. A new species of *Xiphydria* Latreille (Hymenoptera: Xiphydriidae) reared from River Birch, *Betula nigra* L., in North America. *Proc. Entomol. Soc. Wash.* 103(4): 962-967.
- Schiff, N.M., A. J. Fleming, and D. J. Quicke. 2001. Spermatodesmata of the sawflies (Hymenoptera : Symphyta): Evidence for multiple increases in sperm bundle size. *J. Hym. Res.* 10(2): 119-125.
- Devall, M., N. M. Schiff & D. Boyette. 2001. Ecology and reproductive biology of the endangered pondberry *Lindera melissifolia*; (Walt.) Blume. *Natural Areas Journal.* 21:250-258.
- Oswald, J. D. and N.M. Schiff. 2001. A new species of the genus *Dilar* (Neuroptera: Dilaridae) from Borneo. *J. Ent. Soc. Washington.* 103:74-80.
- Schiff, N. M. and T.R. Schiefer. 1999. New Blattodea records from Mississippi and Alabama. *Ent. News* 110:240-242.
- Smith, D. R and N.M. Schiff. 1998. The genera *Macroxyela* Kirby and *Megaxyela* Ashmead (Hymenoptera: Xyelidae) in North America. *Proc. Ent. Soc. Wash.* 100:636-657.
- Schiff, N. M. & W.S. Sheppard. 1996. Genetic differentiation in the queen breeding population of the western United States. *Apidologie.* 27:77-86.
- Schiff, N. M. & M. F. Feldlaufer. 1996. Neutral sterols of sawflies (Symphyta): their relationship to other Hymenoptera. *Lipids.* 31:441-443.
- Sheppard, W. S., T. E. Rinderer, M. D. Meixner, H. R. Yoo, J. A. Stelzer, N. M. Schiff, S. M. Kamel & R. Krell. 1996. *Hinf1* variation in mitochondrial DNA of Old World honey bee races. *Journal of Heredity.* 87:35-40.
- Schiff, N. M. & W. S. Sheppard. 1995. Genetic analysis of commercial honey bees (Hymenoptera: Apidae) from the southeastern United States. *J. Econ. Entomol.* 88:1216-1220.
- McCauley, D. E, N. M. Schiff, F. J. Breden & G. M. Chippendale. 1995. Genetic differentiation accompanying a range expansion by the southwestern corn borer, *Diatraea grandiosella* (Lepidoptera: Pyralidae). *Ann. Ent. Soc. Amer.* 88:357-361.
- Svoboda, J. A., N. M. Schiff, & M. F. Feldlaufer. 1995. Sterol composition of three species of sawflies (Hymenoptera:Symphyta) and their dietary plant material. *Experientia* 51:150-152.
- Schiff, N. M., W. S. Sheppard, G. M. Loper & H. Shimanuki. 1994. Genetic diversity of feral honey bee (Hymenoptera: Apidae) populations in the southern United States. *Ann. Ent. Soc. Amer.* 87: 842-848.
- Schiff, N. M. & W. S. Sheppard. 1993. Mitochondrial DNA evidence for the 19th century introduction of African honey bees into the United States. *Experientia.* 49: 530-532.
- Schiff, N. M., Y. Feng, J. A. Quine, P. A. Krasney & D. R. Cavener. 1992. Evolution of the expression of the GLD gene in the reproductive tract of *Drosophila*. *Mol. Biol. Evol.* 9: 1029-1049.
- Feng, Y., N. M. Schiff, and D. R. Cavener. 1992. Organ specific patterns of gene expression in the reproductive tract of *Drosophila* are regulated by the sex determination genes. *Dev. Biol.* 146:451-460.

- Schiff, N. M., G. P. Waldbauer and S. Friedman. 1990. Gustatory insensitivity of two insect species to L-aspartyl-L-phenylalanyl methyl ester (Aspartame). *Ent. Exp. & Appl.* 54: 189-190.
- McPherson, B. A. and N. M. Schiff. 1989. New distribution records for three dragonfly species (Odonata: Anisoptera) in Illinois. *J. Kansas Ent. Soc.* 61: 494-495.
- Schiff, N. M., G. P. Waldbauer and S. Friedman. 1989. Dietary self-selection by *Heliothis zea* larvae: roles of metabolic feedback and chemosensory stimuli. *Ent. Exp. & Appl.* 52:261-270.
- Schiff, N. M., G. P. Waldbauer and S. Friedman. 1989. Response of last instar *Heliothis zea* larvae to some carbohydrates: stimulation of biting, nutritional value. *Ent. Exp. & Appl.* 52:29-38.
- Schiff, N. M., G. P. Waldbauer, & S. Friedman. 1988. Dietary self-selection for vitamins and lipid by larvae of the corn earworm, *Heliothis zea*. *Ent. Exp. & Appl.* 46:240-256.
- Cohen, R. W., G. P. Waldbauer, S. Friedman, & N. M. Schiff. 1987. Nutrient self-selection by *Heliothis zea* larvae: a time lapse film study. *Ent. Exp. & Appl.* 44:65-73.

BOOK CHAPTERS, OBITUARIES, NON REFEREED PUBLICATIONS, CD's:

- Wilson, A. D., T.D. Leininger, W. J. Orosina, L.D. Dwinell, and N. M. Schiff. 2004. The impact and control of major southern forest diseases. pp. 161-178. In: Rauscher, H. M.; Johnsen, K., eds. *Southern forest science: past, present, and future*. U.S. Department of Agriculture, Forest Service, Southern Research Station, Asheville, NC. Gen. Tech. Rep. SRS-75.
- Devall, M. S. and N. M. Schiff. 2004. *Lindera melissifolia* (Walt.) Blume. In: Wildland shrubs of the United States and its territories: Thamnisc descriptions. Vol. 1. J. K. Francis editor. USDA FS Gen. Tech. Rep. 11TF-GTR-26 830 pp.
- Schiff, N. M. and H. Abbas. 2004. *Pueraria montana* var. *lobata*. In: Crop protection compendium 2004 Edition. Wallingford, UK: CAB International.
- Leininger, T.D., N. M. Schiff and J. Henne-Kerr. 2004. Impacts of insect defoliation in cottonwood plantations in Mississippi. Proceedings of the 12th biennial southern silvicultural research conference. Gen. Tech. Rep. SRS-71. Asheville, NC. USDA For. Ser. SRS. 594 p. K.F. Connor ed.
- Schiff, N. M., M. S. Devall and K. F. Conner. 2004. Germination conditions for poison ivy, *Toxicodendron radicans* (L.) Kunst. Proceedings of the 12th biennial southern silvicultural research conference. Gen. Tech. Rep. SRS-71. Asheville, NC. USDA For. Ser. SRS. 594 p. K.F. Connor ed.
- Devall, M. S., N. M. Schiff and S. Skojac. 2004. Pondberry (*Lindera melissifolia*) recovery on protected sites in Mississippi. Proceedings of the 12th biennial southern silvicultural research conference. Gen. Tech. Rep. SRS-71. Asheville, NC. USDA For. Ser. SRS. 594 p. K.F. Connor ed.
- Devall, M and N. Schiff. 2002. Conservation education and pondberry, an endangered species. *Delta Wildlife* 10 (3):24-25.
- Devall, M.S. and N.M. Schiff. 2002. A guide to finding pondberry. USDA Forest Service. Science Update, SRS 003.
- Schiff, N.M. and M.S. Devall. 2001. Leland Middle School students get involved in conservation project. *The Leland Progress*. 13 December 2001.

- Loper, G. M., J. Fewell, D. R. Smith, W. S. Sheppard and N. Schiff. 1999. Genetic changes of a population of feral honey bees in the Sonoran desert of southern Arizona following the arrival of *Acarapis woodi*, *Varroa jacobsoni* and Africanization. pp. 47-51. In R. Hoopingarner and L. Connor (eds.), *Apiculture for the 21st century*. Wicwas, Cheshire, CT.
- Wilson, A.D., D.L. Lester and N.M. Schiff. 1999. North American hardwood borers. Photo CD of "Solomon, J. 1995. Guide to insect borers of North American broadleaf trees and shrubs." Agric handbk. 706. Washington DC: U.S. Dept of Agric., Forest Service 735pp.
- Schiff, N. M. 1998. An entomologist reads Borneo. In "The exploration of Gunung Buda." J. Lane and T. Burks (eds.) Published by Subterranean Explorers, Sarawak, Malaysia
- Oswald J.T. and N.M. Schiff. 1998. Obituary for E.G. MacLeod. *J. Neuropterology* 1:155-159.
- Leininger, T.D., J.D. Solomon, A.D. Wilson and N.M. Schiff. 1998. A guide to major insects, diseases, air pollution injury, and chemical injury of sycamore. USDA Forest Service, General Technical Report SRS-28. 44pp.

SUBMITTED:

- Devall, M., N. Schiff, T. Hawkins, K Connor, C. Echt, E. Gardiner, P. Hamel, T. Leininger and D. Wilson. Studies on the endangered pondberry (*Lindera melissifolia* [Walt.] Blume). Submitted to IUFRO Proceedings Montpellier, France. November 2004.
- Lockhart, B.R., E.S. Gardiner, T.D. Leininger, K.F. Connor, P.B. Hamel, N.M. Schiff, A.D. Wilson and M.S. Devall. A flooding facility to study ecophysiology of floodplain species for restoration of bottomland hardwood ecosystems.
- Lockhart, B. R., E. S. Gardiner, T.P. Stautz, T.D. Leininger, P.B. Hamel, K.F. Connor, N.M. Schiff, A.D. Wilson and M.S. Devall. Non-destructive estimation of leaf area for pondberry (*Lindera melissifolia* (Walter) Blume).
- Pinto, M.A., W. S. Sheppard, J.S. Johnston, W.L. Rubink, R.N. Coulson, N.M. Schiff, I. Kandemir and J.C. Patton. Evidence that honey bee (Hymenoptera:Apidae) mitochondrial DNA haplotypes of sub-Saharan origin occurred in non-Africanized areas of the southern United States. Submitted to *Annals of the Entomological Society of America: Genetics*.
- Connor, K.F., G.M. Lindstrom, J. Donahoo, M.Devall, T. Hawkins E. Gardiner, T. Leininger, D.Wilson,, N. Schiff, P. Hamel and C. Echt. Maturation and Chemical composition of pondberry (*Lindera melissifolia*) seeds. Submitted to the Proceedings of the 13th BSSRC, Memphis, TN.

IN PREPARATION:

- Schiff, N., M. Devall, K. Connor, E. Gardiner, P. Hamel, T. Leininger, D. Wilson, T. Hawkins, C. Echt, B. Lockhart. Mass propagation of an endangered species, pondberry (*Lindera melissifolia* [Walt.] Blume).
- Schiff, N.M. Insects associated with forest fires in Northern California and Oregon.
- Schiff, N. M. and A. D. Wilson. Identification of the fungal symbiont of *Xiphydria maculata* Say.

- Wilson, A.D and N. M. Schiff. Competitive interactions of xiphydriid wood wasp fungal symbionts.
- Wilson, A.D. and N.M. Schiff. Wood decay potential of xiphydriid wood wasp fungal symbionts.
- Schiff, N.M. and L.P. S. Kuenen. Stepwise helical locomotion by a primitive hymenopteran larva.
- Schiff, N.M. and W.S. Sheppard. Haplodiploidy does not result in reduced heterozygosity for sawflies (Hymenoptera: Symphyta).
- Solomon, J.D. and N.M. Schiff. Coreid bug, *Euthochtha galeator* (Fab), feeding injury causes terminal mortality in young Nuttall oak plantations.
- Schiff, N.M., Webb, D., and M.D. Devall. Insects associated with the endangered shrub, Pondberry (*Lindera melissifolia* Walt [Blume]).

INVITED PRESENTATIONS:

2006. Controlling *Sirex noctilio* in North America: a New Paradigm. 17th USDA Interagency Research Forum on Gypsy Moth and Other Invasive Species. Annapolis, MD 10-13 January. Co-Author A.D. Wilson
- 2005 Searching China for biocontrol agents of Kudzu. East Texas Forest Entomology Seminar. Nacogdoches, Texas. (28-29 April 2005)
2005. Some thoughts on provisioning the ivory-billed woodpecker. Ivory-billed Woodpecker Research Forum. Brinkley, Arkansas. (26-28 Sept.) Co-Author P. Hamel.
- 2005 *Sirex noctilio* a new threat to *Pinus* in the United States. Annual Conference of the Mississippi Entomological Association. Starkville, MS. (3 November 2005).
- 2004 Insects associated with forest fires in Northern California and Oregon. Invited symposium "Special Adaptations of Insects to Fire." XXII International Congress of Entomology, Brisbane, Australia (15-21 August).
- 2004 Aspects of Sawfly Biology: Sterol utilization and an unusual form of locomotion. Milwaukee Public Museum, WI. (13 May 2004).
- 2003 Oviposition behavior of Xiphydriid wood wasps. Informal Conference, International Society of Hymenopterists, ESA National Meeting, Cincinnati, Ohio. Coauthors A.D. Wilson, L. Williams III and L. Macdonald.
- 2003 An Africanized bee detective story. Dept. Biology, Univ. Mississippi. (17 March).
- 2002 Sawfly Behavior: life out on a limb. Informal Conference, International Society of Hymenopterists, ESA National Meeting, Fort Lauderdale, Florida. Co-Author L.P.S. Kuenen.
- 2002 Aspects of Sawfly Biology: Sterol utilization and an unusual form of locomotion. University of Illinois, Urbana-Champaign. 11 February 2002.
- 2001 Insects associated with forest fires. Stephen F. Austin University. 26 April 2001.
- 2000 Insect and disease research of SRS with emphasis on symbiotic associations of American woodwasps. Shikoku Research Station, Kochi, Japan.
- 1998 Honey bee population systematics and sawfly studies. SEL, Beltsville, MD.
- 1998 Genetic characterization of U.S. honey bee populations. Bee Res. Lab. Beltsville, MD.
- 1996 Natural history of insects: a modern synthesis. USDA For. Ser., Stoneville, MS.
- 1996 Genetic characterization of U.S. honey bee populations. USDA ARS WRRC.
- 1996 Genetic characterization of U.S. honey bees. University of Massachusetts, Amherst.

- 1996 PCR Applications in Population Genetics. University of Massachusetts, Amherst.
- 1994 Dietary self-selection by the corn earworm. University of Maryland.
- 1992 Assessment of mitochondrial DNA variation in feral honey bees: potential for monitoring future movement of Africanized honey bees in the United States. USDA ARS Beltsville MD.
- 1991 Evolutionary aspects of transcriptional regulation. USDA ARS Beltsville, MD.
- 1990 Dietary self-selection by the corn earworm. Department of Biology, Vanderbilt University.
- 1990 Dietary Self-selection by the corn earworm. Penn. State Univ., State College, PA.

CONTRIBUTED POSTERS AND PRESENTATIONS:

2005. Identification of a New York siricid larva. ESA National Meeting, Fort Lauderdale, Florida. Schiff, N., A.D. Wilson, D.A. Haugen, E.R. Hoebeke, E. Angell and P.Wrege. (6-10 November).
2005. Linking stakeholder research needs and the federal data quality act: A case study of an endangered forest shrub in the Southern United States. XXII IUFRO World Congress. 8-13 August 2005, Brisbane, Australia. B. R. Lockhart, E. S. Gardiner, T. D. Leininger, K. F. Connor, M. S. Devall, P. B. Hamel, T. Hawkins, D. A. Wilson, N. M. Schiff, and G. L. Young.
- 2005 Ecology of the endangered pondberry *Lindera melissifolia* [Walt.] Blume. Devall, M. and N. Schiff. Pondberry Fact-Finding Symposium requested by the Mississippi Department of Environmental Quality, Stoneville, MS (5 April).
- 2005 Conservation of an endangered shrub in the southeastern United States. Devall, M., N. Schiff and S. Skojac. International Congress of Botany, Vienna, Austria. (July)
- 2005 Black twig borer, a potential vector of the Botryosphaeria stem canker and dieback fungus of pondberry in the Delta National Forest of Mississippi. Wilson, A. D., N. M. Schiff, T. D. Leininger, P. B. Hamel, E. S. Gardiner, K. Connor, M. Devall Coauthors. National APS Meeting, Austin, TX. 30 July-Aug 3 (Published Abstract)
- 2005 The role of stem canker and dieback in pondberry health and survival. Wilson, D. and N. Schiff. Pondberry Fact-Finding Symposium requested by the Mississippi Department of Environmental Quality, Stoneville, MS (5 April).
- 2005 Insects associated with pondberry. Schiff, N, M. Devall, D. Webb and D. Wilson. Pondberry Fact-Finding Symposium requested by the Mississippi Department of Environmental Quality, Stoneville, MS (5 April).
- 2005 A study of the early fruit characteristics of the endangered plant pondberry (*Lindera melissifolia*). K. Connor, T. Leininger, M. Devall, E. Gardiner, P. Hamel, D. Wilson, N. Schiff. 13th BSSRC Memphis, TN. 2-4 March 2005.
- 2005 Micropropagation of an endangered clonal shrub, pondberry (*Lindera melissifolia* Walt [Blume]). N. Schiff, M. Devall, D. McCown, K. Connor, E. Gardiner, P. Hamel, T. Leininger, D. Wilson. 13th BSSRC Memphis, TN. 2-4 March 2005.
- 2004 Handling Unfamiliar Seeds: How to Start from Ground Zero. Connor, K., N. Schiff. Fifth Longleaf Alliance Regional Conference, Longleaf Pine: *Making Dollar\$ and Sense* Hattiesburg, MS, 12-15 October 2004.
- 2004 *Homalodisca coagulata* can vector sycamore bacterial leaf scorch disease. ESA National Meeting, Salt Lake, Utah. Schiff, N.M., T.D. Leininger, and K. Corbin.

- 2004 Research on the endangered pondberry (*Lindera melissifolia* [Walt] Blume). Devall, M.S., Schiff, N., Hawkins, T.S., Hamel, P.B., Connor, K., Echt, C., Gardiner, E.S., Leininger, T.D., Wilson, A.D. The Society for Wetland Scientists Conference Seattle, WA . July 18-23, 2004 (Abstract Published)
- 2004 Bottomland hardwood forest composition and structure associated with occurrence of the federally endangered species, *Lindera melissifolia* (Lauraceae) in Mississippi. Hawkins, T. S., B. R. Lockhart, M. S. Devall, N. Schiff, T. Leininger, and P. Hamel Coauthors. Botanical Society of America Annual Meeting, Salt Lake City, Utah. 31 July-August 5. (Abstract Published)
- 2004 An ecological study of the endangered pondberry (*Lindera melissifolia* [Walt] Blume. Devall, M. S., Schiff, N. M., Hawkins, T., Connor, K., Echt, C., Gardiner, E., Hamel, P., Leininger, T., Wilson, D. Coauthors. Botanical Society of America Annual Meeting, Salt Lake City, Utah. 31 July-August 5. (Abstract Published)
- 2004 Reproductive biology of pondberry (*Lindera melissifolia* [Walt] Blume). Devall, M.S., Schiff, N. M., Skojac, S. A. Coauthors. Botanical Society of America Annual Meeting, Salt Lake City, Utah. 31 July-August 5. (Abstract Published)
- 2004 The glassy-winged sharpshooter transmits *Xylella fastidiosa* between sycamore trees. T. D. Leininger, N.M. Schiff and K.C. Corbin. American Phytopathological Society 96th annual meeting, Anaheim CA. 30 July-4 August. (Abstract Published).
- 2004 Incidence and severity of Botryosphaeria stem canker and dieback of pondberry (*Lindera melissifolia*) in Mississippi. APS National Meeting, Anaheim, CA. (31 July-3 August) A. D. Wilson, N. M. Schiff, M. S. Devall, K. F. Conner, P. B. Hamel, E. S. Gardiner, and T. D. Leininger (Coauthors) (Abstract Published).
- 2004 Studies on the endangered pondberry (*Lindera melissifolia* [Walt.] Blume. Devall, M., N. Schiff, T. Hawkins, K Connor, C. Echt, E. Gardiner, P. Hamel, T. Leininger and D. Wilson. IUFRO Division 1 Conference, "Meeting the Challenge: Silvicultural Research in a Changing World" Montpellier, France. 14-18 June 2004. (Abstract Published)
- 2004 Research on the endangered pondberry: from backwater to the big time. Southern Hardwood Forestry Research Group Meeting, Stoneville, MS (17 February). M. Devall, N. Schiff, K. Connor, E. Gardiner, P. Hamel, T. Leininger, D. Wilson, T. Hawkins, C. Echt, B. Lockhart (Coauthors).
- 2004 Research on the endangered pondberry *Lindera melissifolia* [Walt.] Blume. Dept. Biology, Mississippi College, Clinton, MS (20 February). M. Devall, N. Schiff, K. Connor, E. Gardiner, P. Hamel, T. Leininger, D. Wilson, Tracy Hawkins, C. Echt, B. Lockhart (Coauthors).
- 2004 Pondberry, *Lindera melissifolia* [Walt.] Blume, one of the best-funded endangered species. Southern Research Station All Scientists Meeting, Atlanta, GA (3 March). M. Devall, N. Schiff, K. Connor, E. Gardiner, P. Hamel, T. Leininger, D. Wilson, T. Hawkins, C. Echt, B. Lockhart (Coauthors).
- 2004 Update on Team 2: Stand Management and Forest Health. Center for Bottomland Hardwoods Research Technical Advisory Visit. (May)
- 2003 SRS RWU 4155 Wildlife Research: Team 1 Problem Area --Regeneration Biology. Wildlife Research Meeting, USDA FS Research. 3-6 November, Albuquerque, NM. (Coauthors: E. Gardiner, J. Stanturf, C. Schweitzer, J Vozzo, P. Hamel)

- 2003 SRS RWU 4155 Wildlife Research: Team 4 Problem Area –Ecology and Restoration. Wildlife Research Meeting, USDA FS Research. 3-6 November, Albuquerque, NM. (Coauthors: M. Devall, E. Gardiner, T. Leininger, C. Echt, A.D. Wilson, K. Connor, T. Hawkins, B. Lockhart, P. Hamel)
- 2003 A partial list of the insects associated with Pondberry (*Lindera melissifolia* [Walt.] Blume.) ESA National Meeting, Cincinnati, OH. Coauthors, M. Devall and D. Webb.
- 2003 Introduction of the endangered pondberry (*Lindera melissifolia* [Walt.] Blume to new sites in Mississippi. (M. Devall presented and S. Skojac coauthors). Botanical Society of America Annual Meeting, Mobile, AL (27-30 July 2003).
- 2003 Wood decay potential of mycosymbionts from siricid and xiphydriid woodwasps of eastern hardwoods. The American Phytopathological Society 95th annual meeting, August 9-13, 2003, Charlotte, NC. Coauthor A.D. Wilson presented (Extended Abstract Published).
- 2003 Detection and diagnosis of bacterial wetwood in cottonwood and baldcypress by electronic aroma detection of headspace volatiles. MAPPAN meeting, February Greenville, MS. Coauthor A.D. Wilson presented.
- 2003 Germination conditions for poison ivy, *Toxicodendron radicans* (L.) Kunst. 12th Biennial Southern Silvicultural Research Conference, Biloxi, MS. Coauthors K. F. Conner and M. S. Devall.
- 2003 Impacts of insect defoliation in cottonwood plantations in Mississippi. 12th Biennial Southern Silvicultural Research Conference, Biloxi, MS. Coauthors T. Leininger (presented) and J.Henne-Kerr (24-27 Feb 2003).
- 2003 Pondberry (*Lindera melissifolia*) recovery on protected sites in Mississippi. Coauthors M. Devall (presented) and S. Skojac. 12th Biennial Southern Silvicultural Research Conference, Biloxi, MS (24-27 Feb 2003).
- 2002 Revision of the Butjaciidae (Coleoptera). ESA National Meeting, Fort Lauderdale, FL. Coauthor K.M.M. Ramsdell.
- 2002 Hermit Thrushes disperse Pondberry, an endangered plant species. North American Ornithological Conference. New Orleans, LA 22-24 September. Coauthors P.B. Hamel (presented), C.G. Smith III and M.Devall.
- 2002 Unusual insect defoliations of Mississippi cottonwood and baldcypress in 2001. Southern Hardwood Forest Research Group Meeting. Stoneville, MS.
- 2002 Restoration of the endangered pondberry (*Lindera melissifolia* [Walt] Blume) IUFRO, Forest Restoration in the Boreal and Temperate Zone, Vejle, Denmark. Coauthor M. Devall presented. 4/28-5/5 2002 (Extended Abstract Published).
- 2002 Drought modifies effects of predators and parasitoids on the goldenrod gall fly. IUFRO, Forest Restoration in the Boreal and Temperate Zone, Vejle, Denmark. Coauthor P. B. Hamel (presented) and O. Cross. (Extended Abstract Published).
- 2002 Goldenrod gall flies on Sharkey Site: if you build it they will come. IUFRO, Forest Restoration in the Boreal and Temperate Zone, Vejle, Denmark. Coauthor P. B. Hamel presented. (Extended Abstract Published).
- 2001 Insect outbreaks in Southern Forests. ESA National Meeting, San Diego, CA.
- 2001 Ecology and reproductive biology of pondberry (*Lindera melissifolia* [Walt] Blume, Lauraceae, an endangered species. Coauthor M. Devall presented. Botanical Society of America. National Meeting, Albuquerque, New Mexico. (Abstract Published).

- 2001 Insects drawn to forest fires. East Texas Forest Entomology Seminar. 26-27 April.
- 2001 Vegetative antagonism between wood-decaying mycosymbionts of xiphydriid woodwasps. Mississippi Pest Management Associations Joint Annual Meeting, Greenville, MS. Coauthor A.D. Wilson Presented. (Abstract Published).
- 2000 Insects associated with forest fires in Northern California and Southern Oregon. ESA National Meeting, Montreal, Canada.
- 2000 Host recognition in xiphydriid woodwasps. XXI International Congress of Entomology, Iguassu Fall, Brazil. A.D. Wilson, L.R. Williams III coauthors (presented by Williams) (Abstract Published).
- 2000 Xylariaceous wood decay fungi:mycosymbionts of xiphydriid woodwasps. American Phytopathological Society Annual Meeting. New Orleans, LA. Coauthor A.D. Wilson Presented. (Abstract Published).
- 2000 Somatic antagonism between fungal symbionts of xiphydriid woodwasps. American Phytopathological Society Annual Meeting. New Orleans, LA. Coauthor A.D. Wilson Presented. (Abstract Published).
- 2000 Identification of wood decay fungi spread by wood-boring wasps. Southern Hardwood Forest Research Group Meeting, Stoneville, MS.
- 1999 Characterization of fungal associates of xiphydriid woodwasps (Hymenoptera: Symphyta: Xiphydiidae). ESA National Meeting, Atlanta, Georgia.
- 1999 Siricoidea and their fungal symbionts. 4th International Hymenopterists Conference, Canberra, Australia. (A.D. Wilson coauthor) (Abstract published)
- 1998 The ecology of pondberry (*Lindera melissifolia*; Lauraceae), an endangered species. U.S. For. Ser. Southern Region All Scientists Meeting, Atlanta, GA. (Margaret Devall coauthor)
- 1998 Fungal associates of siricoid woodwasps. U.S. For. Ser. Southern Region All Scientists Meeting, Atlanta, GA. (A.D. Wilson coauthor)
- 1998 Insect-fungus interactions in the primitive Hymenoptera (Hymenoptera: Siricidae, Xiphydriidae). ESA National Meeting, Las Vegas, NV. (A.D. Wilson coauthor)
- 1998 Classical biological control of kudzu. Southern Forest Insect Work Conference, Asheville, NC.
- 1998 Pre-emptive systematics:cottonwood leaf beetle population genetics. Southern Forest Insect Work Conference, Asheville, NC.
- 1997 Genetic characterization of cottonwood leaf beetle populations. ESA National meeting, Nashville, TN
- 1997 Molecular genetic analysis of North American honey bees. East Texas Forest Entomology Seminar. Lufkin, TX.
- 1995 High heterozygosity in haplodiploid Symphyta. (W.S. Sheppard coauthor). ESA National meeting, Las Vegas, NE.
- 1995 Sterol composition of seven species of Symphyta and their hosts. (M. Feldlaufer coauthor). Int. Soc. Hymenopterists, third conference, Davis, CA.
- 1994 Mitochondrial DNA and allozyme analyses of commercial honey bee populations from the southern United States. ESA National meeting, Dallas, TX. (W. S. Sheppard coauthor).
- 1993 Genetic characterization of Arizona feral honey bees. ESA National meeting Indianapolis, IN. (W. S. Sheppard, G. M. Loper, H. Shimanuki coauthors).

- 1993 Historical genetic contributions to a feral honey bee population: inferences from mitochondrial DNA. ESA Eastern Branch meeting, Williamsburg, VA. (W. S. Sheppard, G. Loper, H. Shimanuki coauthors).
- 1992 Mitochondrial DNA evidence for historical African bee introduction to the United States. ESA National meeting, Baltimore, MD. (W. S. Sheppard coauthor).
- 1991 Conserved promoter elements direct glucose dehydrogenase expression in *Drosophila*. ESA National meeting. Reno, NE.
- 1990 Evolution and regulation of glucose dehydrogenase (Gld) expression. *Drosophila* Research Conference, Asilomar, CA. (P. Gunaratne, Y. Feng, E. Organ, D. Cavener, coauthors) (Abstract published).
- 1989 Evolutionary aspects of glucose dehydrogenase expression in adults of the family Drosophilidae. ESA National meeting, San Antonio, TX. (D. R. Cavener coauthor).
- 1989 Developmental and evolutionary determinants of Gld expression. *Drosophila* Research Conference, New Orleans, LA. (Y. Feng, C. Carr, D. R. Cavener coauthors) (Abstract published).
- 1988 The roles of sensory and metabolic feedbacks in nutrient self-selection by the corn earworm. ESA National meeting, Louisville, KY (S. Friedman, G. P. Waldbauer coauthors).
- 1987 Nutrient self-selection by the corn earworm *Heliothis zea*: taste versus physiological feedback. ESA National meeting, Boston MA. (S. Friedman, G. P. Waldbauer coauthors).
- 1986 Taste perception and utilization of sugars by larvae of the corn earworm *Heliothis zea* (Boddie). ESA National meeting, Reno NE. (S. Friedman, G. P. Waldbauer coauthors).
- 1985 Self-selection of vitamins by the corn earworm *Heliothis zea* (Boddie). ESA National meeting, Hollywood FL. (S. Friedman, G.P. Waldbauer coauthors).

PROFESSIONAL SOCIETIES

American Association for the Advancement of Science.
 Society for the Study of Evolution.
 Entomological Society of America.
 Pacific Coast Entomological Society.
 Genetics Society of America ('88-'90).
 International Society of Hymenopterists.
 Lepidopterists Society.
 Southern Lepidopterists Society.
 Association for Tropical Lepidoptera.
 Coleopterists Society.
 Entomological Society of Washington.
 Maryland Entomological Society.
 American Entomological Society.
 International Carnivorous Plant Society.
 Le Pou Agouti (Forest Conservation in French Guiana).
 Field Associate of the Bohart Museum of Entomology, U.C. Davis.
 Research Associate Florida State Collection of Arthropods

CURRICULUM VITAE

JAMES H. TUMLINSON, III

Ralph O. Mumma Professor of Entomology, Department of Entomology, The Pennsylvania State University, 111 Pesticide Research Laboratory, University Park, PA 16802

EDUCATION:

B.S.	Virginia Military Institute, Lexington, Virginia	1960	Chemistry
M.S.	Mississippi State University, State College, Mississippi	1966	Organic Chemistry <i>Entomology minor</i>
Ph.D .	Mississippi State University, State College, Mississippi	1969	Organic Chemistry <i>Biochemistry minor</i>

PROFESSIONAL EXPERIENCE:

1964-1969	Chemist, USDA-ARS, Boll Weevil Research Laboratory, State College, MS.
1969-1970	Postdoctoral Position with R. M. Silverstein, New York State College of Forestry, Department of Chemistry, Syracuse, NY.
1970-1972	Research Chemist, USDA-ARS, Insect Attractants, Behavior and Basic Biology Research Laboratory, Gainesville, FL.
1970-1975	<i>Adjunct Assistant Professor; University of Florida, Institute of Food and Agriculture (IFAS), Department of Entomology and Nematology, Gainesville, FL.</i>
1975-1982	<i>Adjunct Associate Professor and member of Doctoral Faculty; University of Florida, IFAS, Department of Entomology and Nematology, and Department of Chemistry, Gainesville, FL.</i>
1982-Present	<i>Adjunct Professor and member of Doctoral Faculty; University of Florida, IFAS, Department of Entomology and Nematology, and Department of Chemistry, Gainesville, FL.</i>
1972-2003	Research Leader, USDA, ARS; Center for Medical, Agricultural, and Veterinary Entomology (formerly, Insect Attractants, Behavior and Basic Biology Research Laboratory), Gainesville, FL.
2003-Present	Ralph O. Mumma Professor of Entomology, Department of Entomology, The Pennsylvania State University, University Park, PA.

FIELD OF SPECIALIZATION:

Insect chemical communication and chemical ecology: defining chemical communication systems, including pheromones and other semiochemicals that mediate insect-insect and plant-insect interactions; biosynthesis of pheromones and plant chemical signals; insect behavior, including learning, mediated by semiochemicals. Emphasis is on developing fundamental knowledge and principles that can be applied in environmentally safe, ecologically sound, sustainable pest management programs.

HONORS:

- 1968 USDA, ARS Award for "Outstanding research which achieved the isolation, identification, and confirmation by synthesis of the male boll weevil sex attractant complex."
- 1975 USDA Superior Service Award (Boll Weevil Pheromone Development Group) "In recognition of the discovery of and for pioneering the development of the pheromone of the boll weevil as a technique for detection, survey, suppression, or elimination of the pest."
- 1979 ARS Award "For outstanding research and leadership accomplishments in identifying chemicals mediating the behavior of insects."
- 1983 USDA Superior Service Award (Insect Chemistry Research Group) "For outstanding service in the isolation, identification, and synthesis of pheromones of a number of major pest insects and providing science and industry with chemicals for insect research and control."
- 1984 ARS Distinguished Research Scientist of the Year.
- 1986 Burdick and Jackson International Award for Research in Pesticide Chemistry, presented by Agrochemicals Division of the American Chemical Society.
- 1989 ARS Fellowship to study at the Center for Insect Science, University of Arizona.
- 1990 J.E. Bussart Memorial Award from the Entomological Society of America for research accomplishments in the area of insect semiochemicals and associated behavior.
- 1991 Florida Entomological Society Annual Research Award (Jointly with W. J. Lewis and T. C. J. Turlings)
- 1994 LeTourneau Memorial Lecture, University of Idaho.
- 1995 USDA, The Secretary of Agriculture's Award for Personal and Professional Excellence "For Pioneering Research on Insect Pheromones that Provided the Basis for Control of Major Insect Pests, Including the Boll Weevil, Thereby Reducing Environmental Contamination by Pesticides".
- 1996 Elected a Fellow of the Entomological Society of America
- 1997 Vice President, International Society of Chemical Ecology
- 1997 Elected to the National Academy of Sciences.
- 1998 President, International Society of Chemical Ecology
- 1998 Distinguished Lecturer in Life Sciences, Boyce Thompson Institute for Plant Research, Cornell University, Ithaca, NY.
- 1998 Alfred M. Boyce Lecturer, University of California at Riverside.
- 1998 Inducted into ARS Hall of Fame.
- 1999 Strickland Lecturer, University of Alberta, Edmonton.
- 1999 Joseph LeConte Lecturer, Georgia Southern University, Statesboro.
- 2000 Recognition Award in Insect Physiology, Biochemistry and Toxicology, from the Entomological Society of America, Montreal, Canada.
- 2002 Kenneth A. Spencer Award for Outstanding Achievement in Agricultural and Food Chemistry
- 2002 ISI Essential Science Indicators; listed Tumlinson's publications in the top 1% in terms of total citations earned in the field of Environment/Ecology.
- 2003 Presidential Rank Award as a Meritorious Senior Professional in USDA, ARS.
- 2003 Jean-Marie Delwart Foundation International Prize (with Dr. W.J. Lewis) for chemical communication.
- 2005 Silver Medal Award of the International Society of Chemical Ecology

OTHER RELATED PROFESSIONAL ACTIVITIES:

- FAO consultant to Greek Scientists, Nuclear Research Center, Demokritos, Greece, on identification of olive fly pheromone, 1974
- Member of Editorial Board of the Journal of Chemical Ecology, 1977-present.
- Member Program Committee, Pesticide Chemistry Division, American Chemical Society, 1978-1982.

- Member Executive Committee, Pesticide Chemistry Division, American Chemical Society, 1979.
- Chairman, Gainesville subsection, American Chemical Society, 1979-1980.
- Member of team of six scientists selected to visit USSR to participate in bilateral exchange program and symposium on integrated pest control, 1980.
- Member of team of five scientists selected to visit Japan, under Japan/USA Agreement on Cooperation in Science and Technology, to participate in First Japan/USA Joint Symposium on IPM, 1981.
- Participated in workshops in the U.S. on *Trichogramma* and on larval parasites of U.S. and European scientists to develop a trans-Atlantic cooperative research effort on the foraging behavior of *Trichogramma*, Wageningen, The Netherlands, 1984.
- Member of panel selected by National Academy of Sciences to prepare briefing report for President's Science Advisor on "Biotechnology in Agriculture," 1985.
- Assisted in organizing and participated as a member in the Western Regional Coordinating Committee on Natural Product Chemistry as a Resource for Biorational Methods of Insect Control, 1991-1993; assisted in reorganizing into Western Regional Project WRRC-82 and in developing a plan to obtain funding for this project, 1993.
- Traveled to Budapest Hungary under sponsorship of USDA, OICD to conduct technical review of project HU-ARS-30, "Exploitation of chemically mediated reproductive communication and niche organization in pest Lepidoptera," September, 1992.
- Presented four lectures on semiochemicals mediating insect behavior in Brazil Summer School on Organic Chemistry, at the invitation of the Universidade Federal de São Carlos, São Carlos, Brazil, February, 1993.
- Assisted in organizing and participated in "Planning Session for Pest Management Needs in a Shifting Agriculture in the Southeast", Tifton, GA, April 13, 1995. Meeting attended by growers, extension agents, ARS and University of Georgia Research Scientists, a representative of the Georgia Conservancy, and the USDA, ARS South Atlantic Area Director.
- Participated in a workshop sponsored by Northeast Region SARE to develop a brochure with the working title of Designing Agroecosystems to Minimize Pest Pressure, Las Vegas, NV, November, 1998.
- Member of the editorial boards of the Journal of Chemical Ecology and of Biological Control: Theory and Application in Pest Management.
- Vice President (1997), President (1998), member of governing council (1999-2002) International Society of Chemical Ecology
- Member, Board on Agriculture and Natural Resources, National Research Council, National Academy of Sciences, April, 2001-2003.

RECENT INVITED PRESENTATIONS:

- a. "Signaling in Tritrophic Plant-Insect Interactions." In Signals and Signal Perception in Biotic Interactions in Plants, a Keystone Symposium on Molecular and Cellular Biology, Taos, NM, Feb 22-27, 2000.
- b. "Signaling in Tritrophic Plant-Insect Interactions" Seminar at Montana State Univ Feb 2000.
- c. "Signaling in Tritrophic Plant-Insect Interactions", Seminar at Michigan State Univ April 2000.
- d. "Chemical signals that mediate tritrophic plant-insect interactions" Gordon Conference on Biological Regulatory Mechanisms Plant Molecular Biology, Plymouth, NH, July 16-21, 2000.
- e. "Volicitin-lipid derived signals in plant-insect interactions." 41st International Conference on the Biochemistry of Lipids, Halle, Germany, Sep. 13-16, 2000.
- f. "Induction of crop volatiles to attract and manage beneficial insects", in symposium on Innovative Approaches in Host Plant Resistance, annual meeting of ESA, Montreal, Canada, December, 2000.
- g. "Induced plant defenses" Gordon conference on Plant-Insect Interactions, Ventura, CA, February, 2001.
- h. "Plant signals guide natural enemies to insect herbivores", in symposium: International Award for Research in Agrochemicals: Ralph O. Mumma An Overview of Plant-Insect Interactions,

- Immunoassay, and Agrochemical Fate at National meeting of American Chemical Society, Chicago, IL, August 27, 2001.
- i. "Induced Plant Chemical Signals Attract Enemies of Insect Herbivores", Seminar, University of Missouri at Kansas City, February, 2002.
 - j. "How Plants Defend Against Insect Pests by Recruiting Wasps as Bodyguards", Award Address, Kenneth A. Spencer Award Banquet, Kansas City, MO, February, 2002.
 - k. "Plant-insect interactions", Workshop on the National Plant Genome Initiative, Objectives for 2003-2008, National Academy of Sciences, National Research Council, Washington, DC, June 6-7, 2002.
 - l. "Biochemistry of fatty acid amide elicitors of plant volatiles in caterpillar digestive system", Symposium: Insect Saliva--An Integrative Approach, National meeting, ESA, Cincinnati, OH, October, 2003.
 - m. USDA, ARS Leadership Conference, New Orleans, LA, January, 2004.
 - n. "The role of induced volatile organic compounds in plant defense", Gordon Research Conference on Biogenic Hydrocarbons & the Atmosphere, Barga, Italy, May 2-7, 2004.
 - o. Served as member of review panel and moderated a session for the meeting: "Malaria control: a reconsideration of the role of DDT", Board on Global health and Board on Agriculture and Natural Resources, The National Academies, Washington, DC, July 21-22, 2004.
 - p. Presented two invited lectures, "Host location by parasitoids" and "Chemical signals that mediate tritrophic plant-insect interactions", in Special Course on Host Recognition, Institute of Zoology, University of Neuchâtel, Neuchâtel, Switzerland, September 8-10, 2004.
 - q. Keynote speaker, Molecular and Environmental Plant Sciences symposium, Texas A&M University, March 8, 2005.
 - r. Silver Medal Lecture, Annual meeting of International Society of Chemical Ecology, Washington, DC, July 24-27, 2005.
 - s. Chemical Ecology of Tritrophic Plant-Insect Interactions, Symposium Kyoto University, Kyoto, Japan, November 1-4, 2005.
 - t. Chemical signals that regulate tritrophic plant-insect interactions, J. H. Tumlinson, symposium Plant Response to Biotic Insults, ACS National meeting, Atlanta, GA, March 29, 2006

GRADUATE STUDENTS AND POST DOCTORALS

Masters Students

Basilios E. Mazomenos 1978 Greece
Thomas M. Dykstra 1994 U.S.
Mary Donohue 2000 U.S.
Nurian, Badillo-Vargas, current, U.S.

Doctoral Students

Peter E. A. Teal 1981 Canada
Fred J. Eller 1990 U.S.
Ted C. J. Turlings 1991 The Netherlands
Ursula Rose 1997 Germany
Yasmin Cardoza 2002 Honduras
Ezra Schwartzberg, current U.S.
Emily Hohlfeld, current U.S.

Post Doctorals

Hajime Sugie Japan
Tatsugi Chuman Japan
Stuart Krasnoff U.S.
Hans Alborn Sweden
Philip McCall England
Nianbai Fang China
John Loughrin U.S.
Yoav Gazit Israel
Paul Pare U.S.
Eric Schmelz U.S.
Consuelo De Moraes Brazil
Alonzo Suaso Honduras
Jurgen Engleberth Germany
Cameron Lait Canada
Naoki Mori Japan
Baldwyn Torto Ghana
Juan Huang China
Katalin Boeroeczky Hungary

Recent Publications (Total 265)

Mori, N., Alborn, H. T., Teal, P. E. A., and Tumlinson, J. H. Enzymatic decomposition of elicitors of plant volatiles in *Heliothis virescens* and *Helicoverpa zea*. *J. Ins. Phys.* 47: 749-757. 2001.

De Moraes, C. M., Mescher, M. C., and Tumlinson, J. H. Caterpillar-induced nocturnal plant volatiles repel conspecific females. *Nature.* 410: 577-580. 2001.

Schmelz, E.A., Alborn, H. T., and Tumlinson, J. H. The influence of intact-plant and excised-leaf bioassay designs on volicitin- and jasmonic acid-induced sesquiterpene volatile release in *Zea mays*. *Planta.* 214: 171-179. 2001.

Rains, G. C., Olson, D. M., Lewis, W. J., and Tumlinson, J. H. Systems Management, pp. 826-828. In Pimental, D. (Ed.) *Encyclopedia of Pest Management*, Marcel Dekker, Inc. New York, NY, 2002.

Cardoza, Y. J., Alborn, H. T., and Tumlinson, J. H. In vivo volatile emissions from peanut plants induced by simultaneous fungal infection and insect damage. *J. Chem. Ecol.* 26: 161-174. 2002.

Schmelz, E. A., Alborn, H. T., Banchio, E., and Tumlinson, J. H. Quantitative relationships between induced jasmonic acid levels and volatile emission in *Zea mays* during *Spodoptera exigua* herbivory. *Planta.* 216: 665-673. 2003.

Schmelz, E. A., Alborn, H. T., and Tumlinson, J. H. Synergistic interactions between volicitin, jasmonic acid and ethylene mediate insect-induced volatile emission in *Zea mays*. *Physiologia Plantarum.* 117: 403-412. 2003.

Engelberth, J., Schmelz, E.A., Alborn, H. T., Cardoza, Y. J., Huang, J. and Tumlinson, J. H. Simultaneous quantification of Jasmonic acid and Sclicylic acid in plants by vapor phase extraction

and gas chromatograph-chemical ionization-mass spectrometry. *Analytical Biochemistry*. 312: 242-250. 2003.

Cardoza, Y.J., C.G. Lait, E.A. Schmelz, J. Huang, and J.H. Tumlinson. Fungus-induced biochemical changes in peanut plants and their effect on development of beet armyworm, *Spodoptera exigua* Hübner (Lepidoptera: Noctuidae), larvae. *Environmental Entomology* 32: 220-228. 2003.

Lait C.G., H.T. Alborn, P.E.A. Teal and J.H. Tumlinson III. Rapid biosynthesis of N-linolenoyl-L-glutamine, an elicitor of plant volatiles, by membrane associated enzyme(s) in *Manduca sexta*. *Proceedings of the National Academy of Sciences USA* 100: 7027-7032. 2003.

Cardoza, Y.J., Teal, P. E. A., Tumlinson, J. H. Effect of Peanut Plant Fungal Infection on Oviposition Preference by *Spodoptera exigua* and on Host-Searching Behavior by *Cotesia marginiventris*. *Environmental Entomology*. 32: 970-976. 2003.

Schmelz, E. A., Alborn, H. T., Engelberth, J., Tumlinson, J. H. Nitrogen Deficiency Increases Volicitin-Induced Volatile Emission, Jasmonic Acid Accumulation, and Ethylene Sensitivity in Maize. *Plant Physiology*. 133: 295-306. 2003.

Huang, J., Cardoza, Y. J., Schmelz, E. A., Raina, R., Engelberth, J., Tumlinson, J. H. Differential volatile emissions and salicylic acid levels from tobacco plants in response to different strains of *Pseudomonas syringae*. *Planta*. 217: 767-775. 2003.

Olson, D. M., Rains, G. C., Meiners, T., Takasu, K., Tertuliano, M., Tumlinson, J. H., Wackers, F. L., Lewis, W. J. Parasitic Wasps Learn and Report Diverse Chemicals with Unique Conditionable Behaviors. *Chemical Senses*. 28: 545-550. 2003.

Alborn, H. T., Brennan, M. M., Tumlinson, J. H. Differential Activity and Degradation of Plant Volatile Elicitors in Regurgitant of Tobacco Hornworm (*Manduca sexta*) Larvae. *Journal of Chemical Ecology*. 29: 1357-1372. 2003.

Aldrich, J. R., Bartelt, R. J., Dickens, J. C., Knight, A. L., Light, D. M., Tumlinson, J. H. Insect chemical ecology research in the United States Department of Agriculture - Agricultural Research Service. *Pest Management Science*. 59: 777-787. 2003.

Suazo, A., Torto, B., Teal, P.E.A. and Tumlinson, J. H. Response of the small hive beetle (*Aethina tumida* Murray) to honey bee (*Aphis Mellifera* L.) and beehive-produced volatiles. *Apidologie*. 34: 525-534. 2003.

Schmelz, E. A., Engelberth, J., Alborn, H. T., O'Donnell, P., Sammons, M., Toshima, H. and Tumlinson, J. H. Simultaneous analysis of phytohormones, phytotoxins, and volatile organic compounds in plants. *PNAS*, 100: 10552-10557. 2003.

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Education Ph.D. in Entomology, 1981. University of California, Berkeley.
M.S. in Entomology, 1977. North Carolina State University.
A.B. in Anthropology, 1970. Indiana University.

Research The ecology of exotic invasive insect species; application of remote sensing **Interests**
technology to the survey and detection of invasive insect populations; the theory and
practice of biological control; regional dynamics of insect populations under the
influence of weather variability and climate change; the population ecology of
arthropod herbivores, predators, and parasitoids; mathematical modeling of plant,
herbivore, and insect natural enemy systems.

**Research
Experience**

**7/03 - present Entomologist, USDA APHIS, PPQ, CPHST, Pest Survey, Detection, and Exclusion
Laboratory, Otis ANGB, Massachusetts.**

Coordinating a project to apply remote sensing technologies, including hyperspectral
imaging and LIDAR, to the survey and detection of emerald ash borer populations.
Exploring natural forests in South Korea in support of a classical biological control
program for emerald ash borer. Developing a program for implementing biological
control of *Sirex noctilio* using the parasitic nematode, *Beddingia siricidicola*, and
evaluating natural control by native parasitoids.

**6/92 - 6/03 Research Entomologist, USDA Forest Service, Northeastern Research Station,
Newtown Square, Pennsylvania.**

Investigated the ecology of Asian longhorned beetle in natural forest stands in South
Korea. Investigated the susceptibility and vulnerability of forests in the Delaware River
Basin to invasive insect pests, including gypsy moth, hemlock woolly adelgid, and Asian
longhorned beetle, using geographic information systems and multivariate analyses.
Investigated potential effects of climate change on the geographical distributions of
outbreaks of forest defoliators and bark beetles using GIS and multivariate analyses.
Analyzed the effects of weather and dispersal on the population dynamics and regional
synchrony of forest defoliators using time series methods and spatial modeling.

**4/88 - 3/92 Research Entomologist, USDA Agricultural Research Service, Beneficial Insects
Research Laboratory, Newark, Delaware.**

Investigated the population ecology of the gypsy moth in New Jersey using historical
data. Investigated the functional response to host density of a larval parasitoid of gypsy
moth in the field. Developed a detailed computer simulation model of a host-parasitoid
system. Designed databases and developed an electronic bulletin board for the National
Biological Control Institute.

2/88 - 3/88 **Consulting Ecologist, Consortium for International Crop Protection, University of Maryland.**

Carried out field experiments on the Mediterranean fruit fly in Guatemala in support of an Environmental Impact Assessment of the MOSCAMED program.

10/84 - 1/88 **Integrated Pest Management (IPM) Systems Specialist, University of California Statewide IPM Project, University of California, Davis.**

Developed crop models for wheat and citrus and associated pest models. Continued development of a grape agroecosystem model. Coordinated research efforts in the cereals, citrus and grape commodity groups.

7/82 - 9/84 **Postdoctoral Modeler/Analyst, University of California Statewide IPM Project, University of California, Berkeley.**

Developed a computer simulation model of grapevine growth. Constructed arthropod pest and plant pathogen population models for linkage with the vine model. Developed and coordinated, with University of California Cooperative Extension personnel, a project for the field validation of the grapevine model.

7/81 - 6/82 **Postdoctoral Fellow, Texas A & M University.**

Investigated the population dynamics and natural control of the boll weevil and *Anthonomus hunteri* on wild cotton and *Hampea* in Yucatan, Mexico.

References Available on request.

Publications List available on request.