

THE CONNECTICUT AGRICULTURAL  
EXPERIMENT STATION

*Record of the Year*

2009-2010



The Connecticut Agricultural Experiment Station, founded in 1875, was the first state agricultural experiment station in the United States. The Station has laboratories, offices, and greenhouses at 123 Huntington Street, New Haven 06511, Lockwood Farm for experiments on Evergreen Avenue in Hamden 06518, the Valley Laboratory and farm on Cook Hill Road, Windsor 06095, and a research center in Griswold and Voluntown (on Sheldon Road). Station research is conducted by members of the following departments: Analytical Chemistry, Biochemistry and Genetics, Entomology, Forestry and Horticulture, Environmental Sciences, and Plant Pathology and Ecology. The Station is chartered by the Connecticut General Statutes to experiment with plants and their pests, insects, soil and water and to perform analyses.



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## *INTRODUCTION*

Staff members at The Connecticut Agricultural Experiment Station (CAES) conduct research and provide services for state residents. The main core program areas are agriculture (includes food safety), forestry, public health, and water and soil quality. During the recent legislative session, a patent bill for the CAES passed and was signed by Governor Rell. Effective on October 1, 2010, this law gives the CAES scientists authority to seek patents, licensing agreements, and trademarks. Legal protection will be sought for new cultivars of strawberry and tobacco plants, which are resistant to insect pests and disease problems. Analyses of seafood samples from the oil-spill area of the Gulf of Mexico, a collaborative effort with the US Food and Drug Administration, had a major impact by allowing previously closed fishing areas to be re-opened. Intensive surveys continue to monitor for the Asian longhorned beetle and Emerald ash borer, major tree pests currently present in nearby areas of Massachusetts and New York State, respectively. West Nile virus and Eastern Equine Encephalitis viruses were isolated from mosquitoes. Research and educational programs are being developed to address bed bug infestations in homes, hotels, and apartments. Finally, more efficient methods of controlling invasive aquatic plants in lakes and ponds have been developed to restore water quality.

The older buildings located on the New Haven campus need attention. \$1.26 million in state bond funding was allocated for architectural design for the Jenkins-Waggoner Laboratory. Other funds were secured to correct roofing and other building problems in the Osborne Library and Johnson-Horsfall Laboratory.

The CAES outreach programs and website have been enhanced to facilitate the transfer of new scientific information to the public. During this reporting period, there were 1,322,425 page views. Of these, 378,184 (29%) page views were recorded for CAES publications. The average duration of visits was about 14 minutes. Staff members gave 1,050 talks and interviews to civic groups and the media, and two Open House events were held to give hundreds of state residents an opportunity to meet scientists, hear presentations on scientific advancements, see experimental plots and laboratories, and to make comments on research and public outreach programs.

## ***BOARD OF CONTROL***

The management of the Station is vested in a Board of Control as specified in Section 22-79 of the General Statutes of Connecticut.

The members of the Board of Control as of June 30, 2010 were

Governor M. Jodi Rell, President	Commissioner F. Philip Prelli
Mr. Terry Jones, Vice President	Dr. Stephen L. Dellaporta
Mr. Paul Larson, Secretary	Ms. Norma O'Leary
Dr. Louis A. Magnarelli, Director	Dr. Johan C. Varekamp

The Board of Control met on August 5, 2009, October 14, 2009, January 19, 2010, and April 6, 2010.

## ***STATION STAFF***

The Experiment Station exists to advance scientific knowledge, and that advance depends completely upon the quality and dedication of its staff. The following was the staff of The Connecticut Agricultural Experiment Station as of June 30, 2010.

### **ADMINISTRATION**

Dr. Louis A. Magnarelli, Director  
Dr. Kirby C. Stafford, III, Vice Director  
Michael Last, Chief of Services  
Dianne Albertini  
Vickie M. Bomba-Lewandoski  
Tess Foley  
Joan Ives-Parisi  
Lisa Kaczinski  
Roberta Milano-Ottenbreit  
Kathryn Soleski

### **ANALYTICAL CHEMISTRY**

Dr. Jason C. White, Department Head  
Terri Arsenault  
William A. Berger  
Dr. Brian D. Eitzer  
Dr. Lester Hankin, Emeritus  
Dr. Walter J. Krol  
Dr. MaryJane Incorvia Mattina, Emeritus  
Craig L. Musante  
John Ranciato  
Dr. Christina S. Robb

### **BIOCHEMISTRY & GENETICS**

Dr. Neil A. McHale, Department Head  
Carol R. Clark  
Dr. Douglas W. Dingman  
Regan Huntley  
Dr. Richard B. Peterson  
Dr. Neil P. Schultes  
Dr. Israel Zelitch, Emeritus

### **BUILDINGS AND MAINTENANCE**

Bancroft Nicholson, Supervisor  
Ronald LaFrazier  
Gloria Mach  
Miguel Roman  
Michael Scott  
Nicole Wachter

## **ENTOMOLOGY**

Dr. Kirby C. Stafford, III, Department Head  
Elizabeth E. Alves  
Dr. John F. Anderson, Distinguished Scientist  
Dr. Anuja Bharadwaj  
Tia Blevins  
Bonnie L. Hamid  
Rose Hiskes  
Ira J. Kettle  
Morgan F. Lowry  
Dr. Chris T. Maier  
Michael J. Misencik  
Dr. Gale E. Ridge  
Dr. Claire E. Rutledge  
Stephen J. Sandrey  
Dr. Victoria L. Smith  
Dr. Kimberly A. Stoner  
Heidi Stuber  
Peter W. Trenchard  
Michael P. Vasil  
Tracy Zarillo

## **ENVIRONMENTAL SCIENCES**

Dr. Theodore G. Andreadis, Department Head  
Dr. Phillip M. Armstrong  
Angela B. Bransfield  
Gregory J. Bugbee  
Shannon L. Finan  
Dr. Melissa C. Hardstone  
Dr. Mark R. June-Wells  
Dr. Charisma V. Lattao  
Dr. Goudarz Molaei  
Angela Penna  
Dr. Joseph J. Pignatello  
John J. Shepard  
Michael C. Thomas  
Dr. Charles R. Vossbrinck

## **FORESTRY & HORTICULTURE**

Dr. Jeffrey S. Ward, Department Head  
Joseph P. Barsky  
Joan Bravo  
Dr. Martin P. N. Gent - Emeritus  
Dr. David Hill - Emeritus  
Dr. Abigail A. Maynard  
Dr. William R. Nail  
Michael R. Short  
Dr. Paul E. Waggoner, Distinguished Scientist  
Dr. Scott C. Williams



**GRISWOLD RESEARCH CENTER**

Robert Durgy

**LOCKWOOD FARM**

Richard M. Cecarelli, Farm Manager

Rollin J. Hannan, Jr.

Michael McHill

**PLANT PATHOLOGY & ECOLOGY**

Dr. Sharon Douglas, Department Head

Dr. Sandra L. Anagnostakis

Dr. Donald E. Aylor, Emeritus

Sandra E. Carney

Dr. Wade H. Elmer

Dr. Francis J. Ferrandino

Mary K. Inman

Dr. Yonghao Li

Dr. Robert E. Marra

Pamela Sletten

Peter W. Thiel

**VALLEY LABORATORY**

Dr. James A. LaMondia, Department Head

Dr. John Ahrens - Emeritus

Jane Canepa-Morrison

Dr. Carole Cheah

Dr. Richard Cowles

Jeffrey M. Fengler

Dr. Dewei Li

Dr. Todd L. Mervosh

James Preste

Diane Riddle

Michelle Salvas

Dr. Hugh Smith

## *PLANT SCIENCE DAY 2009*

The weather for Plant Science Day was warm and threatening. Severe thunderstorms were predicted for the afternoon, but they didn't occur. Attendance was very good – 1,048 visitors, including 210 children.

The following short talks and demonstrations were all very well attended:

### SHORT TALKS:

Dr. Victoria L. Smith	Asian Longhorned Beetle: A Threat to our Forests
Dr. Douglas W. Dingman	Honey bees and American Foulbrood
Dr. Francis J. Ferrandino	Weather Monitoring, Pathogen Biology, and Disease Management for Winegrapes In Connecticut
Dr. John F. Anderson	Detection and Control of Bed Bugs

### DEMONSTRATIONS:

Dr. Claire E. Rutledge	Do I Have the Asian Longhorned Beetle? How to Identify This Major Threat to Connecticut's Trees
Mr. Thomas M. Rathier	Gardening with Containers

### WALKING TOURS:

Dr. Robert E. Marra conducted two walking tours. Many visitors took advantage of the opportunity to stop at many of the plots and talk with scientists.

Dr. Jeffrey S. Ward guided visitors on a ½ hour tour of our native shrub planting and gave them information on using native shrubs for naturalistic landscapes without using pesticides and fertilizers.

Mr. Jeffrey M. Fengler led a Butterfly Identification Walk through the Bird and Butterfly Garden.

Ms. Jane Canepa-Morrison demonstrated Deadheading Perennials in the Bird and Butterfly Garden.

### PESTICIDE CREDIT TOURS

Mr. Thomas M. Rathier brought participants who wanted their attendance to count toward pesticide credits around to different displays and plots. Stops on the tour included:

Dr. Hugh A. Smith	Management of Strawberry Sap Beetle
Dr. Sandra L. Anagnostakis	Control of Blight on American Chestnuts
Dr. James A. LaMondia	Biodiesel Oilseed Crops for Biological Control of Soilborne Pathogens
Dr. Chris T. Maier	Invasive Alien Insects in Connecticut

## BARN EXHIBITS:

The following Barn Exhibits were very popular and well attended.

### FEPS – The Food, Environmental, and Product Safety Laboratory

Investigators: Dr. MaryJane Incorvia Mattina, Dr. Walter J. Krol, Dr. Christina S. Robb, Dr. Brian D. Eitzer, John F. Ranciato, Craig L. Musante, Terri Arsenault, and WilliamA. Berger

### Photosystem II: Origin of Plant Growth

Investigator: Dr. Richard B. Peterson

### Natural & Biological Tick Control

Investigators: Dr Anuja Bharadwaj and Dr. Kirby C. Stafford, III

### How to Control Barberry and Reduce Ticks

Investigators: Dr. Jeffrey S. Ward, Dr. Scott C. Williams, Thomas E. Worthley, and Dr. Kirby C. Stafford, III

### Controlling Bacterial Plant Diseases with Bacteriophages

Investigator: Dr. Botond Balogh

### Detection and Identification of Mosquito-Borne Viruses in Connecticut

Investigators: Dr. Philip M. Armstrong, Dr. Theodore G. Andreadis, Shannon L. Finan, John J. Shepard, and Michael C. Thomas

## CHILDREN'S ACTIVITIES

For the fifth year, the Station offered the Passport for Kids and other fun activities for children of all ages. The Station has increased its focus to get young people interested in the sciences and their natural surroundings. More than 210 young people participated in Plant Science Day 2009.

## STATION FIELD PLOTS AND DISPLAYS

Visitors made their way through the Station field plots. The plots are planted and maintained by Station scientists with the help from Farm Manager Richard Cecarelli and his staff, Rollin Hannan and Michael McHill. Together, with help from summer farm helpers L. Bespuda and C. Remetz, they prepared Lockwood Farm for the hundreds of visitors that attended Plant Science Day.

Tents were set up by Ronald LeFrazier, Miguel Roman, Michael Scott, and Nicole Wachter under the supervision of Bancroft Nicholson, Head of the Maintenance Department, and Richard Cecarelli, Rollin Hannan, and Michael McHill of the Farm Crew, and by Vickie Bomba-Lewandoski and Roberta M.-Ottenbreit of Administration.

At 11:20 Dr. Louis A. Magnarelli, Director, welcomed visitors to Plant Science Day, 2009.

The Century Farm Award was presented to John “Whit” Davis and his family of the “Davis-Stanton Homestead in Stonington, CT. The presenter was Dr. John F. Anderson, former Director.

The Davis-Stanton Homestead is located in Lower Pawcatuck (part of the town of Stonington, Connecticut). Thomas Stanton started the first business in 1654, which consisted of a grist mill and later a sawmill. Surrounding an historic mid-17<sup>th</sup> century farmhouse are more than 300 acres of prime farmland, which has been cultivated for at least 355 years. This property has great historic value spanning thousands of years.

John Davis married Sally Stanton, who was Robert Stanton’s granddaughter, and bought the farm from the Stanton family in 1772. The farm provided hay to the Continental Army and salt pork, bacon, cider, cheese, and other products to the Stonington whaling ships.

John “Whit” Davis began farming at the age of 11. He had a garden plot, pony, and a cart for his first growing season. For several decades, he planted several acres of Indian white flint corn, which has been passed from one generation to the next. Strong ties exist between Whit Davis and Native American tribes. Having strong interests in conservation, he has served on the Stonington Conservation and Inland Wetland Commission and has sold development rights to the State of Connecticut.

Today, Whit Davis and his son Larry grow sweet corn, tomatoes, peppers, and broccoli, but their main crops are upland hay and salt hay cut on the “Continental Marsh”. The salt hay is cut during the winter to prevent damaging the marsh. Chickens are raised to produce eggs for local farm markets.

After the Century Farm Award was presented, Dr. Magnarelli introduced Margery Winters, Senior Educator, Roaring Brook Nature Center, Canton, who gave the Samuel W. Johnson Lecture: “Saving our Wild Areas, One Yard at a Time”. After her talk, Dr. Magnarelli presented Ms. Winters with a certificate signed by Governor M. Jodi Rell, President of the Board of Control, Paul C. Larson, Secretary of the Board of Control, and himself as the Director of the Station.

Following the Samuel W. Johnson Lecture, Dr. Magnarelli introduced Pamela Weil, President of the Experiment Station Associates, who spoke on the activities of the Associates and invited visitors to join.

The combined efforts of the entire staff – Professional, Technical, Clerical, Administrative, Maintenance, and Farm Crew – all made Plant Science Day 2009 the successful day it was.

## *EVENTS HELD AT THE STATION*

### *LOCKWOOD LECTURES*

#### DR. CLIVE A. EDWARDS

On March 11, 2010, Dr. Clive A. Edwards, Professor of Entomology and Environmental Sciences at Ohio State University, presented the lecture “The Use of Aqueous Solutions from Vermicomposts in the Suppression of Plant Diseases of Tomatoes and Cucumbers”. Dr. Edwards is a world-renowned expert on earthworm biology and vermicomposting. He was invited by Dr. Wade Elmer of the Department of Plant Pathology and Ecology.

#### DR. KEVIN T. SMITH

On May 21, 2010, Dr. Kevin T. Smith, Project Leader and Supervisory Plant Physiologist at the Northern Research Station of the USDA Forest Service in Durham, New Hampshire spoke on “Tree Survival and Response to Injury, Infection, and Environmental Change”. Dr. Smith, who is also an Affiliate Professor in the Department of Biological Science at the University of New Hampshire, is a world-renowned plant physiologist who investigates the effects of environmental disturbance on tree biology and the contribution of trees to forest biogeochemistry. Dr. Smith was invited by Dr. Robert Marra of the Department of Plant Pathology and Ecology.

### FARM TO CHEF PROGRAM

On April 5, 2010, the Station hosted the CT Department of Agriculture’s Farm to Chef Program in Jones Auditorium. Station scientists gave presentations on how their research can help the Farm to Chef Program’s goal of increasing the amount of locally-grown food served in local restaurants. The audience included local farmers, growers, chefs, restaurant owners, and journalists. The exchange of information was part of establishing a relationship that was newly conceived between the Department of Agriculture and the Experiment Station’s agricultural scientists for the USDA Specialty Crops Block Grant. Tess Foley, who hosted the event, identified this opportunity to have the Station scientists who received this funding present aspects of their research at this program. Director Louis Magnarelli welcomed the attendees. Drs. Abigail Maynard, Martin Gent, Richard Cowles, Kimberly Stoner, Walter Krol, William Nail, Francis Ferrandino and Wade Elmer gave presentations. Members of the audience were also given a tour of the Analytical Chemistry laboratories, the Plant Disease Inquiry Office, the Insect Inquiry Office and the Soil Testing laboratory.

## SIGMA XI POSTER CONFERENCE

On April 17, 2010 The Northeast Regional Undergraduate and Graduate Student Sigma Xi Poster Conference was hosted by the Experiment Station in Jones Auditorium. The event was sponsored by the Quinnipiac Sigma Xi Chapter, of which many Station scientists are members. The event was organized by Drs. Douglas W. Dingman, Richard B. Peterson, and Neil P. Schultes. 48 posters were submitted by students from many colleges and universities in the northeast. Also assisting with the judging of the posters were Dr. Sandra L. Anagnostakis and Dr. Sharon M. Douglas.

## CGGA-CAES-UCONN DIAGNOSTICS WORKSHOP

The Station hosted a Diagnostics Workshop for members of Connecticut's Green Industry in Jones Auditorium on June 22, 2010. The workshop was co-organized by the Connecticut Greenhouse Growers Association, the Experiment Station and UCONN. Thirty stations of plants with either biotic (disease, insect, or mite) or abiotic (cultural or environmental) problems challenged the diagnostic skills of 48 attendees. After an initial round of self-diagnosis, participants heard several presentations, including "Diagnosing Plant Health Problems: How to Get Started" by Dr. Sharon M. Douglas, "How to Identify & Diagnose Plant Disease Symptoms" by Dr. Wade H. Elmer, "How to Identify and Diagnose Abiotic Disorders" by Richard McAvoy (UCONN), "How to Identify and Diagnose Insect Related Disorders" by Leanne Pundt (UCONN), and "Weed, Algae and Related Problems" by Dr. Todd Mervosh. Also participating were Mary Inman, Peter Thiel and Joan Allen (UCONN). Bob Heffernan, of the CT Green Industries, coordinated registration and refreshments. Nicole Wachter assisted with set up in Jones Auditorium.

## GOVERNOR RELL VISITS THE STATION

On June 25, 2010, Governor M. Jodi Rell visited the Station. She delivered the news that a House Bill to give the Experiment Station scientists authority to seek patents, licensing agreements, and trade marks was ready for her signature. Dr. Richard Cowles, who will seek a patent for a new strawberry cultivar, brought some strawberries produced from the new plants for the Governor and staff members to sample. He made up strawberry shortcake. The Governor declared that the new strawberries were excellent. She also announced that she would support bond funding to add to and renovate Jenkins Laboratory.

## *EVENTS HELD AT THE VALLEY LABORATORY*

### TWILIGHT MEETING OF CT CHRISTMAS TREE GROWERS

A Twilight Meeting of the Connecticut Christmas Tree Growers Association was held at the Valley Laboratory on July 9, 2009. More than 70 growers participated. Station scientists spoke on the research in Christmas tree production. Several new findings were disclosed which would significantly benefit the CCTGA members. Scientists who

participated were Dr. Richard Cowles, Dr. John Ahrens, Dr. Sharon Douglas, and Dr. Scott Williams. Staff from the Valley Laboratory in Windsor helped with set up for the meeting.

#### NURSERY AND LANDSCAPE RESEARCH TOUR

Over 25 nursery and landscape professionals attended the Valley Laboratory's annual Nursery and Landscape Research Tour on September 10, 2009. Attendees were welcomed by Dr. James LaMondia and then toured research plots for the following presentations: Cover crops for disease/nematode management, Dr. James LaMondia; Managing deer with repellents, Dr. Scott Williams; Managing Japanese knotweed, Dr. Todd Mervosh; Use of insectary plants to augment IPM efforts, Dr. Hugh Smith; Arborvitae blackened foliage syndrome, Tom Rathier; Weed management for field grown woody plants, Dr. John Ahrens and Dr. Todd Mervosh; Container media/water relationships, Tom Rathier; Weed management in container grown plants, Dr. Todd Mervosh; and the CAES/CNLA education garden, Rose Hiskes. The tour was concluded with the following talks: Biology of Asian longhorned beetle, Dr. Claire Rutledge; Systemic insecticides for Asian longhorned beetle, Dr. Richard Cowles; Asian longhorned beetle outreach efforts, Rose Hiskes; Arthropods and pesticides update, Rose Hiskes; and Disease and cultural problem update, Dr. Botond Balogh. James Preste, Jane Morrison and Jonn Winiarski provided help with preparations and during the meeting.

#### BIOLOGICAL CONTROL WORKSHOP

On March 24, 2010, staff members at the Valley Laboratory hosted a day-long workshop entitled Biological Control of Insects and Mites in Greenhouses. Hugh Smith organized the workshop which was taught by Ms. Suzanne Wainwright Evans of BugLady consulting. Mr. Smith and Leanne Pundt of the University of Connecticut assisted with the training. There were 28 participants, including nursery and greenhouse growers from Connecticut and Rhode Island, and extension agents from the University of Rhode Island and Cornell University.

#### *EVENTS HELD AT LOCKWOOD FARM*

##### SOILS WORKSHOP HELD AT LOCKWOOD FARM

On September 10, 2009, an afternoon workshop was presented to learn more about the soil types at Lockwood Farm and how to build a soil monolith. The Natural Resource Conservation Service presented the demonstration. Station staff attended, as well as Yale faculty members, a CT DEP representative and students from Trinity College.

## 2009 CT GREEN EXPO

On September 12, 2009, the Station participated in the 2009 CT Green Expo at Lockwood Farm where for the first time the Tour des Farms bike tour visited. The bike tour was part of the CT Folk Music Festival and Green Expo being held in New Haven. Dr. Louis A. Magnarelli, Dr. Kirby Stafford, Dr. Kimberly Stoner, and Tess Foley hosted the cyclists, gave tours, had refreshments ready for them, and gave them a spot to rest while learning about the Station and Lockwood Farm.

The Green Expo also had an event held at Edgerton Park. Ira Kettle was there with a display of honey bees. Dr. Gale Ridge provided a children's workshop on insects, and Lisa Kaczinski presented talks and posters on her work in bluebird preservation.

### CONGRESSWOMAN ROSA DELAURO VISITS LOCKWOOD FARM AT THE JUNE ANNUAL PICNIC AND MEETING OF THE CONNECTICUT BEEKEEPERS ASSOCIATION

At the invitation of Association President Ted Jones, Congresswoman Rosa L. DeLauro met with members of the Connecticut Beekeepers Association and the Experiment Station during the club's annual picnic on June 12, 2010 at Lockwood Farm. She was greeted by Mr. Ted Jones and Dr. Kirby Stafford. They discussed honey bees, agriculture, concerns that face beekeepers, and progress on honey bee research. Other Station staff participating in the meeting were Dr. Brian Eitzer and Dr. Douglas Dingman.

### *THE STATION IN THE COMMUNITY*

#### BRINGING BACK THE EASTERN BLUEBIRD

In late summer of 2005, Lisa L. Kaczinski began a project at Lockwood Farm to bring back the Eastern Bluebird. With the help of her father, William Kaczinski, she installed bluebird nesting boxes at the farm. There are 20 boxes there now, up from only 2 before she started her project. William Kaczinski, built and helped her put the additional nesting boxes up, and repaired the two that were already established. In the spring of 2009 Lisa was given permission to start a second bluebird trail at Gouveia Vineyards in Wallingford, CT. She maintains the boxes at both the farm and the vineyards every weekend, evicting predators and checking on the progress of hatchlings and fledglings. By the end of the nesting season of 2009, there were 17 fledglings at Lockwood Farm and 10 fledglings at Gouveia Vineyards. Lisa's statistics are sent to Cornell University's News Watch program. She has given workshops to students on building their own nest boxes, and has given presentations on the two trails at the CT Folk Festival and Green Expo.



## GIRLS AND SCIENCE MENTORSHIP PROGRAM

On November 18, 2009, six middle school-aged girls from the New Haven Public School System began a “Girls and Science Mentorship Program.” Dr. Sharon Douglas developed the program with some help from Tess Foley as a part of the CAES Research Foundation. The goal is to keep girls interested in science and help them keep up with boys in their skills in math and science when they reach middle school. The students were matched one on one with a female scientist from the Station. The volunteer mentors were Dr. Sharon Douglas, Dr. Christina Robb, Dr. Anuja Bharadwaj, Dr. Claire Rutledge, Dr. Kimberly Stoner, and Dr. Gale Ridge. Other support was given by Vickie Bomba-Lewandoski and Tess Foley. The students were given an opportunity to have hands on experience in “real world” science challenges and were made aware of the wide variety of careers available in science. The program ran for 12 weeks and was funded by the Community Foundation of Greater New Haven, The Connecticut Agricultural Experiment Station, and the New Haven Public School System.

## TOBACCO RESEARCH MEETING; HELD AT SUFFIELD VO-AG CENTER

On February 17, 2010, over 135 people attended the Station’s annual Tobacco Research Meeting held at the Suffield High School auditorium. Dr. James LaMondia and Anne Willard (Interim Director of the Suffield High School Vo-Ag Program) welcomed the growers. Dr. James LaMondia spoke about research on management of tobacco pathogens and the progress of the breeding program for multiple pathogen resistance. Dr. Hugh Smith spoke about management of semi-persistent aphid-borne viruses, Thomas Rathier spoke on nutrient management in shade and broadleaf tobacco, and tobacco cultural considerations. Talks were also given by invited speakers in other areas of tobacco growing. Michelle Salvas, Jane Canepa-Morrison, and James Preste assisted with much of the behind the scenes work for the meeting.

## CONNECTICUT FLOWER AND GARDEN SHOW

On February 18-20, 2010, the Station had a booth at the Connecticut Flower and Garden show at the Connecticut Convention Center in Hartford. Rose Hiskes, Peter Trenchard, and Stephen Sandrey staffed the booth and gave out information on the Asian Longhorned Beetle and the Emerald Ash Borer. The exhibit won first place in the special exhibits division, and also won a judges special award. More than 2,000 visitors visited the booth and 1,000 Asian Longhorned Beetle green tote bags were given out.

## DISPLAY PRESENTATION AT PEABODY MUSEUM

On April 17, 2010, Drs. Kirby Stafford and Anuja Bharadwaj, and Michael Thomas presented a display on ticks, mosquitoes, and their associated diseases at the Yale

Peabody Museum of Natural History for their event “Backyard Bloodsuckers: Biodiversity Bites Back!”. This event was sponsored, in part, by a Science Education Partnership Award (SEPA) from HHH to the Peabody Museum, which CAES is a participant, to help people learn about West Nile virus and Lyme disease. There were 973 visitors including 512 children. Live mosquitoes and ticks could be examined under a microscope and information handouts were available. The mosquito and tick specimens were very popular with the children.

#### NEW HAVEN PUBLIC SCHOOL SCIENCE FAIR 2010

Station staff participated in the New Haven Public School Science Fair that took place from May 11-13, 2010 in the Commons of Yale University. Dr. Philip Armstrong and Dr. Joseph Pignatello served as science fair judges for the event. Dr. Douglas Dingman and Dr. Sharon Douglas were invited to attend the Awards Ceremony held in Sheffield-Sterling –Strathcona Hall at Yale on May 13. Dr. Douglas presented “The Connecticut Agricultural Experiment Station Award” to Rhianna Bennett, a Grade 6 student of Davis Street School for her science project “War of the Fertilizers.” The award (\$100) was given to the best project related to food, plants, insects, or the environment.

#### NORWALK-WILTON TREE FESTIVAL

On May 22, 2010, Station staff participated in the Norwalk-Wilton Tree Festival held in Cranbury Park in Norwalk. Dr. Sharon Douglas organized and coordinated the Station’s participation, which included two booths. It was the third year that the Station participated in the “by invitation only” event. Dr. Douglas, Dr. Douglas Dingman, Dr. Claire Rutledge, Katherine Dugas, Rose Hiskes, Mary Inman, and Ira Kettle answered questions, distributed coloring books, and distributed other literature to attendees. Displays of specimens of the Asian Longhorned Beetle and the Emerald Ash Borer attracted many visitors. Questions about honey bees and tree diseases were answered. More than 1275 adults and 900 children participated in the event.

#### *DONATIONS MADE TO THE COMMUNITY*

##### LOCKWOOD FARM

A total of 22,891 pounds of pak choi, tomatoes, summer squash peppers, eggplant cucumbers, peaches, apples, beans, sweet corn, pumpkins, watermelon, and winter squash grown at Lockwood Farm were donated to the Connecticut Foodbank in East Haven, Golden Hill Methodist Church in Orange, St. Ann’s Church in Hamden, and High Meadows in Hamden. Drs. Martin Gent, David Hill, Abigail Maynard, Kimberly Stoner, and Lockwood Farm Crew Richard Cecaelli, Rollin Hannan, and Michael McHill grew and distributed the produce.

## VALLEY LABORATORY

A total of 6,770 pounds of tomatoes, plums, cabbage, corn, squash, and watermelon grown at the Valley Laboratory were donated to Foodshare of Hartford. An additional 1,000 lbs. of pumpkins were donated to Northwest Park of Windsor for their fall Country Fair event. Drs. Abigail Maynard, David Hill, Todd Mervosh, and James LaMondia generated the fresh produce, and Jim Preste and Dr. LaMondia organized the distribution effort. The Valley Laboratory also provided Christmas trees to the Governor's mansion, and loaned irrigation equipment to the Connecticut Epilepsy Foundation in support of their Mud Volleyball Tournament Fundraiser. Mr. Preste coordinated the distribution of the irrigation equipment.

### *AWARDS AND RECOGNITION RECEIVED BY STATION STAFF DURING 2009-2010*

On June 20, 2009, Dr. Louis A. Magnarelli received the "Connecticut Friend of Floristry, 2009" Award from the Connecticut Florists Association in recognition of his outstanding contributions and service to the Connecticut florist industry.

On October 26, 2009, Dr. Kimberly A. Stoner received the New Haven County 2009 Outstanding Partner in Support of Natural Resource Conservation Award. It was presented to her by the Southwest Conservation District. It was given in recognition of her efforts to organize the first Community Supported Agricultural Program at Cheshire's Boulder Knoll Farm while serving the citizenry of the State as an Entomologist at the Station.

On November 4, 2009, Dr. Joseph J. Pignatello was named a 2009 Soil Science Society of America Fellow. The award was presented at the Soil Science Society of America Awards Program held in Pittsburgh, PA.

On December 1, 2009, Dr. Jason White was elected Executive Vice President of the International Phytotechnology Society at the 6<sup>th</sup> International Phytotechnologies Conference held in St. Louis, MO.

On December 8, 2009, Dr. Kimberly A. Stoner was presented with an Environmental Service Award by the NOFA Organic Land Care Program for 10 years of service as the founding Chair and active member of the Organic Land Care Committee of NOFA. The presentation was made at the Annual Update Course of the Organic Land Care Program in Sturbridge, MA.

On December 10, 2009, Dr. William Nail was appointed to the New England Vegetable and Fruit Conference Steering Committee

On January 5, 2010, Dr. Todd L. Mervosh was presented with the Outstanding Researcher Award given to him by the Northeastern Weed Science Society at their annual meeting in Cambridge, MA

On January 12, 2010, Dr. Brian Eitzer was elected to the Board of Directors of the American Association of Professional Apiculturists at the American Bee Research Conference in Orlando, FL

On January 20, 2010, Gregory Bugbee received the 2010 Outstanding Member Award from the Northeast Aquatic Plant Management Council at their 11<sup>th</sup> annual conference held in Saratoga Springs, NY

On February 17, 2010, Dr. Thomas Rathier was awarded a plaque in recognition of 33 years of outstanding service to tobacco growers from the Conn-Mass Tobacco Association.

On March 13, 2010, Dr. Thomas Rathier received the “Merit Award” for 2010 from the Connecticut Christmas Tree Growers’ Association at their annual meeting in Middletown, CT. There were more than 100 attendees.

On May 21, 2010, Gregory Bugbee received a Mentorship Award for assisting a student with a science project, at the Amity High School Science Night.

## *EXPERIMENT STATION ASSOCIATES*

### 2010 ANNUAL MEETING

The Annual meeting of the Experiment Station Associates was held on March 18, 2010 in Jones Auditorium at the Station. Dr. Gale Ridge presented the talk “The Return of the Bed Bugs” and Dr. Jason White presented the talk “Use of Plants to Remove Toxic Chemicals from the Soil.” The public was invited to the meeting.

### FIELD TRIP TO THE CONNECTICUT SCIENCE MUSEUM

On May 13, 2010, the Experiment Station Associates took a field trip to the Connecticut Science Museum. The Museum is a “hands on” learning experience. Members stopped for lunch in the Banquet Room at the Museum, and Dr. Louis A. Magnarelli talked to them about new happenings around the Station. Dr. Claire Rutledge also spoke about her work with the Emerald ash borer and her novel method of surveying for it.

***SCIENTIFIC OFFICERSHIPS AND MEMBERSHIPS ON STATE,  
NATIONAL, OR REGIONAL COMMITTEES***

**DEPARTMENT OF ANALYTICAL CHEMISTRY**

**JASON C. WHITE**

- Vice President, International Phytotechnology Society
- Managing Editor, International Journal of Phytoremediation
- Editorial Board, Environmental Toxicology and Chemistry
- Editorial Board, Environmental Pollution
- Member, Science Advisory Board for Annual International Conference on soils, Sediments, Water, and Energy held in October of each year at the University of Massachusetts, Amherst

**BRIAN D. EITZER**

- Member, Conservation Commission, Town of Bethany
- Member, Board of Directors, American Association of Professional Apiculturists

**WALTER J. KROL**

- Secretary, New Haven Section of the American Chemical Society
- Judge, New Haven Section of the American Chemical Society at the New Haven Public Schools Science Fair, May, 2010
- Chair, New Haven Section of ACS National Chemistry Week Program

**CHRISTINA S. ROBB**

- Chair, “Food Analysis” session at Eastern Analytical Symposium in November each year

**DEPARTMENT OF BIOCHEMISTRY AND GENETICS**

**NEIL MCHALE**

- American Society of Plant Biologists

**RICHARD PETERSON**

- Vice President and voting delegate, Quinnipiac Chapter Sigma Xi
- American Society of Plant Biologists

**NEIL SCHULTES**

- Steering Committee at Yale University for Bioethics section of the Institute for Social and Policy Studies
- Masters Research Committee for a student advised by Dr. George Mourad at the University of Indiana/Purdue

- Linnaean Society of London Fellow
- Sigma Xi Programs Committee

#### DOUG DINGMAN

- Sigma Xi programs committee (Quinnipiac Chapter)

### DEPARTMENT OF ENTOMOLOGY

#### LOUIS A. MAGNARELLI

- Research Affiliate, Epidemiology and Public Health, Yale University School of Medicine
- Administrative Advisor, Multistate Research Project NE-1040 on nematodes
- Member, Legislative Invasive Plants Council
- Councilor, Connecticut Academy of Science and Engineering

#### KIRBY C. STAFFORD III

- Member, Multi-State Activities Committee, Northeastern Region Association of Experiment Station Directors
- Administrative Advisor, Multistate Research Project NE-1931 on potato breeding
- Administrative Advisor, Multistate Research Project NE-1043 on biology disease vectors
- Member, Connecticut Coalition Against Bed Bugs
- Member, U.S. EPA Network for Lyme Disease Prevention

#### TIA M. BLEVINS

- Treasurer, Horticultural Inspection Society, Eastern Chapter, 2009 – 2012

#### CHRIS MAIER

- Curatorial Affiliate in Entomology, Peabody Museum of Natural History, Yale University
- Member, Advisory Committee, Cooperative Agricultural Pest Survey, USDA
- Member, Connecticut Endangered Species Committee, Invertebrate Subcommittee
- Member, Program Committee, Connecticut Pomological Society
- Research Associate, Division of Plant Industry, Florida Department of Agriculture and Consumer Services
- Research Associate, Mohonk Preserve, New Paltz, New York

#### GALE E. RIDGE

- Chair, Connecticut Coalition Against Bed Bugs
- Member Rapid Response Research Activity Working Group for Bed Bugs (Series 500)

#### VICTORIA SMITH

- Northeast Area Association of State Foresters Firewood Working Group; member

- USDA-APHIS-CPHST National Plant Pathogen Laboratory Accreditation Program (NPPLAP); member
- USDA National Cooperative Agricultural Pest Survey Committee; Eastern Plant Board Representative
- National Plant Board Board of Directors; member
- National Plant Board/PPQ *Phytophthora ramorum* Protocols Working Group; Co-chair and member
- National Plant Board National Meeting Agenda Committee; member
- Eastern Plant Board; Member and Vice-President
- USDA-APHIS-PPQ Early Detection-Rapid Response Committee; member
- New England Wildflower Society, Connecticut Task Force; member

#### KIMBERLY STONER

- Board of Directors, Northeast Organic Farming Association of Connecticut
- Member of the Organic Land Care Committee, a joint project of the Connecticut and Massachusetts chapters of the Northeast Organic Farming Association
- Member, Multi-State Research Project NC1173 – Sustainable Solutions to Problems Affecting Bee Health
- Member Association of Professional Apiculturalists
- President, Friends of Boulder Knoll

## DEPARTMENT OF ENVIRONMENTAL STUDIES

#### THEODORE G. ANDREADIS

- Lecturer in Epidemiology and Public Health, Yale University School of Medicine
- Adjunct Professor, Department of Pathobiology, University of Connecticut
- Member, Multi-State Research Project NE-1043: Biology, Ecology & Management of Emerging Disease Vectors
- Member, Multi-State Research Project S-1024: Discovery of Entomopathogens and Their Integration and Safety in Pest Management Systems”
- Member, State of Connecticut Mosquito Management Program
- Member, Peabody Fellows Biodiversity and Human Health Program, Yale University

#### GREGORY J. BUGBEE

- Director, Clear Lake Improvement Association
- Editor, *Journal of Aquatic Plant Management*
- Member, Northeast Soil Testing Committee, NEC-67
- Member, Government Affairs Committee, New England Aquatic Plant Management Society

#### JOSEPH J. PIGNATELLO

- Adjunct Professor in Environmental Engineering, Department of Chemical Engineering, Yale University
- Fellow, Soil Science Society of America

- Associate Editor, *Environmental Engineering Science*
- Associate Editor, *Journal of Environmental Quality*
- Secretary, W-2082 Multi-State Research Project: Evaluating the Physical and Biological Availability of Pesticides and Contaminants in Agricultural Ecosystems
- Past Chair, Division S-11 (Soils and Environmental Quality) Soil Science Society of America

#### MICHAEL THOMAS

- Member, Endangered Species Advisory Committee for Insects and Arachnids, Connecticut Department of Environmental Protection
- Member, Technical Working Group, Connecticut State Grassland Habitat Conservation Initiative, Connecticut Department of Environmental Protection

#### CHARLES R. VOSSBRINCK

- Visiting Assistant Professor, Department of Pathology, Albert Einstein College of Medicine, Yeshiva University, Bronx, New York
- Member, Multi-State Project S-1024: Discovery of Entomopathogens and Their Integration and Safety in Pest Management Systems

## DEPARTMENT OF FORESTRY AND HORTICULTURE

#### JOSEPH P. BARSKY

- Executive Committee, New England Society of American Foresters

#### MARTIN .P.N. GENT

- Official representative, NE1035 Regional Research Committee.
- Steering Committee, New England Vegetable & Berry Growers Conference.
- Associate Editor, *Journal of Plant Nutrition*.

#### ABIGAIL A. MAYNARD

- Ex-Officio Member, Connecticut Council on Soil and Water Conservation
- Member, State Technical Committee
- Editorial Board, *Compost Science & Utilization*
- Member, Solid Waste Advisory Committee of DEP

#### WILLIAM R. NAIL

- Secretary, American Society of Enology and Viticulture- Eastern Section
- Secretary, NE-1020: Multi-state Evaluation of Winegrape Cultivars and Clones
- National Risk Management (Sustainable) Guidelines working group, National Viticulture Extension Leadership
- Statistics and Data Collection, Protocol Subcommittees for NE-1020: Multi-state Evaluation of Winegrape Cultivars and Clones
- CAES representative, Connecticut Farm Wine Development Council
- Steering Committee, New England Vegetable & Berry Growers Conference.



JEFFREY S. WARD

- Secretary, Connecticut Tree Protection Examination Board
- Executive Board Member, Connecticut Urban Forest Council
- Research Chair, Connecticut Forestland Council
- Advisor, Fairfield County Municipal Deer Management Alliance
- Ex-Officio Member, Goodwin Scholarship Committee

SCOTT C. WILLIAMS

- Executive Board Member, Connecticut Urban Forest Council
- Advisor, Fairfield County Municipal Deer Management Alliance
- Connecticut Representative, Deer-Vehicle Crash Information and Research Center
- Commissioner, Town of Guilford Inland Wetlands Commission
- Commissioner, Town of Guilford Land Acquisition Commission
- Commissioner, Town of Guilford East River Preserve Management Plan Steering Committee

DEPARTMENT OF PLANT PATHOLOGY AND ECOLOGY

SANDRA L. ANAGNOSTAKIS

- Treasurer, Northern Nut Growers Association
- Park Naturalist and Board Member, Sleeping Giant Park Association
- International Registrar for Cultivars of *Castanea*, International Society for Horticultural Science

SHARON M. DOUGLAS

- Member, APS Foundation Board, American Phytopathological Society
- Member, Local Arrangements Committee (2012), Northeastern Division of American Phytopathological Society
- Member, USDA-APHIS-PPQ Cooperative Agricultural Pest Survey Committee (CAPS) for Connecticut
- Member, Institutional Biosafety Committee, The Connecticut Agricultural Experiment Station
- Member, Board of Directors, Connecticut Tree Protective Association
- Chair, Education Committee, Connecticut Tree Protective Association

WADE H. ELMER

- Member, Membership Committee (Ad hoc), American Phytopathological Society
- Councilor, Northeastern Division of American Phytopathological Society
- Chair, Constitution Committee (Ad hoc), Northeastern Division of American Phytopathological Society
- Chair, Site Selection Committee, Northeastern Division of American Phytopathological Society
- Coordinator, Widely Prevalent Fungi List Coordinator, New England

- Member, Program Committee, Connecticut Greenhouse Grower's Association
- Member, Northeast Research, Extension and Academic Program Committee
- Member, State Advisory Council for Agriculture Science and Technology

#### ROBERT E. MARRA

- Chair, Local Arrangements Committee (2012), Northeastern Division of American Phytopathological Society
- Chair, Graduate Student Awards Committee, Northeastern Division of American Phytopathological Society

### VALLEY LABORATORY

#### JOHN F. AHRENS

- Advisor, Connecticut Christmas Tree Growers Association, Chairman of the Fire Safety and Tree Improvement Committees.
- Co-Chairman of the Program for the 50<sup>th</sup> Anniversary meeting of the Connecticut Christmas Tree Growers Association
- Member, National IR-4 Committee (Interregional Committee No. 4) that prioritizes pesticide registration needs for ornamental crops.

#### CAROLE CHEAH

- Fellow of the Cambridge Philosophical Society, UK
- Member of International Organization of Biological Control

#### RICHARD S. COWLES

- Japanese Beetle Harmonization Agreement Treatment Committee
- Treasurer, Connecticut Entomological Society

#### JAMES A. LAMONDIA

- President, Northeast Division of American Phytopathological Society
- Ex-Officio Member, Connecticut Tree Protection Examining Board.
- Worker Protection Standards Trainer for the Valley Laboratory.
- North American Blue Mold Forecast Center State Coordinator
- Vice-President Society of Nematologists Executive Board Member
- Society of Nematologists Executive Board Member
- Society of Nematologists Extension Committee

#### DEWEI LI

- Board Member of the EMPAT Task Force of American Industry Hygiene Association (AIHA)

#### TODD L. MERVOSH

- Connecticut Invasive Plant Working Group – Member of Steering Committee & Symposium Planning Committee, Chair of Stewardship Committee.

- Weed Science Society of America – Member of Weed Alert Committee and Herbicides for Minor Uses Committee
- Northeastern Weed Science Society – Nominating Committee

THOMAS M. RATHIER

- Advisory Board for Community Gardens in Hartford, Knox Parks Foundation
- Advisory Board, Agri-Science, Bloomfield High School
- Member, Cooperative Agricultural Pest Survey Committee
- Science Liaison, Connecticut Christmas Tree Growers Association
- Member, Concentrated Animal Feeding Operation Committee, EPA
- Advisor, USDA Natural Resource Conservation Service.
- Member, Education Subcommittee, Connecticut Tree Protective Association

## LECTURES, SEMINARS AND INTERVIEWS

During the year, staff members present formal lectures and seminars to organized groups outside the Station. They also describe their research to organized groups visiting the Station and occasionally report on their research to elected officials. At other times, newspaper, radio and TV reporters interview our staff. These occasions are listed below.

### AHRENS, JOHN F.

- Participated in a Board of Director's meeting of the Connecticut Christmas Tree Growers Association (as an advisor) in East Hartford *July 8, 2009*
- Spoke about vegetation control in the summer with selective post-emergence treatments and shearing of pine versus true firs at a twilight meeting of the Connecticut Christmas Tree Growers Association held at the Valley Laboratory (50 attendees) *July 9*
- Participated in a meeting of the Board of Directors of the Connecticut Christmas Tree Growers Association as the official advisor to the group *September 8*
- Presented the talk "Postemergence control of weeds in actively growing conifers" at the Ninth International Christmas Tree Research and Extension Conference in Puyalup, WA (50 attendees) *September 14-18*
- Participated in an IR-4 ornamental workshop to set future research priorities necessary to obtain federal herbicide registrations of value to ornamental nurseries, landscapers, and the Christmas tree industry *October 7-8*
- Presented a paper coauthored by Dr. Todd Mervosh entitled "Postemergence weed control in actively growing conifers" at the 64<sup>th</sup> annual meeting of the Northeastern Weed Science Society held in Cambridge, MA January 5-7, 2010
- As Co-Program Chairman of the 50<sup>th</sup> Anniversary of the Connecticut Christmas Tree Association, met with other members of the Association to discuss plans for the meeting on August 6-7 at the Jones Family Farm in Shelton, CT *February 3*
- Spoke on Weed Control Update at the Pennsylvania Christmas Tree Short Course in College Park, PA (125 attendees) *February 11*
- As Chair, met with the Connecticut Christmas Tree Growers Association Christmas Tree Improvement Committee at the Valley Laboratory to discuss plans for the year *March 2*
- Spoke about the new Christmas Tree Improvement Committee at the Connecticut Christmas Tree Growers annual meeting (80 attendees) *March 13*
- Spoke on weed control at the twilight meeting of the Connecticut Christmas Tree Growers Association at Peaceful Hill Tree Farm in East Hampton, CT (30 attendees) *June 9*

### ANAGNOSTAKIS, SANDRA L.

- Spoke to a visiting group of teachers and showed them chestnut trees and blight and biocontrol at Lockwood Farm (20 adult attendees) *July 7, 2009*

- Participated in a Board meeting (as Treasurer) and reported on finances; gave two papers entitled “Where are the Ozark chinquapins?” and “Planting chestnut trees in the forest”; and discussed canker diseases of butternuts and their hybrids at a tour of the Ostry plantings at the Annual Meeting of the Northern Nut Growers Association in West Lafayette, Indiana (140 adult attendees) *July 18-22*
- Participated in a workshop on “Agriculture and Climate Change: Risk Assessment” at the University of Connecticut in Storrs (65 attendees) *August 24*
- Was interviewed about chestnuts at Lockwood Farm by Stephanie Valickis for the TV show “Crossroads Magazine” *September 22*
- Reported on Experiment Station chestnut research at the annual meeting of the Multistate Research Project NE-1033, “Biological improvement of chestnut through technologies that address management of the species, its pathogens and pests” in Ocean Grove, NJ *September 24-27*
- Exhibited a poster on chestnut research at the first Plant Science Day at Griswold Research Farm (14 adult and 4 youth attendees) *October 3*
- Met with members of the Fairfield Garden Club who wanted to see hybrid chestnut trees and discuss a chestnut project for the 100<sup>th</sup> anniversary of the founding of Garden Clubs of America (4 attendees) *October 6*
- Gave a talk on “Planting chestnuts in the forest” at the New York Botanical Garden in New York, NY (25 attendees) *October 24*
- Gave a presentation to and met with the Board of Directors of the Greentree Foundation and their staff about the chestnut project on their property, and presented a proposal for a chestnut arboretum with seven species to be planted along a walking trail in Manhasset, LI (15 attendees) *November 20*
- Gave a talk on “Bringing back the timber chestnuts” at the Fairfield Garden Club in Fairfield (80 attendees) *January 26, 2010*
- Gave a talk on chestnuts, butternuts, and elms at the Forest Health Workshop held in Jones Auditorium (45 attendees) *February 18*
- Spoke on chestnuts to Dr. Charles Reddington’s class at Springfield College (20 attendees) *March 1*
- Was interviewed about her research on butternuts by a Vermont National Public Radio reporter in the New Haven NPR studio *May 4*
- Gave a lecture on “Restoration of timber chestnut trees” (45 adult attendees) and facilitated planting some of her hybrid chestnut trees on the Princeton Battleground in Princeton, NJ *May 6*
- Gave a talk on “Elms for the Elm City” to the New Haven Garden Club in Jones Auditorium (60 attendees) *May 10*
- Gave a talk titled “Restoration of timber chestnut trees” in Petersham, MA (80 adult and 1 youth attendees) *May 27*
- Helped identify plants and fungi at the BioBlitz at Sleeping Giant State Park in Hamden *June 13*
- Gave a paper on “Connecticut Chestnuts” at the Annual Meeting of the Chestnut Growers of America held in Sherwood, Oregon (30 attendees) *June 19*

ANDREADIS, THEODORE G.

- Was interviewed about the impact of the June rains on mosquito populations around the state and projected arbovirus activity this summer by Amy Wrubel of NBC 30 *July 1, 2009*
- Was interviewed about the impact of the June rains on mosquito populations around the state and projected arbovirus activity this summer by WFSB TV3 *July 2*
- Was interviewed about the impact of the June rains on mosquito populations around the state and projected arbovirus activity this summer by Jodi Latino of WTNH TV8 *July 7*
- Was interviewed about the impact of the June rains on mosquito populations around the state and projected arbovirus activity this summer by Marc Sims of CT Public Radio *July 7*
- Was interviewed about the impact of the June rains on mosquito populations around the state and projected arbovirus activity this summer by Edward Stannard of the New Haven Register *July 7*
- Was interviewed about the impact of the June rains on mosquito populations around the state and projected arbovirus activity this summer by WICC Radio-Talk of the Town with Paul Pucelli *July 8*
- Was interviewed about the impact of the June and July rains on mosquito populations around the state and projected arbovirus activity this summer by Carrie MacMillan of the Waterbury Republican *July 13*
- Was interviewed about the impact of the June and July rains on mosquito populations around the state and projected arbovirus activity this summer by Doug Green of NBC 30TV *July 14*
- Presented a lecture entitled “West Nile virus: a ten-year perspective on an emerging mosquito-borne disease in the western hemisphere” to a group of secondary school teachers from Connecticut as part of the “Peabody Fellows Program on Biodiversity and Vector-Borne Diseases (15 attendees) *July 14*
- Was interviewed about the impact of the June and July rains on mosquito populations around the state, arbovirus activity this summer, and the mosquito trapping and testing program by Al Terzi on the program Three on Your Side at WFSBTV3 *July 22*
- Was interviewed about the impact of the June and July rains on mosquito populations around the state and projected arbovirus activity this summer by Judy Benson of The New London Day *July 30*
- Was interviewed about the impact of the June and July rains on mosquito populations around the state and projected arbovirus activity this summer by Dan Kane of WFSB TV3 *July 31*
- Was interviewed about the detection of West Nile virus in mosquitoes collected in Greenwich by Lisa Chamoff of the Greenwich Times *August 4*
- Was interviewed about the impact of the excessive rainfall in June and July on mosquito populations and West Nile virus activity in Connecticut by Steve Kotchko of Connecticut Public Radio *August 4*

- Was interviewed about the impact of the excessive rainfall in June and July on mosquito populations and West Nile virus activity in Connecticut by Metro News *August 4*
- Was interviewed about the impact of the excessive rainfall in June and July on mosquito populations, West Nile virus activity in Connecticut by Rinker Buck of the Meriden Record Journal *August 4*
- Was interviewed about the impact of the excessive rainfall in June and July on mosquito populations and West Nile virus activity in Connecticut by Kara Buckley of the New York Times *August 6*
- Was interviewed about the detection of West Nile virus in mosquitoes collected in Monroe by Marla Hoffman of the Monroe Courier *August 31*
- Participated in a state-wide conference call with Governor M. Jodi Rell and officials from the Departments of Health, Environmental Protection, Agriculture, Emergency Management and Homeland Security held at the State Armory in Hartford to update local municipal leaders and health districts on the current status of Eastern Equine Encephalitis activity in the state *September 17*
- Was interviewed about the current status of West Nile virus activity in the state this year by Bob Miller, Danbury News Times *September 18*
- Was interviewed about Eastern Equine Encephalitis activity in eastern Connecticut by Emily Grove of the Norwich Time *September 18*
- Was interviewed about the detection of Eastern Equine Encephalitis in Darien, Shelton, South Windsor, and Voluntown by Fran Schneido of WCBS Radio, New York *September 22*
- Was interviewed about Eastern Equine Encephalitis and West Nile virus activity in Connecticut and the northeastern US by Steve Kotchko of Connecticut Public Radio *September 22*
- Was interviewed about Eastern Equine Encephalitis and West Nile virus activity in Connecticut and the northeastern US by Susan Wolf of the Redding Pilot *September 24*
- Was interviewed about Eastern Equine Encephalitis and West Nile virus activity in Connecticut and the northeastern US by Tess Foley, WMNR Radio *September 25*
- Gave a tour of the mosquito and biosafety level 3 laboratories to a scientist from the Connecticut Science Center, and discussed the Station's participation in a exhibit *October 10*
- Presented an Epidemiology of Microbial Diseases seminar entitled "West Nile virus: a ten-year perspective on an emerging mosquito-borne disease in the western hemisphere" at the Yale School of Public Health (30 attendees) *October 22*
- Presented a lecture in a course on Ecology and Epidemiology of Vector-borne and Zoonotic Diseases entitled: "Connecticut's Response to West Nile Virus: Surveillance and Control" to a class of graduate students at Yale University (20 attendees) *October 27*
- Gave a lecture about mosquitoes and West Nile virus to students from Park City Prep Charter School in Bridgeport and St. Ann School in Bridgeport, and provided a tour

of the Biosafety Level 3 and Electron Microscope laboratories as part of the NIH/NSF sponsored Peabody Fellows Program, Yale University (42 students)  
*November 5*

- Gave a lecture about mosquitoes and West Nile virus to students from Trinity College who visited the Station *November 17*
- Presented a talk entitled “Evidence for Competitive Reduction of Native Mosquitoes in the Northeastern United States by the Invasive Exotic Species *Ochlerotatus j. japonicus* (Diptera: Culicidae) at the 58<sup>th</sup> annual Meeting of the American Society of Tropical Medicine and Hygiene in Washington, DC (over 1,000 attendees)  
*November 18-22*
- Presented an invited talk entitled “Evidence for Competitive Reduction of Native Mosquitoes in the Northeastern United States by the Invasive Exotic Species, *Ochlerotatus japonicus japonicus* (Diptera: Culicidae)” at the 55<sup>th</sup> Annual Meeting, Northeastern Mosquito Control Association, (100 attendees) Sturbridge, MA  
*December 3*
- Presented a summary of current research activities and accomplishments on mosquitoes and mosquito-borne diseases at the annual meeting of Multi-state project NE-1043, Biology, Ecology, & Management of Emerging Disease Vectors, held at Rutgers University, New Brunswick, NJ (15 attendees) *February 25, 2010*
- Presented an invited talk entitled “Evidence for Competitive Reduction of Native Mosquitoes in the Northeastern United States by the Invasive Exotic Species, *Ochlerotatus japonicas japonicas* (Diptera: Culicidae) at the annual meeting of the New Jersey Mosquito Control Association, held in Atlantic City, NJ (150 attendees)  
*March 11*
- Was interviewed about the impact of the record rainfall and high temperatures in March on mosquito populations in the state and anticipated Eastern Equine Encephalitis and West Nile virus activity by Judy Benson and Edward Stannard of the New Haven Register *April 8*
- Was interviewed about the impact of the record rainfall and high temperatures in March on mosquito populations in the state and anticipated Eastern Equine Encephalitis and West Nile virus activity by Diana Perez of NBC-30 TV *April 9*
- Was interviewed about the impact of the record rainfall and high temperatures in March on mosquito populations in the state and anticipated Eastern Equine Encephalitis and West Nile virus activity by Jill Konopka of WFSB-TV3 *April 9*
- Was interviewed about the impact of the record rainfall and high temperatures in March on mosquito populations in the state and anticipated Eastern Equine Encephalitis and West Nile virus activity by Marc Sims of CT Radio Network and WTIC Radio *April 12*
- Was interviewed about the impact of the record rainfall and high temperatures in March on mosquito populations in the state and anticipated Eastern Equine Encephalitis and West Nile virus activity by Jocelyn Maminta of WTNH-TV *April 13*
- Was interviewed about the impact of the record rainfall and high temperatures in March on mosquito populations in the state and anticipated Eastern Equine



Encephalitis and West Nile virus activity by Sam Gingerella of WTIC Radio *April 21*

- Was interviewed about the impact of the record rainfall and high temperatures in March on mosquito populations in the state and anticipated Eastern Equine Encephalitis and West Nile virus activity by William Weir of the Hartford Courant *April 28*
- Lectured on mosquitoes and West Nile virus to a group of visiting students from the Sound School in New Haven *May 10*
- Participated in the final dissertation defense of Charles McGee, a Ph.D. candidate at the University of Texas School of Biomedical Sciences at Galveston, TX *May 24*
- Presented an overview of the Station mosquito and arbovirus research and surveillance programs to State Representative John Hethrington of New Cannan who was visiting the Station *June 2*
- Was interviewed about the start of the State Mosquito Trapping and Testing Program for West Nile and Eastern Equine Encephalitis viruses by Marc Sims of Connecticut Radio Network *June 3*
- Was interviewed for research on a paper to be published in the Proceedings of the National Academy of Sciences by Dr. Janelle Weaver, a free-lance science writer for Nature *June 4*
- Was interviewed about the State Mosquito Trapping and Testing Program and the outlook for 2010 by WNLK, Norwalk *June 7*
- Was interviewed about the State Mosquito Trapping and Testing Program by Jeannette Ross of the Wilton Bulletin *June 8*
- Was interviewed about West Nile and Eastern Equine Encephalitis viruses by Harlan Levy of the Journal Inquirer *June 22*
- Was interviewed about the first isolation of West Nile virus in mosquitoes for the season in Stamford by Jan Schneido of CBS Radio, New York *June 23*
- Was interviewed about the first isolation of West Nile virus in mosquitoes for the season in Stamford by Sam Singer of the Associated Press *June 23*
- Was interviewed about the first isolation of West Nile virus in mosquitoes for the season in Stamford WTIC Radio, New York *June 23*
- Was interviewed about mosquitoes, West Nile and Eastern Equine Encephalitis viruses and the state mosquito surveillance program by Steve Kotchko of Connecticut Public Radio New York *June 24*
- Was interviewed about the first isolation of West Nile virus in mosquitoes for the season in Stamford by Jocelyn Maminta of WTNH TV8 *June 24*

#### ARMSTRONG, PHILIP M.

- Gave a poster presentation entitled “Infection Patterns and Genetic Diversity of Cache Valley Virus Among Mosquitoes Collected in Connecticut at the 58<sup>th</sup> Annual Meeting of the American Society of Tropical Medicine and Hygiene in Washington, DC (1,000 attendees) *November 18-22, 2009*

- Served as a judge at the New Haven Science Fair held at Yale University *May 11-12, 2010*

#### ARSENAULT, TERRI

- Participated in the annual “FERN Chemistry Cooperative Agreement Program Technical Meeting”, New Haven, CT August 11-13, 2009
- Was the invited instructor at a Food Emergency Response Network (FERN) course entitled “Identification of Toxins by Gas Chromatography – Mass Spectrometry (GC-MS)” in Pearl City, Hawaii *February 9-11, 2010*
- Spoke about pesticide residues in soil, water, and other environmental samples to 7<sup>th</sup> and 8<sup>th</sup> grade students from Hamden Hall Day School (20 students) *April 19*
- Was the invited instructor at a Food Emergency Response Network (FERN) course entitled “Identification of Toxins by Gas Chromatography – Mass Spectrometry (GC-MS)” in New Haven, CT *June 8-10*
- Along with Dr. Brian Eitzer, Dr. Walter Krol, and Dr. Jason White, participated in a conference call with the FDA Forensic Chemistry Center to discuss the development of extraction and analysis methods for chemical contamination of seafood due to the Deepwater Horizon oil spill. The Minnesota Department of Agriculture was also on the call *June 16*

#### AYLOR, DONALD E.

- Gave a talk entitled “Sampling and quantifying plant disease spores in the atmosphere” to a group at Virginia Tech University in Blacksburg, VA (84 adult and 16 youth attendees) *August 11, 2009*
- Participated in judging the finalists of the 7<sup>th</sup> Grade Physical Science Division at the Connecticut Science Fair at Quinnipiac University in Hamden (11 student attendees) *March 11, 2010*
- Participated in the final examination of Brian J. Viner during the defense of his Ph.D. thesis titled “Numerical modeling of meteorological and topographical effects on pollen shed, dispersion, and viability” at Iowa State University in Ames, IA *April 28*

#### BALOGH, BOTOND

- Gave a talk on “Diseases of vegetables” at the Stonington Grange in North Stonington (15 adult, one youth attendees) *July 17, 2009*
- Talked about his research and late blight of tomato on the Len and Lisa “Garden Talk” radio program on WTIC *August 1*
- Gave a talk entitled “Common diseases of Christmas trees” at the Connecticut Christmas Tree Growers Association meeting held at Holiday Farm in New Hartford *August 10*

#### BARSKY, JOSEPH P.

- Spoke on methods of controlling invasive species for Sacred Heart University students at Veteran’s Park cleanup in Bridgeport (60 attendees) *September 3*

- Staffed the Station's booth at the Brooksville Fall Festival in Hamden (300 attendees) *October 17*
- Spoke on "Why are trees important?" to kindergarten students from Bear Path School in Hamden (59 students, 20 adults) *October 23*
- Administered a tree identification exam to students participating in the Connecticut FFA Fall Forestry Career Development Event at the University of Connecticut, Storrs (30 students from 19 Vo-Ag schools) *November 6*
- Served as host of a Forest Forum Roundtable at the 5<sup>th</sup> Annual Forest Conservation and Research Forum at the University of Connecticut, Storrs *November 24*
- Gave a report of forest research at the New England Society of American Foresters Executive Committee Meeting in Concord, NH *December 17*
- Spoke on "Career Opportunities in Natural Resources and Environmental Sciences" to Wilbur Cross High School upper-class students as part of the New Haven Public Schools Career Day Event at Southern Connecticut State University (12 student attendees) *March 25*
- Spoke on "Safety issues when using a flame weeding device" at the Flame-Weeding for Invasive Shrub Control Workshop sponsored by the USDA-NRCS in Vernon (42 attendees) *March 30*
- Hosted a student from Manchester High School on a job shadowing event *April 15*
- Spoke on "Overview of Forestry and Wildlife Research" to visiting students from the New Haven Sound School (15 attendees) *May 10*
- Gave a presentation "Safe usage of flame weeding equipment" at a Flame Weeding Workshop at the Griswold Research Farm (43 attendees) *May 26*
- Gave six talks on "How trees grow" at the Southington School Nature Day in Southington (120 student and 20 adult attendees) *June 3*
- Provided a field workshop on inventorying the forest understory for CLEAR students in New Milford (16 student and 2 teacher attendees) *June 24*

#### BERGER, WILLIAM A.

- Briefed the Connecticut Academy of Science and Engineering Peer Review Committee on the results of the CAES Department of Analytical Chemistry research and final report on tire crumb rubber *April 28, 2010*

#### BHARADWAJ, ANUJA

- Participated in a conference call with the CDC about our tick control research *November 12, 2009*
- Presented a talk on natural and biological control of *Ixodes scapularis* while attending the Annual Meeting of the Entomological Society of America in Indianapolis, IN (50 attendees) *December 13*

#### BLEVINS, TIA

- Presided as Treasurer at the 36<sup>th</sup> Annual meeting of the Horticultural Inspection Society, Eastern Chapter, in Albany, NY. She presented the financial report of the chapter at their business meeting and served on the Resolutions and Finance Committees *April 12-15, 2010*

#### BRAVO, JOAN

- Presented a workshop on “Garden Planning and Implementation at the Connecticut Family, Career, and Community Leaders of America State Conference at Manchester Community College (30 student attendees) *March 16, 2010*
- Assisted in the second “Bedbug Conference” held at Southern Connecticut State University (250 attendees), and developed a database to access and manage information dissemination *March 18*
- Assisted with the “Conservation Arboriculture” Forest Conference at Sessions Woods (50 attendees) *April 12*

#### BUGBEE, GREGORY J.

- Spoke on the 2008 CAES Invasive Aquatic Plant Program Aquatic Plant Survey of Coventry Lake at a town meeting held at the Coventry Town Hall (25 attendees) *July 8, 2009*
- Spoke on “Control of Variable Milfoil in Bashan Lake” at the annual meeting of the Bashan Lake Association in East Haddam (65 attendees) *July 18*
- Was interviewed about the aquatic plant problems in North Farms Reservoir by Samai Hernandez of the Record Journal *September 4*
- Was interviewed about invasive aquatic plant problems in Connecticut by Nancy Cohen of National Public Radio *September 8*
- Was interviewed about aquatic plant problems in North Farms Reservoir by Samai Hernandez of the Record Journal *September 16*
- Spoke on “Controlling Nuisance vegetation in Shallow Ponds to the Young’s Pond Commission in Branford (10 attendees) *September 22*
- Was interviewed about invasive aquatic plant problems in Connecticut by Bob Wilson of TV-8 News *September 30*
- Spoke on “Connecticut’s Invasive Aquatic Plant Program: A Model for Other States” at the North American Lake Management Society Conference in Hartford (100 attendees) *October 29*
- Presented findings of the 2009 CAES Candlewood Lake Invasive Aquatic Plant Survey at a meeting of the Candlewood Lake Technical Committee in New Milford (10 attendees) *November 3*
- Was interviewed about using leaves in the home garden by John Burgeson of the Connecticut Post *November 5*
- Spoke about “Managing Nuisance Aquatic Vegetation” to the members of the West Lake Association at the Guilford Police Station (30 attendees) *November 19*

- Presented a talk entitled “Invasive Aquatic Plants in Candlewood Lake” as part of “Science Night” at Western Connecticut University (75 attendees) *December 10*
- Spoke to the Fall Mountain Lake Association in Terryville on Managing Nuisance Aquatic Vegetation (30 attendees) *January 9, 2010*
- Spoke at the annual meeting of the Spring Lake Condominium Association in Southington on Managing Nuisance Aquatic Vegetation (50 attendees) *January 12*
- With Martha Balfour, ran the Multistate Aquatic Supervisory License Recertification Program at the 11<sup>th</sup> annual Northeast Aquatic Plant Management Conference in Saratoga Springs, NY (150 attendees) *January 18-20*
- Presented a seminar entitled, Soil and Fertilizer as part of the Bartlett Arboretum arborists training program in Stamford (approx. 20 attendees) *February 4*
- Was interviewed for a story on “Invasive Aquatic Plants” by Greg Hladky of the New Haven Advocate *February 8*
- Gave two Invasive Aquatic Plant workshops with Martha Balfour as part of the 2010 Connecticut Envirothon (75 attendees) *February 13*
- With Dr. Martha Balfour, gave an “Invasive Aquatic Plant Workshop” to town and lake association officials at the Ellington town hall (30 attendees) *March 2*
- With Dr. Martha Balfour, presented the results of the 2010 Invasive Aquatic Plant Surveys of Lakes Candlewood, Lillinonah, and Zoar to The FirstLight and Power Resources Inc. technical committee in New Fairfield *March 3*
- Spoke on “Container Gardening Indoors and Out” to the Connecticut Audubon Society in Fairfield (40 attendees) *March 17*
- Spoke on “Connecticut’s Invasive Aquatic Plant Problem: Searching for Solutions” at the annual meeting of the Northeast Association of Environmental Biologists in Newport, RI (30 attendees) *March 18*
- With Michael Cavadini, gave two Environmental Chemistry workshops as part of the 2010 Connecticut High School Science Olympiad at the University of Connecticut in Storrs (30 attendees) *March 27*
- Spoke on “Composting” as part of a gardening program at the Colchester Public Library (20 attendees) *April 6*
- With Dr. Martha Balfour presented a seminar on “Connecticut’s Invasive Aquatic Plant Problem” to a graduate level environmental science class at Yale University (20 attendees) *April 8*
- Presented a talk “Container Gardening Indoors and Out” as part of a gardening program at the Thomaston Public Library (20 attendees) *April 10*
- Presented a talk on “Improving Soil in the Home Garden” to the Milford Garden Club at the Milford Public Library (100 attendees) *April 12*
- Presented a talk “Improving Soil in the Home Garden” to the Orange Garden Club at the Orange Public Library (55 attendees) *April 13*
- Spoke on “Invasive Aquatic Plants in Candlewood Lake” for New Fairfield Public Television in the NFPTV studio *April 17*
- Presented a talk, “Connecticut’s Invasive Aquatic Plant Problem – Searching for Solutions” at CAES Plant Science Day in the Spring *April 22*

- Spoke on Connecticut's Invasive Aquatic Plant Problem and gave an Invasive Aquatic Plant Identification Workshop to the Federated Garden Club in the Jones Auditorium (50 participants) *May 4*
- Spoke on "Container Gardening: Indoors and Out" to a class at Albertus Magnus College (12 attendees) *May 5*
- Spoke on "Controlling Nuisance Aquatic Vegetation" to the Fence Rock Lake Association in Guilford (20 attendees) *May 10*
- Spoke on "Composting" as part of the Warren Public Library Gardening Series (20 attendees) *May 15*
- Spoke on Candlewood Lakes invasive aquatic plant problem in the New Fairfield Public Access TV Channel 17 studio as part of documentary on watershed protection *May 25*
- Spoke at a meeting of the directors of the Sloper Lake YMCA Camp in Southington on Managing Nuisance Aquatic Vegetation *June 2*
- Participated in the USEPA public hearing on National Pesticide Discharge Elimination System permits for aquatic vegetation and mosquito control in Boston, MA *June 21*
- Under his direction, summer research assistants Andrea Ellison and Jennifer Fanzutti taught students at project CLEAR how to identify and map Eurasian water milfoil on Candlewood Lake *June 24*
- Spoke on "Managing Nuisance Aquatic Vegetation" at the annual meeting of the Rogers Lake Association in Lyme *June 29*

#### CHEAH, CAROLE A.

- Was interviewed about biological control of Mile-a-minute vine by Frank MacEachern of the Greenwich Times *July 2, 2009*
- With press coverage from the New Haven Register and the Republican American, conducted the first releases of *Rhinoncomimus latipes*, an introduced weevil for biological control of Mile-a-minute vine, in Connecticut at Quinnipiac River State Park in North Haven *July 2*
- With press coverage from the Greenwich Times and Danbury News Times, conducted releases of *R. latipes* at sites in Greenwich, Bridgewater, New Milford, and Newtown *July 30*
- Gave an update on CT's Hemlock Woolly Adelgid biological control program for the walking tour on Plant Science Day (15 attendees) *August 5*
- Gave a presentation on hemlocks, biological control and HWA at the 100<sup>th</sup> Anniversary Open Forest Day, Great Mountain Forest, Norfolk (40 attendees) *September 26*
- Gave a presentation on biological control of mile-a-minute vine in Connecticut at UCONN Torrington for the Invasive Plants and Insects Program organized by the Northwest Conservation District and Town of Torrington (20 attendees) *September 30*

- Gave an update on Connecticut’s biological control program for Mile-a-minute invasive weed at the CAPS meeting in Windsor (15 attendees) *November 12*
- Gave a presentation on biological control of Mile-a-minute vine at the general meeting of the CT Invasive Plant Working Group (55 attendees) *November 17*
- Gave a presentation on CT’s biological control program for Mile-a-minute invasive weed at the NOFA Organic Land Care Update Course, (200 attendees) Sturbridge, MA *December 8*
- Submitted a presentation on CT’s biological control program for Mile-a-minute invasive weed that was shown at the Mile-a-minute Biological Control Cooperators Meeting at the University of Delaware *January 26, 2010*
- Gave two presentations on Connecticut’s biological control program for Mile-a-minute invasive weed and on the red bark phenomenon at the Forest Health Monitoring Workshop, at New Haven (40 attendees) *February 18*
- Co-presented with Dr. De-Wei Li on the red bark phenomenon at the Northeast Forest Pest Council Meeting, York Harbor, ME (65 attendees) *March 17*
- Hosted Dr. Ashley Lamb from the University of Tennessee for discussions on HWA Biological Control and a tour of the Kenneth White Insectary at the Valley Laboratory *March 30-31*
- Gave a presentation on invasive species and Connecticut’s biological control program for Mile-a-minute weed and hemlock woolly adelgid for the Power of Agriculture lecture series at the Harris Agriscience Center, Bloomfield (25 attendees) *April 9*
- Gave a presentation on biological control of hemlock woolly adelgid and Mile-a-minute weed at the Spring 2010 Open House at CAES, New Haven (102 attendees) *April 22*
- Gave a presentation on biological control of Mile-a-minute weed at the Town of Newtown Invasive Plants Seminar (15 attendees) *May 15*

#### COWLES, RICHARD

- Presented the talk “Managing armored scales” for a Connecticut Christmas Tree Growers’ Association Meeting at the Valley Laboratory, Windsor (40 attendees) *July 9, 2009*
- Presented the talk “Managing armored scales” for a Connecticut Christmas Tree Growers’ Association Meeting in New Hartford (40 attendees) *August 10*
- Participated in a workshop on the impacts of global warming on Connecticut agriculture at the University of Connecticut, Storrs (40 attendees) *August 24*
- Gave the talk “Systemics for Asian Longhorned Beetle” for the Valley Laboratory Field Day, Windsor (13 attendees) *September 10*
- Was interviewed about chemical control practices for Asian longhorned beetle control by Megan Jenny of the Toxics Action Center *September 17*
- Conducted a web seminar for a Northeast Regional IPM program on the topic “Root weevils and white grubs in strawberries” (20 attendees) *September 30*

- Gave the talk “Optimizing systemic insecticides to control hemlock woolly adelgid” at the Griswold Research Center Field Day (12 attendees) *October 3*
- Gave the talk “Activities at The Connecticut Agricultural Experiment Station” at a Windsor Historical Society meeting (12 attendees) *October 7*
- Gave the talk “Black vine weevil, white grubs, and lace bugs” to the Massachusetts Chapter of the Rhododendron Society, Waltham, MA (30 attendees) *October 21*
- Presented a guest lecture on “Pollinators” at Eastern Connecticut State University (11 attendees) *October 16*
- Gave the talk “Bed bugs: Slick ways to evict our coevolutionary bedfellows” for the Eastern Connecticut State University Biology Department’s Seminar series (50 attendees) *October 23*
- Participated in an ad hoc DEP work group regarding pesticides applied to school grounds *October 8*
- Discussed “Prospects for integrated management of armored scales in Christmas trees” to the Executive Committee of the Northeast Regional IPM Project at the Dzen Farm in South Windsor (20 attendees) *November 4*
- Gave the talks “Managing annual bluegrass weevils” and “Mode of action of insecticides” to the Connecticut Golf Course Superintendents’ Annual Meeting in Berlin, CT (180 attendees) *January 19, 2010*
- Taught the class “Turf insecticides and their mode of action” to the University of Massachusetts Winter Turf School, Sturbridge, MA (150 attendees) *January 20*
- Presented his research on “Managing root feeding pests of strawberries” and “Prospects for breeding strawberries resistant to root pests” to the Empire State Vegetable and Fruit Growers’ Expo, Syracuse, NY (120 attendees) *January 27*
- Spoke about “Organic management of turf insect pests” and “Managing white grubs” for the Connecticut Grounds Keepers Association meeting, in Preston, CT (90 attendees) *January 28, 29*
- Presented “Insect Pests in Christmas Trees, Part 1” and “Managing Armored Scales in Christmas Trees” at the Penn State Christmas Tree Management Short Course, State College, PA (115 attendees) *February 10-11*
- Participated in a conference call with New England state foresters to discuss chemical control for quarantine treatments for hemlock woolly adelgids *March 1*
- Participated in the Northeast Regional Hatch Project NE-1025 in Providence, RI where he presented data from last year’s field trials *March 3-4*
- Discussed “New Insecticides and Miticides for Use in Nurseries and provided pesticide applicator recertification training credit at Summerhill Nursery in Madison (6 attendees) *March 9*
- Gave the talk “Managing Armored Scales in Christmas Trees” at the winter meeting of the Connecticut Christmas Tree Growers’ Association in Middletown (60 attendees) *March 13*
- Spoke about “Facts and Fallacies of Organic Agriculture” to the Windham Garden Club in Willimantic (15 attendees) *March 17*



- Presented “Breeding Strawberries for Resistance to Soil-Dwelling Pests” at the Farm to Chef meeting in Jones Auditorium (20 attendees) *April 5*
- Presented “Managing armored scales in Christmas trees” to the Rhode Island Christmas Tree Growers’ Association, Tiverton, RI (40 attendees) *May 1*
- Met with officials at the Cornell Cooperative Extension Service at Lasdon Park, Westchester County, NY, to discuss hemlock woolly adelgid and armored scales (5 attendees) *May 24*
- Gave the talk “Managing armored scales in Christmas trees” to the Connecticut Christmas Tree Growers Association, Haddam, CT (50 attendees) *June 9*

DINGMAN, DOUGLAS W.

- Presented a talk on honey bees and American foulbrood, in addition to conducting a laboratory tour, for teachers participating in advanced learning classes at Southern Connecticut State University *June 30, 2009*
- Participated in Sigma Xi (Quinnipiac chapter) board meeting for planning a student research symposium, Hamden *July 10*
- Hosted a student internship (80 hrs.) for a student from Ludlow High School, Fairfield *July 13*
- Participated with other Station scientists on the WTIC radio talk show “Garden Talk” with hosts Len and Lisa *August 1*
- Was interviewed about research results about American foulbrood prevalence in Connecticut by Averton Baily of AP Press *August 12*
- Presented a seminar to the Backyard Beekeepers Association entitled “American foulbrood – a hidden disease” in Weston, CT *September 29*
- Presented a seminar entitled “Honey bee (*Apis mellifera*) Biology” to two groups of students at Ludlow High School, Fairfield, CT *January 12, 2010*
- Participated in an all day forum on implementing Good Agricultural Practices (GAP) sponsored by the CT Department of Agriculture and the University of Connecticut Extension Service, West Hartford, CT *February 2*
- Participated in the all day beekeeping school sponsored by the CT Beekeeping Association *February 13*
- As a committee member, participated in a meeting of the Programs Committee for the Quinnipiac Chapter of Sigma Xi *February 22*
- As a committee member, participated in a meeting of the Programs Committee for the Quinnipiac Chapter of Sigma Xi *April 6*
- Helped to host the Northeast Regional Sigma Xi Student symposium and presented the keynote address entitled “Bees, Bacteria, and Geography” *April 17*
- Hosted a visit by Sound School students during which he conducted a tour of the facilities in the Department of Biochemistry and Genetics and gave a brief description of research activities in the department *May 10*
- Helped with a bee hive demonstration in the CAES Booth at the Norwalk-Wilton Tree Festival held in Norwalk *May 22*

- Participated in the beekeeping field day sponsored by the CT Beekeeping Association at Lockwood Farm *June 12*

#### DOUGLAS, SHARON M.

- Was interviewed about how weather is affecting plant growth and crops in Connecticut and about late blight of tomato by Bob Miller of the Danbury News-Times *July 1, 2009*
- Was interviewed about late blight of tomato and potato by Nancy Cohen of WNPR *July 8*
- Was interviewed about how late blight is affecting tomatoes in Connecticut by Diana Perez of Channel 30 TV *July 8*
- Gave a talk about current diseases of Christmas trees at the Twilight Meeting of the Connecticut Christmas Tree Growers at the Valley Lab in Windsor (50 adult attendees) *July 9*
- Was interviewed about late blight in 2009 by Shana Wickett of the New Haven Register *July 10*
- Participated in the CTPA Summer Meeting, organized the CAES booth, and answered questions about tree diseases at the Farmington Club (545 adult and 17 child attendees) *July 16*
- Was interviewed about late blight in Connecticut 2009 by Mark Sims of Connecticut Radio Network *July 24*
- Was interviewed about late blight by Fox 61 News *July 24*
- Was interviewed about important diseases of perennials this season by Brian Albright of Landscape Management *July 28*
- Was interviewed about late blight and its impact on tomato prices and availability in Connecticut by Emily Groves of the Norwich Bulletin *July 28*
- Discussed Plant Science Day 2009 as a guest on Len and Lisa's "Garden Talk" radio program on WTIC Radio *August 1*
- Was interviewed about late blight of tomato and potato by Nancy Crevier of the Newtown Bee *August 3*
- Was interviewed about the 2009 outbreak of late blight of tomato and potato and implications for crop pricing and availability by Bob Miller of the Danbury News-Times *August 12*
- Was interviewed about late blight of tomato and potato by Colleen Fitzpatrick of The Connecticut Horticultural Society Newsletter *August 14*
- Was interviewed about this season's weather, how it has affected corn growth, and implications for fall corn mazes by Meg Barone of the Connecticut Post *August 14*
- Was interviewed about late blight of tomato by Marc Robbins of Channel 8 WTNH-TV *August 17*
- Participated in a conference call about the "CAES Girls and Science mentorship Program" *September 4*
- Participated in a meeting of the Board of Directors of the Connecticut Tree Protective Association (15 attendees) *September 8*

- Participated in the administration of the oral exam for an arborist license by the Connecticut Tree Protection Examining Board *September 9*
- Participated in a conference call for members of the Board of Directors for the APS Foundation *September 21*
- Gave a presentation entitled “Common diseases of greenhouse crops” at the CGGA Pesticides and Roast Beef Workshop held in Jones Auditorium (84 attendees) *October 13*
- Participated in the monthly meeting of the CTPA Board of Directors (12 attendees) *October 13*
- Gave a talk entitled “Tomatoes in greenhouses and high tunnels – Disease identification and management” at the 2009 Greenhouse and High Tunnel Tomato Conference in Sturbridge, MA (189 adult and 2 youth attendees) *November 3*
- Was interviewed about Sudden Oak Death and its status in Connecticut by Ed Stannard of the New Haven Register *November 5*
- Participated in the CAPS meeting at the Valley Laboratory and discussed chrysanthemum white rust and Ramorum blight (12 attendees) *November 12*
- Organized and participated in the CAES Girls & Science information meeting held in the atrium of the Johnson-Horsfall building (18 adult and 12 youth attendees) *November 12*
- Gave presentations on the CAES Girls & Science and web grants to the directors of the Experiment Station’s Research Foundation (8 attendees) *November 19*
- Organized and participated in the CTPA Workshop titled “Trees: Up by Roots ... and Keeping Them There” held at the Gray Conference Center, University of Hartford (75 attendees) *December 1*
- Participated in a meeting of the CTPA Board of Directors at Aqua Turf in Plantsville (14 attendees) *December 8*
- Answered questions for growers about plant diseases at the CNLA/CGGA Winter Symposium held at Mountain Ridge in Wallingford (600 attendees) *January 14, 2010*
- Organized and participated in the Annual CTPA meeting at Aqua Turf in Plantsville as a member of the CTPA Board of Directors and organized the CAES booth for the meeting (806 attendees) *January 21*
- Was interviewed about the late blight outbreak of 2009 and the outlook for 2010 by Will Rowlands of the Connecticut Gardener *January 22*
- Participated in the monthly meeting of the Connecticut Tree Protection Agency Board of Directors (12 attendees) *February 9*
- With Dr. Douglas Dingman and Dr. Richard Peterson, organized and participated in a meeting with officials from the Sound School to discuss collaborations with CAES scientists to develop a curriculum in agricultural biology (5 attendees) *February 23*
- Gave a presentation entitled “Eco-friendly management of plant diseases” at the 16<sup>th</sup> Annual Conference and Eco-Marketplace of the Ecological Landscaping Association (50 attendees) *February 25*

- Was interviewed about current diseases of trees by Dan Staruk of Tree Care Industry Association Magazine *February 25*
- Gave a presentation about plant pathology and the role of the Plant Disease Information Office to Dr. Charles Reddington's biology class from Springfield College (20 attendees) *March 1*
- Was interviewed about the impact of this year's weather on ornamental and agricultural crops by Jan Spiegel of WSHU *March 1*
- Assisted with oral arborist exams conducted by the Connecticut Tree Protective Association and reviewed questions for the written component of the arborist exam *March 3*
- Organized and participated in a meeting of the Education Committee of the CTPA Board *March 8*
- Participated in a meeting of the CTPA Board of Directors *March 9*
- Participated in a conference call to discuss CAES as the host of a meeting of the NE Plant Diagnostic Network in February 2011 *March 10*
- Gave a presentation entitled "Recognizing and managing Phytophthora root rot ... and other conifer diseases" and examined samples and answered questions on conifer diseases at the annual meeting of the Connecticut Christmas Tree Growers Association in Middletown (100 attendees) *March 13*
- Participated in a conference call of the APS Foundation Board of Directors *March 15*
- Organized the final meeting of the Girls and Science Mentorship Program *March 17*
- Participated in the Farm-to-Chef meeting held in Jones Auditorium *April 5*
- Was interviewed about late blight of potato and tomato and what to expect in 2010 by John Burgeson of the Connecticut Post *April 6*
- Participated in the monthly meeting of the CTPA Board of Directors *April 13*
- Participated as a judge for the Quinnipiac Sigma Xi Chapter's student poster contest *April 17*
- Participated in the monthly conference call of the APS Foundation Board of Directors *April 19*
- Organized and participated in the Station's Spring Open House 2010 *April 22*
- Was interviewed about early flowering of fruit trees and potential problems with cold weather and frost by Emily Groves of the Norwich Bulletin *April 22*
- Gave a talk titled "Eco-friendly management of plant diseases" at the Orchard Valley Garden Club of Southington *April 27*
- Was interviewed about late blight of potato and tomato and what to expect in 2010 by Nancy Cohen of WNPR *April 27*
- Gave a presentation titled "Eco-friendly approaches to managing plant diseases" at the Federated Garden Club's Environment Study School in Jones Auditorium (25 attendees) *May 4*
- Participated in the Board of Directors meeting of the CTPA to report on the upcoming workshop and lecture by Dr. Kevin T. Smith *May 4*

- Was interviewed about dogwood anthracnose and other diseases by John Burgeson of the Connecticut Post *May 6*
- Spoke about the importance of correctly diagnosing plant diseases and the Station's Plant Disease Information Office and organized a tour of CAES for Sound School biology students and their teachers (13 student and 2 teacher attendees) *May 10*
- Was interviewed about the recent frost and potential for damage on trees and small fruit throughout the state by Emily Gross of the Norwich Bulletin *May 13*
- Organized and moderated a CTPA Workshop titled "Tree Decay – Concepts in Compartmentalization and Detection" held at Sessions Woods Wildlife Management Center in Burlington (65 attendees) *May 20*
- Co-sponsored, with Dr. Robert E. Marra, a Lockwood Lecture by Dr. Kevin T. Smith (USFS, Durham, NH) titled "Tree Survival and Response to Injury, Infection, and Environmental Change" in Jones Auditorium (61 attendees) *May 21*
- Assisted the Connecticut Tree Examining Board with administering oral examinations to arborist candidates *June 9*
- Participated in the planning meeting for the Connecticut Tree Protective Association's summer meeting at the Farmington Club in Farmington *June 9*
- Spoke about the Department of Plant Pathology and Ecology and the role of the Plant Disease Information Office in assisting green industry professionals and homeowners with plant health problems to students from Central Connecticut State University (18 student and 1 teacher attendees) *June 15*
- Participated in a conference call of board members of the APS Foundation to discuss the Foundation's strategic business plan 2010-2015 *June 16*
- Gave the talk "Diagnosing plant health problems: How to start" and assisted attendees with identifying plant health issues, at the CGGA Diagnostic Workshop, which was co-organized by UCONN, CAES, and CGGA (48 attendees) *June 22*

#### DURGY, ROBERT J.

- Gave a talk entitled "Late Blight and the Summer With No Tomatoes" at the Coventry Farmer's Market in Coventry (20 attendees) *August 23, 2009*
- Gave a talk on common garden insect pests at the Community Gardening Conference in Hartford (11 attendees) *September 19*
- Taught Math Calculations and Calibration for pesticide applicator's training in East Haven (45 attendees) *February 25, 2010*
- Taught Math Calculations and Calibration for pesticide applicator's training in East Haven (45 attendees) *February 25*
- Taught Math Calculations and Calibration for pesticide applicator's training in West Hartford (35 attendees) *March 2*
- Presented two workshops at the CT-NOFA Annual Conference entitled Top 10 Vegetable Insects (75 attendees) and Organic Weed Control (52 attendees) *March 6*

EITZER, BRIAN D.

- Was interviewed for the Colin McEnroe show that is broadcast on WNPR *October 5, 2009*
- Presented a paper on “Determination of Pesticide Residues in Honey Bee Pollen by HPLC/MS/MS” at the Society for Environmental Toxicology and Chemistry’s 30<sup>th</sup> Annual Meeting in New Orleans, LA *November 19-22*
- Presented a talk entitled “Pesticide Analysis at the Stationary Apiaries”, and was a participant in the Principal Investigator meetings for the Coordinated Agricultural Program on Sustainable Solutions to the Problems Affecting the Health of Managed Bees and the NC-1173 Multi-State Hatch on Sustainable Solutions to Problems Affecting Bee Health, at the American Bee Research Conference in Orlando, FL *January 12-15, 2010*
- Was a judge at the Connecticut Science Fair at Quinnipiac University in Hamden, CT *March 10-11*
- Gave a talk entitled “Pesticide Residues in Pollen Collected by Foraging Honey Bees in Connecticut” at the American Chemical Society’s 239<sup>th</sup> National Meeting in San Francisco, CA *March 25*
- Participated in a meeting at the University of Massachusetts, Amherst to help plan a grant submission focused on pollinators to Northeast specialty crops *April 20*
- Along with Dr. Kirby Stafford, met with Congresswoman Rosa L. DeLauro at the Connecticut Beekeepers Association annual June picnic and meeting held at Lockwood Farm in Hamden, CT *June 12*
- Presented a lecture entitled “The analysis of paraquat and diquat by HPLC-MS in beverages” at the Food Emergency Response Network National Training Conference in Minneapolis, MN *June 28-July 2*
- Along with Dr. Jason White, Dr. Walter Krol, and Terri Arsenault, participated in a conference call with the FDA Forensic Chemistry Center to discuss the development of extraction and analysis methods for chemical contamination of seafood due to the Deepwater Horizon oil spill. *June 16*

ELMER, WADE H.

- Was interviewed about salt marsh dieback by Margaret Van Patten, Communications Director for Connecticut Sea Grant, University of Connecticut *July 28, 2009*
- Participated in a workshop on “Agriculture and Climate Change: Risk Assessment” at the University of Connecticut in Storrs *August 24*
- Gave the presentation “Plant parts and their diseases” to the second-grade classes at Mile Creek School in Old Lyme (92 students and 9 adult attendees) *September 25*
- Participated on the Committee for Agriculture Education in Bloomfield (18 attendees) *September 29*
- Was invited by the Department of Plant Pathology and Crop Physiology of Louisiana State University to present the seminar “Investigation of *Fusarium* spp. On declining *Spartina alterniflora* plants in Atlantic salt marshes affected by Sudden Vegetation Dieback *October*

- Was interviewed about the pumpkin crop by Ed Stannard of the New Haven Register *October 2*
- Was interviewed about potential projects for students by Thomas McKenna of the Connecticut Science Center in Hartford *October 19*
- Gave a talk entitled “Influence of biochar and earthworms on asparagus growth, Fusarium crown and root rot, and mycorrhizae colonization” at the 12<sup>th</sup> International Asparagus Symposium in Lima, Peru (147 attendees) *October 28-November 1*
- Participated in the post 12<sup>th</sup> International Asparagus Symposium tour to southern regions of Peru near Ica to visit commercial asparagus operations *November 1-2*
- Presented an invited seminar “Strategies to suppress Fusarium crown and root rot of asparagus” to the staff of the Instituto de Investigaciones Agropecuarias (INIA)-Quilamapuín in Chillan, Chile (18 attendees) *November 12*
- Participated as a Councilor for the Northeastern APS Division in the American Phytopathological Society Governance Council in St. Paul, MN *December 14*
- Presented a talk titled “Management of Fusarium Corm Rot of Gladiolus” at the North American Gladiolus Council meeting in Albuquerque, NM (27 attendees) *January 21, 2010*
- Co-organized and presented a talk entitled “Update on emerging diseases, fungicides, and plant nutrition” at the 2010 CAES-UCONN Spring Bedding Plant Workshop held in Tolland (36 attendees) *February 9, 2010*
- Participated in the governance council of the American Phytopathological Society Council as the Northeastern Division Councilor in St. Paul, MN (28 attendees) *February 18-21*
- Co-organized and presented a talk entitled “Update on emerging diseases, fungicides, and plant nutrition” at the 2010 CAES-UCONN Spring Bedding Plant Workshop held in Torrington (35 attendees) *February 23*
- Participated in the Connecticut State Department of Education’s State Consulting Committee for Agricultural Science and Technology meeting in Southington (16 attendees) *March 25*
- Spoke on “Soil fertility and vegetable crop diseases” at Crop Production Services Vegetable Night in Glastonbury (65 attendees) *March 25*
- Presented a brief overview of his research on Sudden Vegetation Dieback and the role of earthworms in plant disease to a group from the Federated Garden Club Landscape Design Class in the Plant Pathology and Ecology greenhouse (16 attendees) *March 31*
- Spoke on “Managing asparagus crown rot for Connecticut markets” at the Farm-to-Chef Program sponsored by the Station and the Department of Agriculture in Jones Auditorium (22 attendees) *April 5*
- Spoke with officials from the DEP to discuss Sudden Vegetation Dieback and his research at Hammonasset State Park *April 13*
- Spoke on “Use of earthworms in plant disease control” to students of the Institute of Learning in Retirement at Albertus Magnus College (10 attendees) *April 15*

- Was interviewed about local asparagus by Jan Spiegel of the Hartford Courant *April 29*
- Participated in the Long Island Sound Education Conference at the Maritime Museum in Norwalk (100 attendees) *April 29*
- Was interviewed about growing asparagus in Connecticut by Jan Ellen Spiegel of the Hartford Courant *May 7*
- Gave the talk “Plant parts and their diseases” to five first-grade classes at Doolittle School in Cheshire (95 student and 11 adult attendees) *May 12*
- Was interviewed about Sudden Vegetation Dieback by Tess Foley at WMNR in Monroe *June 10*
- Participated in the BioBlitz at Sleeping Giant State Park in Hamden *June 13*
- Spoke on “How to identify and diagnose plant diseases” at the CGGA Diagnostic Workshop, which was co-organized by UCONN, AES, and CGGA (48 adult attendees) *June 22*

#### FERRANDINO, FRANCIS J.

- Presented posters describing the Southern New England Grape Information Network at the first Plant Science Day at Griswold Research Farm (14 adult and 4 youth attendees) *October 3, 2009*
- Presented posters and spoke about his remote weather stations in the grape vineyards to Dr. Charles Reddington’s biology class from Springfield College (20 attendees) *March 1, 2010*

#### FOLEY, TESS

- Presented the CAES Research Foundation at the Connecticut Tobacco Growers Association annual meeting (100 attendees) *January 2010*
- Spoke about the crop research of scientists at the Station and how their research can benefit CT farmers at the CT Department of Agriculture’s “Farm to Chef Program” annual conference (200 attendees) *January 25*
- Co-hosted an information meeting for CAES Research Foundation’s funded program, “Girls & Science Mentorship” for science teachers, participating students, and interested parents with CAES scientist mentors *January 2010*
- Wrote an article on CAES food crop scientists’ new interest in collaborating with the Connecticut Department of Agriculture’s Farm-to-Chef Program. The Station hosted a “Talk and Tour” for the farmers and chefs, and the food crop scientists gave a brief overview of the crops they are researching *April 5*
- Interviewed Dr. Wade Elmer about the importance of wetland restoration on WMNR’s interview program “Fine Arts Forum” *June 27*
- Hosted a USDA representative from Washington, DC for a site visit to both Lockwood Farm and the Valley Laboratory *June 29*



GENT, MARTIN P. N.

- Attended a meeting at Geremia Greenhouses with Representatives Mary Fritz and Rosa DeLauro to discuss the benefits of a commercial demonstration greenhouse facility, and the possibility of funding *July 1, 2009*
- Presented posters on “Recycling Nutrient Solution for Greenhouse Tomato Grown in Rockwool” and “Rapid Watering to Achieve Partial Saturation of Root Medium on Flooded Floors” at the American Society for Horticultural Science Annual Meeting, St. Louis, MO (800 attendees) *July 24-28*
- Moderated a workshop on “Whole Plant Physiology in High Tunnels and Under Protected Cultivation” at the American Society for Horticultural Science Annual Meeting, St. Louis, MO (50 attendees) *July 25*
- Gave a talk on “A dynamic model to couple carbon and nitrogen metabolism with transport in whole plants” at the American Society of Agronomy Annual Meeting in Pittsburgh, PA (50 attendees) *November 2-5*
- Moderated a session on “Nutrient Value of Plants for Human Health” and presented a talk on “Changes with Season of Nutrients in Salad Greens Grown in High Tunnels” at the New England Vegetable and Fruit Conference in Manchester NH, (50 attendees) *December 17*
- Moderated a session on “Greenhouse Tomato” and presented a talk on “Recirculating Used Nutrient Solution for Greenhouse Tomato” at the New England Vegetable and Fruit Conference in Manchester, NH (70 attendees) *December 17*
- Met with officials at the Imagine Nation Museum to provide advice on an exhibit of Hydroponic Plants, Bristol *December 21*
- Gave a talk to the Branford Garden Club on “Use of row covers, high tunnels, and cold frames to extend vegetable production in Connecticut” (20 adults) *February 8, 2010*
- Gave a seminar on “My Career at The Connecticut Agricultural Experiment Station” at Mitchell College in New London, CT (10 student attendees) *February 18*
- Participated in NCERA101 regional research committee on “Controlled Environment Technology and Use” at the University of Wisconsin, Madison, WI (80 attendees) *March 20-22*
- Represented the Station when Kathleen Merrigan (Deputy Secretary for USDA) and Representative Rosa DeLauro toured Geremia Greenhouses *March 27*
- Gave a talk on “Effect of Environment and Fertilizer on Composition of Vegetables” at the Farm-to-Chef Program held in Jones Auditorium (25 attendees) *April 5*

HISKES, ROSE T.

- Gave a talk on “Houseplants and Asian Longhorned Beetle” to the Portland Garden Club in Portland (15 attendees) *July 1, 2009*
- Conducted an introductory meeting with Norwich town officials and Master Gardeners about the ALB survey program in Norwich (20 attendees) *July 7*
- Staffed an ALB CAES booth at the summer meeting of the Connecticut Tree Protective Association in Farmington (400 attendees) *July 16*

- Conducted an introductory meeting with Torrington town officials and Master Gardeners about the ALB survey program in Torrington (20 attendees) *July 29*
- Talked about ALB on the Len and Lisa Garden Talk radio show on WTIC 1080 AM *August 1*
- Gave a talk on the ALB and did an invasive plant walk at the Sharon Audubon Festival in Sharon (150 attendees) *August 8*
- Gave an introduction to ALB at a town-wide meeting in Norwich (12 attendees) *August 12*
- Gave an introduction to ALB at a town-wide meeting in Torrington (4 attendees) *August 18*
- Gave a talk on the ALB at Mystic Seaport's Garden Days in Mystic (8 attendees) *August 22*
- Conducted an ALB detection activity in the Connecticut Nursery and Landscape Discovery and Education Gardens, gave a talk on the ALB outreach program and gave an insect update at the Nursery and Landscape Research Tour in Windsor (12 attendees) *September 10*
- Staffed an ALB display table at Enfield Family Days in Enfield *September 20*
- Organized and ran an evaluation meeting of the Northeast Forest Pest Survey and Outreach Program Committee at the Valley Laboratory in Windsor *October 13*
- Gave a talk on "Insects: The good, the bad, the beautiful and the just plain ugly" and the ALB to the Redding Garden Club in Redding (30 attendees) *October 19*
- Gave a talk on the ALB to the Connecticut Nursery and Landscape Association's Nursery Professional Course in Southington (50 students) *October 20*
- Staffed a display table of ALB and Emerald ash borer literature at a meeting of the Wallingford Conservation Commission in Wallingford (35 attendees) *October 21*
- Gave a talk and staffed a display table on the ALB and Roadsides at the Connecticut Urban Forest Council meeting in Wallingford (230 attendees) *October 22*
- Gave a lecture on the Asian Longhorned Beetle to a pest control class at Naugatuck Valley Community College in Waterbury (18 students) *November 4*
- Gave a presentation on the Asian Longhorned Beetle and the Emerald Ash Borer to the East Granby Land Trust Annual Meeting in East Granby (20 attendees) *November 5*
- Gave an update on the Worcester, MA Asian Longhorned Beetle situation to the Connecticut Maple Syrup Producers in Haddam (100 attendees) *November 7*
- Hosted and chaired the State CAPS Committee Meeting in Windsor (10 attendees) *November 12*
- Participated in an Asian Longhorned Beetle webinar *November 13*
- Gave a presentation on the Asian Longhorned Beetle and the Emeralds Ash Borer to the Suffield Land Trust Annual Meeting in Suffield (25 attendees) *November 14*
- Participated in a Connecticut Invasive Plant Working Group Symposium Planning Committee Meeting in Windsor *November 17*

- With Katherine Dugas gave a presentation on the Asian Longhorned Beetle and the Emerald Ash Borer to garden clubs and tree workers in Greenwich (74 attendees) *November 18*
- With Katherine Dugas gave a presentation on the Asian Longhorned Beetle and the Emerald Ash Borer to Stamford municipal treeworkers in Stamford (20 attendees) *November 20*
- Was interviewed about the Asian Longhorned Beetle by Frank MacEachern of the Greenwich Times *November 25*
- Gave a presentation on the Asian Longhorned Beetle and the Emerald Ash Borer to COVERTS wildlife volunteers in New Haven *December 3*
- With Claire Rutledge gave a presentation on the Asian Longhorned Beetle and the Emerald Ash Borer to the Sharon Audubon volunteers in Sharon (25 attendees) *December 5*
- With Katherine Dugas gave a presentation on the Asian Longhorned Beetle and the Emerald Ash Borer to the Greenwich Audubon Volunteers in Greenwich (30 attendees) *December 6*
- With Tom Rathier gave a presentation on the Asian Longhorned Beetle and the Emerald Ash Borer to the Hartford Audubon volunteers, trail workers, and municipal tree workers at the Valley Laboratory in Windsor (25 attendees) *December 10*
- Participated in a Connecticut Invasive Plant Working Group Symposium Planning Committee meeting in Windsor *December 10*
- Gave a presentation on the Asian Longhorned Beetle and the Emerald Ash Borer to the Litchfield Audubon Annual Meeting in Litchfield (40 attendees) *January 4, 2010*
- With Hugh Smith gave a presentation on the new Arthropod Management Database and staffed a CAPS and Asian Longhorned Beetle booth at the Connecticut Nursery and Landscape Winter Meeting in Wallingford (7,600 attendees) *January 13*
- Taught a class on pest management in ornamentals and turf to the NOFA Organic Landcare Course in Newburyport, MA (70 attendees) *January 15*
- With Peter Trenchard and Steve Sandrey staffed a booth on the Asian Longhorned Beetle and Emerald Ash Borer at the Connecticut Groundskeepers Association Annual Meeting at the Mohegan Sun Casino in Montville (800 attendees) *January 29*
- Staffed a booth on Asian Longhorned Beetles and Emerald Ash Borer at the Hartford Flower Show at the Connecticut Convention Center in Hartford *February 18-21*
- Prepared a display board and literature on the Asian Longhorned Beetle for display at the Colchester Library for the month of *March*
- Gave a talk on forest pests such as the Asian Longhorned Beetle, Emerald Ash Borer, and Don't Move Firewood, to the Middletown Garden Club and Steep Rock Association Meeting at the Russell Library in Middletown *March 4*
- Gave a talk on the Asian Longhorned Beetle, Emerald Ash Borer and Don't Move Firewood, at the White Memorial Center in Litchfield *March 6*
- Gave a talk on insects to the garden class at Manson Youth Prison in Cheshire *March 10*

- Prepared a 3 panel poster board and literature on Asian Longhorned Beetle for display at the Connecticut Christmas Tree Growers' Association Meeting *March 13*
- Prepared a 3 panel poster board and literature on Asian Longhorned Beetle for display at the Maple Syrup Festival in Hebron *March 20-21*
- With Mike Thomas and John Shepard staffed a Station booth covering mosquitoes and forest pests at Ag Day at the Capitol in Hartford *March 18*
- Participated in a Connecticut Invasive Plant Working Group Symposium Planning Committee Meeting in Windsor *March 19*
- Gave a talk on butterflies and forest pests at the Haddam Garden Club in Haddam *March 24*
- Prepared a 3 panel poster board and literature on forest pests for display at the Connecticut Botanical Society Meeting in New Haven *March 26*
- Staffed a forest pest display at the Connecticut Master Gardener Conference in Manchester *March 27*
- Gave a talk on forest pests to the Clinton cub scouts in Clinton *March 30*
- With Tom Rathier gave a workshop on forest pests such as the Asian Longhorned Beetle, Emerald Ash Borer, and Don't Move Firewood, to the Federated Garden Clubs of Connecticut in New Haven *April 7*
- Gave a talk on general gardening and forest pests to a senior learning class at Albertus Magnus College in New Haven *April 8*
- Participated in the Eastern Regional Cooperative Agricultural Pest Survey Meeting in Albany, NY *April 12-15*
- Gave a talk on "Landscape Plants: Native or Exotic" at the Spring Open House in New Haven *April 22*
- Gave a presentation on forest pests such as the Asian Longhorned Beetle, Emerald Ash Borer, and firewood to the Forest Landowners of Eastern Connecticut in Brooklyn, CT (35 attendees) *May 19*
- Staffed a table on forest pests at the Norwalk Tree Festival in Norwalk (1,275 attendees) *May 22*
- Participated in a forest pest project conference call *May 27*
- Gave a presentation on general gardening and forest pests such as the Asian Longhorned Beetle (ALB), Emerald Ash Borer (EAB), and firewood at the Warren Public Library in Warren (6 attendees) *June 3*
- Staffed a table on forest pests at the Mystic Seaport Garden Days Festival in Mystic (500 attendees) *June 20*
- Participated in a forest pest project conference call *June 24*
- With Thomas Rathier, Katherine Dugas and Katelynn King, gave a forest pest presentation to children at the Channel 3 Kids Camp in Andover (120 children) *June 30*

INMAN, MARY K.

- Gave a talk on "Plant Propagation" to the East Haven Garden Club at the Beach House in East Haven (19 attendees) *August 20, 2009*

- Spoke on “Care and propagation of houseplants” to residents of Maple Woods at Hamden in Hamden (14 attendees) *November 19*
- Presented the talk “Update from the Plant Disease Office of The Connecticut Agricultural Experiment Station” to members of the Northeast Plant Diagnostic Network, at the division meeting of the Second National Meeting of the National Pest Diagnostic Network (25 attendees) Miami, FL *December 9*
- Along with Rose Hiskes, Dr. Claire Rutledge, and Thomas Rathier, answered questions at the CAES booth at the Annual Meeting of the Connecticut Tree Protective Association held at Aqua Turf in Plantsville January 21, 2010
- Spoke about seed testing to Dr. Charles Reddington’s biology class from Springfield College (20 attendees) *March 1*
- Spoke about seed testing to a group from the Federated Garden Club Landscape Design Class (16 attendees) *March 31*
- Spoke on “Maintaining healthy perennials” at the Cheshire Public Library (22 attendees) *April 20*
- Spoke on “Houseplants” to students of the Institute of Learning in Retirement at Albertus Magnus College (12 attendees) *April 29*
- Gave the talk “Pruning woody ornamentals” to the Bridgeport Men’s Garden Club at Sterling House in Stratford (14 attendees) *June 16*

#### KETTLE, IRA J.

- Gave a presentation on honey bees for the New Haven Free Public Library at the Wilson Branch (32 children, 5 adults) *July 14, 2009*
- Gave a presentation on honey bees at the Fair Haven Branch of the New Haven Free Public Library (13 children, 4 adults) *July 15*
- Gave a presentation on honey bees at the Stetson Branch of the New Haven Free Public Library (29 children, 4 adults) *July 16*
- Gave a honey bee presentation at the Ives Library in New Haven (52 children, 11 adults) *July 22*
- Gave an outreach presentation on the Asian Longhorned Beetle and the Emerald Ash Borer at a 4-H Fair held at the North Stonington Fair Grounds in North Stonington *July 26*
- Gave a presentation on the Asian Longhorned Beetle and Emerald Ash Borer to a group from the Sound School Agricultural Science Program (15 students, 1 adult) *July 29*
- Gave a presentation on the Asian Longhorned Beetle and Emerald Ash Borer to a group of young children from the Farm Camp at Brookvale Park, Hamden at Lockwood Farm. He also gave a honey bee demonstration to the same group (11 children, 4 adults) *July 29*
- Gave a presentation on honey bees, Asian Longhorned Beetle, and the Emerald Ash Borer at the Mitchell Library in New Haven (30 children, 9 adults) *July 30*
- Was interviewed about honey bees by Eriin Singer of the New Haven Magazine *August 10*

- Manned a table with his honey bee display, along with a display on the Asian longhorned beetle and Emerald ash borer at an outreach program at the Mystic Seaport for Garden Days *August 21-23*
- Answered questions from the public on the Asian longhorned beetle and Emerald ash borer displays at the Woodstock Fair in Woodstock *September 5-7*
- Answered questions about Asian longhorned beetle and Emerald ash borer from visitors at the Hebron Fair *September 10-11*
- Talked about the Asian longhorned beetle and Emerald ash borer to visitors at Edgerton Park in New Haven *September 12*
- Gave a honey bee demonstration and Asian longhorned beetle and Emerald ash borer outreach at Harkness Park in Waterford (1,065 visitors to his tables) *September 13*
- Along with Stephen Sandrey and Peter Trenchard, stood at the honey bee, Asian longhorned beetle and Emerald ash borer displays and answered questions from the public at “Celebrating Agriculture Day” held at the Woodstock Fairgrounds (874 visitors to the tables) *September 26*
- Participated in the spring meeting of the Connecticut Beekeepers Association and re-established old ties with the membership after a winter’s absence (55 attendees) *April 10, 2010*
- Gave a honey bee presentation to the children of Lake Street School in Vernon. He also held a question and answer period. (20 students and 9 adults) *April 12*
- Displayed an educational table on the importance of honey bees in Connecticut at Totoket Valley Elementary School in Northford (1,150 students and adult visitors) *April 16*
- Gave a presentation of live bees to the K-1 classes at Highland Elementary School in Wallingford (98 children and 5 adult attendees) *May 11*
- Gave a presentation on honey bees at the Norwalk-Wilton Tree Festival held at Cranbury Park in Norwalk (1,270 attendees) *May 22*
- Manned the Asian longhorned beetle and Emerald ash borer displays for Nature Day at Panthorn Park in Southington (166 attendees – youths and adults) *June 3*

#### KROL, WALTER J.

- Presented the talk entitled “T021 and T022 Toxins Through QuEChERS: Making State and Federal Work Two Sides of the Same Coin”, and participated in the organization of, and acted as host for the Food Emergency Response Network (FERN) Chemistry Cooperative Agreement Technical Meeting held at the Station (60 attendees) *August 11-13*
- Provided a tour and discussion into the operation of the laboratories in Analytical Chemistry to Board of Control member Terry Jones and three of his associates *August 18*
- Organized and ran a poster competition for students from K-12 on behalf of the New Haven Section of the American Chemical Society. The theme of the contest was “Chemistry – It’s Elemental” *October 18-24*

- Participated in an Executive Board Meeting of the New Haven section of the American Chemical Society as Secretary *January 21, 2010*
- Presented a talk entitled “Biofuels and the Food Supply” to 4<sup>th</sup>-12<sup>th</sup> grade students from the Future Problem Solving Program of Connecticut at the Station in New Haven (120 attendees) *February 24*
- Presented a lecture entitled “Pesticide Residues in Food”, and led a tour of the Analytical Chemistry Labs for the Farm-to-Chef Program held at the Connecticut Agricultural Experiment Station (20 participants) *April 5*
- Was interviewed about pesticides in organic foods by Valerie Bannister, an independent reporter *April 5*
- Participated in a Biofuels symposium at UConn’s Center for Environmental Sciences and Engineering in Storrs *April 8*
- Spoke about pesticide residues in food to 7<sup>th</sup> and 8<sup>th</sup> graders from Hamden Hall Day School (20 students) *April 19*
- Served as a judge on behalf of the New Haven Section of the American Chemical Society at the New Haven Public Schools Science Fair 2010 *May 12*
- Organized an awards banquet as part of the New Haven Section of the American Chemical Society National Chemistry Week. The banquet and awards ceremony were held in Jones Auditorium (100 student, teacher and parent attendees) *May 25th*
- Along with Dr. Brian Eitzer, Dr. Jason White, and Terri Arsenault, participated in a conference call from the FDA Forensic Chemistry Center to discuss the development of extraction and analysis methods for chemical contamination of seafood due to the Deepwater Horizon oil spill. *June 16*

LAMONDIA, JAMES A.

- Participated in an Executive Board meeting at the annual meeting of the Society of Nematologists in Burlington, VT, where he also presented a poster entitled “Brassica Glucosinolate Profiles Associated with Biofumigant Activity Against *Meloidogyne Hapla*” *July 11-15, 2009*
- Participated in a meeting of the Connecticut Agricultural Information Council in Windsor *July 27*
- Spoke about Biofumigation Research for Soilborne Pathogens Using Brassicas during the pesticide recertification tour and spoke about B2 – a new pathogen resistant broadleaf tobacco line to the Board of Control at Plant Science Day *August 5*
- Was interviewed about tobacco diseases and the growing season by Aaron Kupec of WTIC Radio *August 7*
- Was interviewed about fungal and virus tobacco diseases and the growing season by Hallie Jackson of WFSB TV *August 17*
- Participated in the Agricultural Workgroup Climate Change Risk Assessment Committee Meeting held at UConn *August 24*
- Participated in the NE-IPM small Fruit Workgroup Pest Issues Tour in Sandwich, MA *August 25-27*

- Welcomed participants and spoke about cover crops for management of nematode pathogens of nursery and landscape plantings as a part of the Valley Laboratory Nursery and Landscape Research Tour (12 attendees) *September 10*
- Was interviewed about shade tobacco harvest by Mark Curtis of National Public Radio *September 24*
- Was interviewed about tobacco diseases affecting the crop in Connecticut and Massachusetts by Bob Salsberg of the Associated Press in Boston *September 25*
- Taught a class on identification, biology, and management of tree diseases to students in the Connecticut Tree Protective Association's Arboriculture 101 class in New Haven (40 students) *October 7*
- Spoke about research results at the annual meeting of the Northeast Regional Multistate Nematology Technical Committee (NE-1019) held in Pine Mountain, Georgia (12 attendees) *October 21-23*
- Presided as President, and presented the talk "Evaluation of strawberry breeding lines for tolerance to black root rot and black vine weevil feeding" at the Northeast Division Meeting of the American Phytopathological Society in Quebec City (55 attendees) *October 27-30*
- Gave two talks and conducted a day-long train-the-trainer NE-SARE Professional Development Program Workshop on "Diagnosis, Visual Assessment and Management of Plant-Parasitic Nematodes of Vegetables and Small Fruits in the Northeast" in Portland, NY (12 attendees) *November 18*
- Presented a Plant Pathology lecture on nematode biology, diseases, sampling and management, and a laboratory exercise on plant parasitic nematode extraction and identification at the University of Connecticut (9 students) *December 8*
- Participated in a meeting of the Connecticut Agricultural Information Council to prepare for the Outstanding Young Farmer Award and Ag Day at the Capitol *January 11, 2010*
- Presented an invited symposium paper on "Management of the tobacco cyst nematode on cigar wrapper tobaccos in Connecticut" (50 attendees) *January 20*
- Spoke about the "2009 Outbreak of Potato Virus Y, Tobacco Etch Virus, and Tobacco Vein Mottling Poty Viruses of Tobacco" (25 attendees) *January 21*
- Welcomed growers and spoke about research on management of tobacco pathogens, including poty viruses and progress of the breeding program for multiple pathogen resistance at the annual CAES Tobacco Research Meeting held at Suffield High School *February 17*
- Participated in a meeting of the Connecticut Agricultural Information Council to prepare for the Outstanding Young Farmer Award and Ag Day at the Capital *February 23*
- Examined candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven *March 3*
- Conducted a workshop on nematode diseases of ornamentals for a group from Pioneer Gardens at the Valley Lab *March 4*



- Spoke about research and services at the Station and summer employment opportunities at the Central Connecticut State University Biology Department Career Fair (40 attendees) *March 15*
- Participated in Agriculture Day at the Capitol as a member of the Connecticut Agricultural Information Council *March 18*
- Was interviewed by July Simmons Harrison of WFSB's Better Connecticut about services and research at the Station *March 22-24*
- Participated in a planning meeting for the 2010 NED-APS and NE-1040 Technical Committee annual meetings in Northampton, MA *March 25*
- Met with cooperators from Pennsylvania State University and Cornell to discuss results and progress on an IPM Cover Crops Project *March 29*
- Was interviewed about the history and importance of tobacco in the Connecticut River Valley by free-lance reporter Staci Heropoulous *March 30*
- Spoke about fungicides and management of fungicide resistance in grapes as a part of a meeting of the Southern New England Grape Information Network meeting for growers held at the Valley Laboratory (7 attendees) *April 27*
- Participated in a tour of the HF Brown Farm in Windsor and spoke with family members to collect information for the Connecticut Agricultural Information Council Century Farm Award selection *June 1*

#### LI, DE-WEI

- Gave a 3.5 hour lecture "AP Biology Fungi" to a group of AP Biology high school teachers at ECSU (15 attendees) *July 10, 2009*
- Gave a presentation on "Airborne Fungi Associated with Greenhouses" at the ASTM Johnson Conference on molds at the University of Vermont (110 attendees) *July 12-15*

#### MAGNARELLI, LOUIS A.

- Was Interviewed about ticks by Sarah Politz of the New Haven Magazine *July 8, 2009*
- Gave a report on Station research to the Experiment Station Associates *July 13*
- Participated in a Governor's Sub-committee meeting on the effects of climate on agriculture held in Windsor *July 14*
- Was interviewed about mosquitoes by Emily Froehlich of the Danbury News Times *July 14*
- Was interviewed about mosquitoes by WTIC Radio *July 24*
- Was interviewed about mosquitoes by Brad Davis of WDRC-AM Radio *July 27*
- Was interviewed about the Station research and outreach programs by Ray Andrewsen of WQUN Radio *July 29*
- Was interviewed about Station research by Alexis Ann of the Resident in Stonington *August 5*
- Was interviewed about Asian longhorned beetles by WFSB TV *August 6*

- Was interviewed about Asian longhorned beetles by John Charlton of Fox 61 TV *August 6*
- Was interviewed about Asian longhorned beetles by Bob Miller of the Danbury News Times *August 6*
- Was interviewed about honey bees by Karen Singer of the New Haven Magazine *August 7*
- Welcomed attendees of the FDA Food Emergency Response Network meeting in Jones Auditorium *August 12*
- Was interviewed about mosquitoes by Vinti Singh of the Darien Times *August 13*
- Was interviewed about rainfall and insect populations by John Stankowitz of the Journal Inquirer *August 19*
- Was interviewed about Asian longhorned beetles and mosquitoes by Ray Andrewsen of WQUN Radio in Hamden *September 2*
- Gave a talk at Lockwood Farm to visitors as a part of the Tour des Farms program *September 12*
- Gave a talk about Station research to the Experiment Station Associates in the Board Room at the Station *September 14*
- Welcomed participants and gave a talk on Station research to the CT Landscape Designers Course *September 16*
- Was interviewed about Lockwood Farm by Mary Jasch of Dig-It Magazine *September 16*
- Was interviewed about regulations for Asian Longhorned Beetle and Emerald ash borer by Nancy Cohen of WNPR *October 6*
- Participated in a meeting of effects of climate change on agriculture at the CT Farm Bureau office in Windsor *October 8*
- Participated in a meeting of the Invasive Plants Council in Windsor *October 13*
- Welcomed members of the Federated Garden Club of CT and gave a report on research progress *November 1*
- Gave a talk on Station research to the Experiment Station Associates in the Board Room at the Station *November 10*
- Attended a meeting of the Legislative Invasive Plants Council and gave a brief report on invasive plants research *November 12*
- Welcomed parents and students participating in an educational program sponsored by the Fund for Women and Girls *November 12*
- Participated in a meeting of the Experiment Station Associates by giving a report on Station research *January 5, 2010*
- Was interviewed about ticks and mosquitoes by Linda Marsa of Discover Magazine *January 7*
- Participated in an Invasive Plants Council meeting in Hartford *January 12*
- Spoke about regulations for Asian longhorned beetle and Emerald ash borer at the annual meeting of the CT Tree Protective Association in Southington *January 21*

- Gave a presentation on Experiment Station research and outreach activities to the Appropriations Committee of the General Assembly *February 17*
- Gave a report to the Experiment Station Associates at their annual meeting in Jones Auditorium *March 18*
- Testified at a Judiciary Committee hearing on House Bill 5543 regarding patents, licensing agreements, and trademarks for the Experiment Station *March 26*
- Spoke to participants of a Landscape Designers' course in Jones Auditorium about Station research programs *March 30*
- Was interviewed about Asian longhorned beetle and Emerald Ash Borer regulations by Nancy Cohen of WNPR Radio *March 31*
- Welcomed participants to the Farm-to-Chef Program in Jones Auditorium *April 5*
- Gave a report on Station research at the Experiment Station Associates Board Meeting in Slate Board Room *April 19*
- Welcomed attendees to the Station's Spring Open House in Jones Auditorium *April 22*
- Welcomed and gave a report on Station research to members of the Federated Garden Club of CT in Jones Auditorium *May 3*
- Reviewed Experiment Station research and outreach programs at a forum on agriculture in Shelton *May 7*
- Welcomed visitors from the US Food and Drug Administration and state laboratories in the Johnson/Horsfall Building *June 8*
- Participated in an Invasive Species Council meeting in Hartford and spoke about incineration procedures for plant materials *June 8*
- Gave a report on Station research at a meeting of the Experiment Station Associates *June 21*
- Was interviewed about the Governor's plan to release bond funds for facility upgrades by Matt Dwyer of WTIC Radio *June 25*
- Was interviewed about Experiment Station research by Melissa Bailey of the New Haven Independent *June 25*

#### MAIER, CHRIS T.

- Displayed two uncommon insects and briefly explained their biology at a meeting of the Connecticut Entomological Society in Jones Auditorium (10 attendees) *September 18, 2009*
- Was interviewed about the emerald ash borer by John Burgesson of the Connecticut Post *October 1*
- Discussed and displayed autumnal flower flies, including polymorphic mimics, at a meeting of the Connecticut Entomological Society at Yale University *October 16*
- Spoke about the lily leaf beetle and the viburnum leaf beetle at a meeting of the Advisory Committee of the Cooperative Agricultural Pest Survey at the Valley Laboratory in Windsor *November 12*

- Organized a seminar for students from Trinity College and spoke to them about alien invasive insects in Connecticut during their visit to the Station *November 17*
- Spoke about Asian Longhorned Beetle: An Overview” at the Annual Meeting of the Connecticut Pomological Society in Glastonbury *December 2*
- Delivered an invited talk entitled “Hungry caterpillars: Wonderful research animals, awful agricultural pests” at EntCent, the 100<sup>th</sup> anniversary celebration of the Department of Entomology, University of Illinois, Urbana, IL *December 11*
- Presented a poster on “Alien Invasive Insects in Connecticut” while attending the Annual Meeting of the Entomological Society of America in Indianapolis, IN *December 16*
- Displayed a poster on “Invasive Alien Insects in Connecticut” at the Annual Meeting of the Connecticut Tree Protective Association in Plantsville *January 21, 2010*
- Spoke about “Invasive Alien Insects in the Forest Understory” and displayed a poster on “Invasive alien Insects in Connecticut” at the Forest Health Workshop in Jones Auditorium (45 adult attendees) *February 18*
- Displayed new entomological literature at a meeting of the Connecticut Entomological Society at the University of Connecticut in Storrs *February 19*
- Displayed a springtime parasitic meloid beetle and its ground-nesting bee host, *Colletes inaequalis*, at the Annual Dinner Meeting of the Connecticut Entomological Society in Jones Auditorium *April 16*
- Spoke about a survey for the European wood-wasp at a meeting of the Cooperative Agricultural Pest Survey Advisory Committee at the Valley Laboratory in Windsor *May 19*
- Spoke about “State-listed Flies (Diptera) of Connecticut” at a meeting of the Connecticut Entomological Society in Jones Auditorium *May 21*
- Presented fact sheets on the brown marmorated stink bug at a twilight meeting of the Connecticut Pomological Society at Belltown Hill Orchard in Glastonbury *May 25*
- Spoke about the brown marmorated stink bug, an invasive insect recently discovered in Connecticut, at a twilight meeting of the Connecticut Pomological Society at Lyman Orchards in Middlefield *June 15*

#### MARRA, ROBERT E.

- Presented the talk “Proposing a new species of *Fusarium*: *F. aestuarinum*” a pathogen of *Spartina alterniflora* associated with wetland dieback in eastern marshes” (coauthored with Dr. Wade H. Elmer) at the annual meeting of the Northeastern Division of the American Phytopathological Society held in Quebec City, Quebec, Canada (60 adult attendees) *October 28-30, 2009*
- Presented the talk “Bacterial Spot of Stone Fruits: Research Update” at the annual winter meeting of the Connecticut Pomological Society, Glastonbury (60 attendees) *December 2*
- Gave a Sigma Xi lecture entitled “Proposing a new species of *Fusarium*: *F. ‘palustrium’*, a pathogen of *Spartina alterniflora* associated with wetland dieback in

eastern marshes” at Quinnipiac University in Hamden (50 attendees) *February 23, 2010*

- Organized and hosted a workshop on “Conservation Arboriculture” with cooperation from the Connecticut Forest & Park Association at the DEP Sessions Woods facility (50 attendees) *April 12*

#### MAYNARD, ABIGAIL A.

- Spoke about the New Crops Program to Dr. Frumento’s class from SCSU at Lockwood Farm (15 adults) *July 7, 2009*
- Was interviewed about the cool, wet weather conditions and crop growth by Richie Radsack of the Journal Courier *July 21*
- Talked about the New Crops Program on WTIC’s Garden Talk radio show *August 1*
- Participated in a meeting of the Agricultural Working Group Stakeholders that is part of the State’s Climate Change Risk Assessment, held in Storrs *August 24*
- With Dr. David Hill, judged fruits and vegetables at the North Haven Fair *September 10*
- Spoke about the New Crops Program to visitors at Lockwood Farm (19 attendees) *September 13*
- Spoke on composting and utilization of compost in the Discovery Center at the Durham Fair (40 attendees) *September 25*
- Gave a tour of Lockwood Farm to Hamden Hall students for Pre-K, kindergarten, and 3<sup>rd</sup> grade (55 students, 10 adults) *October 20*
- Reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation (18 attendees) *November 5*
- Was interviewed about butternut squash by Mary Jasch of Dig It Magazine *November 16*
- Assisted a Hamden Hall Country Day School Biology class with their science projects (14 students, 1 teacher) *January 28, 2010*
- Worked with Upper School Biology students at Hamden Hall Country Day School on their research projects (16 student participants, 1 teacher) *February 18*
- Spoke about the benefits of using compost to Sandra Fox of the Danbury News Times *March 26*
- Gave a talk on the New Crops Program at a Station mini-tour of the Farm to chefs (25 adult participants) *April 5*
- Assisted in planning Hamden Hall Middle School’s Earth Summit *April 15 and 21*
- Gave a talk on the New Crops Program and tour of Lockwood Farm to middle school students of Hamden Hall Country Day School (18 student and 2 teacher participants) *April 19*
- Gave a talk on back yard gardening at Albertus Magnus College (15 adult attendees) *April 22*
- Talked to students from the Sound School about the New Crops Program (15 student, 2 teacher attendees) *May 10*

- Spoke about the New Crops Program to the Connecticut Urban Forest Council at Lockwood Farm (10 attendees) *May 19*
- Was interviewed about ethnic vegetables and the New Crops Program by Steven Singer from the Associated Press *May 25*
- Reported on Station activities at a Quarterly meeting of the Council on Soil and Water Conservation (10 adults) *May 26*
- Met with NRCS employees to plan Diversity Day at Lockwood Farm *June 2*
- Spoke about the New Crops Program and gave a tour of Lockwood Farm plots to NRCS employees as part of their Diversity Day (44 adult attendees) *June 23*

#### MCHALE, NEIL A.

- Gave a lecture on “Evolution and Domestication of Crop Plants” to the Old Ripton Garden Club of Shelton *October 5, 2009*
- Presented a seminar entitled “Beyond Meristems: WOX Gene Function in Lateral Organ Primordia” in the Department of Molecular, Cellular and Developmental Biology at Yale University *February 2, 2010*
- Gave a presentation to Charles Reddington’s class of Plant Biology students from Springfield College *March 1*
- Presented “Botany for Kids” to 3<sup>rd</sup> graders at the Orange Avenue School in Milford, CT *May 14*

#### MERVOSH, TODD L.

- With press coverage by the New Haven Register and Waterbury Republican American, participated in the release of 1,000 *Rhinoncomimus latipes*, a weevil that is a biological control agent against mile-a-minute vine, in Quinnipiac River State Park in North Haven *July 2, 2009*
- With press coverage by the Newtown Bee participated in the release of 1,000 *Rhinoncominus latipes*, a weevil that is a biological control agent against mile-a-minute vine in Newtown *July 9*
- Spoke about weed management and presented an informational display of weeds at a twilight meeting of the Connecticut Christmas Tree Growers Association at the Valley Laboratory in Windsor (50 attendees) *July 9*
- While being interviewed by Cablevision News 12 of Norwalk, participated in the release of 1,000 *R. latipes* weevils in patches of mile-a-minute vine at the Audubon Society’s Gimbel Sanctuary in Greenwich *July 10*
- With press coverage by The Greenwich Time and The Danbury News-Times participated in the release of 4,000 *R. latipes* at several sites infested with mile-a-minute vine in Greenwich, New Milford, Bridgewater, and Newtown *July 30*
- Spoke about weed management at a meeting of the Connecticut Christmas Tree Growers’ Association in New Hartford (30 attendees) *August 10*
- Was interviewed about tobacco diseases and mile-a-minute vine by Carolyn Moreau of The Hartford Courant *August 12*

- Manned a booth with information about the Station and invasive species at Farm Fest, held at Hilltop Farm in Suffield (300 attendees) *September 7*
- Spoke about his experiments on control of Japanese knotweed and on efficacy of various granular herbicides in nursery containers at the Nursery and Landscape Research Tour at the Valley Laboratory (15 attendees) *September 10*
- Presented a display of native plants and invasive plants at the Suffield Land Conservancy booth at “Suffield on the Green” (500 attendees) *September 12-13*
- Spoke about mile-a-minute vine and other invasive plants in a presentation at General Electric headquarters in Fairfield (20 attendees) *November 4*
- Participated in meetings for the Connecticut Invasive Plant Working Group at the Valley Laboratory *November 17*
- Presented an update on invasive plants at the annual meeting of the Connecticut Environmental Council in Southington (170 attendees) *November 24*
- Was interviewed about the biological control project for mile-a-minute vine in Greenwich by Frank MacEachern of the Greenwich Time newspaper *December 1*
- Participated in a symposium planning meeting for the Connecticut Invasive Plant Working Group at the Valley Laboratory *December 10*
- Gave a talk entitled “Several treatment options for control of Japanese stiltgrass in a woodland” (30 attendees) and served as moderator of the Ornamentals Section at the annual meeting of the Northeastern Weed Science Society in Cambridge, MA (160 attendees) *January 5-7, 2010*
- Participated in a symposium planning meeting for the Connecticut Invasive Plant Working Group at the Valley Laboratory *January 12*
- Spoke about “Biological control of mile-a-minute vine in Connecticut at the New England Region 1 Pesticide Inspector Residential Training Workshop in Windsor (30 attendees) *February 2*
- Spoke on “Diagnosis of ornamental plant injury symptoms (30 attendees) at the New England Region 1 Pesticide Inspector Residential Training Workshop in Windsor *February 3*
- Participated in a symposium planning meeting for the Connecticut Invasive Plant Working Group at the Valley Laboratory *February 9*
- Participated in a state liaison meeting for the IR-4 Specialty Crops Program at the New York State Agricultural Experiment Station in Geneva, NY *March 10-11*
- Spoke about management of invasive plants at the Connecticut Christmas Tree Growers’ Association annual meeting in Middletown (80 attendees) *March 13*
- Spoke about invasive plants in coastal areas at a community workshop in Chatham, MA (70 attendees) *March 18*
- Participated in a symposium planning meeting for the Connecticut Invasive Plant Working Group at the Valley Lab *March 19*
- Presented talks on use of herbicides in integrated vegetation management and on biological control of mile-a-minute vine at a pesticide training course for county employees run by Cornell Cooperative Extension of Suffolk County in Riverhead, NY (15 attendees) *March 24*

- Spoke about weed identification and management at the Yankee District Convention of the American Rose Society in Taunton, MA (60 attendees) *March 27*
- Served on the scholarship selection committee for the Connecticut Nurserymen's Foundation at meetings at the Valley Laboratory *March 31 and April 14*
- Participated in a symposium planning meeting for the Connecticut Invasive Plant Working Group at the Valley Laboratory *April 20*
- Led a group of volunteers working on Japanese knotweed control at Holcomb Farm Educational Center in Granby (5 attendees) *April 27*
- Participated in a symposium planning meeting for the Connecticut Invasive Plant Working Group at the Valley Laboratory *May 19*
- Spoke about weed management at a meeting of the Connecticut Christmas Tree Growers' Association in East Hampton (40 attendees) *June 9*
- Spoke about weed identification and management in greenhouses at a plant diagnostic clinic for the Connecticut Greenhouse Growers Association at CAES, New Haven (50 attendees) *June 22*

#### MOLAEI, GOUDARZ

- Hosted Jacob Greenberg, a student from the University of New Mexico, and instructed him in molecular methods in mosquito blood meal identification *August 17-21, 2009*
- Gave a talk entitled "Epidemiology of West Nile Virus in Southern California: The Role of *Culex quinquefasciatus* and House Finches" at the 58<sup>th</sup> Annual Meeting of the American Society of Tropical Medicine and Hygiene held in Washington, DC (1,000 attendees) *November 18-22*
- Presented an invited talk entitled "Blood Feeding Behavior of *Anopheles quadrimaculatus* and *Anopheles punctipennis* from Eastern encephalitis virus foci in Northeastern USA" at the 55<sup>th</sup> Annual Meeting, Northeastern Mosquito Control Association, (100 attendees) *Sturbridge, MA December 3*

#### MUSANTE, CRAIG

- With John Ranciato, participated in a two-day training session for the Department's new inductively coupled plasma optical emission spectrometer (ICP-OES) *April 26-27, 2010*

#### NAIL, WILLIAM R.

- Participated in a meeting of the Connecticut Vineyard and Winery Association and gave a presentation on midsummer vineyard management at the Connecticut Food Association in Farmington (16 attendees) *July 13, 2009*
- Presented a talk on vine balance and general viticulture at Vineyard Day at Miranda Vineyards in Goshen (23 attendees) *July 18*
- Presented a poster presentation "Effects of Horticultural Oil on Incidence and Severity of Harvest Rots on Winegrapes" at the American Society of Enology and Viticulture – Eastern Section in Painesville, OH *July 21*



- Participated in three Board of Director’s meetings at the American Society of Enology and Viticulture – Eastern Section, in Painesville, OH *July 19-21*
- Served on the judging panel for the Viticulture and Enology Student Presentation Competitions at the American Society of Enology and Viticulture – Eastern Section in Painesville, OH *July 21*
- Participated in a planning meeting for a potential CAP project for eastern viticulture and enology in Painesville, OH *July 23*
- Participated in the Agriculture Adaptation to Climate Change Workshop at the University of Connecticut in Storrs *August 24*
- Participated in a meeting of the Connecticut Farm Wine Development Council at the Department of Agriculture in Hartford *September 10*
- Participated in a meeting of the Connecticut Vineyard and Winery Association *September 14*
- Gave a presentation on harvest strategies and activities at the Connecticut Food Council in Farmington (19 attendees) *September 14*
- Participated in the annual meeting of NE-1020: Multistate Evaluation of Winegrape Cultivars and Clones and was elected Secretary to the Board, in Wooster, OH *November 3-5*
- Participated in a stakeholder meeting for potential SCRI and NERA projects “Addressing Research and Extension Needs of the Emerging Cold-Climate Wine Industry in the Northeast and Upper Midwest” in Burlington, VT (42 attendees) *November 12-13*
- Participated in a meeting of the Connecticut Farm Wine Development Council at the Department of Agriculture in Hartford *December 10*
- Gave two presentations, “Winegrape Cultivar Trials in Connecticut” and “Vine Pruning and Training Systems for New England” during the Viticulture session of the New England Vegetable and Fruit Conference in Manchester, NH *December 10*
- Gave a pruning and training demonstration at Preston Ridge Vineyard in Preston *January 14, 2010*
- Participated in a meeting of the Steering Committee of the New England Vegetable and Fruit Conference in Methuen, MA *February 23*
- Participated in a meeting of the Connecticut Farm Wine Development Council at the Department of Agriculture in Hartford *March 17*
- Participated in a meeting of researchers and grape growers at the Valley Laboratory *April 27*
- Presented two talks, “Criticality of Vineyard Best Practices” and “Weed and Disease: Whittling Down the Options” at the Vermont Grape and Wine Council Annual Conference in Randolph, VT (72 attendees) *June 7*
- Presented a poster “Dry Matter Accumulation and Partitioning in Response to Leaf Removal in Pinot Noir Grapevines” at the American Society of Enology and Viticulture annual conference in Seattle *June 23-24*

- Participated in a planning meeting for a funded SCRI project “Improved grape and wine quality in a challenging environment: An eastern US model for sustainability and economic vitality” in Seattle *June 23*

PETERSON, RICHARD B.

- Participated in a meeting of the Executive Committee of the Quinnipiac Chapter of Sigma Xi voting on hosting the annual Northeast Regional Student Research Conference at the Experiment Station in 2010 *July 10, 2009*
- Gave a presentation to the Nelson/Irish Laboratory Group at Yale University on “Linear Gradients for C4 Photosynthesis in Maize leaves” *October 1*
- Served as a judge for a Science Fair at the Micro Society Magnet School in New Haven. The event was for elementary and middle school age students who presented posters detailing class science projects *April 1, 2010*
- Was one of the judges for a student research conference sponsored by the Quinnipiac chapter of Sigma Xi held at the Station *April 17*

PIGNATELLO, JOSEPH J.

- Presented a talk entitled “Impact of Biochar on the Bioavailability in Soil of Chemicals Important in Agriculture” at the 2009 North American Biochar Conference, held in Boulder, CO *August 9-12, 2009*
- Presented an invited talk entitled “Desorption Resistance of Chemicals in Soil” in a symposium on Soil Bound Residues and Relevance to Environmental Exposure, at the 238<sup>th</sup> Meeting of the American Chemical Society in Washington, DC *August 16-20*
- Presented a keynote talk entitled “Interaction of Anthropogenic Organic Chemicals with Organic Matter in Natural Particles” at the International Symposium of Molecular Environmental Soil Science at the Interfaces in the Earth’s Critical Zone” held at Zhejiang University in Hangzhou, China *October 10-14*
- Gave a talk entitled “Impact of Biochar amendment on the bioavailability of Agriculturally Important Chemicals in Soil at the Annual Meetings of the ASA-CSSA-SSA held in Pittsburgh, PA *November 1-5*
- Presented an invited seminar entitled “Interactions of Anthropogenic Organic Compounds with Environmental Black Carbon to the Chemistry Department, University of Toronto, Canada *November 13*
- Presented a talk entitled “Sorption of the antimicrobial sulfamethazine to biochar” at the 239<sup>th</sup> American Chemical Society Meeting, Environmental Chemistry Division held in San Francisco, CA *March 21-25, 2010*
- Served as a judge at the New Haven Science Fair held at Yale University *May 12*
- Presented the talk “Sorption of the Swine Antibiotic Sulfamethazine to Biochars, at the SETAC Europe 20<sup>th</sup> Annual Meeting held in Sevilla, Spain *May 23-27*

RIDGE, GALE E.

- Was interviewed about insects and how a wet spring might affect their life cycles by the Danbury Times *July 2, 2009*
- Was interviewed on bed bugs by the Hartford Courant July 7
- Gave a talk on bed bugs at the Hartford Bed Bugs Forum held at the Hartford Public Library. 209 attendees *July 15*
- Was interviewed about a controversy in the Stamford Police Department regarding officers being exposed to ticks, bird mites and/or dust mites by the Stamford Advocate *August 18*
- Was interviewed about a controversy in the Stamford Police Department regarding officers being exposed to ticks, bird mites and/or dust mites by Channel 12 news *August 19*
- Was interviewed about yellowjackets which colonize homes and how citizens might manage them by WTIC Radio *September 4*
- Was interviewed about yellowjacket nests in homes by Dana of WTIC Radio, Hartford *September 4*
- Presented a workshop on the ecology and morphology of insects and lectured on flies, their influence on the history of man, on religion, culture, and medicine at the Connecticut Folk Festival and Green Expo in New Haven *September 12*
- Was interviewed about flies and their influence on the history of man, on religion, on culture and medicine by Joe Giaimo of the Connecticut Pest control association, Cromwell *September 29*
- Was interviewed by NBC News Television, Channel 8 News and WSHU Public Radio about the largest migration in years of the multi-colored Asian lady beetle out of Connecticut forests onto buildings across Connecticut *October 20*
- Organized a second bed bug forum held at the Station to educate professionals from health departments, visiting nurse associations, legal entities, pest control operators, homeless shelters, higher education and the hospitality industry about bed bugs. 130 attendees *October 15*
- Was interviewed about the bed bug forum held at the Station on October 15 by Diane Orson of WNPR Radio, New Haven *October 15*
- Was interviewed about the bed bug forum held at the Station on October 15 by Channel 3 TV News, New Haven *October 15*
- Was interviewed about Multicolored Asian Lady Beetles by Ben McKenzie of NBC TV News, New Haven *October 20*
- Was interviewed about Multicolored Asian Lady Beetles by Geoff Fox of WTNH Channel 8 News, New Haven *October 20*
- Was interviewed about the Lady Beetle migrations and what people can do about them by Naomi Sterobin of WSHU Public Radio, Fairfield *October 23*
- Was interviewed about bed bugs during a series of interviews for the Miller-McCune magazine *November 5-19*

- Conducted a meeting of the Bed Bug Committee (now the Connecticut Coalition Against Bed Bugs) *November 3*
- Talked to a group of Trinity College students and demonstrated work done in the Insect Inquiry Office *November 17*
- Was interviewed on bed bugs, the state of reporting, the EPA spring conference and use of canine detectors by Devon Lash of the Stamford Advocate *November 24*
- Was interviewed about bed bug management and the use of bed bug detection dogs by a reporter from the New Haven Register *December 24*
- Was quoted by U.S. News and World Reports and the Associated Press on bed bug detection dogs. She was quoted as the Chair of the newly formed Connecticut Coalition Against Bed Bugs which is under the leadership of the Station *January 2010*
- Participated in a national webinar hosted by the National Center of Healthy Housing, Environmental Protection Agency (EPA) and advocated education of medical professionals on dermatological injury caused by bed bug feeding because of misdiagnosis and the need for professional identification of the insects prior to remediation efforts *February 25*
- Advised the Attorney General's Office on policy issues pertaining to the shipment of bedding materials and bed bugs in Connecticut *March 12*
- With Mike Lipsett, as board member representatives of the CT Coalition Against Bed Bugs, advised and assisted the State Attorney General's Office on policy issues pertaining to the shipment of bedding materials and bed bugs in Connecticut *March 12*
- Spoke on bed bugs at the annual meeting of the International Executive House Keepers Association in Newington (50 executive representatives of the hospitality industry, including major Connecticut hospitals attended) *March 12*
- Gave an invited talk on how young people should prepare for their careers and what they need to know to students at the Moran Middle School in Middletown (via Podcast) *March 15*
- Presented a final report on research project with her mentoree from the New Haven school system in the Young Women in Science project *March 17*
- Spoke about bed bugs and the worldwide pandemic to the Experiment Station Associates at their annual meeting. 50 attendees *March 18*
- Helped organize and participated in a third bed bug forum which was held at Southern Connecticut State University. (250 attendees) *March 22*
- Did a radio broadcast on WNPR Radio's Colin McEnroe Show about bed bugs, social stigmas, and what to do *March 31*
- Published a tri-fold brochure titled "Bed bugs: How to deal with them" and posted it on the Station's website. This was in response to wide public requests for such a publication *April 5*
- Introduced participants of the Farm-to Chef Program to the Insect Inquiry Office and its activities *April 5*

- Spoke about bed bugs at a meeting of Infection Control Nurses of Connecticut held in Cromwell (125 attendees) *April 23*
- Was interviewed about wasps, bees, and hornets by Mr. Bill Weir of the Hartford courrant *April 29*
- Talked to students from the Sound School about the activities of the Insect Inquiry Office *May 10*
- Held a special Connecticut Coalition Against Bed Bugs Board Meeting in the Board Room of Slate Laboratory. Staff from CT DEP and DCP attended *June 2*
- Explained the functions of the Insect Information office to students from Central Connecticut State University *June 15*
- Was interviewed about fireflies, cottony taxus and maple scales and spring time populations by Bob Miller of the Danbury News Times *June 16*
- Held a meeting of the CCABB to and focused on the recycling of used mattresses in Connecicut *June 29*
- Spoke about bed bug management at a meeting held by the East Hartford Housing authority in East Hartford. She also convened a meeting with health, pest control, and housing officials outdoors while the meeting room, halls, and elevators were treated, and advised them on future management policies *June 30*

#### ROBB, CHRISTINA

- Met with professors of St. Josephs College, West Hartford to discuss their current and previous programs to introduce middle school girls to science. The current program “Go-Girls” is a 10 week program that encompasses biology, chemistry, mathematics, and engineering to the young women. *September 17, 2009*
- Was a visiting scientist with the Biobus when it visited the Wooster School in Danbury and explained her career as a scientist to six classes of students. She also performed ELISA experiments and gel electrophoresis experiments with four classes of students *November 2-3*
- Participated in the Middle School Girls’ Science Mentorship Program funded by the Community Foundation of Greater New Haven, Fund for Women and Girls. The Program ran for 12 weeks from *November 12*
- Was a session organizer and invited speaker of the “Contaminants of Food” session at the Eastern Analytical Symposium in Somerset, NJ *November 16-19*
- Participated in an on-line “HPLC Master Class” Webinar Part 1, held by Professor Peter Schoenmakers, UVA, The Netherlands *January 19, 2010*
- Spoke about pesticides in water and food to 7<sup>th</sup> and 8<sup>th</sup> grade students from Hamden Hall Day School *April 19*
- Presented a lecture entitled “ELISA analysis of abrin” at the Food Emergency Response Network National Training Conference in Minneapolis, MN *June 28-July 2*

## RUTLEDGE, CLAIRE

- Attended the Connecticut Tree Protective Association annual summer meeting in Farmington CT *July 16, 2009*
- Presented demonstration titled 'Do I Have the Asian Longhorned Beetle? How to Identify this Major Threat to Connecticut's Trees' Plant Science Day, Hamden CT *August 5*
- Presented the talk 'Biology of the Asian Longhorned Beetle and a history of its invasions in North America' Nursery & Landscape Research Tour, Windsor CT *September 10*
- Taught the Insects and Trees portion of the Arboriculture 101 course presented by the Connecticut Tree Protective Association in Jones Auditorium (45 attendees) *October 1, November 10 and December 9*
- Presented the talk 'Mating frequency and fecundity in the Emerald Ash Borer.' Emerald Ash Borer Research and Technology Development Meeting, Pittsburg PA (200 attendees) *October 21*
- Participated as a mentor in the Connecticut Agricultural Experiment Station's 'Girls in Science' mentoring program. New Haven, CT. *November 2009 – April 2010.*
- Presented the talk 'Cerceris fumipennis, the beetle hunting wasp.' to a visiting class from Wesleyan University (20 attendees) *November 17*
- Presented the talk 'Emerald Ash Borers' USDA PPQ, CAES Forest Pest Outreach 'Train the Trainers' session. Sharon, CT (25 attendees) *December 5*
- With Rose Hiskes, presented a workshop on Asian longhorned beetle and Emerald ash borer at the Sharon Audubon Society (20 attendees) *December 5*
- Co-authored with Bohne M, Souto D, Teerling C, Payton B, Rutledge C, Burnham C, Wiemer J, Weaver J, Hanson T, Fierke M, Heillman W, Hoebecke R a poster 'Biosurveillance of Buprestidae in New York and New England.' that was presented at the USDA Interagency Research Forum on Invasive Species, Annapolis MD. *January 12, 2010*
- Attended the annual winter meeting of the Connecticut Tree Protective Association. *January 21*
- Taught the Insects and Trees portion of the Arboriculture Course presented by Bartlett Arboretum in Stamford, CT (14 attendees) *February 11*
- Taught the class "Insects that feed on trees" for the CTPA Arboriculture 101 course held in Jones Auditorium (40 attendees) *February 17*
- Presented the talk 'Shiny beetles and the wasps who love them' to the Forest Health Workshop. New Haven, CT (40 attendees) *February 18*
- Taught the "hands-on" night for the CTPA Arboriculture 101 course in Jones Auditorium (40 attendees) *March 10*
- Taught sessions of CTPA Arboriculture 101 in Jones Auditorium (45 attendees) *February 17, March 10 and April 7*
- Presented the poster 'Polyandry and Fecundity in Emerald Ash' at the Eastern Branch Meeting of the Entomological Association of America, Annapolis MD *March 7-8*
- Participated in the APHIS/ FS cooperator meeting, Concord NH *April 1*

- Presented a talk on the Emerald ash borer to a Federated Garden Club workshop in Jones Auditorium (25 attendees) *April 7*
- Presented the talk “Cerambycidae and Buprestidae: Not so boring after all” to Master Gardeners’ Advanced Class (25 attendees) Bethel, CT *April 20*
- Presented the talk “Insects that feed on trees” to the Master Gardeners (40 attendees) Stamford, CT *April 21*
- Presented a talk titled “The beetle hunting wasp” to the Experiment Station Associates at the Discovery Center in Hartford (40 attendees) *May 13*
- Presented the talk “Cerceris fumipennis, the beetle hunting wasp” during an Experiment Station Associates outing, (40 attendees) Hartford, CT *May, 15*
- Gave a presentation titled “What is an insect?” to children at Cuddletime Day Care Center in Hamden (20 children attendees) *May 21*
- Hosted a table on Asian Longhorned Beetles and Emerald Ash Borers at the Norwalk-Wilton Tree Festival held in Cranbury Park in Norwalk, CT (1,275 attendees) *May 22*
- Presented the talk ‘The Emerald Ash Borer’ at a joint CTPA/ CNLA class Naugatuck Valley Community College, Waterbury, CT (30 attendees) *June 29*

#### SANDREY, STEPHEN

- Staffed a booth on Asian longhorned beetles and Emerald ash borer at the Hartford Flower Show at the Connecticut Convention in Hartford *February 18-21, 2010*
- Answered questions on Asian longhorned beetles for students at Winter Farm City, Brookside Farm, Litchfield *March 22*
- Presented the Archivist Report at the Horticultural Inspectors Society meeting in Albany, NY *April 12-15*

#### SCHULTES, NEIL P.

- Hosted a student from Sacred Heart University and gave him a tour of each department and highlighted the research being done in each and what type of jobs are being performed with different education degrees *July 15, 2009*
- Presented a poster entitled “Physiological measurements along a developing maize leaf unveil no transition from C3 toward C4 photosynthesis” at the Sigma Xi Annual Meeting & International Research Conference in Houston TX *November 11-14*
- Presented a series of lectures on Genetic Engineering in Agriculture to Yale students in the course Sci130 “Current topics in Science” *January-February 2010*
- Gave a presentation to Charles Reddington’s class of Plant biology students from Springfield College (15 participants) *March 1*
- Hosted and gave a tour of the Station to an official from the USDA, Beltsville *March 4*
- Gave a lecture entitled “Genetic modification of plants in agriculture” to students at the Common Ground Magnet School in New Haven *May 10*

#### SHEPARD, JOHN J.

- Presented a display on mosquitoes and Eastern Equine Encephalitis and was interviewed by Sarah L. Hamby of the *Reminder News* during the Open House at the Griswold Research Center (14 attendees) *October 3, 2009*
- Spoke to students from Park City Prep Charter School in Bridgeport and provided hands on activities about mosquito biology and arbovirus surveillance as part of the NIH/NSF Peabody Fellows Program, Yale University (24 students) *November 5*
- Presented an invited talk entitled “Arbovirus Activity in Connecticut: 2009” at the 55<sup>th</sup> Annual Meeting, Northeastern Mosquito Control Association, held in Sturbridge, MA (100 attendees) *December 2*
- Presented information on mosquitoes and Eastern Equine Encephalitis at Ag Day at the Capitol *March 18, 2010*
- Was interviewed about mosquitoes developing in vernal pools by Ed Stannard of the *New Haven Register* *April 8*
- Was interviewed about mosquitoes, Eastern Equine Encephalitis, and West Nile virus by Jocelyn Maminta of WTNH-TV *April 13*
- Talked to three 2<sup>nd</sup> grade classes at Spring Glen School in Hamden about insects and invertebrates found in vernal pools (approximately 60 students) *May 4*
- Was interviewed about trapping and testing of mosquitoes for West Nile virus by Jocelyn Maminta of WTNH TV 8

#### SHORT, MICHAEL R.

- Spoke about hydroponic greenhouse production and Ebb & Flood watering of greenhouse crops with members of the “Institute for Science Instruction and Study” of Southern Connecticut State University (12 students) *July 7, 2009*
- Co-hosted a forestry and natural resources tool identification demonstration table at the Connecticut FFA Fall Forestry Career Development Event at the University of Connecticut, and prepared the General Knowledge Exam and the Forest Disorders Exam, Storrs, (30 students from 19 Vo-Ag schools) *November 6*

#### SMITH, HUGH

- Gave a presentation in Spanish entitled “El monitoreo de plagas en viveros en Connecticut” (Monitoring Pests of Connecticut Nurseries) at the summer meeting of the CNLA at Imperial Nurseries in Granby (20 attendees) *July 16, 2009*
- Gave the invited presentation “Ecological approaches to the management of arthropod pests of horticultural crops” at the annual meeting of the American Society for Horticultural Science in St. Louis, MO (30 attendees) *July 27*
- Gave a presentation on insectary plants for enhancement of biological control for the Landscape and Nursery Research Tour at the Valley Laboratory *September 10*
- Participated in a meeting sponsored by UConn and UMass Cooperative Extension at Grower Direct on biological control in greenhouses, in Somers, CT *January 6, 2010*



- Gave a presentation at the New England Vegetable and Berry Growers' Association meeting entitled "Strawberry Sap Beetle Management", in Chicopee, MA (80 attendees) *January 8*
- Gave a presentation at the CNLA Winter symposium entitled "Identificacion de insectos plaga en los viveros de Connecticut" or "Identification of pest insects in Connecticut's nurseries" at Mountain Ridge (38 attendees) *January 14*
- Assisted with the Connecticut Vegetable and Small Fruit Growers' Conference as a member of the steering committee, in Vernon, CT (179 attendees) *January 20-21*
- Gave the presentation "Management of semi-persistent aphid-borne viruses" at the Annual Tobacco Research Meeting in Suffield, CT (135 attendees) *February 17*
- Gave a two-hour training course in Spanish on the identification of pest arthropods and bio-control agents for five workers from Grower Direct, a greenhouse in Somers *March 5*
- Gave a two-hour training course in English on the identification of pest arthropods and bio-control agents for three workers from Grower Direct, a greenhouse in Somers *March 11*

#### SMITH, VICTORIA L.

- Participated in a program evaluation tour of fruit, cut flower, and ornamental plant shipping facilities in Sacramento and Watsonville, California, sponsored by the National Plant Board, to evaluate effectiveness of pest mitigation efforts for *P. ramorum* and Light Brown Apple Moth by plant product exporters (30 participants) *July 12-17, 2009*
- Participated in the summer meeting of the Northeast Sustainable Agriculture Research and Education Administrative Council (NE-SARE), held in Manchester, NH (60 participants) *July 21-24*
- Was interviewed about the Asian longhorned beetle by NBC-30 News *August 6*
- Participated in the Annual Meeting of the National Plant Board as Vice-president of the Eastern Plant Board, the *P. ramorum* Working Group, and as a member of the Plant Board's Board of Directors, held in Oklahoma City, OK (200 participants) *August 10-14*
- Presented a talk entitled "Asian Longhorned Beetle: A Threat To Our Forests" to the Flanders Nature Center, at the Senior Center in Woodbury (5 attendees) *September 24*
- Gave the talk "ALB: A Threat to Our Forests" to the Middlesex County Farm Bureau meeting held in East Hampton (45 participants) *October 14*
- Participated in the annual meeting of the North American Plant Protection Association where she participated in discussions on chrysanthemum white rust and invasive pests (215 participants) Chicago *October 19-22*
- Participated in the annual meeting of, and gave a presentation of data on forest health monitoring and aerial survey, at the USFS Forest Cooperators held at the Durham, NH field office (25 participants) *October 27-28*

- As Vice President of the Eastern Plant Board, participated in a joint meeting of the USDA-APHIS-PPQ Executive Team and the National Plant Board's Board of Directors, held in New Orleans, LA *November 1-4*
- Participated in a program review of the New England Forest Pests Outreach and Survey Project, via Webinar *November 13*
- Gave the talk "Asian longhorned beetle: A threat to our forests" at the CT Forest Conservation and Research Forum: Connecticut Forests in a Changing World, from Global to Local, held at the Rome Commons on the campus of the University of Connecticut (200 participants) *November 24*
- Participated in the annual meeting of the Connecticut Pomological Society, leading discussions on import regulations for apples and the threat of Asian Longhorned Beetle (65 participants) Glastonbury *December 2*
- Participated in the USDA-APHIS *Phytophthora ramorum* Quality Assurance Review Meeting, with discussions on deregulation of *P. ramorum*, new advances in knowledge of the pathogen, modeling of the epidemics, and an assessment of the threat to eastern forests (65 participants) Riverdale, MD *December 15-16*
- Presented a talk titled "Asian Longhorned Beetle (ALB): a Threat to our Forests" at the Regional Water Authority's annual Permit Holders Meeting held at RWA Headquarters in New Haven (60 participants) *January 13, 2010*
- Manned a table on Asian Longhorned Beetles and other invasives at the CT Nursery and Landscape Association Winter Meeting, held at Mountain Ridge in Wallingford, (200 participants) *January 14*
- Participated in the winter meeting of the National Cooperative Agricultural Pest Survey (CAPS) Committee, as the State Plant Regulatory Official representative of the Eastern Plant Board, held at the National Detector Dog Training Center in Newnan, GA (25 participants) *January 26-29*
- Presented a talk entitled "Exotic Invaders: The Latest on Emerging Pests and Diseases" at New England Grows, held at the Boston Convention and Exhibition Center, Boston, MA (approximately 2,000 participants) *February 5*
- Organized the annual Forest Health Workshop held in the Jones Auditorium, and presented a talk entitled "What's the Deal with *P. ramorum*?" (45 participants) *February 18*
- Presented a talk entitled "Asian Longhorned Beetle: a Threat to Our Forests" to the Greater Bridgeport Men's Garden Club at the Sterling House in Stratford (20 participants) *March 17*
- Participated in the National Plant Board, Board of Directors meeting held at the Menger Hotel in San Antonio, TX (15 participants) *March 23-25*
- Participated in a meeting of USDA-Forest Service and USDA-APHIS cooperators, held at the Audubon Center in Concord, NH (40 participants) *April 1*
- Was interviewed for an article on Beekeeping in the Northeast by Ross Conrad of Bee Culture Magazine *April 9*
- Participated in the 85<sup>th</sup> Annual Meeting of the Eastern Plant Board, held at the Holiday Inn in Albany, NY, as Eastern Plant Board Vice-President and a member of

the National Plant Board's Board of Directors, a member of the *Phytophthora ramorum* working group, and a member of the National CAPS Committee (150 participants) *April 12-15*

- Participated in the Spring meeting of the CT Cooperative Agricultural Pest Survey Committee, with a discussion on *P. ramorum* survey activity, insect trapping, and outreach efforts (20 participants) *May 19*
- Discussed the Light Brown Apple Moth at the Twilight Meeting of the Connecticut Pomological Society held at Belltown Orchards in Glastonbury (60 participants) *May 25*
- Participated with the Survey and Inspection Team in a Snail Blitz, coordinated by the Wallingford Office of USDA-APHIS-PPQ. Trained detector dogs and their handlers from the Detector Dog Training Center in Newnan, GA searched for invasive snails and slugs in areas surrounding ports and rail freight yards. *May 27*
- Participated in the annual meeting of the California Oak Mortality Task Force, held at Dominican University of California in San Rafael, California, with discussions on *Phytophthora ramorum* movement in landscapes, symptomology, and survival, and a field trip to the experimental nursery, and to the first known infestation of *P. ramorum* at China Camp State Park (approximately 100 participants) *June 8-11*
- Discussed the Light Brown Apple Moth at a Twilight Meeting held at Lyman Orchards in Middlefield (60 participants) *June 15*

#### STAFFORD, KIRBY C.

- Participated in the joint meeting of the Northeastern Regional Association of Experiment Station Directors (NERA) and Extension Directors (NEED) in Portland, ME *July 12-14, 2009*
- Spoke on ticks and Lyme disease at the Yale Peabody Museum as part of their 2009 Peabody Fellows Institute for Teachers (13 adult attendees) *July 16*
- Participated in a regional conference call of the NE Exotic Forest Pest Outreach and Survey Project *July 23*
- Spoke on ticks and Lyme disease and the Asian longhorned beetle at the annual meeting of the Connecticut Environmental Health Association in Madison (75 attendees) *August 6*
- Spoke about regulatory issues and the Asian longhorned beetle at a Forest Pest Town Meeting in Norwich (10 attendees) *August 12*
- Spoke about regulatory issues and the Asian longhorned beetle at a Forest Pest Town Meeting in Torrington (6 attendees) *August 18*
- Was interviewed about bird mites and Lyme disease in the Stamford Police Department by Jeff Morgansteen of the Connecticut Post *August 18*
- Greeted bicyclists visiting Lockwood Farm for the Tour des Farms as part of the Connecticut Folk Festival and CT Green Expo *September 12*
- Spoke about the Asian longhorned beetle at a meeting of the Connecticut Entomological Society in Jones Auditorium (10 attendees) *September 18*

- Participated in the USEPA Regional Scientific Workshop on Biodiversity/Landscape Change and Lyme Disease-Science and application, and spoke on “Cultural, biological, and natural tick control for the management of Lyme disease” (52 attendees plus 23 on the webinar) *September 22-23*
- Participated in an NASDA-APHIS Invasive Forest Pests Forum on Asian Longhorned Beetle in Worcester, MA *September 29*
- Participated in a conference call on the Northeast Forest Pest Outreach and Survey Project *October 1*
- Spoke on ticks, deer, and Lyme disease at the Newtown Public Library to the Tick-Borne Disease Action Committee (16 attendees) *October 7*
- Participated in a Results Based Accountability Training Session in Hartford *October 8*
- Participated in a CSREES web-conference on upcoming planned changes to the CRIS reporting system to a web-based system *October 8*
- Participated in an ALB program evaluation meeting at the Valley Laboratory in Windsor *October 13*
- Welcomed attendees to the Connecticut Bed Bug Forum held in Jones Auditorium (180 attendees) *October 15*
- Participated in a Connecticut teleconference on H1N1 status and preparedness *October 16*
- Was interviewed about Lyme disease by Abigail Dumas, a Yale graduate student *October 19*
- Provided a brief update on the Station and ALB at the New Haven County Farm Bureau annual meeting in Hamden (40 attendees) *October 20*
- Participated in the public hearing on the adoption of proposed regulations on the ALB and Emerald ash borer in Hartford *October 28*
- Spoke on current tick research at the Ridgefield Health Department’s Lyme Disease Education and Training Symposium in Ridgefield (50 attendees) *November 6*
- Participated in a Cooperative Agricultural Pest Survey Committee Meeting in Windsor *November 12*
- Participated in a conference call about our tick control research *November 12*
- Participated in an informational meeting on the Girls & Science Mentorship Program in the Atrium of the Johnson-Horsfall Building *November 12*
- Participated through a webinar in the review of the Northeast Forest Pest Outreach and Survey Project held in Durham, NH *November 13*
- Spoke to a seminar class from Trinity College about Lyme disease (17 students) *November 17*
- Spoke about Asian longhorned beetle and Emerald ash borer at the annual meeting of the Connecticut Environmental Council in Plantsville (170 attendees) *November 24*
- Was interviewed about deer and ticks by Kendra Bobowich of the Newtown Bee *January 20, 2010*

- Spoke on “Pest Management: Ticks and Lyme Disease” at the Organic Land Care Course in Jones Auditorium (45 attendees) *January 25*
- Spoke at the Legislative Regulations Review Committee hearing for the Asian Longhorned Beetle and Emerald Ash Borer regulations in Hartford *January 26*
- Spoke on Lyme disease and tick control at the Old Ripton Garden Club in Shelton (43 adult attendees) *February 1*
- Participated in a conference call for the multi-state project on collaborative potato breeding (NE-1031) *February 11*
- Was interviewed about the Connecticut state insect, the European praying mantis, by Sean Melony of Fox 61 *February 16*
- Spoke on the Asian longhorned beetle outreach and survey project at the Forest Health Workshop in Jones Auditorium (45 adult attendees) *February 18*
- Participated in a meeting of the bed bug committee in the Slate Board Room *February 22*
- Participated in a meeting of the multi-state project Biology, Ecology, and Management of Emerging Infectious Diseases (NE-1043) at Rutgers University *February 25*
- Participated on a conference call of the EPA’s Lyme Disease Prevention Network *March 4*
- Spoke on ticks and Lyme disease at a meeting of the Hill and Dale Garden Club in Glastonbury (46 attendees) *March 11*
- Gave a talk on the Asian longhorned beetle and Emerald ash borer to the Friends of Hammonasset State Park in Madison (44 attendees) *March 16*
- Spoke on ticks and Lyme disease at Western Connecticut State University in Danbury as part of their Science at Night series (65 attendees) *March 18*
- Participated in the meeting of Northeastern Regional Association of Agricultural Experiment Station Directors (NERA) in Baltimore, MD *March 22-24*
- Welcomed and provided an update at the spring meeting of the Connecticut Beekeepers Association held in Jones Auditorium (55 attendees) *April 10*
- Was interviewed about risk for ticks and Lyme disease for growers by Steven Dravis for Christmas Tree News *April 13*
- With Dr. Anuja Bharadwaj, presented a display on ticks and Lyme disease for Biodiversity Day at the Yale Peabody Museum in New Haven (461 adult and 512 student attendees) *April 17*
- With Dr. Theodore Andreadis, was interviewed about mosquitoes, ticks, and associated diseases by Sam Gingerella, WTIC-Radio, at the studio in Farmington *April 21*
- Participated in a conference call on the Forest Pest Outreach & Survey Project *April 22*
- Spoke to Greenwich High School students about research and survey activities in the Department of Entomology (14 student attendees) *April 26*

- With Dr. Jason White and William Berger, participated in a meeting of the Peer Committee of the CT Academy of Science and Engineering on the Artificial Turf Study *April 28*
- Was interviewed about the impact of deer densities on Lyme disease by Madeline Bodin for Northern Woodlands Magazine *April 28*
- Spoke on ticks and Lyme disease to the Seabury Retirement Community in Bloomfield (70 attendees) *April 29*
- Was interviewed about tick activity and tick bite prevention measures by William Weir of the Hartford Courant *April 30*
- Was interviewed about honey bees and colony collapse disorder by Rick Harrison of the Republican American *May 6*
- Participated in a conference call of the U.S. Environmental Protection Agency's Lyme disease network *May 6*
- Was interviewed about honey bees, bee health, and colony collapse disorder by John Krebs from WTXN-Fox 61 *May 7*
- Participated in the meeting of the Cooperative Agricultural Pest Survey at the Valley Laboratory in Windsor *May 19*
- Participated on a Forest Pest Outreach and Survey Project conference call *May 27*
- Participated in a meeting of the Connecticut Coalition Against Bed Bugs in the Slate Building Board Room *June 2*
- Participated in a conference call of the US EPA Lyme Disease Network *June 3*
- Was interviewed about Lyme disease prevention by John Dankosky on WNPR's "Where We Live" program at the WNPR studio in New Haven *June 8*
- At the request of Representative Christopher Caruso, and with Gregory Bugbee, attended an Eagle Scout Recognition Dinner as representatives of the Experiment Station *June 10*
- With Dr. Brian Eitzer and Dr. Douglas Dingman, participated in the summer meeting of the Connecticut Beekeepers Association at Lockwood Farm and provided a brief welcome and update on Station activities (81 attendees) *June 12*
- Spoke with Congresswoman Rosa DeLauro about Station activities at the Connecticut Beekeepers Association summer meeting at Lockwood Farm *June 12*
- Participated in a meeting of the Connecticut Academy of Science and Engineering Peer Review Committee for the synthetic turf field study in Rocky Hill *June 15*
- Participated in Affirmative Action Update Training in Hartford *June 18*
- With Dr. Louis A. Magnarelli, attended a results based accountability update session at the Legislative Office Building in Hartford *June 23*
- Participated in a conference call of the Connecticut Academy of Science and Engineering Peer Review Committee for the synthetic turf field study *June 28*
- Was interviewed about ticks and Lyme disease by Mark Sims of Connecticut Radio Network *June 30*

STONER, KIMBERLY A.

- Participated in a meeting on methods of measuring the effects of pesticides on honey bees, sponsored by the USDA-APHIS and the USDEP, held in Alexandria, VA *July 8-9, 2009*
- Participated in an on-farm workshop sponsored by CT NOFA and the CT Greenhouse Growers Association held at Gilberti's Herb Farm in Easton *July 21*
- Gave a presentation entitled "Why Organic?" to the Massachusetts Organic Lawn and Turf Course at the University of Massachusetts in Amherst (45 attendees) *August 7*
- Participated in a meeting of the Board of Directors of NOFA in Berlin (12 attendees) *August 16*
- Gave a presentation entitled "Why Organic?" to the Connecticut Organic Lawn and Turf Course at the Valley Laboratory in Windsor (45 attendees) *August 20*
- Participated in the workshop of the CT Climate Change Working Group on Risk Assessment for Agriculture at the University of Connecticut in Storrs (50 attendees) *August 24*
- Spoke to visiting bicyclists at Lockwood Farm and Boulder Knoll Farm in Cheshire as part of the Tour des Farms, organized by the Connecticut Folk Festival and CT Green Expo (30 attendees at Lockwood Farm and 20 attendees at Boulder Knoll Farm) *September 12*
- Spoke on "Threats to the health of honey bees and wild bees" to the Cheshire Garden Club (45 attendees) *September 14*
- Participated in a meeting of the Organic Land Care Committee of NOFA at the Valley Laboratory (10 attendees) *September 15*
- Participated in a meeting on modifying the ban on pesticides at day care centers and K-8 schools at the Department of Environmental Protection (18 attendees) *October 8*
- Organized and chaired a meeting funded by the Northeast Experiment Station Directors Research Association to plan an improved proposal for research on "Integrated Pest Management and Pollinator Protection in the Northeast" at the Valley Laboratory (7 attendees) *October 16*
- Presided over the annual meeting of the Friends of Boulder Knoll at Elim Park in Cheshire (15 attendees) *October 22*
- Led a coalition of organizations to organize two events highlighting the importance of getting the concentration of carbon dioxide in the atmosphere below 350 parts per million on the International Day of Climate Action (more than 350 participants at the two events) *October 24*
- Co-organized the 4<sup>th</sup> Annual Community Farming Conference and made a presentation as part of a panel describing the process of starting a community farm, held in Jones Auditorium (40 attendees) *October 31*
- Co-organized the 4<sup>th</sup> Annual Community Farming Conference, moderated the afternoon session, and made a presentation as part of a panel on how community farms are started and organized in Jones Auditorium (45 attendees) *November 1*

- Co-organized the CT NOFA Organic Harvest Festival in Jones Auditorium (40 attendees) *November 7*
- Participated in a meeting of the Girls & Science mentorship Program in the Atrium of the Johnson-Horsfall Building (30 attendees) *November 12*
- Participated in a day-long working meeting of the Organic Land Care Committee at the Valley Laboratory in Windsor (9 attendees) *November 20*
- As guest of honor as the Founder of the Organic Land Care Program, participated in the 10<sup>th</sup> anniversary celebration of the Organic Land Care Program in Bloomfield (13 attendees) *November 20*
- Presented a display on Experiment Station research, regulatory, and educational activities on bees at the Southern New England Bee Assembly at the Unitarian Society of New Haven in Hamden (70 attendees) *November 21*
- Participated in a meeting at the Connecticut Department of Environmental Protection on possible modifications to the school pesticide law *December 1*
- Participated in a meeting of the Board of Directors of CT NOFA *December 6*
- Was interviewed about research on pesticides and bees and new developments in organic farming by Richard Hill and Guy Beardsley of WPKN *December 10*
- Participated in a meeting of the Organic Land Care Committee *December 15*
- Participated in a series of meetings held in association with the Annual Meeting of the American Beekeeping Federation in Orlando, Florida, and presented a paper co-authored with Dr. Brian Eitzer titled “Pesticide in Pollen Trapped from Honey Bee Hives in Connecticut – Two Years of Results in Relation to Acute Toxicity Data” at the American Bee Research Conference (200 attendees). Also participated in the Annual Meeting of the multi-state Hatch project NC-1173, sustainable Solutions to Problems Affecting Bee Health *January 12-15, 2010*
- Participated in the annual retreat of the Board of Directors of CT NOFA at the Isabella Freedman Center in Falls Village *January 16*
- Taught two segments in the Massachusetts NOFA Organic Land Care Course titled “Pest Management Overview” and “Organic Management of Ticks and Lyme Disease” at Parker River National Wildlife Refuge in Newburyport, MA (80 students) *January 19*
- Taught “Principles and Procedures” as a part of the Connecticut NOFA Organic Land Care Course in Jones Auditorium (45 students) *January 21*
- Taught “Pest Management Overview” as a part of the Connecticut NOFA Organic Land Care Course in Jones Auditorium (45 students) *January 25*
- Was interviewed about community farms by Lauresha Xhiani of the Waterbury Republican-American *January 26*
- Presented a display on “Bees at The Connecticut Agricultural Experiment Station” as part of the Connecticut Groundskeepers Association at the Mohegan Sun in Uncasville *January 29*
- Presented a talk titled “Organic Management of Vegetable Insect Pests” and hosted the Getting Started in Organic Farming Conference in Jones Auditorium (38 attendees) *January 30*



- Spoke on “Organic Management of Insect Pests” as a part of the Adult Education Program on Sustainable Living at the Middletown High School /Agriscience Center (15 attendees) *February 2*
- Spoke on “Threats to the Health of Wild Bees and Honey Bees” at the Whitney Center in Hamden at the invitation of their Environment Committee (45 attendees) *February 4*
- Participated in a meeting on possible changes in legislation regulating the use of lawn care pesticides at schools and day care centers at Department of Environmental Protection in Hartford (16 attendees) *February 17*
- Participated in a meeting of the Connecticut NOFA Board of Directors by conference call (12 attendees) *February 21*
- Spoke about the “Pest Management Overview” as a part of the Rhode Island NOFA Organic Land Care Course at the Save the Bay Center in Providence, RI (57 attendees) *February 24*
- Participated in a meeting of the NOFA Organic Land Care Committee in Sturbridge, MA (10 attendees) *February 24*
- Spoke on “Plight of the Bumble Bee – Threats to the Health of Wild Bees and Honey Bees” at the Ecological Landscaping Conference in Springfield, MA (60 attendees) *February 25*
- Participated in a “Meet the Experts,” a meeting on how to encourage farming on farmland in Connecticut owned by municipalities, land trusts, and other non-profit organizations, organized by Jiff Martin of the American Farmland Trust (25 attendees) *February 26*
- Presented a talk on “Threats to the Health of Wild Bees and Honey Bees” at the CT NOFA Winter Conference at Manchester Community College (45 attendees) *March 6*
- Participated in the annual planning retreat of the NOFA Organic Land Care Committee in Chester (12 attendees) *March 12-14*
- Participated in a meeting of the Board of Directors of CT NOFA in Hamden (12 attendees) *March 21*
- Organized and facilitated a conference call reviewing the NOFA Organic Land Care Standards for Wildlife Management (5 attendees) *March 30*
- Was interviewed on community-supported agriculture by Jesse Buchanan of the Meriden Record-Journal *April 2*
- Presented research on pesticides in pollen to the Farm-to-Chef Program in Jones Auditorium (22 attendees) *April 5*
- Was interviewed about organic pest management on WPKN Radio *April 8*
- Organized an event with Chef Tim Cipriano, Executive Director of Food Services for the New Haven Public Schools, to present the opportunities for the New Haven Public Schools to work with local farmers to increase the amount of local produce in school lunches and provide education to local city students about food and agriculture *April 10*

- Was interviewed about community farms leasing land from towns and land trusts and how to make those arrangements work more smoothly by Jack O'Will of the Working Lands alliance *April 12*
- Spoke on "Organic Management of Pests of Vegetables" to the Down-to-Earth Garden Club in South Windsor (40 attendees) *April 14*
- Participated in a meeting by conference call of the Board of Directors of CT NOFA (10 attendees) *April 18*
- Organized and led a day-long meeting of researchers and stakeholders from across New England on Pollination of Northeastern Specialty Crops at the University of Massachusetts in Amherst, MA. This meeting was funded by the Northeastern Regional Association of State Experiment Station Directors in order to develop a proposal to the Specialty Crop Research Institute (12 attendees) *April 20*
- Met with Bill Duesing, Executive Director of CT NOFA, about the future of the NOFA Organic Land Care Program *April 21*
- Gave the presentation "Why pollinator decline is important" to the Wild Ones (a native plant group) at Connecticut College in New London (25 attendees) *May 1*
- Spoke about her research on bees to a visiting group of students from the Sound School *May 10*
- Participated in a meeting of the NOFA Organic Land Care Committee at the Valley Laboratory in Windsor (12 attendees) *May 11*
- Participated in a meeting of the CT NOFA Board of Directors at the NOFA Office in Oxford (12 people) *May 16*
- Spoke on "Threats to the health of wild bees and honey bees" to the Naugatuck Audubon Society at the Kellogg Environmental Center in Derby (40 attendees) *May 18*

#### THOMAS, MICHAEL C.

- Assisted scientists and Earthwatch volunteers (ten science teachers) studying interactions between caterpillars and their natural enemies at the American Museum of Natural History Southwest Field Research Station in Portal, AZ *August 10, 2009*
- Demonstrated insect collecting techniques to the Yale University EEB Terrestrial Arthropods class at the Yale Forestry Camp in Norfolk, CT (6 student attendees) *September 12*
- Presented information on mosquitoes and Eastern Equine Encephalitis at Ag Day at the Capitol *March 18*
- Was interviewed about mosquitoes, Eastern Equine Encephalitis, and West Nile virus by Jocelyn Maminta of WTNH-TV *April 13*
- Presented a display on mosquitoes and their associated diseases at the Yale Peabody Museum of Natural History for their event "Backyard Bloodsuckers: Biodiversity Bites Back!" (451 adult and 512 student attendees) *April 17*
- Gave a presentation on the status of State-listed *Odonata* at a meeting of the Connecticut Entomological Society held at the CAES in New Haven *May 1*

TRENCHARD, PETER W.

- Presented an Asian longhorned beetle (ALB) Survey and Regulatory overview at the Torrington town-wide meeting at UCONN in Torrington *August 18*
- Staffed the Station exhibit at Celebrating Agriculture and presented material about ALB at the Woodstock Fair Grounds in Woodstock *September 26*
- Spoke about ALB survey activities at the ALB program evaluation meeting at the Valley Laboratory in Windsor *October 13*
- Displayed honey bees and beekeeping equipment and spoke about honey bees to elementary school children at Farm City 2009 at Greenbacker Farm in Durham (100 attendees) *October 20*
- Staffed the Station exhibit at the CNLA Winter Meeting at Moutainside Resort, Wallingford and presented material about ALB and other invasives *January 14, 2010*
- Presented a talk titled “A survey of Surveys” at the Forest Health Monitoring Workshop held at the Station *February 18*
- Staffed a booth on the ALB and Emerald Ash Borer at the Hartford Flower Show at the Connecticut Convention Center in Hartford *February 18-21*
- Presented the talk “Asian longhorned beetle life history and impact on maple sugar production” to 5<sup>th</sup> grade students from Torrington at the Farm City Program of the Connecticut Agricultural Education Foundation at Brookside Farm II, Litchfield *March 23, 2010*
- Attended the 36<sup>th</sup> Annual Meeting of the Horticultural Inspection Society, Eastern Chapter, and presented a talk on Connecticut’s inspection and survey activities titled “A Survey of Surveys”, Albany, NY *April 12-15*
- Spoke about ALB survey activities at the ALB Program Planning Meeting, Valley Lab, Windsor *May 19*
- Participated in the Spring Meeting of the CT Cooperative Agricultural Pest Survey Committee, with a discussion on *P. ramorum* survey activity, insect trapping, and outreach efforts at the Valley Lab, Windsor *May 19*
- Participated in a Snail Blitz, coordinated by the Wallingford Office of USDA-APHIS-PPQ. Trained detector dogs and their handlers from the Detector Dog Training Center in Newnan, GA, searched for invasive snails and slugs in areas surrounding ports and rail freight yards. Snails and slugs were found and collected, and retained for later identification *May 27*

VOSSBRINCK, CHARLES R.

- Chaired a scientific session on “Microsporidial Economics” and presented an invited talk entitled “The origin of *Nosema bombycis* in the silk moth *Bombyx mori*: a phylogenetic approach” at the International Symposium on *Bombyx mori*: Functional Genomics and Modern Silk Road held in Chongqing, China *October 22-24*
- Participated in a conference on molecular evolution entitled “*Conversations with Carl Woese*” hosted by the University of Illinois Institute for Genomic Studies (12 participants) February 10, 11, 2010

WARD, JEFFREY S.

- Along with Dr. Scott Williams, met with officials from Providence Water to discuss barberry control options, Providence, RI *July 1, 2009*
- Hosted a display on controlling Japanese barberry at the Jones Tree Farm's Red, White and Blue Festival in Shelton (20 children, 10 adults) *July 3*
- Led a field walk on invasives and forest management for the Talcott Farm Homeowners Association in Old Lyme (10 attendees) *July 14*
- Along with Dr. Louis A. Magnarelli, Dr. Scott Williams, Gregory Bugbee, and Michael Thomas, met with Representative Chris Caruso and members of the Connecticut Yankee Council Boy Scouts of America to discuss potential collaborative projects *August 25*
- Spoke on "Tree Biology" for the Arboriculture 101 class sponsored by The Connecticut Tree Protective Association, in Jones Auditorium (49 attendees) *September 2*
- Spoke on importance of controlling invasive species to Sacred Heart University students at Veteran's Park cleanup in Bridgeport (60 attendees) *September 3*
- Was interviewed about the effect of weather on fall colors by Bridget Ruthman of the Waterbury Republican *September 3*
- Was interviewed about the effect of weather on fall colors by Ryan Hanrahan of NBC-30 News *September 8*
- Was interviewed about fall colors by Amanda Cuda of the Connecticut Post *September 9*
- Spoke on "Controlling Japanese Barberry: Alternative methods and Impact on Tick Populations" at the Natural Areas Conference 2009 in Vancouver, WA (35 attendees) *September 16*
- Was interviewed about the relationship between tree crowns and roots by John Cox of the New Haven Register *September 22*
- Was interviewed about the relationship between barberry and ticks by Mary Jasch of the New Jersey Chapter of the American Society of Landscape Architecture Newsletter *September 23*
- Spoke on "Quantifying Forest Change" at the Great Mountain Forest GMF Centennial in Norfolk (50 attendees) *September 26*
- Spoke on controlling invasive species at Oxford High School (14 students, 2 adults) *September 30*
- Was interviewed about fall leaf colors by Ed Stannard of the New Haven Register *October 2*
- Was interviewed about bumper acorn crop by Amanda Cuda of the Connecticut Post *October 6*
- Spoke on woody plant identification for Gardening Study School in New Haven (28 attendees) *October 6*
- Participated in a meeting of Connecticut Forestlands Council in Middlefield *October 7*

- Spoke on the history of Connecticut’s forests for the Hill and Dale Garden Club in Glastonbury (35 attendees) *October 8*
- Spoke on methods of controlling invasive species to managers at the Department of Environmental Protection in Burlington, CT (12 attendees *October 19*)
- Spoke on “Dispersal of exotic species by white-tailed deer in Connecticut” at the Connecticut Forest Ecology Mini-Symposium at Highstead Arboretum in Redding (62 attendees) *November 12*
- Participated in the Connecticut Urban Forest Council meeting in Middlefield *November 18*
- Was interviewed about the effect of climate change on oaks by Christina Woodside of Connecticut Woodlands *November 18*
- Was interviewed about environmental impact of live vs. artificial Christmas trees by Bill Weir of the Hartford Courant *November 23*
- Spoke on “Connecticut Highlands Ecosystem Health Project” at the 5<sup>th</sup> Annual Connecticut Forest Conservation and Research Forum in Storrs (70 attendees) *November 24*
- Participated in and chaired a Connecticut Forestlands Council Research Committee Meeting in Middlefield *December 10*
- Participated in a Connecticut Forestlands Council Executive Board Meeting in Middlefield *December 10*
- Was interviewed about barberry control research by Sue Wolf of the Redding Pilot *December 11*
- Spoke on “Controlling Japanese barberry: alternative methods and impact on tick populations” to the Department of Environmental Protection – Wildlife staff in Burlington (45 attendees) *December 16*
- Conducted a field tour and provided advice on forest regeneration to CT-DEP foresters and others at Cockaponset State Forest (7 attendees) *January 5, 2010*
- Spoke on “Tree Biology” for the Arboriculture 101 class sponsored by the Connecticut Tree Protective Association in Jones Auditorium (49 students) *January 6*
- Participated in the Connecticut Forest Forum Roundtable at Yale University *January 8*
- Participated in the Connecticut Urban Forest Council meeting in Middlefield *January 20*
- Was interviewed about natural forest regeneration by Patrick White of Farming Magazine *January 22*
- Participated in the CT-DEP, Division of Forestry LEAN event in Hartford *January 26*
- Spoke on “A short history of the Connecticut forest” for an advanced Master Gardeners class at Bartlett Arboretum in Stamford (28 attendees) *January 27*
- Spoke on “Non chemical control of Japanese barberry” at the 2010 Connecticut Turf, Landscape, and Irrigation Conference in Montville (38 attendees) *January 28*

- Spoke on “Landscape Design to Reduce Lyme Disease Risk” at the Landscapes That Improve Human and Environmental Health Seminar, sponsored by the University of Maine - Cooperative Extension in Lewiston, ME (100 attendees) *February 9*
- Spoke on “Crop Tree Management” at the 15<sup>th</sup> annual Forest Health Monitoring Workshop in Jones Auditorium (33 attendees) *February 18*
- Spoke on “Forest Management for Wildlife and Diversity” for the Branford Land Trust stewards (25 attendees) *February 23*
- Spoke on using propane torches to control invasives at the Yankee-SAF meeting (30 attendees) *February 26*
- Administered practical and oral examination to arborist candidates for the Connecticut Tree Protection Examining Board *March 3*
- Spoke on “How deer affect wildflowers, invasives, and Lyme disease” at the CT Envirothon Wildlife Workshop in Burlington (40 children, 5 adult attendees) *March 6*
- Spoke on “Using propane torches to control barberry” at the New England Society of American Foresters annual conference in Nashua, NH (60 attendees) *March 9*
- Spoke on “Wildflowers and invasives” at the Connecticut Highlands Ecosystem Health Workshop at the White Memorial Conservation Center, Litchfield (70 attendees) *March 16*
- Participated in the Connecticut Urban Forest Council meeting in Middlefield *March 17*
- Spoke on “Invasive control strategies: theory and practice” at the “30 Hour Course”, a pesticide applicators certification course sponsored by the Cornell University Cooperative Extension, Yaphank, NY (15 attendees) *March 23*
- Spoke on “Using propane torches to control barberry” at the Flame-Weeding for Invasive Shrub Control Workshop sponsored by the USDA-NRCS in Vernon (42 attendees) *March 30*
- Presented a poster “Controlling Japanese Barberry: Alternative Methods and Impact on Tick Populations” at the Central Hardwood Forest Conference XVII in Lexington, KY (140 attendees) *April 6*
- Presented a paper “Stand and Individual Tree Growth After Crop Tree Management in Southern New England: 5-Year Results” at the Central Hardwood Forest Conference XVII in Lexington, KY (50 attendees) *April 7*
- Spoke on “A short History of the Connecticut Forest” at the Cheshire Public Library (20 attendees) *April 22*
- Spoke on “Importance of Trees” at the Guilford Lakes Elementary School in Guilford (444 student and 60 adult attendees) *April 23*
- Was interviewed about the effect of deer on forests by Madeline Bodin of Northern Woodlands Magazine *April 27*
- Visited the Marvelwood School in Kent and talked on invasive species control (7 student and 2 adult attendees) *April 28*
- Spoke on “Invasive shrub control” for the Kent Land Trust (8 attendees) *April 28*

- Spoke on “Tree and shrub care for the homeowner” at Bartlett Arboretum in Stamford, CT (8 attendees) *May 1*
- Spoke on “Strategies for reducing deer browse damage” for the Branford Evening Garden Gate Club (15 attendees) *May 10*
- Was interviewed about tree pollen production by Dana Waylon of WTIC-1080 radio *May 13*
- Visited Bridgeport to advise Steve Hladun, special Projects Coordinator- City of Bridgeport, on tree care and invasive shrub control *May 13*
- Spoke on Japanese barberry control and forest management at the Scituate Reservoir Watershed Public Field Tour in Foster, RI (65 attendees) *May 15*
- Along with Dr. Scott Williams, gave a walking tour of Lockwood Farm to the Executive Committee of the Connecticut Urban Forest Council (10 attendees) *May 19*
- Spoke on “Alternative methods of controlling invasive shrubs” at a Flame Weeding Workshop at the Griswold Research Farm (43 attendees) *May 26*
- Gave six talks on “Fruits of the Forests” at the Southington School Nature Day in Southington (118 student and 18 adult attendees) *June 3*
- Spoke on controlling invasive species at an evening workshop at Creaser Park in Coventry (19 attendees) *June 10*
- Provided an overview of horticulture and forestry research for Central Connecticut State University Students (18 attendees) *June 15*
- Along with Dr. Scott Williams, visited Charles Island, Milford, to advise CT DEP Wildlife on invasive tree management *June 16*
- Spoke on controlling invasive species at Regional Water Authority Deer Day in North Branford (14 adults and 3 children) *June 21*
- Provided a field workshop on tree measurements for CLEAR students in New Milford (16 student and 2 teacher attendees) *June 24*

#### WHITE, JASON C.

- Presented an invited talk entitled “Determining the Bioavailability of Highly Weathered Organochlorine Insecticide Residues” in session on Soil Bound Residues and Relevance to Environmental Exposure at the 238<sup>th</sup> Meeting of the American Chemical Society in Washington, DC *August 18-21, 2009*
- Met with Brian Ronholm, a staffer of Congresswoman Rosa DeLauro, on the accomplishments of the Invasive Aquatic Weed Program, in Rayburn House Office Building in Washington, DC *August 19*
- Was interviewed about the use of phytoremediation at contaminated sites in CT, NY, and elsewhere by Jennifer Read of New York Newsday *August 27*
- Participated in a conference call to discuss the appointment of a new Senior Associate Editor for the International Journal of Phytoremediation (Dr. White is the Managing Editor for the journal) *October 2*
- Participated in a Food Emergency Network CAP Laboratory Conference call *November 12*

- Co-organized and chaired two sessions: “Persistent Organic Pollutants” and “Plant Interactions with Nanoparticles”; presented two platform presentations: “Assay Dependent Toxicity of Nanoparticles to Agricultural Plants” and “Phytoremediation of Persistent Organic Pollutants: Mechanistic Studies and Field Application”, and chaired a meeting of the Editorial Board of the International Journal of Phytoremediation of which he is Managing Editor, at the 6<sup>th</sup> International Phytotechnologies Conference held in St. Louis, MO *December 1-4*
- Participated in a Northeast Food Emergency Response Network conference call *December 8*
- Participated in a Chemistry Cooperative Agreement Laboratory conference call *December 10*
- Discussed ways to increase collaborative work between DPH and Station scientists, toured the Department of Public Health laboratories, and attended the laboratory preparedness meeting in Hartford at the Department of Public Health *January 11, 2010*
- Participated in a Chemistry Cooperative Agreement (CAP) Laboratory conference call *January 14*
- Participated in a Northeast Regional FERN Laboratories conference call *February 9*
- Participated in a FERN Chemistry Cooperative Agreement (CAP) Laboratory conference call *February 11*
- Participated in a conference call and webinar with Cytoviva Incorporated regarding the potential use of microscopy coupled with hyperspectral imaging to visualize carbon and elemental nanoparticles in plants *February 17*
- Participated in a conference call of the organizing committee for the 7<sup>th</sup> International Phytotechnologies Conference to be held in Parma, Italy September 26-29. Dr. White is on the organizing committee and is Executive Vice President of the International Phytotechnology Society *February 17*
- Spoke on Sustainable Soil Management “Phytoextraction of weathered persistent organic pollutants” at the Yale University School of Forestry and Environmental Studies *February 18*
- Participated in a web-based Training Seminar that was offered on the new features found in the FERN website *February 25*
- Participated in the monthly Laboratory Preparedness Network meeting at the Department of Public Health in Hartford *March 1*
- Along with his staff, participated in a FERN Chemistry Cooperative Agreement Laboratory conference call *March 11*
- Gave a lecture entitled “Phytoremediation of Soils Contaminated with Persistent Organic Pollutants” at the annual meeting of the Experiment Station Associates *March 18*
- Participated in a monthly Laboratory Preparedness Network meeting at the Department of Public Health in Hartford *April 5*
- Participated in a conference call for the organizing committee of the 6<sup>th</sup> International Phytotechnologies Conference in Parma, Italy September 26-29, 2010 *April 7*



- Participated in a FERN Chemistry Cooperative Agreement Laboratory conference call *April 15*
- Participated in a Northeast Regional FERN laboratories conference call *April 20*
- Along with William Berger briefed the Connecticut Academy of Science and Engineering Peer Review Committee on the results of the CAES Department of Analytical Chemistry research and final report on tire crumb rubber *April 28*
- Presented a talk entitled “The Connecticut Agricultural Experiment Station Department of Analytical Chemistry: 115 Years of Food Safety Research”, and participated in the monthly Laboratory Preparedness Network meeting at the Department of Public Health in Hartford *May 3*
- Participated in a FERN Chemistry Cooperative Agreement Laboratory conference call *May 13*
- Accompanied by Analytical Chemistry staff, participated in a FERN Chemistry Cooperative Agreement Laboratory conference call focusing on the role of FERN CAP in the testing of seafood for the Gulf Oil Spill *May 21*
- With staff from Analytical Chemistry, participated in a FERN-wide conference call focusing on the role of all FERN laboratories in the testing of seafood from the Gulf *May 27*
- Discussed the various research and service projects within the Analytical Chemistry Department with State Representative John Hetherington and a constituent *June 2*
- Along with staff of the Analytical Chemistry Department, hosted a 3-day Food Emergency Response Network course on gas chromatography/mass spectrometry. Terri Arsenault was one of three instructors for the course (12 attendees from FERN laboratories around the country) *June 8-10*
- Participated in a conference call sponsored by the US EPA concerning the planning of the upcoming International Phytotechnology Society meeting in Parma, Italy in September *June 9*
- With staff, participated in a FERN Chemistry Cooperative Agreement (CAP) Laboratory conference call *June 10*
- Participated in a Connecticut Academy of Science and Engineering (CASE) briefing from the Peer Review Committee on their reevaluation of the CAES Department of Analytical Chemistry research and final report on tire crumb rubber *June 15*
- Along with Dr. Brian Eitzer, Dr. Walter Krol and Terri Arsenault, participated in a conference call with the FDA Forensic Chemistry Center to discuss the development of extraction and analysis methods for chemical contamination of seafood due to the Deepwater Horizon Oil Spill. The Minnesota Department of Agriculture was also on the call *June 16*
- Participated in a CT DEP sponsored conference call focusing on the release of the multi-agency report on tire crumb rubber *June 28*
- Participated in the Food Emergency Response Network National Training Conference in Minneapolis, MN *June 28-July 2*

WILLIAMS, SCOTT C.

- Gave a talk on the effectiveness of various deer repellents on preventing browse damage at the Christmas Tree Growers Twilight Meeting at the Valley Lab (60 attendees) *July 9, 2009*
- Met with staff from UConn Extension, DEP Wildlife Division, and DEP Forestry planning the Coverts Project to Enhance Forestry and Wildlife Conservation Practices at Goodwin State Forest Headquarters *July 24*
- Along with Dr. Jeffrey Ward, led a Japanese barberry control demonstration for staff of the Norcross Wildlife Sanctuary staff (4 attendees) *July 30*
- Gave an invited lecture at the 5<sup>th</sup> Annual Mid-Atlantic Exotic Pest Plant Council Conference title “Managing Japanese Barberry Infestations Reduces Blacklegged Tick Abundance and Infection Prevalence with *Borrelia burgdorferi*” in Johnstown, PA (55 attendees) *August 12*
- Participated in the Connecticut Urban Forest Council meeting in Middlefield *September 9*
- Gave an invited lecture titled “Effectiveness of Deer Repellents on Yews in Connecticut” at the Nursery and Landscape Research Tour at the Valley Laboratory (35 attendees) *September 10*
- Gave a lecture about the inter-relationship between Japanese barberry and blacklegged ticks and *Borrelia burgdorferi* prevalence at the COVERTS Project Seminar in Chaplin (40 attendees) *September 12*
- Spoke about deer research and capture techniques at Lyman Memorial High School in Lebanon (45 students) *September 25*
- Gave a talk on the relationship of Japanese barberry, blacklegged ticks, and Lyme disease prevalence to managers at the Department of Environmental Protection, Burlington, CT (12 attendees) *October 19*
- Gave an invited lecture entitled “Roadside Habitats and Deer-Vehicle Collisions” at the Connecticut Urban Forest Council Conference, Wallingford (40 attendees) *October 22*
- Co-hosted a forestry and natural resources tool identification demonstration table at the Connecticut FFA Fall Forestry Career Development Event at the University of Connecticut, Storrs (30 students from 19 Vo-Ag schools) *November 6*
- Gave two invited lectures entitled “Japanese Barberry, A Public Health Concern?” and “Overabundant White-Tailed Deer as Seed Dispersal Agents” at the Annual Meeting of the Grafton Land Trust in Grafton, MA (55 attendees) *November 6*
- Spoke to a class at Trinity College about the relationship between Japanese barberry, blacklegged ticks, and Lyme disease threat (20 students) *November 17*
- Spoke on “Dispersal of exotic species by white-tailed deer in Connecticut” to the Department of Environmental Protection – wildlife staff (45 attendees) *December 16*
- Participated in a committee meeting for Acima Cherian, a Ph.D. student in Wildlife Management at the University of Connecticut *January 13, 2010*
- Participated in the Connecticut Urban Forest Council meeting in Middlefield *January 20*

- Gave an invited lecture “Wildlife Laws and Deer Damage Avoidance” at the 9<sup>th</sup> Annual 5-day Course in Organic Land Care, sponsored by the Northeast Organic Farming Association in Jones Auditorium (45 attendees) *January 26*
- Participated in doctoral committee meeting for Acima Cherian, Ph.D. student in Wildlife Management at the University of Connecticut *February 2*
- Gave an invited lecture “Wildlife Laws and Deer Damage Avoidance” at the 9<sup>th</sup> Annual 5-day Course in Organic Land Care, sponsored by the Northeast Organic Farming Association, Elmsford, NY (45 attendees) *February 16*
- Gave a lecture “Preliminary Results from 16 Connecticut Deer Exclosures” at the Forest Health Monitoring Workshop, Jones Auditorium (33 attendees) *February 18*
- Gave a talk to Boy Scout Pack 475 about wildlife issues in Connecticut and white-tailed deer capture techniques, Guilford, CT (35 scouts, 25 parents) *February 23*
- Participated in doctoral committee meeting for Acima Cherian, Ph.D. Student in wildlife management at the University of Connecticut *March 1*
- Met with and conducted a field visit with members of the Town of Newtown’s Conservation Commission Anti Tick-Borne Disease Action Committee to assess the overall health of four different municipally owned forests and provided some insight into different management strategies (12 attendees) *March 19*
- Participated in the Connecticut Urban Forest Council Executive Meeting in Middlefield *March 27*
- Spoke on “Efficacy of Repellents in Keeping Deer Away from Roadways and Roadway Vegetation” at the Cornell Cooperative Extension’s “30 Hour Course”, Riverhead, NY (15 attendees) *March 23*
- With Joseph Barsky, conducted a field visit to the Town of Vernon to assess the feasibility of a small tree planting *March 24*
- Participated in a conference call about revising NOFA wildlife management standards with members of the Northeast Organic Farming Association from Connecticut, Massachusetts, and Rhode Island *March 30*
- With Joseph P. Barsky, gave a presentation “Forestry tools and techniques” to students from Lyman Memorial High School in Lebanon (18 student and 1 teacher attendees) *April 8*
- Participated in the oral comprehensive exam for Acima Cherian, Ph.D. student in Wildlife Management at the University of Connecticut *April 21*
- Was interviewed by Northern Woodlands reporter Madeline Bodin about the negative impacts of overabundant white-tailed deer populations on forested ecosystems and human health *April 28*
- With Michael Short, managed the ecosystem portion of the FFA Regional Environmental and Natural Resources Career Development Event at the University of Connecticut (30 student attendees) *April 30*
- Spoke on “The link between Japanese barberry and Lyme disease” at a Flame Weeding Workshop at the Griswold Research Farm (43 attendees) *May 26*
- Spoke on “Wildlife Research at The Connecticut Agricultural Experiment Station” to members of the Branford Land Trust (14 attendees) *June 22*

## ***ADVANCES IN KNOWLEDGE***

### ***DEPARTMENT OF ANALYTICAL CHEMISTRY***

The format adopted in the previous year's Record will be continued in order to focus succinctly on the work of the Department of Analytical Chemistry over the twelve months from July 1, 2009 through June 30, 2010. Narratives will be brief and key issues are presented in bulleted outlines where possible. Sources of more detailed information are provided, when available. This format should provide information more conveniently and, therefore, be of more use to the Record's readers.

#### **STAFF**

Dr. Jason C. White, Chief Scientist  
Dr. Brian D. Eitzer  
Dr. Walter J. Krol  
Dr. Christina S. Robb  
Terri Arsenault  
William Berger  
Craig Musante  
John Ranciato  
Dr. MaryJane Incorvia Mattina, Emeritus, State Chemist  
Dr. Xiaolin Li (left state service Feb. 2010)

#### **FOCUS AREAS**

Service, research, and outreach activities in the Department are conducted within two Focus Areas:

##### **Environmental Monitoring/Remediation**

##### **Food Safety**

Service and research activities in each focus area are often mutually complimentary.

#### **I. SERVICE ACTIVITIES**

Analyses are conducted across a very wide range of sample matrices submitted to the Department of Analytical Chemistry by other State of Connecticut agencies, municipal agencies, police departments, non-profit groups, Connecticut businesses, and other departments at the Connecticut Agricultural Experiment Station (CAES). This list is not intended to be all-inclusive.

##### **1. ANALYSES ON BEHALF OF CONNECTICUT DEPARTMENT OF AGRICULTURE**

Analytical Chemistry has two long-standing programs with the CT Department of Agriculture involving the analysis of feed and fertilizer products.

###### *a. Animal Feeds:*

- **Analysts:** Craig Musante, John Ranciato
- **Goal:** To assure products are in compliance with stated label guarantees.

- Summary: This analysis served as the rationale for Station's establishment in 1875.
- Products for both household pets and commercial agricultural operations are included.
- Samples are collected by inspectors from the Connecticut Department of Agriculture.
- Analytical results are reported to Connecticut Department of Agriculture, product manufacturer, product dealer.
- From July 1, 2009 to June 30, 2010 we received no feed samples for analysis and as such, no results were reported for this period. This lack of samples was due to the retirement of the primary Feeds/Fertilizer control officer during the current reporting period. As of June 30, 2010, we have logged in 188 feed samples for analysis. These samples will be analyzed for parameters such as protein, fat, moisture, fiber, and micronutrients, and will be reported in the 2010-2011 Record.

*b. Fertilizers:*

- Analysts: Craig Musante, John Ranciato
- Goal: To assure products are in compliance with stated label guarantees.
- Summary: This analysis served as the rationale for Station's establishment in 1875.
- Products from residential and commercial agricultural operations are included.
- Samples are collected by inspectors from the Connecticut Department of Agriculture.
- Analytical results are reported to Connecticut Department of Agriculture, product manufacturer, product dealer.
- From July 1, 2009 to June 30, 2010, we completed analysis of 21 samples for macronutrients, such as nitrogen, available phosphoric acid, and potash, and for micronutrients, including but not limited to, boron, sulfur, cobalt, magnesium, and iron. Deficient samples (determined according to the investigational allowances outlined in the Official Publication of the Association of American Plant Food Control Officials) numbered 1 (4.7%). The small number of samples submitted was due to the retirement of the primary Feeds/Fertilizer control officer in the current reporting period. As of June 30, 2010, we have logged in 125 fertilizer samples for analysis. These samples will be reported in the 2010-2011 Record.

**2. ANALYSES ON BEHALF OF CONNECTICUT DEPARTMENT OF CONSUMER PROTECTION, FOOD AND STANDARDS DIVISION**

Analyses conducted by the Analytical Chemistry department for the Department of Consumer Protection (DCP) are important to public safety. The results of these analyses are reported in a timely fashion and can lead to the recall of products that have levels of chemical residues deemed unacceptable by regulatory agencies.

*a. Pesticide residues in food:*

- Analysts: Walter Krol, Brian Eitzer
- Goal: To determine concentrations of agrochemicals in fresh and processed foods from local, domestic, and imported sources offered for sale in Connecticut and to assure compliance with established tolerances.

- Market basket survey samples are collected by Inspector Ellen Sloan of the DCP.
- Results are published in annual Station bulletin available by mail and at [www.ct.gov/caes](http://www.ct.gov/caes).
- From July 1, 2009 through June 30, 2010, 254 samples of fresh (156; 61.4%) and processed (98; 38.6%) samples were analyzed for pesticide residues.
- Beginning January 1, 2006, all market basket samples were analyzed using the QuEChERS method, providing lower limits of detection and increased number of detectable agrochemicals (Figure 1). Please see the Record of the Year 2006-2007, 2007-2008, and the Research section below, and Station bulletins for details.
- Of the 254 samples analyzed from July 1, 2009 to June 30, 2010, 178 samples (70.1%) contained a total of 562 residues. The three most commonly detected residues were the fungicide boscalid (10%), the insecticide phosmet (9%), and the fungicide carbendazim (8%). The average residue found was 0.122 ppm, and the average number of pesticide residues found on each sample containing residues was 3.14 in 2009 - 2010. The impact on the pesticide residue program of fully implementing QuEChERS in our laboratory is shown graphically in Figure 1 below. Note that both the number of residues observed and the proportion of samples with residues have dramatically increased. At the same time, the average residue concentration has decreased by a factor of 10. This is because the new technique allows for the detection of many more pesticides than the old procedure and can detect those pesticides at much lower concentrations than the older procedure. Together, these factors decrease the average reported concentration while increasing the number of residues, number of samples with residues present and number of violations due to the finding of residues where there is no tolerance allowed.

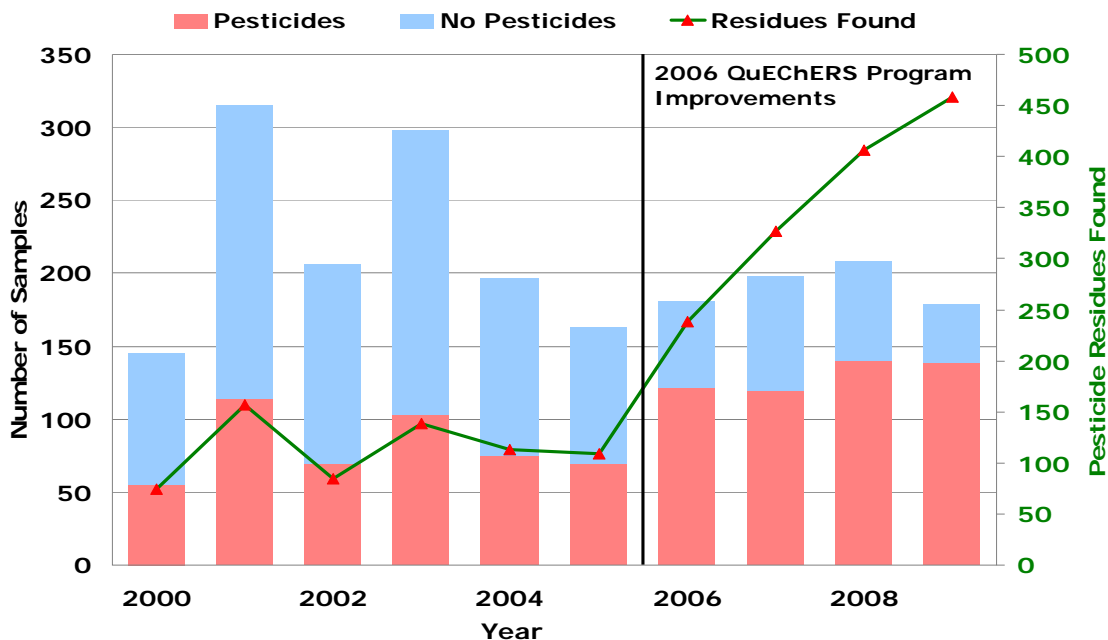


Figure 1. Pesticide Residue Data 2004 -2009

*b. Peanut allergens*

- Analyst: Christina Robb
- Summary- In April of 2010, we received approximately 60 samples from CT DCP to screen for the presence of peanut allergens. The analysis is by enzyme-linked

immunosorbent assay (ELISA); funding to purchase the analytical kits was through the US Food and Drug Administration (FDA). At this time, the study is focused mainly on shelf-stable imported foods. Of the approximately 60 samples which were analyzed, two tested positive for peanut allergens. Although this is not a regulatory violation, the data were turned over to CT DCP. As of the writing of this report, DCP regulatory officials were still determining the most appropriate response.

*c. Miscellaneous samples*

- Analyst: Department staff
- From July 1, 2009 to June 30, 2010, 220 samples were submitted for variety of analytical requests such as identification of foreign material, possible product adulteration or tampering. For some samples, we rely on the expertise of Station staff in other departments.

**3. ANALYSES ON BEHALF OF DEPARTMENT OF CONSUMER PROTECTION,  
LIQUOR CONTROL DIVISION**

*a. Beverages/products for ethanol content*

- Analyst: John Ranciato
- Goal: To provide % ethanol by volume for label registration and taxation purposes.
- We analyzed 68 products such as beers, wines, liquors, and wine sorbet ice cream for ethanol content. The average % ethanol content for beers, wines and liquors was 6.75, 12.3, and 34.0%, respectively.

Impact- Several samples of wine sorbet ice cream were brought in by DCP inspectors for ethanol content determination. The label lists these products as non-alcoholic, equivalent to a % ethanol content of less than 0.5%. Initial analysis by our Department showed % ethanol content of 1%; a clear label violation. The DCP inspectors communicated these findings to the manufacturer, with the mandate that the label description be met. One month later, three additional samples were collected by DCP inspectors from the manufacturer and all had % ethanol content of less than 0.5%.

*b. Beverage authenticity*

- Analyst: Brian Eitzer
- Goal: To determine if products offered to customers at Connecticut establishments are authentic as to brand.
- Summary: 29 alcoholic products were examined for authenticity; a small number of the products were determined as unauthentic. These results are returned to the Division of Liquor Control, who then follow up on violations on a case-by-base basis.

**4. ANALYSES ON BEHALF OF DEPARTMENT OF CONSUMER PROTECTION,  
PRODUCT SAFETY DIVISION**

*a. Lead and cadmium in toys, children's jewelry*

- Analyst: Craig Musante
- Summary: From July 1, 2009 to June 30, 2010, we analyzed 18 samples, such as crayons and toys, for lead content. In addition, three samples of children's jewelry were analyzed for cadmium content.

- None of the items had lead over acceptable limits. Several samples were found to contain high amounts of cadmium. However, during the reporting period, there were no regulatory levels for cadmium in these products.

## **5. ANALYSES ON BEHALF OF DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP), WASTE MANAGEMENT BUREAU**

### *a. Analysis of PCBs (polychlorinated biphenyls)*

- Analysts: Brian Eitzer, William Berger
- Goals: To ascertain the extent of polychlorinated biphenyl (PCB) contamination.
  - Common matrices include soils, waters, oils, sediments, surface wipes.
  - From July 1, 2009 to June 30, 2010, a total of 28 samples were analyzed from pre-existing sites and/or spill locations in CT. The sample collection by DEP is part of mandatory long-term monitoring of these areas. As such, the findings are reported to DEP for assessment of continued regulatory compliance.

### *b. Analysis of pesticides*

- Analysts: Brian Eitzer, Terri Arsenault, Christina Robb
- Goals: To ascertain pesticide concentration associated with misapplication or drift in support of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Matrices include, but are not limited to soils, waters, oils, sediments, surface wipes. Water, vegetation and soil samples can now be routinely analyzed for glyphosate using liquid chromatography/mass spectrometry (LC/MS). This analytical procedure was developed in our Department after being requested by other laboratories.
  - Summary: From July 1, 2009 to June 30, 2010, a total of 112 samples were analyzed under this program.

Impact: In March of 2010, we were contacted by the Emergency Response and Spill Prevention Unit of CT DEP regarding an elderly homeowner in Milford CT. The homeowner had added an old stock solution of chlordane to a squirt bottle and sprayed the material in his bathroom to eliminate ants. During that activity, the homeowner collapsed due to a pre-existing heart condition. Upon the advice of DEP and the CT Department of Public Health (DPH), the site had to be remediated before the couple would be allowed to re-enter the house. Wipe samples from several locations in the bathroom were submitted on March 24 (before cleaning) and March 25 (after cleaning). We reported the results of our analysis on March 29. Subsequently, the CT DPH became concerned about potential chlordane contamination of the air within the residence. In coordination with CT DEP Pesticides Bureau, air samples were taken from two locations in the residence and we reported the results out within 5 days. The levels of chlordane in the house were judged to be of minimal concern and the homeowners were granted access to the residence once again.

## **6. ANALYSES ON BEHALF OF MUNICIPAL AND FEDERAL AGENCIES**

### *a. Analysis of samples from Food Emergency Response Network (FERN)*

- Analysts: Terri Arsenault, William Berger, Brian Eitzer, Craig Musante, Christina Robb, Walter Krol



- **Summary:** The Analytical Chemistry department has a Cooperative Agreement with the United States Food and Drug Administration (FDA) to conduct research and analyses related to chemical contaminants in food. As a part of that agreement, the Analytical Chemistry department has successfully participated in performance tests and surveillance exercises for various chemical contaminants on several different analytical instruments.

*b. Analysis of samples from for municipalities*

- **Analysts:** Terri Arsenault, William Berger, Brian Eitzer, Craig Musante,
- **Summary:** From July 1, 2009 through June 30, 2010, Department staff analyzed 7 samples for municipalities. This included analysis for pesticides in several organs from the carcass of a dead squirrel for the New Haven Health Department; in this case, relatively low levels of the pesticide metabolites hydroxychlorothalonil, oxychlorodane, and DDE were found. Several instances of foreign material analysis in food samples were conducted for the Newtown District Department of Health, the Town of Stratford Department of Health, and the Town of Wilton Health Department. As examples of the findings, the Wilton Health Department sample involved a salmon sample in which our staff, in conjunction with the Department of Entomology, identified a sealworm/codworm. The Stratford sample involved a calzone purchased at a local restaurant; the foreign material was identified as a lobster antenna. Last, a sample of a buoy from Indian Lake was analyzed for the Town of Orange Department of Health; the foreign material was identified as a mass of fungal hyphae, algae, and yeast.

**7. ANALYSES ON BEHALF OF OTHER STATION DEPARTMENTS**

*a. Analysis for Soils- Department of Forestry and Horticulture*

- **Analyst:** Craig Musante, John Ranciato
- **Summary:** From July 1, 2009 through June 30, 2010, a total of 301 soil samples from various sites across Connecticut were extracted and analyzed as part of a Forest Health Project being coordinated by Dr. Jeffrey Ward of the Department of Forestry and Horticulture. The soil extracts were analyzed for nutrient content, including nitrogen, aluminum, calcium, potassium, magnesium and phosphorus.

*b. Analyses related to pollinator decline- Department of Entomology*

- **Analyst:** Brian Eitzer
- **Summary:** Upon request from Dr. Kim Stoner in the Entomology Department, we determine concentrations of agrochemicals in pollen and wax to ascertain possible relationship to bee health.
  - LC/MS methods have been developed for low level detection of pesticides. See Research section below.

*c. Analyses of samples for Nootkatone- Department of Entomology*

- **Analyst:** Terri Arsenault; for the Department of Entomology.
- **Summary:** See Research/Natural products section below for details.

*d. Analysis of seawater samples- Department of Environmental Sciences*

- Analysts: Craig Musante
- Summary: From July 1, 2009 through June 30, 2010, a total of 70 seawater samples were analyzed for bromine content. This project is being coordinated by Dr. Joseph Pignatello of the Department of Environmental Sciences and Professor William Mitch in the Environmental Engineering Program at Yale University.

## **8. ANALYSIS OF CHECK SAMPLES**

- Analysts: Walter Krol, Terri Arsenault, William Berger, Christina Robb, Brian, Eitzer, Craig Musante
- Summary: Annual performance evaluation samples required by our certifying agency, Connecticut Department of Public Health, as well as annual proficiency testing samples related to our FDA FERN work, were completed during the reporting period. Our reported results exceeded required criteria in all instances.

## **II. RESEARCH ACTIVITIES**

Research projects in the Department of Analytical Chemistry include applied and fundamental studies. Research is often stimulated by our service work and in turn, research results often impact service activities.

### **1. FOOD SAFETY**

Project 1: *Comparison of two methods for determination of pesticide residues in food*

- Investigators: Walter Krol, Terri Arsenault, Brian Eitzer,
- Summary: The implementation and validation of more sensitive extraction methods for pesticides in food more accurately reflects the residues present in food commodities. This information increases the effectiveness of food safety surveillance and also more accurately informs the consumer as to the residues present in the food they purchase. An extensive comparison of our previous extraction method, the VegPrep, with the Quick, Easy, Cheap, Effective, Rugged, Safe (QuEChERS) method is ongoing. In summary, the QuEChERS method can detect more pesticides at concentrations up to ten-times lower than previously used methods.

Project 2: *Improvement to FERN methods: phyto-toxins*

- Investigators: Christina Robb
- Summary: Integral to our Cooperative Agreement with the FDA is assessment of various FERN procedures for detecting toxins in foods. The development of rapid, sensitive and accurate methods for the detection of these toxins increases the robustness of food safety and security systems in the United States. This year, we have been looking at plant phyto-toxins that are readily available and could be intentionally used to adulterate food commodities. One of these toxins is Abrin, a chemical that is present in the seeds of *Abrus precatorius* (or Rosary pea). Dr. Robb has conclusively shown that enzyme linked immunosorbent assays (ELISA) are effective for the detection of the toxic proteins associated with this plant. Conversely, we have demonstrated that LC/MS can be used to detect a non-toxic but related biomarker molecule known as abrine (Figure 2). This approach is safer in the laboratory, and we have identified the presence of several other compounds of interest in the extract, including one unknown. In the next year, we will be working with our FERN partners in Florida to identify this unknown.

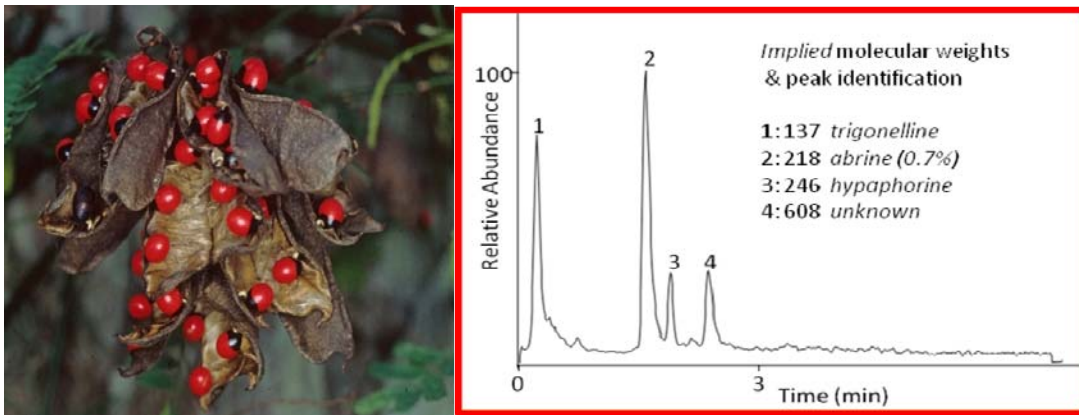


Figure 2 . Rosary pea or *Abrus precatorius* (left). Chromatogram of solvent extract of seeds showing the non-toxic biomarker (abrine) and other analytes of interest (left).

Project 3: Improvement to FERN testing: Deepwater Horizon Oil Spill

- **Investigators:** Walter Krol, Terri Arsenault, Jason C. White

- **Summary:** As a part of our food safety cooperative agreement with FDA, we were asked to develop and validate a new screening method to rapidly test for oil contamination of seafood coming out of the Gulf of Mexico starting in June 2010. As the release of oil from the Deepwater well began, large areas of commercial fisheries in the Gulf were closed. After establishing re-opening protocols, Federal and state officials became concerned about the potential for a large bottleneck of samples for chemical testing. As a result, the Forensic Chemistry Center (FCC) contacted two state FERN laboratories, the CAES Department of Analytical Chemistry and the Minnesota (MN) Department of Agriculture, for assistance in the development and validation of a QuECHERS ("Quick, Easy, Cheap, Effective, Rugged, and Safe") extraction procedure followed by liquid chromatography with fluorescence detection (HPLC-FLD). Within two weeks, the three laboratories (FCC, CAES, MN) reported levels of detection at or below 1 part per billion (ppb) for 15 polycyclic aromatic hydrocarbons (PAHs); known chemical constituents of oil. The three labs also developed a total fluorescence approach to estimate total PAH contamination. Once the method was validated, the three laboratories were told to expect up to 20 samples per day for five days a week, and that the reporting of results to FDA was expected within 24 hours of sample receipt (Figure 3).

- **Impact:** The new extraction and analysis procedure developed and validated by CAES and its partner laboratories has been adopted by the FDA, and the results produced by our laboratory have been used to determine that oil contamination in specific closed fisheries are below that which cause a public health concern. As a result, select waters off of Louisiana, Florida, Mississippi, and Alabama have been reopened for commercial fishing and shellfish harvest.



Figure 3. Seafood samples from the Gulf of Mexico being prepared for analysis to measure potential oil contamination.

## 2. ENVIRONMENTAL MONITORING/REMEDIATION

### Project 1: *Nanoparticle contamination of agricultural crops*

- Investigators: Craig Musante, Jason C. White

• Summary: Nanomaterials (NM) have at least one dimension less than 100 nm and this small size results in unique properties not observed with equivalent bulk particles. Current nanomaterial use is ubiquitous; over 1000 NM-containing products are commercially available in areas such as electronics, health-care, cosmetics, pharmaceuticals, and food processing. We specifically note the recent and increasing use of nanomaterials in agriculture, including pesticides and fertilizers directly applied to food crops. The impact of nanomaterials on biota has only recently been explored, and studies have included bacteria, algae, nematodes, crustaceans, fish, rats, and humans. While these research areas are still being pursued, data have shown that in some instances, particles that are supposed to be inert can have significant physiological effects. To date, little work has focused on agricultural plants and the potential for particle transfer through the food chain. This lack of understanding on NM fate and effects is disconcerting given that food crop contamination is a significant uncharacterized pathway of human exposure. This research project is seeking to define the impact of NMs on common food crops, with a focus on the risk posed to humans from exposure to these contaminated plants. In preliminary investigations using hydroponic studies, we have shown that in several instances, the toxicity of a given nanoparticle is indeed significantly greater than that of the corresponding bulk material. In addition, when zucchini plants were exposed to equivalent concentrations of bulk and nanoparticle silver, the amount of metal that was subsequently found in plant shoots was on average four times greater for the smaller particles (Figure 4).

Impact: Our research demonstrates that the toxicity of nanoparticles to agricultural plant species can be significantly greater than that observed for the corresponding non-nano or bulk material. These findings have implications for the widespread use of nanomaterials in commercially available products.

### Project 2: *Phytoremediation of soils contaminated with weathered persistent organic pollutants (POPs)*

- Investigators: William Berger, Jason C. White

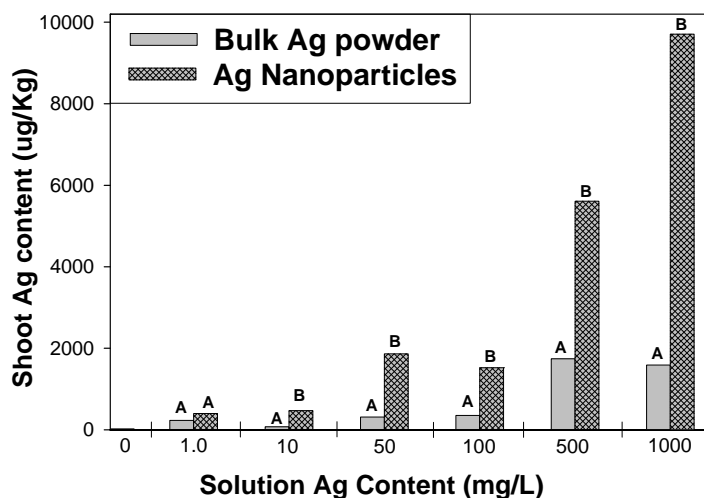


Figure 4. Shoot Ag content of plants exposed to nanoparticle or bulk Ag solutions.



• Summary: This project illustrates the overlap of service and research activities in the Department of Analytical Chemistry. In 1990, samples from our market basket survey were found to contain chlordane residues, although the registration for this insecticide on food crops had long been terminated. Our research has shown that some agrochemicals such as DDT and chlordane have measured half-lives in soil of years, if not decades or longer. Several separate lines of investigation were pursued to determine the potential of plants to remediate soils contaminated with these pollutants.

a. Studies were conducted on the potential of certain vegetation to remove moderately low levels of persistent organic pollutants from soil. Previous data had indicated that *Cucurbita pepo* ssp *pepo* (zucchini) cultivars have remarkable abilities to phytoextract the weathered residues but that significant crop variability may exist down to the subspecies level. Studies were conducted under this line of investigation in the past year. In field experiments at Lockwood farm, six different cultivars of *C. pepo* were grown in soil containing weathered DDE at levels of 50-300 ng/g. Three of the cultivars were from the subspecies *pepo* and have been previously shown to accumulate significant amounts of weathered DDE in the roots and stems. The other three cultivars were from the subspecies *ovifera* and have been previously shown to accumulate negligible amounts of weathered DDE. During the 2007 field season, the DDE uptake abilities of these cultivars were again confirmed, but I also created all possible hybrid crosses between the different DDE accumulating and non-accumulating cucurbit cultivars. Manual pollination of female flowers began in the middle of the growing season. Viable F1 seeds were harvested and planted during the 2008 field season. In addition, F1 backcross cultivars were created during 2008 and seed was planted during the 2009 growing season. The data show that the ability of the hybrids to accumulate DDE does change upon hybridization. Non-accumulating squash that are crossed with DDE-accumulating zucchini acquire the ability to extract the pesticide but then lose that ability when backcrossed with the original parent. However, the converse is not true; DDE-accumulating zucchini that are crossed/pollinated with non-accumulating squash retain partial ability to extract the pesticide (Figure 5) but do not fully regain the capacity upon backcrossing with the original parent.

**Impact:** The ability to accumulate and translocate weathered DDE is a unique ability restricted to *C. pepo* ssp *pepo*. Following the inheritance patterns of the DDE accumulating abilities of F1-F3 hybrids of *C. pepo* will make it possible to determine the underlying molecular basis for this unique ability. Once this is done, efforts to maximize this ability in zucchini or transfer the gene(s) to other plants will become possible.

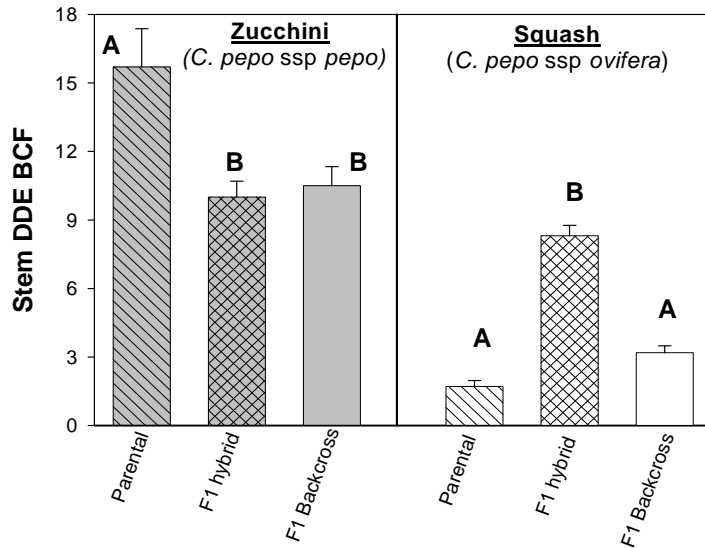


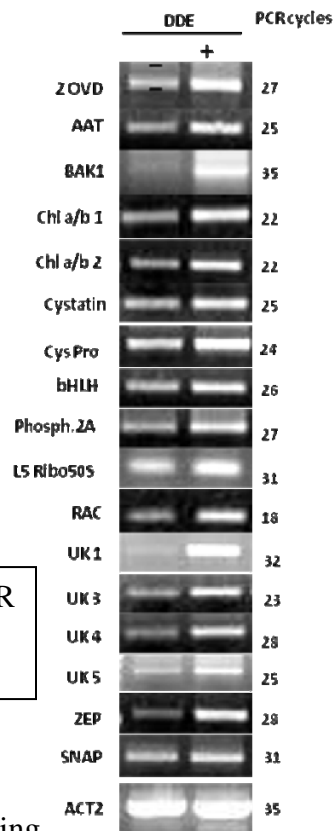
Figure 5. Uptake of weathered DDE by parental zucchini and squash, F1 hybrids, and F1 backcrosses obtained by cross pollination. BCF is the dry weight ratio of DDE in the stem to that in the soil.

b. In collaborative experiments with Dr. Om Parkash of the University of Massachusetts, molecular analysis of DDE-accumulating and non-accumulating cucurbit cultivars that were grown in hydroponic solutions containing the contaminant at levels just under water solubility continued. Tissues from exposed plants were frozen in liquid nitrogen and subjected to a differential mRNA subtraction analysis. A colony array method for screening the differentially expressed subtracted cDNAs from *C. pepo* ssp *pepo* stem and root tissues exposed to DDE but absent in DDE-exposed *C. pepo* ssp *ovifera*. We continue to sequence these differentially expressed cDNA clones. A Basic Local Alignment Search Tool (BLAST) search against plant gene database showed the sequence homology with 'Phloem Protein 1 (PP1)' from *Cucurbita maxima* and many 'novel' genes with unknown function. The PP1 protein is suspected to be involved in long distance transport of solutes and metabolites. Further, we used semi quantitative real-time polymerase chain reaction (RT-PCR) to confirm the differential regulation of the putative PP1, cyt P450 and other 'novel' genes from exposed and un-exposed *C. pepo* ssp *pepo* (zucchini) tissues. Our initial results showed that the mRNA transcript expression level for over 20 genes is increased in zucchini upon contaminant exposure (Figure 6). We are in the process of analyzing the significance of these molecular changes.

**Impact:** The ability to accumulate and translocate weathered DDE is a unique ability restricted to *C. pepo* ssp *pepo*. Isolation of the molecular/genetic controls of this system will enable a full characterization of the remedial potential of this species, as well as potential transfer of the genes to plants perhaps more effective and amenable to field scale phytoremediation.



Figure 6. Semi-quantitative RT-PCR analysis of zucchini subtracted cDNA clones from seedlings.



c. Additional hydroponic investigations are being conducted to evaluate the role of aquaporins, water channels in the membranes of root cells, in providing entry into the cell for POPs. These root pores are known to transport a variety of small solutes. One way of examining what takes place in the aquaporin channels is to cause the channels to shut down. The addition of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) to the growth solution could generate hydroxyl radicals (\*OH), which have been shown to close the aquaporin channels in other plant systems. In preliminary studies, a decrease in chlordane uptake by the plants exposed to H<sub>2</sub>O<sub>2</sub> was observed and supports the concept that aquaporins are a potential pathway for chlordane to enter the roots of *C. pepo*.

**Project 3 : *Analysis of Diquat and Paraquat in beverages and lake water***

**Investigators:** Christina Robb, Brian Eitzer

**Summary:** We have developed a method to analyze for polar pesticides such as diquat and paraquat. These two chemicals are widely used herbicides but unlike most other chemicals in this group, they have significant mammalian toxicity. The analytical procedures include a new LC-MS/MS protocol for the direct analysis of paraquat/diquat in water. These compounds cannot be retained by typical reverse phase liquid chromatographic (RPLC) conditions; therefore, we used Hydrophobic Interaction Liquid Chromatography (HILIC) stationary phase in this work. HILIC is a combination of a

polar stationary phase that is used in conjunction with a semi-aqueous mobile phase. This combination makes an extremely mass spectrometry friendly system, and typically by changing from suitable RPLC conditions to HILIC conditions, a substantial increase in sensitivity is observed. We have spiked the chemicals into numerous beverages and shown acceptable recoveries down to 5 ppb. As an example of an extension and practical application of this new analytical method, CAES Department of Environmental Sciences staff added diquat to Crystal Lake in Middletown CT for invasive weed control. We analyzed levels of the herbicide after application at various locations within the lake and showed diquat persistence for up to seven days.

Impact: Diquat (Reward<sup>TM</sup>) is widely used in CT for the control of invasive aquatic plants in CT but monitoring the persistence of this herbicide in lake water was complicated by the chemistry of the molecule and the lack of a robust analytical method. The method developed in our laboratories addresses this shortcoming, allowing both applicators and regulators to make more informed decisions on the use of this material.

#### Project 4: 2009 Study of Crumb Rubber Derived from Recycled Tires

Investigators: William Berger, Xiaolin Li, MaryJane Incorvia Mattina, Craig Musante

Summary: As a part of a broad, State of Connecticut-funded study of several aspects of artificial turf fields, including components, such as crumb rubber infill, the Department of Analytical Chemistry at the Station was charged with the following: (1) Develop protocols to identify comprehensively substances which volatilize and leach from crumb rubber material (CRM) and alternative infill materials under laboratory conditions. (2) Develop simulated crumb rubber aging protocols.

In laboratory studies, 11 compounds were detected in the headspace over the virgin CRM samples, although four of the chemicals were below the level of quantitation (LOQ). Six of these eleven compounds were polycyclic aromatic hydrocarbons (PAHs), including the four that were below the LOQ. The compound released at the highest concentration is consistently benzothiazole; this chemical is typically present at ten times the level of the other constituents. Four different chemicals (xylenes and styrenes) were released from the alternate infill products. Under simulated rain conditions, benzothiazole and zinc were the primary constituents released from the CRM samples. Conversely, the alternate infill products released proportionately larger amounts of chromium under leaching conditions. Over a ten-week weathering experiment, the amount of out-gassed volatile compounds decreased by 20-80%. A limited comparison of virgin CRM to the same product sampled from the field two years later showed similar compound-specific reductions in outgassing.

Impact: Our findings show that although volatile chemicals are released from virgin crumb rubber, the amount of outgassing seems to decline significantly over relatively short periods of time. These findings were included in a larger multi-agency report that can be found at the CT Department of Environmental Protection website (<http://www.ct.gov/dep>). With regard to the results of other agencies, the CT Department of Public Health (DPH) conducted a screening level risk assessment on CRM. The results indicate that in spite of worst case assumptions incorporated into the DPH analysis, cancer risks were only slightly above de minimis levels for all scenarios evaluated. This includes children playing indoors, the scenario with the highest exposure. These risks are



well within typical risk levels in the community from ambient pollution sources and are below target risks associated with many air toxics regulatory programs.

Project 5: *Analysis of Pesticides in Connecticut Pollen - Baseline Survey*

Investigators: Brian Eitzer and Kim Stoner (Dept. of Entomology)

Summary: We are conducting research into how honey bees get exposed to pesticides through their foraging activities. A honey bee can travel up to two miles away from its hive as it collects pollen. It brings the pollen back to the hive for use as a food. During this time, the honey bee can be exposed to pesticides used in the residential or agricultural fields from which it collects. Although all pesticides can potentially stress the honey bees, there is a particular interest in a new class of pesticides known as the neonicotinoids, as one member of that class (imidacloprid) has shown significant honey bee toxicity and has been banned in several countries. Our study is aimed at determining the current typical background exposure of honey bees to pesticides. We are collecting pollen from a set of honey bee hives that represent urban, suburban and rural locations. The pollen is being collected from the same location for a period of several years allowing us to look at time trends within the data. The pollen is brought to the laboratory, where it is analyzed by using a multi-pesticide screening technique that we have developed. The method is based on the QuEChERS procedures used in our fruits and vegetables residue work, but has had several small modifications to enhance the utility for pollen analysis. Over the past three years, we have found an average of 5 pesticides per sample. We have also found that the amount and numbers of pesticides vary with both time and hive location. For example, in 2009 samples taken from one orchard had an average of 12 pesticide residues per sample, whereas all other samples only had an average of 5 residues per sample.

Impact: Honey bees are being exposed to pesticides. Long-term monitoring from the same hives and locations provides background data that can be used to assess trends and changes in pesticide exposure.

Project 6 : *Analysis of Neonicotinoid Pesticides in Flowers, Pollen and Nectar*

Investigators: Brian Eitzer and Kim Stoner (Dept. of Entomology), Dr. Frank Drummond, (University of Maine) Dr. Anne Averill, (University of Massachusetts)

Summary: This is a new two year project that we are participating in along with collaborators at other research institutions. We are interested in learning how much of a systemic pesticide applied as a part of a normal agricultural practice will be found in the pollen of the plant when it blooms. To conduct the study, we are growing crops of summer squash, cranberries and blueberries. Within each crop several different pesticide treatments were used. These treatments include seed treatments and foliar sprays used as directed. When the crop was in bloom, samples of the pollen and/or flowers were taken and brought to the laboratory for pesticide residue analysis. These analyses are conducted using the QuEChERS extraction procedures followed by LC/MS/MS. Our analyses have shown that the residues of these systemic pesticides can be found in the flowers of blueberry and cranberry (nectar and pollen samples were not submitted) and in the flowers nectar and pollen of summer squash. These data indicate the potential exposure to these chemicals by foraging bees.

Impact: Knowledge of the pesticide residue levels in pollen and nectar from differing plant treatment protocols can allow us to choose a protocol that will minimize the exposure to honey bees.

Project 7: Coordinated Agricultural Program on Honey Bee Health

Investigators: Brian Eitzer and Dr. Keith Delaplane (University of Georgia, Lead Principal Investigator)

Summary: This is a very large multi-institutional project (over 20 funded investigators from 15 different institutions) that is considering issues related to the health of honey bees and other native pollinators. These issues relate to various pathogens and parasites (colony collapse disorder, *Nosema*, *Varroa* mites, etc.), as well as management practices. One of the threats to honey bees is use of pesticides in agricultural settings as well as within the beekeeping community. The role of the CAES within this project is the analysis of pesticide residues. These residues will be examined as a part of several separate research projects included within the overall project. Pesticide residues will be examined in pollen taken from sentinel apiaries (apiaries maintained by University researchers) on a monthly basis so that pesticide exposure can be examined as a co-factor in studies on honey bee health. Our results from these apiaries show that the pesticide content varies not only with sampling date and location but also within hives from the same location and time; two hives from the same apiary during the same time frame can have very different loads of pesticides in their pollen indicating that those two hives were foraging at different locations (Figure 7). A second project is looking at pollen and wax from commercial beekeepers but these samples have not yet been analyzed.

Impact: Analysis of pesticide residues from apiaries that are being intensively monitored for infectious agents and colony health will allow us to determine if they are a co-factor in some of the problems being faced by honey bees.

Project 8: Analyses of samples for Nootkatone

Investigators: Terri Arsenault, Drs. Kirby Stafford and Anuja Bharadwaj (Department of Entomology)

Summary: The effectiveness of nootkatone, an essential oil of grapefruit and other plants, for control of the deer tick (*Ixodes scapularis*), the primary vector for Lyme disease, is being investigated. In 2008, applications were made in the field to track the degradation of nootkatone. Filter paper samples were laid prior to the application and were then collected over a three week time period. More than 90% of the nootkatone had degraded within two weeks of the application. In 2009, the goal was to develop a formulation that would be more persistent in the environment and thereby give better long-term control. Preliminary laboratory results showed that a lignin-based formulation would prevent the degradation of nootkatone by UV light. However, based on field data, the Nootkatone would still break down rapidly in the environment. In June of 2009, we had unusually rainy weather, and this contributed to the breakdown of the filter paper; therefore, method development work is continuing. In addition, this year, we showed that Nootkatone can be extracted from and detected in both soil and foliage samples taken from the application sites. In 2010, a new nootkatone formulation, maillard soyscreen, was compared to the lignin-based formulation. Filter paper assemblies were

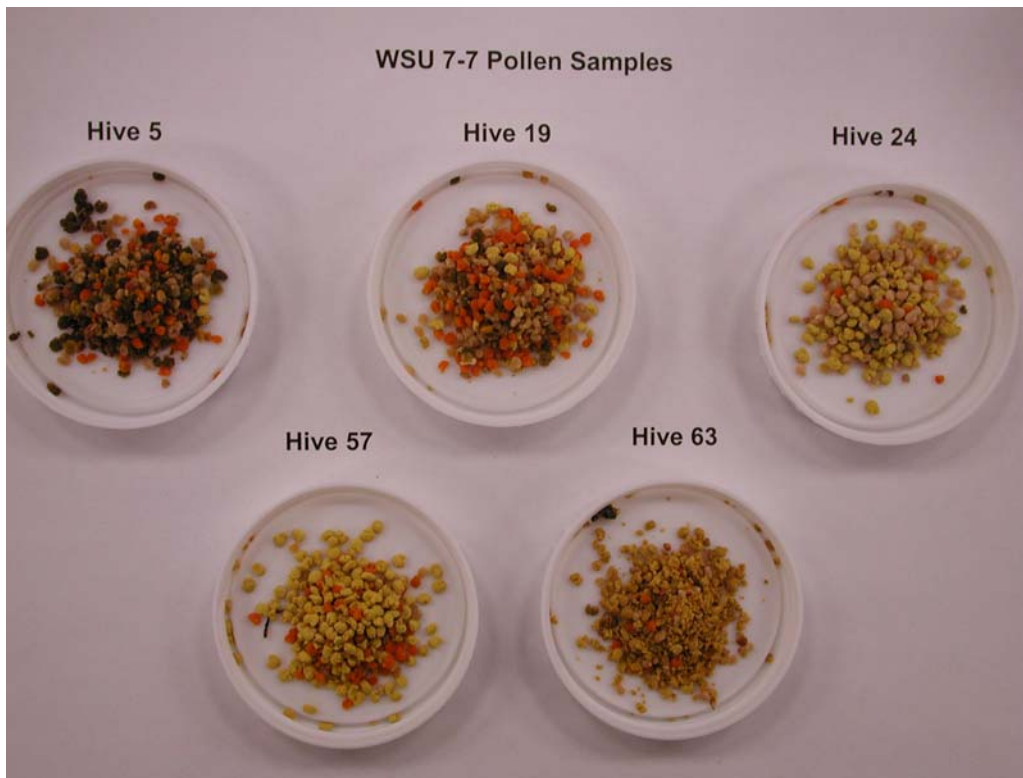


Figure 7. Photograph demonstrating the differences between hives at a single apiary. All five hives were sampled on the same day yet the pollen collected by the bees was very different and had differing pesticide loads.

put out at seven locations, applications of the two formulations were made, and the assemblies were removed over a one week period. The filter papers will be assayed to determine the distribution of the applications, and the degradation of the nootkatone. Soil and foliage samples were also collected to compare to the filter paper assay.

**Impact:** The development and use of a persistent and effective natural product for deer tick control will reduce human exposure to both insecticides and to the Lyme disease vector.

### **PUBLIC OUTREACH**

**Telephone/internet inquiries:** We receive about 1,000 calls from the public each year requesting information on issues such as pesticides in food and in the environment, lead in paint, food, soils, and consumer products. In some instances, we refer the caller to a more appropriate CAES Department or State agency.

**Station Bulletins:** Station Bulletins are typically published annually by our Department. These bulletins are available in printed form and on the CAES web site ([www.ct.gov/CAES](http://www.ct.gov/CAES)). They are also available at libraries throughout Connecticut.

***Fact Sheets:*** Listed on the CAES web site under “Publications” are several articles written for the general public regarding topics of timely and widespread interest, with examples focusing on issues such as wood preservatives, persistent organic pollutants, and removal of pesticide residues from produce. A limited number of articles are also available in printed format. Department members also cooperate with the Connecticut Department of Public Health in producing fact sheets published by them.

## DEPARTMENT OF BIOCHEMISTRY AND GENETICS

### Protecting Honeybee hives from American Foulbrood Disease:

**Dr. Douglas W. Dingman**, assisted part-time by Cindy Musante or Regan Huntley, continued investigations on the bacterium *Paenibacillus larvae*: causative agent of the disease American foulbrood (AFB) in larvae of honey bee (*Apis mellifera*). AFB is a devastating disease worldwide, causing economic losses in honey production, and disrupting managed pollination of agricultural crops. In collaboration with Mr. Ira Kettle (Connecticut state bee inspector) the presence of AFB was surveyed in 87 apiaries in CT. The current level of AFB (sub-clinical and clinical infections) is 46%. *P. larvae* isolates are being tested for resistance to Terramycin, the antibiotic used by beekeepers to control AFB. No new apiaries, beyond the five currently identified, have been found to contain tetracycline resistant *P. larvae*. Three types of 16S-23S intergenic transcribed spacer (ITS) regions have been identified in rDNA operons of *P. larvae* and DNA sequencing of these regions has been completed. Genomic restriction fragment length polymorphism analysis on 104 *P. larvae* isolates shows only three phylogenetic types of *P. larvae* in CT. Type I and Type Ib represented 44% and 46% of the infected apiaries, respectively. *P. larvae* Type III has been found in only four apiaries in CT. A PCR-based genomic fingerprinting analysis continued to show lower reproducibility and had limited strain resolution compared to pulsed-field gel electrophoresis. This testing protocol has been discontinued. Several *P. larvae* cultures were obtained from Argentina through USDA registration and licensing. These cultures will be used for molecular comparison with isolates from CT. The eight cultures represent strains isolated in Argentina, Chile, and Czechoslovakia. The cultures do not show tetracycline resistance and have the same 16S-23S ITS-PCR fingerprint as the CT isolates. Investigation of a sanitation protocol for combating AFB has shown promise under “real world” conditions. Based on field investigations, techniques have been modified to provide an easier and more efficient approach. Currently, a baseline subclinical infection profile for an apiary, over the course of a bee season, is being obtained. This baseline profile will be used for comparative analysis of future sanitation tests. Database entry of all registered beekeepers in CT for the years 2007-2009 has been completed with help from a student volunteer Reese Blackburn. Survey results obtained for all the AFB isolates are being linked to this database for future GIS mapping analysis. A “rough” PCR diagnostic test has been developed for identification of *Nosema apis* and *Nosema ceranae* in samples of adult honey bees. In addition, collaborative work was initiated with Dr. John F. Anderson on the use of *Lysinibacillus sphaericus* and *Bacillus thuringiensis* for biological control of mosquitoes in storm drain catch basins.

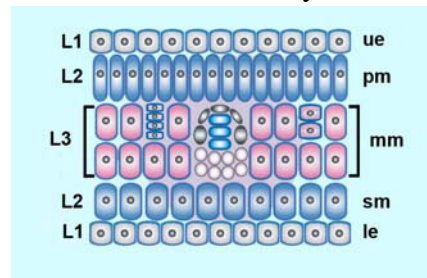


## Impact

American foulbrood is a bacterial disease with the potential to disrupt honey production and managed pollination of agricultural crops worldwide. From the approximate 3 million managed honey bee hives in the U.S., honey sales alone produce \$150-\$200 million annually. Because agricultural pollination by honey bees contributes greatly to crop yield, pollination services return approximately \$150 million annually. The annual loss to beekeepers, in equipment and bees, resulting from known AFB infections is approximately \$5 million. Losses in honey sales, pollination services, and crop yields are unknown. Improved colony health through increased sanitation and eradication of AFB will significantly benefit beekeeping and agriculture. Loss of Terramycin as a label antibiotic for use on honey bees has severely impacted the treatment for AFB. Having an effective and easy sanitation protocol would be very beneficial to beekeepers and fill this AFB treatment void. Currently, one beekeeper has plans to use the sanitation protocol. Two other beekeepers (one a commercial beekeeper) have agreed to participate in a second investigation monitoring the effectiveness of the beehive sanitation protocol.

## Genetic Regulation of Leaf Blade Development

**Dr. Neil McHale** assisted by Regan Huntley continued work on the molecular mechanisms controlling formation of the leaf blade in tobacco. Plant photosynthesis is carried out in the leaf blade, a highly specialized structure with distinct cell layers performing different functions. The upper (ue) and lower (le) epidermis prevent desiccation but allow free gas exchange with the atmosphere through small stomatal openings. Light interception and photosynthesis occur primarily in the palisade mesophyll (pm), just below the upper epidermis. The inner layers of middle mesophyll (mm) house the vascular system that transports sugars (phloem) and water (xylem). Identification of key genes governing blade growth would provide valuable tools for eventual engineering of crop plants with higher primary productivity.



Because plants can survive without leaf blades (stems are photosynthetically active), we reasoned that genes governing all major steps in blade formation could be identified through isolation of mutations that disrupt the process. We induced a random set of mutations in a wild diploid species of tobacco (*Nicotiana sylvestris*) with ethylmethane sulfonate (EMS) and isolated a broad spectrum of single gene knockouts that either compromised or eliminated blade formation. Among the most dramatic was a mutation disrupting the function of a gene named *LAMI*. Loss of this function results in the failure in the development of leaf blades. Leaf blades are initiated normally, but then fail to grow outward from the flank of the primordium. Studies with this “bladeless” mutant



plant revealed that blade formation occurs in two distinct phases. The first involves recruitment of a loosely organized set of blade founders, a process not requiring *LAMI*. It is in the following phase, where these cells are organized into distinct cell layers, that *LAMI* function is essential. Because technical obstacles precluded cloning of *LAMI* in tobacco, the molecular identity of this key organizing function remained unknown. This roadblock was recently circumvented by identification of the *LAMI* ortholog by transposon mutagenesis in alfalfa (Noble Foundation, Ardmore, OK). A wild-type copy of a gene named *STENOFOLIA* (*STF*) fully restores blade formation in *lam1* mutants of tobacco, proving that they encode the same function. Using primers based on the *STF* sequence in alfalfa, we cloned *LAMI* from tobacco, and conducted a sequence analysis showing that it is a member of the WUSCHEL-like family of transcription factors. DNA gel blots show that the entire coding region of this gene has been deleted in mutant *lam1* plants. Analysis of the promoter region revealed four elements known to function as binding sites for auxin response factor proteins. This suggests that *LAMI* is a target gene regulated by the plant hormone indole acetic acid (IAA), which governs a broad range of plant functions including leaf initiation, flower formation, and root development. Our results indicate that *LAMI* guides the basic patterns of IAA accumulation and transport along the margins of leaf primordia, a process critical to blade growth and subsequent vascularization of the blade.

### **Impact**

IAA is a remarkably versatile molecule, recognized decades ago as a key regulator of growth in leaves, flowers, fruit and roots of all higher plants. As population growth and climate change place increasing pressure on the global food supply, it is among the highest of agricultural priorities to understand how this simple molecule works. Identifying genes critical to IAA synthesis and transport will bring the ability to manipulate the growth of virtually any edible plant part in any crop plant. Our *LAMI* gene falls in this category and is a prime example of the cloned genes and mutant strains from our program that have influenced the direction of investigations in many other research laboratories. Dr. Jun-Yi Yang in the Plant Molecular Biology program at Rockefeller University is using one of our transgenic strains and our bladeless *lam1* mutant has been a subject of work for several years in the Plant Genome program at the Noble Foundation (Ardmore, OK).

## Genetic Dissection of Photosynthetic Performance in Leaves

**Dr. Richard Peterson** in collaboration with **Dr. Neil Schultes** and assisted by Carol Clark engaged in studies intended to identify genes that control the rate of photosynthesis. This process is the primary means for accumulation of dry matter by plants and improving photosynthetic performance will be an important step in efforts to increase global food production. Grasses like maize use a specialized leaf architecture and unique two cell biochemistry to capture carbon through a highly efficient C4 pathway, contributing to rapid growth and high productivity. There is intense interest in discovering the genes involved in C4 development and regulation. In collaboration with Dr. Israel Zelitch (emeritus Biochemistry & Genetics) and Dr. Thomas Brutnell at the Boyce Thompson Institute (BTI), we are taking 3 different experimental approaches to this goal. First, a systems approach to C4 photosynthesis will lay the foundation for an extensive databank that will be used in gene identification. Samples from defined positions along a developing maize leaf (representing different stages in C4 development and hence gene expression) are analyzed. Each sample represents a snapshot of gene expression (called a transcriptome) or all the proteins present in the sample (a proteome) or metabolites present in the sample (a metabolome). Our contribution is to generate photo-physiological measurements for each sample, representing a physiome. By comparing different developmental samples, or generating new samples with specific perturbations, a comparative view of gene expression will help identify key genes in C4 photosynthesis. In a second approach, we are investigating the role of photorespiration in regulating C4 biochemistry and hence C4 gene expression. In the previous year, we published a manuscript in *Plant Physiology* that uncovered the essential nature of photorespiration in C4 photosynthesis. It is our working hypothesis that glycolate – an early metabolite in photorespiration – is essential for C4 gene expression. Through the use of an inhibitor of glycolate oxidase, the key enzyme in photorespiration, increasing amounts of glycolate are generated and measured in maize seedling leaf samples. In turn the samples are subjected to a deep sequencing procedure to generate transcriptomes of gene expression. By comparing the transcriptomes of different glycolate-containing leaf samples, it has been possible to identify genes that are up or down regulated. In the next series of experiments, we will verify the observed expression patterns of candidate genes through independent techniques RNA blot analysis or reverse transcriptase polymerase chain reaction procedures. In a third approach to identifying C4 photosynthetic genes, we are leveraging the extensive diversity available among disparate maize ecotypes. Highly inbred Nested Association Mapping (NAM) maize lines obtained from BTI are subjected to a variety of sensitive photosynthetic measurements. Differences in net photosynthesis and conductance of CO<sub>2</sub> diffusion through the mesophyll tissue have been observed. The significance of those results rests on the fact that NAM lines are constructed to facilitate genetic dissection of complex traits such as mesophyll conductance. Application of novel genetic approaches are used to locate chromosomal regions carrying genes involved in the queried trait.





**Impact:**

A substantial increase in the global food supply will be required to meet the demands of a growing world population. Among the critical restraints will be availability of water, placing new importance on development of crops that can thrive in semi-arid conditions. Plants like maize have evolved a C<sub>4</sub> pathway for photosynthetic carbon fixation that allows for rapid growth and exceptional water use efficiency. In collaboration with scientists at the Boyce Thompson Institute, our goal is to characterize patterns of gene expression governing the development of C<sub>4</sub> photosynthesis in maize, and ultimately transfer this unique pathway into major crop plants such as rice, which accounts for more than one fifth of the calories consumed worldwide by humans.

**Plant Nucleobase Transporters**

**Neil Schultes** in collaboration with Dr. George Mourad (University of Indiana/Purdue at Fort Wayne) and assisted by Regan Huntley and Carol Clark continued work on molecular characterization of purines and pyrimidine transport in plants. Plant metabolites are in a constant state of flux, moving within and between plant cells and tissues. Membrane bound transporters act as metabolite-specific gatekeepers that regulate traffic of metabolites between compartments. Because transporters are often key control points in plant biochemistry, understanding their function is an important goal for eventual enhancement of crop productivity and improved efficiency in use of fertilizers.

We have identified a novel nucleobase transporter gene in *Arabidopsis* residing at locus At5g03555. This locus encodes for the sole representative of the Purine Related Transporter (PRT) super family in plants, and is named AtPRT1. The microbial PRT paralogs are numerous and mainly used in scavenging extracellular nitrogen sources. However, plants nucleobase biochemistry is more complex with distinct, synthesis, catabolism and recycling pathways regulating transport. Our studies have defined the function of this transporter and determined that has a unique solute transport specificity. The research involved molecular and physiological characterization of three *Arabidopsis* lines carrying independent T-DNA insertion mutations at locus At5g03555. We probed the solute transport specificity of AtPRT1 through seedling growth studies and found enhanced resistance to growth on toxic nucleobase analogs 8-azaguanine, 8-azaadenine and 5-fluorouracil, but no growth advantage when grown on 5-fluorocytosine pyrimithamine (a thiamine analogue) 5-bromodeoxyuridine or 2-fluorodeoxyuridine, or with allantoin as a sole nitrogen source. The transport specificity of adenine, guanine and uracil is unique for PRTs and was further verified by two alternate means. Wild type and AtPRT1 deficient plants were assayed for the ability to take up radio-labeled adenine, guanine or uracil from external media. The solute transport specificity determined by this method matches the results from the growth studies. In addition, the *AtPRT1* gene was tested in yeast *Saccharomyces cerevisiae* for growth on toxic analogues. Heterologous expression in yeast confirms the solute specificity of a novel *Arabidopsis* guanine/adenine/uracil transporter. We identified AtPRT1 paralogs from a number of plant species, including algae *Chlamydomonas reinhardtii* and *Ostreococcus lucimarinus*, nonvascular moss *Physcomitrella patens*, higher vascular plants *Zea mays*, *Oryza sativa*, *Vitis vinifera* and

*Arabidopsis thaliana*. Interestingly, plant genomes contain only one or two PRT genes, while there are numerous PRT genes in microbial genomes.

### **Impact**

The movement of nitrogen and carbon-based compounds within plants is highly regulated by transporter proteins in the cell membrane. Understanding nitrogen and carbon use patterns by plants will have important implications for both basic plant biology as well as applied science. Developing plants that use fertilizer more efficiently is just one example of how results from this research may be applied. Our investigations on nucleobase-ascorbate transporter genes in plants has an impact on a number of other research laboratories investigating similar research interests. One example is our collaboration with Dr. Mourad on uracil transporter-encoding genes in *Arabidopsis thaliana*.

## *DEPARTMENT OF ENTOMOLOGY*

The Department of Entomology is involved in a variety of service, research, pest surveillance, and regulatory activities. The primary service activities are provided through the Kenneth A. Welch Insect Inquiry Office. Staff in this office answer insect related questions and identify insects and related arthropods for the public, government agencies, growers, and business organizations. All scientists provide information to citizens of Connecticut by answering telephone inquiries, making farm visits, participating in meetings of growers and other groups, and speaking on their research. Most of the research in the Department has a major applied aspect, addressing the integrated management of ticks, pests of field crops, nurseries, and orchards, and wood-boring insects. Staff members also work closely with organic farmers and landscapers in Connecticut.

The Office of the State Entomologist at the Connecticut Agricultural Experiment Station, created by the Connecticut General Assembly in 1901, is part of the Department of Entomology with responsibility, in part, to ensure our nursery industry is free of plant pests and certify their products for shipment to other states and outside the United States. The Connecticut Green Industry (i.e., nursery, greenhouse, floriculture, sod, Christmas trees) is the largest agricultural business in Connecticut. The industry estimates that environmental horticulture generates \$1.022 billion gross income supporting AT LEAST 22,000 full and part-time jobs in Connecticut. In conjunction with regulatory activities, Department staff conducts a surveillance program in Connecticut for a variety of established pests and for exotic plant pests not yet established in the state, some of regulatory concern, that represent a threat to our green industry, forests, and urban ornamental trees and shrubs. Surveillance for plant pests is performed in partnership with the United States Department of Agriculture (USDA) through the Cooperative Agricultural Pest Survey (CAPS) program and the U.S. Forest Service. Examples are Ramorum blight (aka Sudden Oak Death), a fungus-like pathogen that can affect many plants, but that can be particularly devastating to oaks and two beetles, the Asian longhorned beetle and Emerald ash borer that represent a threat to our maples (and other trees) and ashes, respectively. In addition, we participated in a regional Forest Pest Survey and Outreach Program supported by the USDA. For plant diseases of regulatory concern, we work closely with the Plant Disease Diagnostic Laboratory in the Department of Plant Pathology and Ecology. We also conduct forest health surveys and a statewide aerial survey for gypsy moth defoliation and a gypsy moth egg mass survey. The results of our plant and forest surveys for 2009 may be found later in the Department's research activities along with summaries of our regulatory activities.

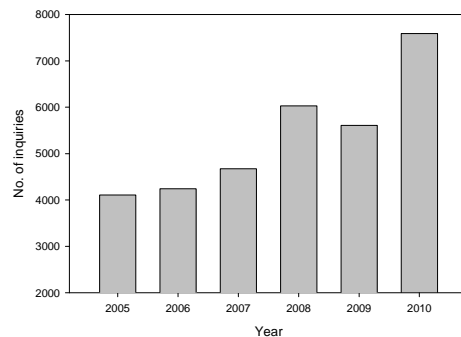
The staff of the Department of Entomology also takes the lead in providing extensive outreach activities for the Experiment Station by providing information to both children and adults about the Experiment Station's research at public events, health fairs, and agricultural fairs, such as the Eastern States Exposition (Big E) in Springfield, MA, Celebrating Agriculture in Woodstock, CT, the Garden Expo in Fairfield, CT, the Yale Peabody Museum's Biodiversity Day, and the Connecticut Flower and Garden Show.

Honey bees, butterflies, wood-boring beetles and/or ticks continue to be popular exhibits at these events.

## SERVICE ACTIVITIES

*Insect Inquiry Office:* **Dr. Gale Ridge** and **Rose Hiskes**, with the assistance in 2010 of **Katherine Dugas** and **Katelyn King**, answered questions from the public. The insect inquiry office in its present form has provided services for over 40 years. Insect identification services date back to the earliest days of the institution starting with the first Annual Report of the Connecticut Agricultural Experiment Station published in 1877. The station announced that was offering to “identify useful or injurious insect....and to give useful information on the various subjects of Agricultural Science for the use and advantage of the citizens of Connecticut”. The insect inquiry office is located on the top floor of the Jenkins Laboratory and receives thousands of visitors each year. Most of the inquiries were from visitors (59% of total) to the office followed by telephone calls (28%), e-mail (7%), and mail (6%). The office served private citizens, pest control operators, the real estate industry, nurseries, land care businesses, arborists, health departments, other medical professionals, housing authorities, museums, municipalities, libraries, state government, and the news media.

Between July 31, 2009 and June 30, 2010 the insect inquiry office handled at least 7,590 inquiries. These inquiries were quite diverse in subject with 856 categories of inquiry including insects, arachnids, animals, and diseases, as well as use of pesticides, insect damage, general entomology, and horticultural issues. Of these, 1,927 (25%) were related to people and medical issues, 496 were undetermined/general inquiries (7%), 4,719 (62%) were natural resources, and 448 (6%) were food related. Human bed bug inquiries are high with 934 (12%) of the identifications performed by the office vs. 501 inquiries the previous year. In order of numbers, the second highest query was the western conifer seed bug, followed by carpenter ants, hemlock woolly adelgid, Indian meal moth, multi-colored lady beetle, springtails, carpenter bees, cicada killer wasps, euonymus scale, elongate hemlock scale, and delusory parasitosis. Termite activity was low with only 60 inquiries. The office identified several exotic insects. They were *Stomatium* species (Cerambycidae) imported in a bookcase from India, the spiraling whitefly imported on Hawaiian orchids, and the Ligurian/Mint leafhopper found on rosemary imported from California.



Number of inquiries from 2004/05 to 2009/10, which have increased in recent years.



Naomi Rogol sitting at stereo microscope with Dr. Gale Ridge and Katherine Dugas examining a squash beetle larva that is molting.

The insect inquiry office encourages the education and training of students in science and entomology. Numerous student groups visit the office during the year. In the winter of 2010, Misha Holland from the New Haven School system was mentored by Dr. Ridge and Naomi Rogal, a junior in Beth Chana Academy High School in Orange, CT spent the summer of 2010 volunteering in the office.

*Tick Testing:* Ticks, primarily the blacklegged tick *Ixodes scapularis*, had the highest number of specimens submitted for identification. Ticks are processed in the Tick Testing Laboratory at the Experiment Station by **Elizabeth Alves** and **Bonnie Hamid**. A total of 4,031 ticks feeding on humans were submitted for identification in 2009, of which 3,669 were the blacklegged tick or “deer” tick, *Ixodes scapularis*. Beginning in 2006, the policy was changed to only test engorged ticks. Therefore, of the ticks received in 2009, 1,768 (48.2%) were tested for the presence of *Borrelia burgdorferi*, the causal organism for Lyme disease, and 666 (38%) were found to carry this organism.

#### *Sponsored Meetings and Conferences:*

*International Day of Climate Action* (October 24, 2009). **Dr. Kimberly Stoner** led a coalition of organizations to organize two events highlighting the importance of the getting the concentration of carbon dioxide in the atmosphere below 350 parts per million to prevent global climate change. One event, on the New Haven Green, drew 300 people to listen to speakers from CT NOFA, Connecticut Fund for the Environment, and the New Haven/Leon Sister City Project and resulted in an aerial photo of people spelling out “3-5-0” on the Green. The other event, at the Friends Meetinghouse in New Haven, drew 50 people to listen to speakers from the New Haven Transition Initiative on the subjects of climate change, peak oil, and developing resilience in the local community to deal with these crises.

*Community Farming Conference, 4<sup>th</sup> annual* (October 31, 2009). **Dr. Kimberly Stoner** organized, along with Bill Duesing of CT NOFA, the farming conference with 40 people attending at Jones Auditorium in New Haven. The keynote speaker was Brooke Redmond, the Executive Director of the Farm-Based Education Association, on the topic, “Turnips, Teachers, Top Hat, and Toddlers: Something for Everyone on a Working Farm.” Other speakers included Priya Morganstern of the Pro Bono Partnership speaking on “Legal Issues for Community Farms,” Kip Kolesinskas, State Soil Scientist for Connecticut and Rhode Island for the Natural Resources Conservation Service, on “How Community Farming Groups Can Assess their Soils,” and Brianne Casadei of Terra Firma Farm on “Business Planning for Community Farms.” Dr. Stoner also spoke as part of a panel on issues in starting up community farms.

*Bird and Butterfly Garden:* The Bird and Butterfly Garden is a partnership of the Federated Garden Club of Connecticut, the Spring Glen Garden Club of Hamden, and the Connecticut Agricultural Experiment Station. Many maintenance and improvements to the garden are done by farm manager **Richard Cecarelli** and his staff and members of the Spring Glen Garden Club. The garden is open to the public Monday-Friday 8:30am-4:00pm, it is closed on the weekends and state holidays. The garden creates several favorable habitats for our native birds, butterflies, and pollinating insects and helps us determine which plants may work best in Southern Connecticut gardens. Plants are

labeled for easy identification. The Bird & Butterfly Garden at Lockwood Farm is listed in the 'Nature Conservancy Open Days Directory for New England'.

**Jeffrey Fengler** observed 12 different butterflies species, 2 species of moth, 18 species of birds, 2 species of dragonflies, 1 wasp, and 1 Green Frog around the garden on Plant Science Day August 5, 2009.

Butterflies, moths, birds and dragonflies observed on Plant Science Day, August 5, 2009.

<i>Butterflies</i>	<i>Birds</i>	<i>Dragonflies</i>
Cabbage White	Bluejay	12-spotted Skimmer
Great Spangled Fritillary	Song Sparrow	Widow Skimmer
Clouded Sulphur	Mourning Dove	
Eastern Tiger Swallowtail	Barn Swallow	
Pearl Crescent	Northern Flicker	
Common Sootywing	Red-tailed Hawk	
Broad-winged Skipper	Turkey Vulture	
Question Mark	House Sparrow	
Peck's Skipper	European Starling	
Silver-spotted Skipper	Tree Swallow	
Tawny-edged Skipper	American Goldfinch	
Black Swallowtail	Ruby-throated Hummingbird	
<i>Moths</i>	American Crow	
Hummingbird Clearwing	Eastern Bluebird	
Snowberry Clearwing	Northern Mockingbir	
	Bluejay	
	Song Sparrow	
	Mourning Dove	

## RESEARCH ACTIVITIES

*Natural Products for Tick Control:* **Dr. Kirby Stafford** and postdoctoral scientist **Dr. Anuja Bharadwaj** began studies on evaluation of natural products for tick control with a grant from the Centers for Disease Control and Prevention in 2008 and experiments continued through 2010 with the assistance of **Heidi Stuber** and summer workers **Lindsley Colligan, Katherine Dugas, and Lauren Edwards**. Nootkatone, a component of the essential oil from the heartwood of Alaska yellow cedar, is also available as a synthetic and an extract from grapefruit. In order to improve the efficacy of nootkatone in the field, Dr. Robert Behle at the USDA-Agricultural Research Service laboratory in Peoria, Illinois, a collaborator in the current project, developed three extended duration formulations of nootkatone. Based on the results of efficacy testing against *Ixodes scapularis* nymphs before and after exposure to UV light, the Lignin Encapsulated 21% Nootkatone was selected for testing in the field in 2009. The field trial with was conducted at 3 home sites in Cannan and Cornwall on 17 June 2009 at the rate of 1.4 g nootkatone/m<sup>2</sup>. The nootkatone provided 100% control throughout the whole sampling period from 20 June until 17 August 2009. Filter paper disks caged in chicken wire mesh placed at the treatment sites were picked up periodically for the nootkatone residual

analysis done in cooperation with the Department of Analytical Chemistry to see how long the compound lasted in the environment. Residual analysis showed that 95% or more of the nootkatone was gone within 7 days in 2008. Unfortunately, a similar pattern of loss was observed with the new formulation in 2009 following application possibly due to the extensive heavy rains with severe loss of nootkatone within days. Only 2% of the nootkatone was found left on the filter papers and 98% was lost by 2 days post application possibly due in part because the filter papers had deteriorated due to heavy rains. However, nootkatone (1.5 ug/g leaf litter) was detectable in the leaf litter 70 days post application. While heavy rains resulted in surface loss of nootkatone, the rain appeared to have moved some of the lignin-bound nootkatone into the tick habitat, resulting in extended control. Formulation and persistence issues need to be addressed to improve efficacy.



Dr. Anuja Bharadwaj and Heidi Stuber monitor the application of the lignin-formulated nootkatone (Photo by Dr. Kirby Stafford).

A garlic-based product (Mosquito Barrier, Garlic Research Labs Inc., Glendale, CA) was also tested in 2009 in plots at 8 home sites in Salisbury, Canaan and Cornwall for suppression of *I. scapularis*. In a small trial in the laboratory, 70% repellency was observed against *I. scapularis* adults with the same product. Garlic appeared to suppress tick activity for 2-3 weeks. The suppression was 100% initially, decreasing to 60% and 42% by 13 and 27 days after application, respectively. The percent control remained at least 38% even after 55 days. The product label suggests reapplication every two weeks.

Field trial for repellency of carvacrol, another compound present in the Alaska yellow cedar essential oil, against *I. scapularis* nymphs were repeated in July 2009. Two concentrations of carvacrol, 2 and 5% (v/v) in acetone were tested at 5 residential sites. Flannel tick drags were treated with carvacrol solutions and the control drags were treated with acetone only. Ticks were sampled by dragging the treated and untreated (control) drags over the vegetation in the marked plots. The carvacrol showed some repellency against *I. scapularis*. There were 20 and 80% fewer ticks on the drags with 2 and 5% carvacrol, respectively.

Some natural products/compounds and DEET (N, N-Diethyl-meta-toluamide) were evaluated for repellent activity against *I. scapularis* nymphs in the laboratory. Different concentrations of eucalyptus oil, mustard oil, allyl isothiocyanate, garlic oil, turmeric and carvacrol were tested using a modified in vitro vertical tick repellency bioassay. In brief, test compound was pipetted onto a cotton-tipped applicator and mounted to the bottom center of a 1-dram friction cap vial in non-toxic modeling clay. The treated area above a line is considered as the repellent zone. Single ticks are introduced at set intervals after treatment. A screening cloth was placed over the vial to prevent the tick from escaping; a

human hand is placed over the vial for stimuli. If a tick crossed above the line and remained in the repellent zone for > 5s, the tick was deemed nonrepelled by the test compound. Carvacrol was found to be highly repellent against nymphs followed by mustard+turmeric combination, mosquito barrier, garlic oil, turmeric, allyl isothiocyanate and mustard oil.

Temprid (cyfluthrin + imidacloprid) was evaluated for its efficacy against *I. scapularis* adults and nymphs. The pyrethroid, deltamethrin, was also tested for comparison with temprid. Two concentrations of temprid, 2.11 and 4.22 ml/litre and one concentration (6.15 ml/litre) of deltamethrin were evaluated, which resulted in an application rate for temprid of 31.1 mg/m<sup>2</sup> (low) and 62.3 mg/m<sup>2</sup> (high), and a rate of application of 12.5 mg/m<sup>2</sup> for deltamethrin. Both temprid and deltamethrin were highly toxic (100% mortality) to both *I. scapularis* nymphs and adults. Temprid produced rapid knockdown of ticks with 100% morbidity within 24 hours with no recovery.

A field trial with lignin encapsulated 21% nootkatone (same as above), maillard encapsulated 25% nootkatone, and garlic product (Mosquito Barrier) was conducted at 5, 4 and 3 home sites in Salisbury, Canaan, and Cornwall on 9 and 11 June 2010. The garlic product was also tested at 6 residential sites in Westport-Weston, CT. Initial tick samples after treatment in June 2010 found 80% control with the lignin-nootkatone, 50% control with the maillard-nootkatone formulation, and 70% reduction in tick activity with the garlic product. Chemical residual analysis and tick sampling are under study and all the data will be compiled at the end of tick season.

**Impact:** Nootkatone and the garlic-based product were effective for control of nymphal *I. scapularis*, the vector of the causal agents for Lyme disease, human anaplasmosis and human babesiosis. Natural products could provide an alternative to synthetic pesticides and an additional tool in an integrated tick management program to control *I. scapularis*. Work needs to continue to develop or improve the new extended-duration formulations of nootkatone.

*Ticks and Tick Associated Diseases:* Dr. **Louis A. Magnarelli**, Dr. **Scott C. Williams**, and Dr. Erol Fikrig (Yale University) assisted by **Tia M. Blevins** investigated the prevalence of antibodies to *Borrelia burgdorferi* and *Anaplasma phagocytophilum* in white-tailed deer (*Odocoileus virginianus*) in Connecticut. Deer sera contained antibodies to both pathogens, the causative agents for Lyme disease and granulocytic anaplasmosis, during different seasons throughout the 11-year study. Of the 224 sera tested, 141 (63%) contained antibodies to *B. burgdorferi*, whereas 124 (55%) were positive to *A. phagocytophilum*. Reactivity to highly specific recombinant antigens (V1sE of *B. burgdorferi* and protein 44 of *A. phagocytophilum*) provided strong confirmatory results of past or current infections. November and December is a suitable period to obtain blood samples from deer to conduct serosurveillance for both bacteria.

**Impact:** Researchers in the midwestern United States are relying on analysis of deer sera to determine if *B. burgdorferi* and *A. phagochytophilum* are present in specified communities.



*Pesticides in Pollen and Nectar of Treated Squash:* There is great concern across the U.S. and around the world about mortality of honey bees and the more general decline of many other species of pollinators. Pesticide exposure is one of many factors that may play a role in honey bee and pollinator decline.

Systemic insecticides in the group called neonicotinoids have been a particular focus of concern for beekeepers in Connecticut and around the world. While there have been studies of pesticide residues in the pollen and nectar of crop plants treated as seeds, there are no studies in the literature of pesticide residues in pollen and nectar of crop plants treated by application of the insecticide to the seed furrow or by application of the insecticide through a drip irrigation system. In 2009, **Dr. Kimberly Stoner**, worked with farm manager **Rich Cecarelli** to set up an experiment where the systemic neonicotinoid insecticides imidacloprid and thiamethoxam were applied at labeled rates to summer squash in two different ways: by spraying the seed hole just before planting the seed, and through application by drip irrigation. With the assistance of **Tracy Zarrillo** and **Morgan Lowry**, samples of male and female flower parts, pollen and nectar were collected from the squash, and analyzed by **Dr. Brian Eitzer** of the Department of Analytical Chemistry, using liquid chromatography/mass spectrometry to quantify the pesticide residues. The systemic neonicotinoid insecticides were found in nectar and in pollen of the squash treated with each of the different methods in levels that have been shown to have effects on the behavior of honey bees and that could also make them more susceptible to some pathogens, according to recent research. Effects on other important pollinators of squash, such as bumble bees and squash bees, are unknown. Insect pollination is absolutely essential to the production of squash, pumpkins and other cucurbit vegetables, so any effects on pollinators would be important to farmers as well as beekeepers. This experiment is being repeated in 2010.

**Impact:** The role of chronic low-level exposure to pesticides is not well documented. This study will provide critical data on transport of several neonicotinoid insecticides applied at label rates in order to evaluate the exposure and role of pesticides on our pollinators.



Female flower of a summer squash with a pollen-covered bumble bee. The bee is seeking nectar at the base of the flower.



**Morgan Lowry** scraping pollen off the synandrium of a male squash flower. The pollen was then analyzed for pesticide residues.

*Improved Use of Lindgren Funnels:* **Dr. Maier**, assisted by **Ellen Bulger, Morgan Lowry, Kaitlyn O'Donnell, and Tracy Zarrillo**, continued to investigate how modifications to baited Lindgren funnels, traps that imitate the form and sometimes the odor of a tree trunk, can improve the detection of beetles, wasps, and their natural enemies associated with wood. During 2009, they conducted field experiments to learn how the trap catch in conifer stands at Pachaug State Forest, Voluntown, varied among Lindgren traps supplied with different killing agents in their collection cup or with different lids on their top.

In a springtime experiment, the number of captured beetles of several species or families differed significantly among traps with different killing agents (vaponal, soapy water, propylene glycol, and 70% ethyl alcohol). The mean catch of checkered beetles, predators of bark and other beetles, was significantly higher in traps with 70% ethyl alcohol than in those with other killing agents. The total catch of the ribbed pine borer (*Rhagium inquisitor*), a common longhorned beetle, was significantly higher in traps with ethyl alcohol than in those with vaponal or propylene glycol, whereas the mean catch of another longhorned beetle (*Asemum striatum*) associated with pine was statistically similar among treatments. Presumably, the addition of alcohol to collection cups can increase the attractiveness of traps to all checkered (Cleridae) and certain longhorned beetles (Cerambycidae). The pattern in catch of a bark beetle (*Dendroctonus valens*) was particularly notable because in funnels with alcohol the number was one third or less than it was in those with other killing agents. This experiment is being repeated to determine if an increased concentration of alcohol repels certain species of bark beetles.

A late-season experiment with the four different killing agents revealed no differences among treatments. The number of targeted insects (checkered beetles, longhorned beetles, and wood-wasps) captured in traps was extremely low in 2009. Predatory checkered beetles, in particular, apparently were not highly attracted to traps baited with the odor of host trees in late summer or autumn, the time when these beetles normally seek suitable shelter for the winter.

In experiments conducted in the spring and in the summer, the lid size (diameter of 30, 45, or 60 cm) of Lindgren traps with the same killing agent had minimal effect on the mean catch of targeted insects. Although numerical variation in catch was evident, no statistically significant differences in the number of captured checkered beetles, longhorned beetles, or wood-wasps occurred. Based on these findings from a pine forest, increasing lid size to reduce the amount of debris and water that enters traps would not negatively impact the catch of targeted insects.

*Longhorned Beetles of Connecticut:* Over the last few years, Dr. Maier and his assistants have captured longhorned beetles in traps and reared them from wood to determine their distribution, host range, and period of adult activity. They have determined that about 220 species of longhorned beetles could potentially infest woody and herbaceous plants in Connecticut, but only a small portion of the total have become pests. By using data from field studies and museum collections, they have found 192 species (87% of the potential total) in the state. To date, they have reared 75 species from dead wood collected in New England, and examined the period of adult activity of over 100 species. They are generating a database, which now has over 7,200 entries,

including biological data derived from their studies. The information stored in this database should be useful for developing management plans for borers that are or may become pests.

**Impact:** The information from these surveys and the longhorned beetle database will document native and exotic invasive insects and wood-borers in Connecticut and assist in developing management plans for the wood-borers that are pests.

*Surveys for Invasive Leaf Beetles:* In 2009-2010, Dr. Maier and his assistants continued their survey to determine the distribution and the hosts of the lily leaf beetle (*Lilioceris lili*) and the viburnum leaf beetle (*Pyrrhalta viburni*) in Connecticut. These destructive non-native beetles feed upon native and cultivated host plants in both their larval and adult stages.

The lily leaf beetle is a major pest of cultivated Asiatic lilies throughout Connecticut. In 2010, this destructive beetle caused considerable damage to two native lilies, the Canada lily (*Lilium canadense*) and the Turk's-cap lily (*L. superbum*). These wild lilies may be threatened with extinction within the state if methods to cope with the Asiatic beetle are not developed.

Dr. Maier discovered that the European viburnum leaf beetle had damaged wild plants of two viburnum species in seven of eight counties in the state. Previously, the beetle was known only from nursery plants in three locations. Its widespread occurrence within the state now poses a serious threat not only to susceptible wild plants, but also to landscape and nursery plants. At several shaded sites in northwestern Connecticut, larvae of the viburnum leaf beetle completely defoliated plants of the native arrowwood viburnum (*Viburnum dentatum*).

*Unscheduled Emergences of the Periodical Cicada:* Populations of the periodical cicada (*Magicicada septendecim*) reliably emerge in central Connecticut forests every 17 years. Mass emergences in the Northeast have been recorded since the 1600's; the next emergence in Connecticut will occur in 2013. In the past, very few individuals were out of developmental synchrony with the main population. In 2009, Dr. Maier discovered that in many forests in Connecticut and in the Hudson Valley of New York, small groups of adults emerged four years early. This oddity also is apparently becoming increasingly common in other parts of the range of the 17-year periodical cicada. In 2009, the accelerated emergences occurred principally at sites where human disturbance had altered the landscape to increase solar exposure and presumably soil temperature.

*Small Japanese Cedar Beetle:* Dr. Claire Rutledge continued investigation of *C. rufipenne*'s chemical ecology in collaboration with Dr. Lawrence Hanks of the University of Illinois, Urbana-Champaign and Dr. Jocelyn Millar of the University of California, Riverside and their students. *Callidiellum rufipenne* is native to eastern Asia and was discovered in live arborvitae in Connecticut in 1998 by Dr. Gale Ridge, Carol Lemmon and Dr. Chris Maier. The borer has since established in the southern half of Connecticut. *C. rufipenne* is found on plants in the family Cupressaceae. Males recognize females by means of a contact pheromone in the female's epicuticle. We have identified the contact pheromone as the branched, saturated hydrocarbon 5,17 – dimethylnonacosane and completed synthesis of the compound, and these results have been published in the Journal Environmental Entomology. Continued investigation into the ecological role of

the long-distance male-produced volatile pheromone was also conducted. It was determined that both males and females responded to the pheromone in the field, but at low numbers.

*Agrilus* species – The genus *Agrilus* (Coleoptera: Buprestidae) contains several species of economic importance, both native and invasive. Dr. Rutledge is pursuing several lines of research with three members of this genus. The Bronze Birch Borer (BBB), *Agrilus anxius* Glory, a native insect, requires stressed, living trees to develop, and thus frequently attack birches in landscape and nursery settings. The beetles cause considerable aesthetic and financial damage to homeowners and nurserymen in Connecticut. The Two-lined Chestnut Borer (TLCB) *A. bilineatus* (Weber) is a pest of oaks and can outbreak when oak trees are stressed by other problems such as drought, winter moth or gypsy moth. The Emerald Ash Borer (EAB), *A. planipennis* Fairmaire, an invasive pest, is a native of Asia that was discovered in Detroit MI in 2002 and has spread widely. While not yet in Connecticut, research is crucial to preparing for its expected arrival.

In collaboration with Dr. Melody Keena USDA FS, Dr. Rutledge is pursuing a multi-pronged approach to studying the reproductive behavior of BBB, EAB and TLCB which encompasses mating behavior, mate choice, the kinetics of sperm transfer and storage, and the impact of mating frequency on fecundity. The results of this research are being used to improve laboratory rearing of EAB, as well as to understand the population dynamics of the species and how it compares to the native *Agrilus*.

*Cerceris fumipennis*: Finally, several studies on the buprestid hunter *Cerceris fumipennis* (Hymenoptera: Crabronidae) are underway. This native, solitary hunting wasp uses adult buprestid beetles to provision her nest for her larvae. The wasps nest in colonies of 1 – 500 holes and prefer hard-packed sandy soil. When colonies are located it is easy to monitor the wasps returning to their holes and identify the beetles that they are carrying. In areas that are infested by EAB, the wasps will bring EAB adults to the nests. Thus the wasp provides a highly efficient, effective and free ‘bio-surveillance’ system. We have located many colonies of the wasp in Connecticut.

The first study was jointly funded by USDA FS and APHIS/ PPQ and is in conjunction with researchers at SUNY ESF in Syracuse, Dr. Melissa Fierke, Maine Forest Service, Ms. Colleen Teerling, and Ag Canada Mr. Philip Careless. The objective is to determine the number of degree days (a measure of accumulated



Top, Mioara Scott working at a *Cerceris* colony; Bottom, a beetle caught in a collar put over a *C. fumipennis* hole.

heat) the wasp requires to emerge as an adult. This knowledge can be used to predict when wasps emerge in natural colonies, and to facilitate rearing of the wasps in the laboratory. Captive wasp colonies can be used to provide ‘surveillance services’ in areas where invasive buprestids are suspected in much the same way that honey bee colonies are used to provide pollination services in agriculture.

The second project, in which Connecticut was part of a multi-state consortium funded by USDA FS, was the ongoing bio-surveillance of known naturally-occurring colonies in Connecticut for the presence of emerald ash borer and other potential invasive buprestid beetles. This year we began the ‘Wasp Watchers’ program in Connecticut. Volunteers were recruited at professional meetings of arborist, nursery growers, master gardener classes, and other outreach events. Each volunteer was then assigned a colony close to their home. Watchers received the equipment and training to monitor their colony and collected beetles that will be sent to us at the end of the season. Twenty-three volunteers completed training. This program allowed us to monitor a large number of colonies with only 2 full-time staff. We now have a network of concerned citizens-scientists who can help to raise awareness of invasive species.

The final project with *Cerceris fumipennis* was begun summer 2009, and continued in summer 2010 in conjunction with Dr. Peter Silk of Agriculture Canada. We are investigating which chemical components common to the epicutical of all Buprestidae that are attractive to *C. fumipennis* females. Wasps will grasp, sting and bring into their nests paralyzed or freshly dead buprestid beetles, but not beetles in other families. The attractive components can be removed by washing with solvents, and then restored by applying the extract. One potential application of this finding is to enable captive wasp colonies to be provisioned with beetles other than buprestids, which are difficult and expensive to rear.

**Impact:** Some native and exotic wood-boring beetles can pose a significant threat to nursery, landscape, and forest trees. Pest detection and knowledge of the biology and possible natural enemies of these beetles is important to successful eradication of imported pests or development of management plans for established wood-borers that are pests.

## NURSERY AND PLANT INSPECTION ACTIVITIES

Plant inspection and regulatory services are coordinated and conducted by State Entomologist **Dr. Kirby Stafford**, Deputy State Entomologist **Dr. Victoria Smith**, Plant Inspectors **Peter Trenchard**, **Stephen Sandrey**, **Jeffrey Fengler**, **Tia Blevins**, and Apiary Inspector **Ira Kettle**.

*The Survey and Inspection Team at the Eastern Plant Board Meeting* (April 6-9, 2009, Portland, ME). The 84<sup>th</sup> Annual Meeting of the Eastern Plant Board was held in conjunction with the 35<sup>th</sup> Annual Meeting of the Horticultural Inspection Society (HIS) and the Cooperative Agricultural Pest Survey (CAPS). During the EPB Meeting, **Dr. Victoria Smith** presented annual reports on behalf of the National CAPS Committee and the National Plant Board *P. ramorum* Working Group, and was elected Vice President of the Eastern Plant Board. For the HIS meeting, **Peter Trenchard** presented two talks titled “CWR Strikes Again” and “Trace-back Troubles: another *P. ramorum* Saga.” Peter

was also elected Newsletter Editor for HIS, **Steve Sandrey** was elected Archivist, and **Tia Blevins** was elected Treasurer. **Rose Hiskes** attended the CAPS meeting as the State Survey Coordinator for Connecticut, and participated in discussions on data management, GIS mapping, surveys, and taxonomy.

*The Survey and Inspection Team participated in a Snail Blitz (27 May 2010), coordinated by the Wallingford office of USDA-APHIS-PPQ. Trained detector dogs and their handlers, from the Detector Dog Training Center in Newnan, GA, searched for invasive snails and slugs in areas surrounding ports and rail freight yards. Snails and slugs were found and collected, and retained for later identification. Pictured are Tia Blevins, Jeff Fengler and Steve Sandrey setting up a sample site.*



*Nursery Inspection and Certification:* Three-hundred and two nurseries were certified to conduct intra- and interstate business. There were 674 nursery inspections during the growing season. Four-thousand, one-hundred and forty acres of nursery stock were examined as well as plants growing under 26,286,945-sq. ft. of greenhouse space. The majority of plants were grown in hoop houses (21,463,004 sq. ft.), followed by plastic greenhouses (3,080,651 sq. ft.) and glass greenhouses (1,743,290 sq. ft.).

*Nursery Insects:* The most abundant pests found in nurseries were aphids on various trees and shrubs, mites on various trees and shrubs, black vine weevil (*Otiiorhynchus sulcatus*) on *Taxus*, Arborvitae leafminer on *Thuja*, elongate hemlock scale on *Tsuga*, and lacebug on *Pieris*, *Rhododendron* and *Azalea*.

*Japanese Beetle Certification:* We observed treatments of 79,904 plants at one nursery and issued phytosanitary certificates to comply with states that quarantine nursery stock from Connecticut because of the Japanese beetle, *Popillia japonica*.

One nursery, which met the containerized nursery stock accreditation program requirements of the United States Japanese Beetle Harmonization Plan, shipped 5,000 plants to other states in 2009.

Four nurseries met other requirements of the United States Japanese Beetle Harmonization Plan and shipped 2,890 plants to states that quarantine plants from Connecticut.

*Japanese Beetle Certification to Canada:* Thirteen Connecticut nurseries, which met the inspection requirements of the US/Canada Japanese Beetle Harmonization Plan, shipped 53,220 plants to Canada in 2009.

*Nursery Dealer Permits:* Nursery dealer permits were issued to 188 firms. One-hundred seventy of these companies operate individual outlets. The remaining businesses have more than one outlet each. In total, there were 577 outlets.

*Phytosanitary Certificates:* Three-hundred and fifty-four phytosanitary inspection certificates were issued covering the shipment of the following plant materials to destinations outside the United States:

Plants	Number
Apples (Cartons)	11,000
Bulbs & Tubers (Dahlia & Gladiolas)(Bags)	616
American Chestnut (unrooted cuttings)	0
Chinese tree peonies (plants)	80
Greenhouse plants	54
Nursery stock (containers - B & B)	25,560
Orchids (plants)	22,553
Perennials (bare root plants)	5,465
(plants)	5,054
(unrooted cuttings)	1,175
Seeds (cartons & bags)	300
Tobacco (bales, boxes, bundles & cartons)	291
Tobacco (pounds)	116,072
Cotton seed meal (bags)	4,686
	1,600

*Special Inspections:* Ten inspections were made for 160 individual plants and bulbs to assist homeowners moving out of state. One-hundred forty seven inspections were made to assist nurseries moving the following plants interstate:

Plants	Number
Perennials (plants)	79,904
Nursery stock (containers)	5,000
(bare root plants)	1,504
(B & B)	2,666
Corn seed (pounds)	2
Geraniums	1,240
Greenhouse plants	286
Orchids	56
Seed (Bags)	132

One tobacco grower had 110.5 acres inspected for the aerial application of pesticides. There was no Post-Entry Quarantine activity in CT in 2009.

*Biotechnology Regulatory Services Inspection Activity:* In cooperation with officers from the Wallingford USDA-APHIS-PPQ office, six inspections were conducted in 2009 at facilities or laboratories working with recombinant or regulated organisms.

*Permits to Move Live Plants, Noxious Weeds, and Soil:* In 2009, there were sixty four PPQ 526 Permits (Permit to move live plant pests, noxious weeds, and soil) approved in CT. There were two PPQ 330 Permits (permit to move soil) approved in CT.

## FOREST HEALTH SURVEY

During the summer of 2009, we examined 51 permanent, one-acre forest plots that were established to monitor forest health in Connecticut. These plots are located on state, Nature Conservancy, and municipal water company properties. We considered 25 pathogens for monitoring and determined which trees served as host plants. Within each plot, 20 to 30 trees were tagged for long-term studies. We evaluated signs of defoliation and disease, such as dead tree branches, limbs and crowns. Descriptions and determinations are designed to reflect increasing damage or tree decline. We measure the trees at Diameter at Breast Height (DBH) as an additional way to monitor their health. We will continue to use these plots to monitor the forests over several years to assess whether our state forests remain healthy or are declining. In general, our forests remain healthy.

*Tornado Damage:* The National Weather Service confirmed that an F1 tornado touched down June 26 in Wethersfield CT. Members of the National Weather Service surveyed damage in Wethersfield and Farmington; damage in towns surrounding Hartford was caused by straight-line winds, but a narrow tornado had formed in Wethersfield. The NWS said winds in the town reached speeds between 85 and 100 MPH. Unfortunately damage was most severe in the historic town center, and many 200-year-old trees were destroyed, along with several historic homes and buildings. In total, 246.4 acres were affected by this tornado.

*Ice Damage:* Several locations in Litchfield County were severely affected by ice storms in the winter of 2008-2009. All species of trees were affected, with breakage of major branches and trunks occurring. Damage was primarily at higher elevations, such as hilltops and ridges. In total, 1,711.0 acres were affected by ice.

## INSECT AND DISEASE SURVEYS

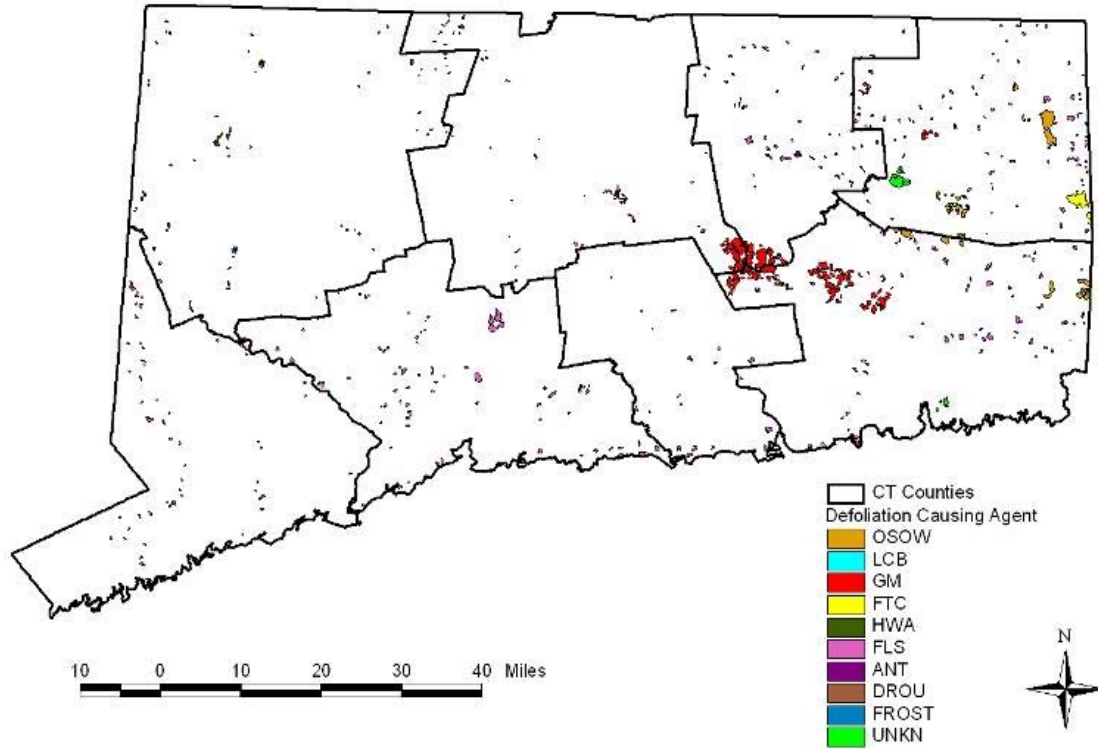
*Gypsy Moth:* Our annual aerial survey for gypsy moth defoliation was conducted in July-August 2009 and covered 1.8 million acres of urban/suburban forest in all eight Connecticut counties. Gypsy moth defoliation of 6,709.0 acres was found in following counties:

COUNTY	TOTAL ACRES
Hartford	1,665.6
New London	1,493.6
Tolland	3,549.8
<b>TOTAL</b>	<b>6,709.0</b>

In November and December, a gypsy moth egg mass survey was conducted in 80-95% favorable host sites on a 7 -mile grid (102 sites) throughout Connecticut. No egg masses were found.



## DEFOLIATION IN CONNECTICUT - 2009



*Orange-Striped Oakworm:* The Orange-striped oakworm, *Anisota senatoria*, is a native moth that ranges from eastern Canada southward to Georgia. It is a common pest of oak species in Connecticut. Occasionally, local infestations occur when oaks have been stressed by other factors such as drought or gypsy moths. Serious defoliation can occur when this happens. The moths lay up to 500 eggs on the undersides of an oak leaves in early summer and are attracted to artificial light. The caterpillars feed on the foliage, and then they burrow into the soil and build an earthen cell, where it pupates and passes the winter. On October 2, 3, & 10, 2007, a statewide aerial survey was conducted for orange-striped oak worm defoliation. Defoliation was found in Windham County (3,062.9 acres) and in New London County (2,152.5 acres). Total acres defoliated were 5,215.4.

*Forest Tent Caterpillar:* The Forest tent caterpillar, *Malacosoma disstria*, is a native insect found throughout the range of hardwood forests in North America. It is more abundantly distributed in eastern North America, but is also common in western areas that have large stands of aspen. At times, this insect can be a damaging defoliator of trees. Trees that are defoliated often flush a new, smaller set of leaves in July. While the forest tent caterpillar does not typically cause mortality to host trees, mortality can occur when populations interact with other disturbances, such as drought or insect outbreaks. Forest tent caterpillar larvae use silk to form trails and to create pads on host trees where

they congregate and rest. During 2009, an outbreak of Forest tent caterpillar resulted in the defoliation of 1,900.4 acres in Windham County.

*Asian Longhorned Beetle:* The Asian longhorned beetle, *Anoplophora glabripennis*, first discovered to be attacking trees in August of 1996 in New York, has spread to within 25 miles of Greenwich in southwestern Connecticut.

There is risk for beetle entry in ports because of the transportation of solid wood packing material on ships coming from areas of the world where this beetle is found. We, therefore, concentrated additional survey efforts in Connecticut in the areas of Bridgeport, Groton, New Haven and New London as well as their surrounding parks that contain a high percentage of maple, a favorite food source of the Asian longhorned beetle. In addition, the 2008 detection of ALB in Worcester, MA, spurred increased interest and vigilance concerning the beetle. We conducted eighty inspections of 7,139 trees in all counties of CT for presence or signs of ALB infestation.

We also participated in a United States Forest Service survey in Southwestern Connecticut. We examined 300 Asian longhorned beetle host species trees in 18 square miles in Greenwich and Stamford. All surveys and identifications, thus far, were negative. We also inspected 1 tree for a homeowner in 2009.

*Septoria Leaf Spot of Maple:* Rainy and cool weather throughout Connecticut during spring and summer created conditions ideal for the fungus known as *Septoria aceris*, which causes septoria leaf spot. A septoria infection is characterized by small brown spots rimmed with yellow when the leaves are still green. As the spots grow and merge, they perforate the leaves, resulting in premature leaf drop and defoliation. The long-term implications for the trees' health are minimal. Damage due to Septoria Leaf Spot of maple was considerable enough to warrant mapping during aerial survey. Data are included on the defoliation map and are summarized below by county.

COUNTY	TOTAL ACRES
Fairfield	663.5
Hartford	665.4
Litchfield	3,278.4
Middlesex	1,977.8
New Haven	1,242.6
New London	2,639.6
Tolland	1,593.0
Windham	2,784.0
<b>TOTAL</b>	<b>14,844.3</b>

*Hemlock Woolly Adelgid:* The hemlock woolly adelgid, *Adelges tsugae*, remains an important pest of hemlock in Connecticut, spreading northward since its coastal detection in 1985 and infesting all 169 towns in the state.

During 2009, we required all hemlock nursery stock that was being shipped out of Connecticut to be treated for Hemlock woolly adelgid. Two nurseries shipped hemlock trees out of state. Our inspectors observed treatments and issued phytosanitary certificates to cover 940 plants in these shipments.

*Ramorum Leaf Blight:* As part of the *P. ramorum* National Nursery Survey, we inspected 20 nurseries during 2009. During the survey, 148,379 plants were inspected and 275 samples were collected from symptomatic plants. All samples were cultured and tested by ELISA; DNA from ELISA-positive plants was sent to Beltsville for confirmation by polymerase chain reaction (PCR). One hundred and forty five samples were ELISA positive; none were PCR-positive.

In conjunction with the US Forest Service, one stream surrounding a production nursery involved in trace-back activity was selected for baiting for *P. ramorum*. One set of baits was located upstream of the nursery, and the second was located downstream, near the irrigation intake for the nursery. The stream was baited with rhododendron leaves for 2-week deployments during April through September 2008, with a 6-week break during July and August, when water temperatures were too warm for *Phytophthora* species. Leaf baits were submitted for testing to labs at Mississippi State University and Cornell University. All baits were negative for *P. ramorum*.

In June of 2009, we received orders for a trace back to be conducted at the CT nursery described above. *P. ramorum*-positive plants had been found at a garden center in North Carolina; this establishment also had received plant material from many other suppliers. Nineteen samples were taken of symptomatic foliage, and irrigation water in 3 ponds was baited with rhododendron leaves. All samples were cultured and tested by ELISA; DNA from ELISA-positive samples was sent to Beltsville for confirmation by PCR. Six foliar samples were ELISA-positive, and none were PCR-positive. The six aquatic samples were negative.

*Daylily Rust:* Daylily rust, caused by, *Puccinia hemerocallidis*, was found on daylilies in a southeastern U.S. nursery for the first time in the summer of 2000, and in 2001 and 2002 on daylilies owned by private citizens. It is now confirmed to occur in three counties. During 2009, we surveyed daylilies in nurseries and garden centers for signs of this rust. Eighty-nine inspections were carried out on 76,899 plants. No signs of *Puccinia hemerocallidis* were found.

*Chrysanthemum White Rust:* In 2009, we conducted twenty one inspections for Chrysanthemum white rust (CWR), caused by the fungus *Puccinia horiana*. As part of trace back activity from a grocery store detection, 50,000 plants were inspected at a grower on August 12-13; no symptomatic plants were found. A second grower reported CWR at his own location in mid-September; 20,000 plants were inspected and 8,500 were destroyed by burial on site. At a third location, 93 symptomatic plants were found and destroyed by disposal in the municipal waste stream.

*Apiary Certification:* Six hundred and seventy eight beekeepers registered 4,209 colonies in 2009. Our bee inspector opened and inspected 707 colonies in areas known to have foulbrood disease. No clinical cases of American foulbrood were detected. *Nosema ceranae* was detected in New London County. Chalkbrood was reported to be widespread. Varroa mite is generally distributed in beehives across the state. There were no positives for tracheal mites.

County	Colonies Opened & Inspected
Fairfield	17
Hartford	32
Litchfield	45
Middlesex	37
New Haven	106
New London	310
Tolland	12
Windham	148
<b>TOTAL</b>	<b>707</b>

## DEPARTMENT OF ENVIRONMENTAL SCIENCES

### *Mosquito Trapping and Testing Program*

Mosquito surveillance for West Nile (WN) virus and Eastern Equine Encephalitis (EEE) is integral to the public health response to these mosquito-transmitted viruses in Connecticut. The objectives of the surveillance program are to provide: 1) early evidence of local virus activity; 2) information on the abundance, distribution, identity and infection rates of potential mosquito vectors and; 3) information that is used to assess the threat of WN virus and EEE to the public and guide the implementation of mosquito control measures. The CAES is responsible for conducting all mosquito trapping and testing activities. The program is conducted by **Dr. Theodore Andreadis** and **Dr. Philip Armstrong**, assisted by **John Shepard**, **Michael Thomas**, and **Shannon Finan**. Mosquito trapping is conducted at 91 permanent trapping stations that are located in 72 municipalities throughout the state.

In 2009, mosquito trapping was conducted from June 2 to October 16. Traps were set and attended by CAES staff every 10 days at each site on a regular rotation. Two trap types were used at all trapping stations – a CO<sub>2</sub>-baited CDC Light Trap, designed to trap host-seeking adult female mosquitoes (all species), and a Gravid Mosquito Trap, designed to trap previously blood-fed adult female mosquitoes (principally *Culex* and container breeding *Ochlerotatus* species). Mosquitoes were transported alive to the laboratory each morning where they were identified to species. Mosquitoes were grouped (pooled) according to species, collecting site, and date and frozen at –80°C. A maximum of 50 female mosquitoes were included in each pool. Aliquots of each mosquito pool were inoculated into Vero cell cultures for detection of WN virus and other mosquito-borne arboviruses of public health importance. Virus isolates from mosquito pools were tested for WN, EEE, Jamestown Canyon (JC), Cache Valley (CV), Trivittatus (TVT), Highlands J (HJ), and LaCrosse (LAC), and Potosi (POTV) viruses. Isolated viruses were identified by Real Time (TaqMan) polymerase chain reaction (PCR) or standard RT-PCR using virus-specific primers. All of the virus isolation work was conducted in a certified Bio-Safety Level 3 laboratory at the CAES. Weekly test results were reported to the CDC electronically via ArboNet and to the DPH for dissemination to other state agencies, local health departments, the media, and neighboring states.

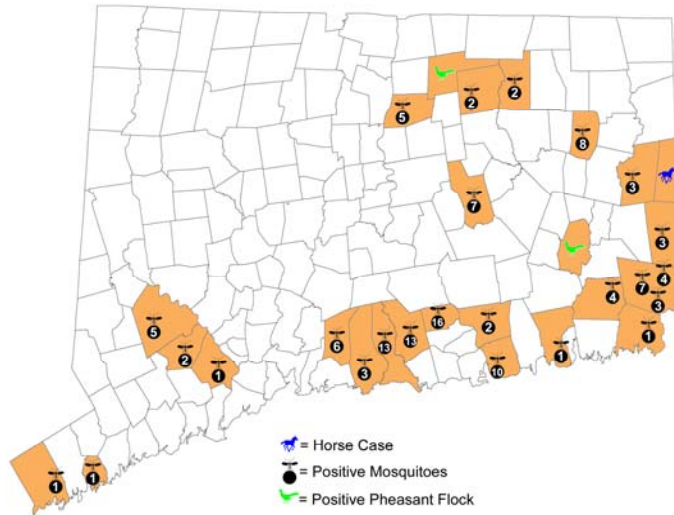
For the 2009 season, a total of 291,641 mosquitoes (16,894 pools) representing 35 species were trapped and tested.

A total of 122 isolations of EEE virus were made from 13 mosquito species: *Culiseta melanura* = 83, *Ochlerotatus canadensis* = 10, *Aedes cinereus* = 6, *Uranotaenia sapphirina* = 4, *Anopheles punctipennis* = 4, *Culex salinarius* = 3, *Ae. vexans* = 2, *An. quadrimaculatus* = 2, *An. walkeri* = 2, *Oc. trivittatus* = 2, *Cx. restuans* = 1, *Oc. cantator* = 1, *Oc. triseriatus* = 1, *Psorophora ferox* = 1, collected at 25 locations in 23 towns in 7 counties: Fairfield (Darien, Greenwich, Monroe, Newtown, Shelton), Hartford (South Windsor), Middlesex (Chester, Killingworth), New Haven (Guilford, Madison, North

Branford), New London (Ledyard, Lyme, North Stonington, Old Lyme, Stonington, Voluntown, Waterford), Tolland (Hebron, Tolland, Willington), and Windham(Hampton, Plainfield).

The first positive mosquitoes were collected on August 17, and the last on October 27. The majority of EEE isolations were from southern regions of Middlesex, New Haven and New London Counties. There was one EEE horse case in Windham County( Sterling) and two EEE positive pheasant flocks in New London (Norwich) and Tolland (Ellington) Counties. There were no human cases of EEE reported.

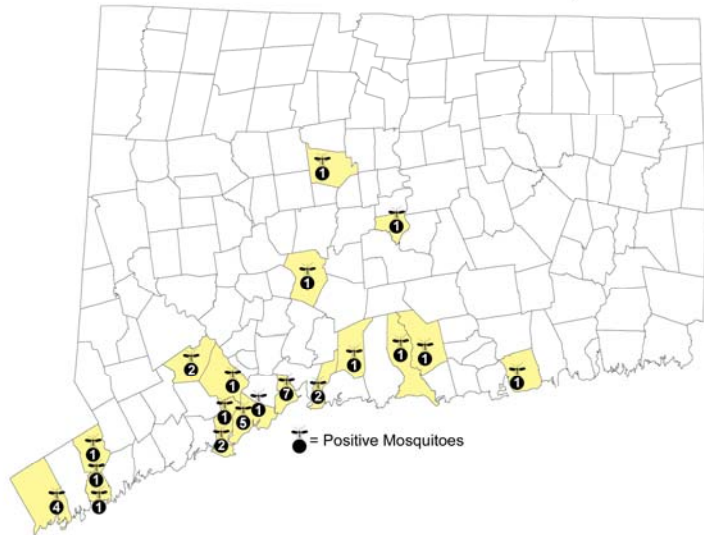
**2009 Eastern Equine Encephalitis Activity**



A total of 35 isolations of WN virus were made from 4 mosquito species: *Culex pipiens* = 25, *Culiseta melanura* = 5, *Cx. restuans* = 3, *Cx. salinarius* = 1, *Ochlerotatus stimulans* = 1, collected at 19 sites in 16 towns in 5 counties: Fairfield, (Darien, Greenwich, Monroe, New Canaan, Shelton, Stratford), Hartford (Farmington), Middlesex (Killingworth), New Haven (Cheshire, East Haven, Madison, Milford, North Branford, West Haven), and New London, (Old Lyme) (Figure 1).

The first positive mosquitoes were collected on July 11, and the last on October 20. This represents the latest historical isolation of WNV in the state. As in prior years, the majority of WN virus activity was detected in densely populated urban and suburban regions in southwestern (Fairfield and New Haven Counties) Connecticut. No human or horse cases of WN were reported.

**2009 West Nile Virus Activity**



Other mosquito-borne viruses isolated included: Highlands J (HJ) = 61 isolates from 12 species (Aug. 8-Oct. 20); Jamestown Canyon (JC) = 43 isolates from 11 species (Jun. 1-Aug. 3); Trivattatus (TVT) = 29 isolates from 4 species (Aug. 8-Sept. 1); Cache Valley (CV) = 1 isolate from 1 species (Aug. 11); Flanders (FL) = 1 isolate from 1 species (July 7).

*Mosquito species trapped and tested for arboviruses in Connecticut, 2009*

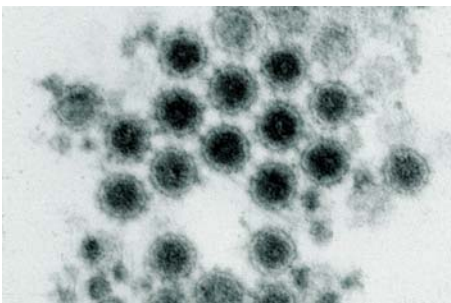
Mosquito Species	# Mosquitoes	# Pools	Virus						
			CV	EEE	FL	HJ	JC	TVT	WN
<i>Aedes cinereus</i>	15,294	1,087		6		2		1	
<b>Ae. Vexans</b>	26,462	1,229		2		2	2	1	
<b>Anopheles barberi</b>	5	5							
<b>An. crucians</b>	4	4							
<i>An. punctipennis</i>	5,573	776		4			1		
<i>An. quadrimaculatus</i>	607	172		2					
<i>An. walkeri</i>	2,381	235		2					
<i>Coquillettidia perturbans</i>	35,389	1,328	1			1	1		
<i>Culex pipiens</i>	20,994	1,250			1				25
<i>Cx. restuans</i>	14,609	1,318		1		2			3
<i>Cx. salinarius</i>	12,605	776		3		1			1
<i>Cx. territans</i>	250	120							
<i>Culiseta melanura</i>	25,595	1,348		83		45			5
<i>Cs. minnesotae</i>	44	17							
<i>Cs. morsitans</i>	290	89				1			
<i>Ochlerotatus abserratus</i>	3,873	207					2		
<i>Oc. aurifer</i>	2,130	144					4		
<i>Oc. canadensis</i>	40,543	1,457		10		1	17	1	
<i>Oc. cantator</i>	4,457	333		1			3		
<i>Oc. communis</i>	64	3					2		
<i>Oc. excrucians</i>	491	88				1			
<i>Oc. grossbecki</i>	1	1				1			
<i>Oc. japonicus</i>	2,861	777							
<i>Oc. provocans</i>	284	12					3		
<i>Oc. sollicitans</i>	263	48							
<i>Oc. sticticus</i>	7,673	346					2		
<i>Oc. stimulans</i>	2,559	285					6		1
<i>Oc. taeniorhynchus</i>	8,765	236							
<i>Oc. thibaulti</i>	14,598	458							
<i>Oc. triseriatus</i>	3,000	556		1		2			
<i>Oc. trivittatus</i>	23,340	1,029		2				26	
<i>Orthopodomyia signifera</i>	5	5							
<i>Psorophora columbiae</i>	1	1							
<i>Ps. ferox</i>	13,677	709		1					

<i>Uranotaenia sapphirina</i>	2,954	445		4		3			
<b>TOTAL</b>	291,641	16,894	1	122	1	61	43	29	35

CV = Cache Valley, FL = Flanders, HJ = Highlands J, JC = Jamestown Canyon, TVT = Trivittatus, WN = West Nile

*Impact.* Mosquitoes were collected at 91 trap sites, located in 72 municipalities, in Connecticut. Following identification, the insects were processed for virus isolations and identified using molecular methods to analyze RNA. During 2009, 291,641 mosquitoes were tested for virus. There were 35 isolations of WN virus and 122 isolations of EEE. There were no human cases in the state linked to WN or EEE virus infection. News releases included information on how residents could protect themselves from mosquito bites, such as the use of repellents. The information contained in the news releases had an immediate impact because many residents did take the suggested precautions. The long-term benefits include a healthy human population and a well-informed public concerning the potential risks of mosquito bites. Participation in the statewide surveillance program provided timely information about levels of virus activity in the mosquito population which was used to assess risk of human infection, inform the public and health care providers of these risks, guide vector control efforts, and prevent disease outbreaks.

### *Mosquito and Arbovirus Studies*



#### **Dr. Philip Armstrong and Dr. Theodore**

**Andreadis** evaluated the role of different mosquito species to serve as vectors of eastern equine encephalitis (EEE) virus in Connecticut. EEE virus is maintained in an enzootic cycle involving *Culiseta melanura* mosquitoes and avian hosts, whereas other mosquito species that feed opportunistically on mammals have been incriminated as bridge vectors to humans and horses. To evaluate the capacity of

these mosquitoes to acquire, replicate, and potentially transmit EEE virus, the infection prevalence and virus titers were estimated from mosquitoes collected in Connecticut in 2009 by cell culture, plaque titration, and quantitative RT-PCR. EEE virus was isolated from 122 mosquito pools representing 14 different species and 7 genera, collected from August 17- October 27, 2009 in 25 of 91 trapping locations. *Cs. melanura* yielded the greatest number of EEE virus isolations (n=83) followed by *Ochlerotatus canadensis* (10) and *Aedes cinereus* (6). Relatively few ( $\leq 4$ ) or no EEEV isolates were obtained from the remaining mosquito species collected. *Cs. melanura* contained significantly higher virus titers (mean=6.55 log<sub>10</sub> plaque forming units (PFU)/mosquito pool) than all other mosquito species for which statistical comparisons were possible (Mann Whitney U test, p<0.01). *Ae. cinereus* and *Oc. canadensis* exhibited the next highest virus titers of 2.92 and 2.82 log<sub>10</sub> PFU/mosquito pool and mean titers ranged from <0.8-1.69 log<sub>10</sub> PFU/mosquito pool in the remaining species. *Cs. melanura* was the only species that supported virus titers associated with EEE virus transmission, previously estimated



between 4-7 logs of virus in transmitting mosquitoes. This suggests that EEE virus is transmitted primarily by *Cs. melanura* and this species may serve as both enzootic and bridge vector in this region of the US, despite repeated virus isolations from other mammalophilic mosquitoes during episodes of virus amplification.

*Impact.* These investigations on the role of different mosquito species to serve as vectors of viral pathogens can be used to target anti-vector interventions more effectively.



A 3-yr study was undertaken by **Dr. Theodore Andreadis** and **Dr. Philip Armstrong** assisted by **John Shepard** and **Michael Thomas** in cooperation with the New York City Departments of Health & Mental Hygiene, to examine the parity status (i.e., whether or not a mosquito has laid eggs), survival

and prevalence of West Nile (WN) virus in overwintering populations of *Culex pipiens pipiens* collected from a hibernaculum located in a WN virus endemic region in New York City. Nearly 6,000 females were collected from December through April. Parity rates were highest among females collected in December and January, ranging from 12.3% to 21.9% depending on the year. In each year of the study, the proportion of parous females (i.e., those that deposited at least one batch of eggs) declined significantly during the course of the winter with the percentage of parous females found in April ranging from 0.9% to 10%. Results provide unequivocal evidence that parous female *Cx. p. pipiens* from this region of the northeastern US enter hibernacula in the fall in comparatively high proportions not previously recognized for this species, and while these females experience significant mortality during the winter some survive to April to emerge in the spring. The absence of any detectible blood remnants in overwintering females reaffirm that blood feeding does not occur among diapausing females during the winter. The possibility that a portion of the diapausing population may be autogenous (production of eggs without a blood meal) as a result of hybridization with sympatric below-ground populations of *Cx. p. pipiens* “form molestus” is discussed. A single isolation of WN virus was obtained in Vero cell culture from a pool of 50 females collected on January 11, 2007 representing an infection prevalence of 0.07% in the overwintering population in 2007 (n = 1,370 mosquitoes, 33 pools). No isolations of WN virus were made from mosquitoes collected in 2008 (n = 1,870 mosquitoes, 190 pools) or 2009 (n = 1,767 mosquitoes, 184 pools). Findings provide further evidence for local overwintering of WN virus in diapausing *Cx. p. pipiens*, albeit at very low rates,

consistent with the paucity of WN virus positive mosquitoes detected in June and early July despite the emergence of females from hibernacula in early May in this region.



Southern California remains an important focus of West Nile (WN) virus activity, with persistently elevated incidence after invasion by the virus in 2003 and subsequent amplification to epidemic levels in 2004. Ecoepidemiological studies of vectors-hosts-pathogen interactions are of paramount importance for better understanding of the transmission dynamics of WN virus and other emerging mosquito-borne arboviruses. **Drs. Goudarz Molaei, Theodore Andreadis, Philip Armstrong** in collaboration with

scientists from several Mosquito and Vector Control Districts in CA investigated vector-host interactions and blood-feeding behavior of 4 competent mosquito vectors by using a PCR method targeting mitochondrial DNA to identify vertebrate hosts of blood-fed mosquitoes. Diagnostic testing by cell culture, real-time RT-PCR, and immunoassays were additionally used to examine WN virus infection in blood-fed mosquitoes, mosquito pools, dead birds, and mammals. Analyses of engorged *Culex quinquefasciatus* revealed that this mosquito species acquired 88% of the blood meals from avian and 11.6% from mammalian hosts, including humans. Similarly, *Cx. tarsalis* fed 82% on birds and 18% on mammals. *Culex erythrorhox* fed opportunistically on both birds (59%) and mammals (41%). In contrast, *Cx. stigmatosoma* acquired all blood meals from avian hosts. House finches and a few other mostly passeriform birds served as the main hosts for the blood-seeking mosquitoes. Evidence of WN virus infection was detected in mosquito pools, wild birds, dead birds, and mammals, including humans with cases of fatalities during the study.

*Impact.* These findings emphasize the important role of house finches and several other passeriform birds in the maintenance and amplification of WN virus in southern California, with *Cx. quinquefasciatus* acting as both the principal enzootic and bridge vector responsible for the spillover of WN virus to humans. Other mosquito species, including *Cx. tarsalis* and *Cx. stigmatosoma*, are important but less widely distributed, and also contribute to spatial and temporal transmission of WN virus in southern California.

### ***Invasive Aquatic Plant Program***

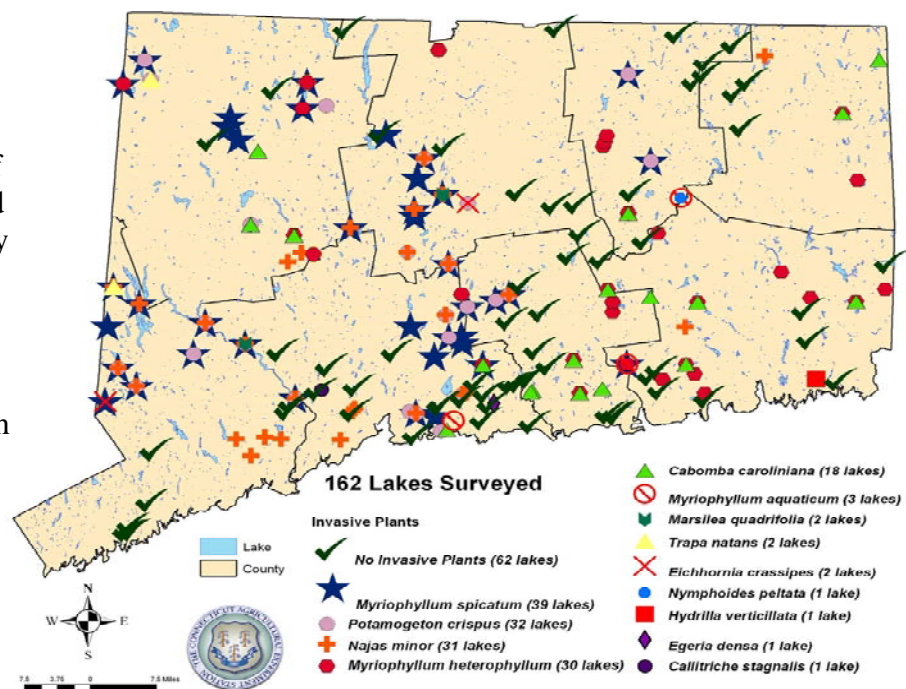


*Statewide surveillance and mapping of Connecticut lakes for aquatic vegetation.* The goal of this project is to quantify the presence of invasive aquatic plants in Connecticut's lakes and ponds, determine their effects on native plant communities, establish baseline data to track their spread and provide information that is critical for developing control strategies.

During the 2009 field season, **Greg Bugbee** assisted by **Martha Balfour**, mapped aquatic vegetation at 24 lakes and ponds. When added to the 138 water bodies previously surveyed, the total is now 162. In addition, Candlewood Lake, Connecticut's largest lake, was surveyed for the third consecutive year to determine the effects of alternate year deep and shallow winter drawdown on the invasive species: Eurasian water milfoil (*Myriophyllum spicatum*), minor naiad (*Najas minor*) and curly leaf pondweed (*Potamogeton crispus*). Lake's Lillinonah and Zoar (other large lakes) were surveyed for the second time to track the long-term population dynamics of invasive and native species. Global positioning system (GPS) derived transects were established within each water body to quantitatively track changes in the abundance and distribution of aquatic plant species over time. Water samples were collected from all lakes and ponds and were analyzed for alkalinity, clarity, conductivity, dissolved oxygen, nitrogen, pH, phosphorus and temperature. These data, along with watershed information, are being used to investigate the factors that influence the susceptibility of certain water bodies to certain invasive species. Dry specimens of all the plant species have been archived in the CAES herbaria for future reference. All information is incorporated into the Invasive Aquatic Plant Program website (<http://www.ct.gov/caes/IAPP>).

More than 60 percent of Connecticut lakes and ponds contain one or more invasive plant species. In some cases, as many as four invasive species are present. The most common invasive plants are Eurasian watermilfoil, variable watermilfoil (**Myriophyllum heterophyllum**), minor naiad, curly leaf pondweed **and** fanwort (**Cabomba caroliniana**). Less common plants are water hyacinth (*Eichhornia crassipes*), water shamrock (*Marsilea quadrifolia*) and hydrilla (*Hydrilla verticillata*). A survey of Fence Rock Pond in Guilford revealed Connecticut's first infestation of Brazilian waterweed (*Egeria densa*).

**Greg Bugbee** is investigating the use of aerial images as a surveillance tool. In 2008, CAES and a consortium of other state agencies funded a flyover of Connecticut by the United States Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP). The high resolution imagery, using red, green, blue and near infrared wavelengths, was supplied to stakeholders in 2009. We compared our 2008 field survey of Candlewood Lake to the



imagery and found reasonably good viewing of the Eurasian watermilfoil beds. Of the 456 acres found by CAES field reconnaissance, 351 acres could be detected by the aerial imagery. More sophisticated software is available for analyzing the imagery that could improve the results, and we will be investigating this in the future imagery.



*Control of Variable Water Milfoil in Bashan Lake, East Haddam, CT.* **Greg Bugbee** and staff are in the eleventh year of research involving the use of spot applications of the herbicide 2, 4-D to control variable watermilfoil in Bashan Lake. They have largely restored the lake to preinfestation conditions; however, regrowth requires yearly surveys and modest retreatments. For a fifth consecutive year, we have shown the effectiveness of late summer herbicide applications, thus limiting the herbicide exposure of those who use the lake. They have integrated underwater video equipment with GPS and geographic information system (GIS) technology to precisely locate and treat the patches of variable watermilfoil.

*Control of curly leaf pondweed and Eurasian Water milfoil with preturion diquat application in Crystal Lake, Middletown CT.* Crystal Lake has extensive growth of curly leaf **pondweed** and Eurasian watermilfoil. Chemical control efforts have been hampered due to the presence of the threatened plant species *Potamogeton vaseyi*. In 2007, **Greg Bugbee** used limnobarriers to isolate the threatened plant and then used the aquatic herbicide diquat to remove the invasive plants. The treatment occurred in late April and after several weeks, the unwanted vegetation was controlled. By late summer re-growth of curly leaf pondweed had begun but no Eurasian milfoil was observed. This trend continued in 2008 with re-growth of the curly leaf pondweed to pretreatment levels but virtually no re-growth of the Eurasian watermilfoil. This near complete elimination of Eurasian watermilfoil by the April diquat treatment may be a new tool for controlling this plant but further study is needed. In 2008, a survey *Potamogeton vaseyi* by CT DEP found that the plant was growing well; however, none was located in 2009. Eight species of native plants were found the year after treatment compared to only four the year prior to treatment. This suggests that the application of diquat did not adversely affect plant communities and may have actually benefited native species. Longer-term control of the curly leaf pondweed probably requires reducing its bank of reproductive structures in the sediment called turions. Consecutive early season Diquat applications were made in 2009 and 2010 to test if this will occur. Again, limnobarriers were installed and populations of all plants were monitored. In 2010, in collaboration with the CAES Department of Analytical Chemistry, the movement and degradation of the diquat herbicide was monitored both inside and outside the limnobarriers and in the outflow stream.



*Biological control of Eurasian milfoil with the milfoil weevil.* **Greg Bugbee** has continued research on the interactions between Eurasian watermilfoil and the milfoil weevil (*Euhrychiopsis lecontei*). We have found that this insect has controlled Eurasian watermilfoil in other states and is native to most lakes with Eurasian watermilfoil in CT.

Unfortunately, weevil populations in CT are rarely high enough to cause a significant reduction in milfoil. We are currently conducting two long-term investigations on augmenting milfoil weevil populations to determine if control of Eurasian watermilfoil will result. The first project is in Candlewood Lake. Although Candlewood Lake contains over 350 acres of Eurasian watermilfoil, our surveillance found the weevil to be nearly nonexistent. This offered an excellent opportunity to determine if weevil augmentation can increase the long-term population. In early 2008, CAES in collaboration with Western Connecticut State University, The Candlewood Lake Authority and EnviroScience, Inc. introduced 10,000 weevils into three carefully selected sites. In 2009, the weevil population in the sites changed little from pretreatment densities. In June 2010, an additional 5000 weevils were stocked into a previously augmented site and 11,000 weevils were stocked into a new site. We will continue to monitor both weevil and milfoil populations in the stocked sites and an un-stocked site to determine if the weevils persist and begin to reach densities capable of controlling Eurasian watermilfoil. Our second milfoil weevil investigation site is located at Indian Lake, in Sharon, CT. The Indian Lake Association initiated a weevil stocking program in 2008. We monitored milfoil and weevil populations prior to augmentation and are currently following populations in a manner similar to that of Candlewood Lake. Unlike Candlewood Lake, Indian Lake already had an abundant weevil population prior to augmentation. Our preliminary data show that average weevil populations in the augmented areas were similar (1.25 weevils/stem) to the non-augmented areas.

*Biological control of Eurasian milfoil, curly leaf pondweed and minor naiad with triploid grass carp in Grannis Lake, East Haven CT.* This was the seventh year of study at Grannis Lake, which has the problematic populations of Eurasian watermilfoil, curly leaf pondweed and minor naiad. After many years of unsuccessful attempts to control the invasive species with herbicides, we introduced the plant



eating fish called grass carp (*Ctenopharyngodon idella*) 2007 (Figure 5). A total of 200 sterile (triploid) fish averaging 25 cm (10 inch) in length were introduced into the 20 acre lake. Over 200 georeferenced sites in the lake are being monitored for the effects of the grass carp on both native and invasive plant species. After no decrease in vegetation in 2008 and 2009, our survey in May 2010 finally began to show the fish were beginning to reduce the invasive species. This is likely because the fish have now become large enough to consume large quantities of plant material.

*Molecular identification and population genetics of invasive aquatic plants.* **Dr. Charles Vossbrinck** is largely finished with developing a database of plant DNA sequences for molecular identification of the aquatic invasive and native species. He has positively identified and sequenced at least one gene from 56 different aquatic plant species and has sequenced all three genes (small ribosomal subunit, internal transcribed spacer ribosomal DNA, atpB-rbcL spacer region) from 41 species. He has submitted 130 sequences to GenBank (<http://www.ncbi.nlm.nih.gov/Genbank/index.html>) where they are now available to researchers worldwide. He has discovered that for certain species, interference by other plant constituents makes DNA extraction difficult. Consequently, he has developed novel methods using cesium chloride/ethidium bromide density gradients and ultracentrifugation to effectively isolate and purify DNA bands. The database and molecular sequencing technology have been used to identify or eliminate from possibility several aquatic plant isolates this past year. We are anxious to apply this tool to the overall invasive plant program over the next two years to help us accurately identify the source of invasive aquatic plants in Connecticut.

**Dr. Charles Vossbrinck** assisted by **Kittyapong Prapayotin Riveros**, has completed the isolation of 12 microsatellite markers for distinguishing different populations of the milfoil weevil (*E. lecontei*). In addition to cloning and sequencing six putative microsatellite loci, they have obtained a rough 454 genomic sequence at the Yale Biotechnology Center for the *E. lecontei* genome. With that information, they were able to quickly develop more microsatellite loci. They will use these markers to examine differences among populations of this biological control agent in Connecticut water bodies. This information could be extremely valuable in determining how well the augmented weevil populations are doing in lakes as they can be differentiated from their native counterparts by small genetic differences.

**Greg Bugbee** is working in cooperation with Dr. Ryan Thum at Grand Valley State University (Michigan) regarding genetic differences in variable leaf watermilfoil (*Myriophyllum heterophyllum*) that may be contributing to increased invasiveness. Variable milfoil is one of the most destructive invasive aquatic plants in Connecticut's lakes and ponds. Its color, density and their characteristics differ from one place to another. Some of the differences are caused by hybridization with other milfoil species such as loose watermilfoil (*Myriophyllum laxum*). We have obtained milfoil plants from three genetically different types (genotype) of variable milfoil from lakes throughout the northeast. In June 2010, they were planted in 250 liter (100 gallon) tanks at the CAES research farm in Hamden and at Grand Valley State University in Michigan. At the end of the growing season, the plants will be harvested, and biomass will be determined and

compared to the other genotypes. We hope to determine if there a genetic basis for invasive growth and if the hybrids are more invasive.

*Outreach.* CAES strives to disseminate all information from our program to the public in a timely fashion and educate stakeholders in the identification, prevention and management of invasive aquatic species. Given the magnitude of invasion by non-native aquatic plants, we are making significant efforts to engage citizens, lake associations, and others as a part of this project



(Figure 6). CAES scientists have given several workshops on the identification of invasive plants and how to control these weeds. We have assembled numerous publications that are freely available in hard copy or electronically via our website (<http://www.ct.gov/caes/IAPP>). Included are digitized interactive maps of all surveyed lakes. In the 2009-2010 reporting period, CAES scientists gave 30 presentations to a variety of groups including professional organizations, such as the Northeast Aquatic Plant Management Society (NEAPMS), the Connecticut Conference on Natural Resources (CCNR), the North American Lake Management Society (NALMS), and local lake associations and other citizens' groups.

### ***Environmental Chemistry***

*Effect of halide ions and carbonates on organic contaminant degradation by hydroxyl radical-based advanced oxidation processes.* **Dr. Joseph Pignatello** in collaboration with William A. Mitch, Yale University. Advanced oxidation processes based on hydroxyl radical chemistry are being used more and more frequently to treat reclaimed waters and other challenging waters that often contain high levels of salts including halide ions ( $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ) and carbonates ( $\text{H}_2\text{CO}_3 + \text{HCO}_3^- + \text{CO}_3^{2-}$ ). These ions scavenge  $\text{HO}^\bullet$ , such that AOP treatment of saline waters would be anticipated to be ineffective. However,  $\text{HO}^\bullet$  scavenging by halides converts  $\text{HO}^\bullet$  to radical reactive halogen species (RHS:  $\text{X}^\bullet$ ,  $\text{X}_2^\bullet$ ) and carbonate radical ( $\text{CO}_3^{\bullet-}$ ) that participate in contaminant destruction, but react more selectively with electron-rich organic compounds. The effects of  $\text{Cl}^-$ ,  $\text{Br}^-$  and carbonates on the UV/ $\text{H}_2\text{O}_2$  treatment of model compounds in saline waters were evaluated. For single target organic contaminants, the suppression of contaminant destruction rate at circumneutral pH followed the order:  $\text{Br}^- > \text{carbonates} > \text{Cl}^-$ . Traces of  $\text{Br}^-$  in the NaCl stock had a greater effect than  $\text{Cl}^-$  itself. Kinetic modeling of phenol destruction demonstrated that RHS contributed significantly to phenol destruction, mitigating the impact of  $\text{HO}^\bullet$  scavenging by halide and carbonate constituents. The extent of treatment efficiency reduction in the presence of halides varied dramatically among different target organic compounds. Destruction of electron-poor contaminants in

seawater was nearly halted, while 17 $\beta$ -estradiol removal declined by only 3%. Mixtures of contaminants with each other and with natural organic matter (NOM) were tested. Although NOM served as a scavenger of oxidants, conversion of non-selective HO $\cdot$  to selective radicals due to the presence of halide and carbonate anions enhanced the removal efficiency of electron-rich contaminants by focusing the oxidizing power of the system away from NOM and towards the target contaminant. The formation of halogenated byproducts was observed but was minimal.

The significance of these results is that the radical halogen and carbonate species formed in the scavenging process can themselves contribute appreciably to contaminant destruction, mitigating the impact of hydroxyl scavenging. Moreover, in the presence of multiple contaminants, halide ions can change the selectivity of the AOP because RHS are generally more electrophilic than hydroxyl. Hence, the degradation rate of contaminants with electron rich reaction centers will be less suppressed by halide ions than contaminants with electron poor reaction centers.

*Effects of Biochar on the Bioavailability of Agriculturally Important Chemicals.* **Dr. Joseph Pignatello** in collaboration with **Dr. Wade Elmer** and **Dr. Jason White**.

Biochar is a coined term for the carbonaceous byproduct of high-temperature technologies that convert biomass waste into liquid or gaseous fuels. It is similar in properties to pulverized charcoal briquettes. Biochar has recognized potential value as a soil amendment, as it appears to increase soil fertility in some cases. Also, due to its inherent stability in the environment (reported half life of several hundred years), biochar may serve as a form of 'sequestered carbon' that, if it were produced on a large scale, could reduce carbon dioxide emissions and help mitigate climate change. Due to their high surface area and microporous nature, charcoal materials are strong adsorbents of organic compounds typically. Thus, a prerequisite to the widescale use of biochar as a soil amendment in agriculture is a thorough assessment of its effects on the biological availability of agriculturally important chemicals in soil, such as pesticides, existing contaminants, and natural plant signaling chemicals (allelochemicals).

Greenhouse tests were conducted on a biochar from Dynamotive-USA. Two soils contaminated with the legacy pesticides chlordane and DDX (DDT + DDE + DDD) were amended with Dynamotive biochar at 0, 0.1, 1.0, and 10% (w/w) levels and then planted with zucchini (*Cucurbita pepo*). The amount of contaminant accumulated by the plants decreased significantly with increasing amounts of biochar. At the 10% amendment level, total chlordane and DDX content in the plants was reduced by 68 and 79%, respectively, relative to the control plants. At 10% biochar, there was an adverse effect on plant growth. We further studied the effects of biochar on the plant systems known to be impacted negatively by natural allelochemicals. The addition of biochar (0.32, 1.60 and 3.20 % (w/w)) to asparagus soils infested with *Fusarium* root rot pathogens increased asparagus plant weights and reduced *Fusarium* root rot disease. The addition of allelochemicals (coumaric, caffeic, and ferulic acids exuded from asparagus roots) involved in plant-mycorrhizal fungi signaling processes did not affect plant weights or disease, but reduced root colonization by beneficial mycorrhizae. However, the addition of biochar partially reduced the negative effect of the allelochemical mixture on



mycorrhizal colonization. Finally, the addition of biochar at 3.5% to the sand potting soil reduced the negative effect of juglone, an allelochemical exuded by black walnut and butternut, on tomato plant growth and stunting and wilting of the fruit. Findings provide convincing evidence that biochar application to agricultural soil can, in specific circumstances, lower contaminant uptake by plants and reduce allelochemical activity.

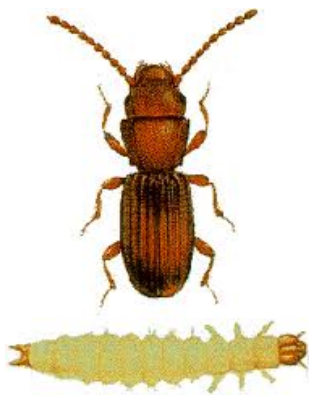
*Artificial Cross-Linking of Humic Acids and Humic Substances in Soils: A Model for Aging of Soil Organic Matter.* **Dr. Joseph Pignatello** in collaboration with Gabriele E. Schaumann, Sören Thiele-Bruhn, and Jingdong Mao. Humic substances can be regarded as macromolecular organic solids. In nature, humic substances undergo physical, chemical, and enzymatic alteration as they age. The formation of intermolecular bonds between strands by bridging groups (referred to as cross-linking) is believed to play an important role in the humification of soil organic matter. Crosslinking leads to an increase of the rigidity of the organic matrix. We have successfully crosslinked a soil humic acid with two model organic crosslinking agents: 3,4-epoxycyclohexyl methyl 3,4-epoxycyclohexane carboxylate (DE) and 1,2,3,4-butanetetracarboxylic acid (BTCA). Crosslinking was verified by water solubility tests and confirmed by Fourier Transform Infrared (FTIR) spectroscopy.

*Sorption Mechanism of the Swine Antibiotic, Sulfamethazine on Black Carbon.* **Dr. Joseph Pignatello** in collaboration with Mercè Granados and Jordan Peccia. Sulfamethazine [SM; 4-amino-*N*-(4,6-dimethylpyrimidin-2-yl) benzenesulfonamide] is one of the most heavily used antibiotics in animal agriculture. Charcoal from natural and deliberate fires is a ubiquitous component of soils and a number of researchers have suggesting adding engineered charcoal (“biochar”) to soil to improve soil fertility. Charcoal and black carbon materials in general are typically powerful adsorbents of hydrophobic compounds. Compared to hydrophobic compounds, little is known about the adsorption of polar and ionizable compounds such as SM. Adsorption of SM to a series of biochars was studied to determine whether biochar amendment to soil could lower its bioavailability through enhanced adsorption. Depending on pH, SM is cationic ( $SM^+$ , protonation of anilino N), anionic ( $SM^-$ , dissociation of sulfonamide N), or uncharged ( $SM^0$ ), ( $pK_{a1} = 2.3$ ;  $pK_{a2} = 7.4$ ). Despite its hydrophilic nature ( $\log K_{ow}^0 = 0.27$ ), the affinity of SM species for biochar is extraordinarily high ( $K_{BC}^0$  up to  $10^4 \times K_{OC}$ ) and follows the order  $SM^0 > SM^+ > SM^-$ . Competition experiments indicate that cation exchange, anion exchange, ion pair sorption and coordination to surface metal ions are unimportant mechanisms. Strong competition by  $\pi$ -acceptor molecules supports a contribution from  $\pi$ - $\pi$ /cation- $\pi$  interactions of the charged anilinium group with surface graphene units.

*Do Contaminants Preferentially Interact with Adsorption Sites in Soil Organic Matter Based on Functional Group Identity? An NMR Study Using Stable Free Radical Probes.* **Dr. Joseph Pignatello** in collaboration with Dr. Jingdong Mao. Soil organic matter is composed of lipid, carbohydrate-like, protein-like, lignin-like and black carbon-like functional units. A number of researchers have proposed that environmental contaminants show preferential sorption in soil organic matter depending on the similarity of their structure to the functional unit. For example, an aromatic compound

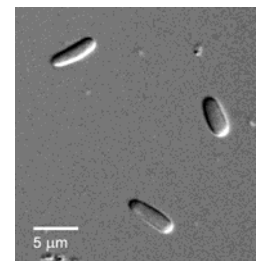
may preferentially interact with the lignin-like or black carbon-like units because such units are rich in aromatic functional groups. However, incorrect approaches were used to test this hypothesis and the results have been conflicting. We have studied sorption of the nitroxyl spin probes, 2,2,6,6-tetramethylpiperidin-N-oxide (TEMPO) and 2,2,6,6-tetramethyl-4-hydroxy-piperidin-N-oxide (HTEMPO), to Pahokee peat soil, which is about 93% organic matter. TEMPO and HTEMPO are stable free radicals that cause relaxation of  $^{13}\text{C}$  transitions and signal suppression in the cross-polarization/magic angle spinning nuclear magnetic resonance (CP/MAS-NMR) spectrum. We found that sorption of either of these aliphatic compounds causes progressive relaxation of all peaks in the spectrum at the same rate with increasing probe concentration. This indicates no preferential sorption of these aliphatic spin probes to soil organic matter on the nanometer scale.

### ***Biological Control of Insect Pests***



*A new parasite of stored grain pests.* A microsporidian parasite that closely resembles *Paranosema* species at the level of the light microscope was isolated from the rusty grain beetle, *Cryptolestes ferrugineus* by **Dr Charles Vossbrinck** and colleagues from the USDA-ARS, Manhattan, KS. Its identity as *N. oryzaephili* (originally described from *Orzaephilus surinamensis*) was confirmed by comparison with a known isolate of *N. oryzaephili* based upon spore size, small subunit rDNA sequence, and relative infectivity to *O. surinamensis*, *Tribolium castaneum*, and *Ephestia kuhniella*. Phylogenetic analysis of the small subunit rDNA indicated that this species belongs in the genus *Paranosema* and the designation *Paranosema oryzaephili* was proposed. In spite of the abundance, economic importance, and world-wide distribution of *C. ferrugineus*, this was the first report of a microsporidian infection in this insect species and the first record of *P. oryzaephili* in the new world.

*Redefinition of parasite of flies based on DNA analysis.* **Dr. Charles Vossbrinck** and **Dr. Theodore Andreadis** conducted a comparative phylogenetic DNA analysis of the microsporidian parasite, *Octosporea muscaedomesticae* isolated from the blowfly *Phormia regina* and demonstrated that this parasite is unrelated to other *Octosporea* species from unrelated hosts. Analyses with 38 other Microsporidia show that *O. muscaedomesticae*, differed from *Octosporea bayeri* (a parasite of the microcrustacean *Daphnia magna*) by 29%, thereby demonstrating that the latter microsporidium is not closely related to the fly parasite at the generic level; *O. muscaedomesticae* should not be placed within the genus *Octosporea*, a conclusion that is further supported by morphological and developmental differences. Considering the number of disparately related hosts from which *Octosporea* species have been previously described based mostly on developmental and morphological characters, it is likely that



many will not fit the current definition of the genus, and it is possible that molecular analysis of these species will show that this genus, as defined, represents a polyphyletic grouping of unrelated taxa.



*A new parasite of the teak moth.* In conjunction with colleagues at the Institute of Wood Science and Technology in Bangalore, India, **Dr. Charles Vossbrinck** reported the pathological effects of a microsporidian parasite (*Nosema* sp.) from the lepidopteran teak defoliator, *Hyblaea puera*. The spores were ovoid-cylindrical and had a mean size of 5.1 to 2.8  $\mu$ m. The midgut and fat body were the primary organs infected by the microsporidium. Subsequently, infection was observed in Malpighian tubules, tracheal epithelium and gonads. The sequence of infection observed was: midgut – fat body – tracheal membrane – Malpighian tubule – gonad. Infection with this microsporidium produced a marked negative effect on the growth and development of larvae. The weight of healthy larvae increased about 22 times from the 3rd instar to pupation, while the increase was about 12 times in the infected larvae. Rearing experiments conducted in the laboratory revealed a high potential for horizontal transmission (.90%) of the microsporidium among the defoliator larvae developing together. A nearly equal degree of vertical transmission (88.7%) was also observed from the infected females to the progeny larvae. Findings indicate the prospect of the microsporidium as a bio-control agent against the defoliator pest if exploited properly. Small subunit rRNA gene sequence analysis revealed that this microsporidium differed from *Nosema bombycis* of silk moth by only two nucleotides. The teak moth and the silk moth are not as closely related as these two parasites appear to be, implying the likelihood of host switching.

*Phylogenetic analysis and superoxide dismutase from Microsporidia.* Working with colleagues at the Southwest University in Chongqing, China, **Dr. Charles Vossbrinck** is unraveling the true identity of the microsporidia (important parasites of insects). What Microsporidia actually are still eludes us. They may be related to the fungi or they may be a eukaryotic life form all their own. They are a group of obligate intracellular eukaryotic parasites with small genomes and they infect animals from a wide variety of phyla, including humans. Two manganese superoxide dismutase (MnSOD) genes, designated *NbMnSOD1* and *NbMnSOD2*, are organized in a tandem array within the *Nosema bombycis* genome. The genes, both 678 bp in length, were found to be more similar to each other than they are to homologous genes of other Microsporidia, suggesting that the tandem duplication occurred after the development of this lineage. Superoxide dismutase is a protective enzyme that changes the reactive radical superoxide to peroxide and then to water. Since this enzyme is found in all life forms, we chose it for comparative analysis. They compared the superoxide dismutase protein sequence from Microsporidia with those of bacteria, plants, animals, fungi, and protozoa and found evidence that Microsporidia are either a very different group of organisms or that genes have been transferred from bacterial species into their cells.

## *Soil Testing*



Testing soil samples for fertility and suggesting methods for growing better plants are a continuing service for citizens of Connecticut. At the laboratory in New Haven, **Greg Bugbee** tested 5,581 samples and answered 1,850 related inquiries

*Impact.* The soil testing services and suggestions made by The Connecticut Agricultural Experiment Station reduce unnecessary fertilizer treatments to lawns and nursery stock throughout the state. This provides direct economic and environmental benefit to the suburban community by reducing nitrogen runoff into soil and water.

## DEPARTMENT OF FORESTRY AND HORTICULTURE

Connecticut's landscape is a quilt of forests, farms, towns, and cities. Scientists in the Department of Forestry and Horticulture are studying the factors that influence both forest and farm productivity, including novel specialty crops, grapes, and the effect of the growing deer population on natural and managed landscapes.

Investigation of new crops is essential to provide new opportunities for farmers during a time of changing agriculture in Connecticut. The number of tobacco and dairy farms in Connecticut has declined dramatically in the last four decades. However, the number of vegetable farms increased from 579 in 1992 to 582 in 2002. Today, about 11,000 acres in Connecticut are devoted to vegetable production. In 2004, the cash value of all vegetable crops grown on approximately 10,000 acres in Connecticut was 24.8 million dollars, this compares to 16.2 million dollars in 1999.

The marketing of produce in Connecticut has shifted from wholesale contracts with local supermarkets to direct retail sales. Approximately 441 farms offer direct sales through roadside stands and sales rooms, where a variety of fruit, vegetables, nursery stock, and Christmas trees are offered. About 36 of these are open all year. Nearly 30% of these farms offer pick-your-own fruit and vegetables to reduce the cost of harvest labor. These savings are passed on to the consumer.

The development of a network of farmers' markets in Connecticut's major urban centers and densely populated suburbs is an important segment of direct sales of vegetables to consumers. All produce sold at farmers' markets must be "Connecticut Grown". Farm fresh produce is offered at reasonable prices to urbanites who cannot travel to the farms. Niche crops valued by diverse ethnic groups are generally sold through these markets. In 2009, there were 130 farmers' markets attended by over 400 farmers compared to 122 markets in 2010 up from 87 in 2007. Many farmers wish to diversify their operations by growing ethnic and specialty vegetables, but little information on the culture of these vegetables in Connecticut is available.

Direct retail sales and small farm sizes require that the farmer grow diversified high-value crops. Since 1982, The Connecticut Agricultural Experiment Station has been investigating specialty crops to provide new opportunities for Connecticut's farmers. Over 40 fruits and vegetables have been studied resulting in over 50 publications. Some of the crops studied in the New Crops Program include globe artichoke, Belgian endive, radicchio, heirloom tomatoes, sweet potatoes, specialty melons, okra, and tomatillos. Research included variety trials and experiments to determine the best cultural methods for growing each specific crop in Connecticut. Crops that were chosen have a high market value and an existing or expanding market that would readily accommodate these commodities.

*Heirloom Tomato Trials:* Interest and sales of heirloom tomatoes have increased dramatically in the past 10 years. More and more consumers are willing to forego

appearance for that real old-fashioned tomato taste. Knowledge of high-yielding cultivars and cultural details would benefit growers, especially those who serve inner city consumers who purchase these vegetables at local farmers' markets throughout the Northeast. But growing heirloom tomatoes can be a challenge. Heirlooms tend to have poor disease resistance and have lower yields when compared to hybrid tomatoes. They are also more susceptible to cracking due to their tender skin. In 2009, **Dr. Maynard** evaluated ten cultivars of ethnic heirloom tomatoes for yield and quality at Windsor and Lockwood Farm.

**Impact: Yields of Dr. Wyche's Yellow and Kentucky Beefsteak (26 lbs and 24 lbs/plant, respectively) were greatest. At a retail price of \$1.99/lb, there is a potential crop value of over \$167,000/A. Virtually all farmers' markets have at least one heirloom tomatoes grower. The long-term benefits of growing heirloom tomatoes include an additional product and revenue for growers who attend farmers' markets or have their own roadside stands.**

*Calabaza – Selection for Early Maturity:* Calabaza squash, also known as tropical pumpkin, is mostly grown in tropical and semi-tropical climates. Calabaza is highly prized by consumers of Hispanic origin. It was identified by the Connecticut Department of Agriculture as one of the most sought-after items at Connecticut's 114 farmers' markets. We are developing a cultivar that produces fruit on shorter vines by saving seeds from plants that have produced fruit within 2 feet of the plant. These seeds are planted at Lockwood Farm and Windsor and selections are again made. Fruit that mature on short vines is appealing to northern growers because the majority of fruit can mature before frost. Fruit that form on longer vines do not always reach maturity. Last year, 82% of the plants at Windsor produced fruit within 2 feet of the plant compared to 37% of the plants at Lockwood Farm. Selections will continue for several more years.

**Impact: Seeds from our selections have been distributed to several commercial growers and backyard gardeners interested in growing calabaza. Yields in 2009 were 21,490 lbs/A. At a retail price of \$0.99/lb, there is a potential crop value of \$21,275/acre. The long-term benefits include additional revenue for farmers, especially those who attend farmers markets in urban areas.**

*Personal-Sized Watermelons Trials:* The newest melons on the marketplace are seedless miniature "personal" watermelons, weighing 3-7 pounds each. Personal-sized watermelons offer an attractive alternative for small families or for consumers that have limited refrigerator space. Beside the smaller size, they also have a thinner rind, which reduces waste. In addition, researchers have found that lycopene and beta-carotene contents are abundant in personal-sized watermelons. Lycopene, an antioxidant, has been linked to the possible prevention of cancer and heart disease. In 2009, **Dr. Maynard** evaluated nine cultivars of personal sized seedless watermelon for yield and quality at Windsor and Lockwood Farm. Unlike other sized watermelons, personal-sized watermelons are sold by the melon, not by the pound. Therefore, estimated yields were measured in number of fruit per plant. Even though they were advertised to be personal sized cultivars, Snack Pack and Big Tasty produced no fruit in the 3-7 lb personal sized

range. Bravo (3.7 fruit/plant), Mielhart (2.8 fruit/plant), Vanessa (2.6 fruit/plant), and Leopard (2.4 fruit/plant) had the greatest yields at both sites. Vanessa (11.4) and Bravo (11.1) averaged the highest Brix values.

**Impact: By growing the cultivar Bravo instead of Vanessa, the grower can produce over 10,600 more personal-sized watermelons per acre. At \$4.99 retail price/fruit, the grower would potentially gross over \$53,000 more per acre by growing Bravo instead of the standard cultivar Vanessa. A grower in Bethel included Bravo in his plantings instead of another cultivar. The long-term benefits of growing personal-sized watermelon include additional revenue for farmers and providing a product that has growing consumer demand. In addition, there may be health benefits for those who consume watermelon.**

*Vegetable Amaranth Trials:* Vegetable Amaranth (Callaloo) is an annual that is native to central Mexico. In Asia and the West Indies, amaranth is widely used in soup. Although it is relatively unknown as a vegetable crop in the United States, it has traditionally been cultivated throughout the humid tropics and is consumed extensively in Africa, Asia, the Caribbean, and Latin America. The greens are of considerable nutritional value being high in calcium, magnesium, iron, vitamins A and C as well as protein. In 2009, **Dr. Maynard** evaluated 8 vegetable amaranth cultivars at Windsor and Lockwood Farm.

**Impact: All Red (3.7 lbs/plant), Red Stripe Leaf (3.3 lbs/plant), and Tender Leaf (2.6 lbs/plant) averaged the greatest yields. At a retail price of \$0.99/lb, there is a potential crop value of \$35,816/acre. High yields of a quality product will benefit local growers and consumers by providing revenue for farmers, a nutritious food for consumers, and preservation of farmland. A grower in Bloomfield now supplies a local school system with his crop of vegetable amaranth.**

*Sweet Potato Trials:* A 1998 Connecticut Department of Agriculture survey showed that sweet potato is one of the most popular specialty vegetables. In the South, the sweet potato is also called yam, but both are identical species. In the United States, North Carolina and Louisiana are the leading producers, but we have found that they can easily be grown in Connecticut. This crop has both a high market value and an expanding market. In addition, it is very nutritious, with high values of beta carotene (vitamin A) and vitamin C. In 2009, **Dr. Maynard** evaluated several cultivars that have short maturities (90 days) at Windsor and Lockwood Farm.

**Impact: Carolina Ruby averaged the greatest yields (3.3 lbs/plant) with both Beaugard and Red Japanese averaging 3.1 lbs/plant. At a retail price of \$0.79/lb, there is a potential crop value of \$37,854/acre. Beaugard is the most popular cultivar grown in Connecticut. The long-term benefits of growing sweet potatoes include additional revenue for farmers and providing a product that has growing consumer demand. In addition, there may be health benefits for those who consume sweet potatoes.**

*Specialty Pumpkin Trials:* The typical predominant market for pumpkins is for jack-o'-lantern types (12 lbs to 20 lbs). However, small pumpkins are often needed for operations specializing in school tours where each child receives a pumpkin to take home. Smooth pumpkins are preferred for painting or coloring. Specialty pumpkins come in a wide range of colors and color combinations including white, pale green, tan, burnt orange, and yellow. Shape also varies from the ideal round, to squatty with a flattened or concave top, to oval, to tall and elongated. In 2009, **Dr. Maynard** evaluated 13 different varieties of specialty pumpkins on yield and quality at Windsor and Lockwood Farm.

**Impact: Gooligan (8.9 fruit/plant), Lil' Pump (7.6 fruit/plant), Baby Boo (7.3 fruit/plant), and Hooligan (7.2 fruit/plant) had the greatest yields. At a retail price of \$1.00/pumpkin, there is a potential crop value of \$32,307/acre. Many Connecticut farmers are now including some of these cultivars in addition to growing Jack-O-Lanterns. The long-term benefits of growing specialty pumpkins include an additional product and revenue for growers who attend farmers markets or have their own roadside stands.**

*Pak Choi Trials:* From 2000 to 2006, the Asian population in Connecticut grew 42%. This and other ethnic groups wish to continue consumption of vegetables that are customarily in their diets, thereby giving farmers opportunities for production of crops with a ready market. Ethnic vegetables also appeal to high-end buyers for whom ethnic vegetables are not every day fare, but who enjoy gourmet produce and culinary variety. Many farmers wish to diversify their operations by growing ethnic vegetables, but there is little information on the culture of these vegetables in Connecticut. In 2009, **Dr. Maynard** evaluated 6 different varieties of pak choi on yield and quality at Windsor and Lockwood Farm. The average yield at Lockwood Farm (loamy upland soil) was 14.0 t/A compared to 9.4 t/A at Windsor (sandy terrace soil).

**Impact: In spring, Joi Choi (4.2 lbs/plant) and Black Summer (3.4 lbs/plant) had the greatest yields. At a retail price of \$0.99/lb, there is a potential crop value of \$40,656/acre. The cultivar Bonsai bolted at both sites in the spring and was unmarketable. A farmer growing Bonsai in the spring would have had a crop failure resulting in no income. Most Connecticut farmers are now growing the cultivar Joi Choi. In fall, Win-Win Choi (3.6 lbs/plant) and Bonsai (3.2 lbs/plant) had the greatest yields with a potential crop value of \$34,848/acre. The long-term benefits include additional revenue for farmers and providing a product that has growing consumer demand.**

*Edamame Trials:* Edamame are specialty varieties of soybeans that are harvested in the green stage. The word "edamame" means "beans on branches" and it grows in clusters on bushy branches. Edamame is consumed as a snack, a vegetable dish, used in soups or processed into sweets. As a snack, the pods are lightly boiled in salted water, and then the seeds are squeezed directly from the pods into the mouth with the fingers. Outside East Asia, edamame is most often found in Japanese restaurants and some Chinese restaurants, but it has also found popularity elsewhere as a healthy food item. In 2009, **Dr. Maynard**



evaluated seven cultivars of edamame for yield and quality at Windsor and Lockwood Farm.

**Impact: The cultivar Green Legend had the greatest yield (0.92 lbs pods/plant). At a retail price of \$2.49/lb, there is potential crop value of over \$133,000/acre. By growing the cultivar Green Legend instead of the cultivar Envy, the grower can potentially produce over 45,000 more pounds per acre or gross almost \$113,000 more per acre. A few farmers in Connecticut are now growing edamame.**

*Specialty Fruit Variety Trials:* As wholesale marketing of major tree fruits becomes unprofitable, many Connecticut growers are turning to retail sales of their fruit. For a retail operation to be successful there must be a diversity of products. Thus, many growers are interested in adding minor specialty fruits to their operations. In response to this grower interest, **Dr. Maynard** in 2001 expanded the New Crops Program at the Station to include fruits. The trial includes 12 cultivar/rootstock combinations of Japanese plum at both Windsor and Lockwood Farm.

**Impact: The greatest yields in 2009 were from Shiro (71 lb/tree) and Obilnaja (45 lb/tree). At a retail price of \$1.99/lb, a planting of 242 Shiro trees per acre would yield a potential crop value of \$34,192/acre. Three Connecticut orchards are growing Station-supplied Shiro trees with great success. Long-term benefits include diversification and greater profits for fruit growers.**

At the request of fruit growers, 306 beach plum seedlings were planted in 2003 at the Station's two experimental research farms. These seedlings were raised at Cornell University from seeds collected from 35 sites from Maine to Delaware.

**Impact: In 2009, heavy yielding plants produced as much as 26 lb/plant. At a retail price of \$2.00/lb, there is an expected crop value of \$52,270/acre. The immediate impact is that growers at two of Connecticut's largest farms are now growing beach plums, which can be made into a premium jam which sells for \$6.40 for an 8 ounce jar. Long-term benefits include farm diversification and greater profits for fruit growers.**

*Sheet Composting of Oak and Maple Leaves:* Many municipalities in Connecticut with leaf collection programs in the fall are turning to farmers to dispose of their leaves. However, not all farmers have extra land to set aside for a standard composting operation. Instead, they layer undecomposed leaves on their fields and simply plow them under. This is called sheet composting. Nitrogen deficiency can be a problem in these soils because microorganisms involved in leaf decomposition use nitrogen more efficiently than plants. There is some question whether the differences in the rates of decomposition between oak and maple leaves would lead to differences in plant response when these leaves are used in a sheet composting operation. This is also a situation that confronts many home gardeners who have a predominance of oaks in their backyards.

To help answer this question, **Dr. Abigail Maynard** conducted a sheet composting experiment in which plots were amended with either all oak or all maple leaves. Undecomposed leaves were layered about 6 inches thick in the falls of 1994-2008 and incorporated into the soil by rototilling. Last year, lettuce, peppers, onions, and carrots were grown with all plots receiving the same amount (1300 lb/A) of 10-10-10 fertilizer. Yields from plots amended with oak leaves were compared to plots amended with maple leaves and the unamended controls. In 2009, lettuce yields from the control plots and plots amended with maple leaves were slightly greater (1.5 lbs/head) compared to yields from plots amended with oak leaves (1.3 lbs/head). The greatest pepper yields were from the plots amended with maple leaves (4.7 lbs/plant) followed by plots amended with oak leaves and the unamended control plots (4.6 and 4.5 lbs/plant, respectively). The greatest carrot yields were from the control plot (3.4 lbs/10 ft row) followed by plots amended by oak leaves (3.2 lbs/10 ft row) and plots amended with maple leaves (2.6 lbs/10 ft row). The greatest onion yields were from the plots amended with maple leaves (17.4 lbs/10 ft row) followed by the control plots (16.0 lbs/10 ft row) and plots amended with oak leaves (14.1 lbs/10 ft row).

**Impact: Many Connecticut homeowners are now disposing of their oak and maple leaves in their gardens without worrying about any deleterious effects on yields in their vegetable gardens. Incorporating tree leaves into gardens improves the environment by storing carbon in the soil and reducing the volume of material in the solid waste collection and disposal system.**

Winegrape growers and Farm Wineries in Connecticut face many challenges. Farm Wineries are required to grow a minimum of 25% of the fruit in their total output, but are having trouble meeting this standard. Consecutive very cold winters in 2003 and 2004 resulted in significant plant loss on less cold-hardy cultivars. This drove up prices for purchasing Connecticut fruit. Little information is available to growers regarding cultural information for growing more cold-hardy and disease-resistant cultivars in the state. Growers of more traditional cultivars require more information on crop regulation and fruit quality. Disease management is critical during the growing season due to Connecticut's warm, humid summers. The industry requires increased production via better management practices in existing vineyards and improved cultivar selection in newly planted vineyards. Innovative practices need to be tested in Connecticut to assess their viticultural and economic appropriateness.

*Winegrapes:* Studies have been initiated by **Dr. William R. Nail** from 2004-2010 to help determine cultural practices for growing high quality winegrapes profitably in Connecticut. The winegrape industry in Connecticut is one of the most rapidly expanding categories of agriculture in the state. The first Farm Winery opened in 1979, and there are currently over 30 wineries with a Farm Winery license, with two or three more scheduled to open each year in the foreseeable future. The existence of these wineries adds substantially to local economies, as local restaurants, hotels, bed and breakfasts, and other establishments receive increased business due to their proximity. The Connecticut Wine Trail brochure, published by the Connecticut Vineyard and

Winery Association, is the most popular brochure in Department of Tourism travel offices.

*Cultural practices in Vitis vinifera:* **Dr. Nail** established a planting of 288 Pinot Gris vines at Lockwood Farm in summer, 2004. Two different rootstocks were used: 3309C, the most commonly planted rootstock in the state, and 101-14, which may tend to ripen fruit earlier and have better tolerance to severe winter freezes.

**Impact: Vines grafted to 101-14 had 32% less mortality due to winter freeze damage than those grafted to 3309C following their first winter. Crown gall (caused by a bacterium) in subsequent years continues to be slightly higher in 3309C vines, although severity has not been enough to warrant removal of vines. Planting on rootstocks more resistant to winter damage can result in savings of \$7.60 for each year of lost production per vine, plus \$3.75 replacement cost per vine plus labor involved in removing diseased vines and replanting. Approximately 60% of new plantings of *V. vinifera* cultivars consist of vines grafted to 101-14 instead of 3309C, as opposed to less than 20% in 2004.**

*Effects of graft union height:* Freeze damage to grafted grapevines frequently occurs at the graft union, which is typically very close to the ground. Crown gall (caused by a bacterium) frequently occurs on severely freeze-damaged vines, although symptoms may not appear for one or two years after the freeze event. Elevating the height of the graft union may result in less injury. Chardonnay clone 96 budwood was grafted onto 3309C rootstock at standard height and 26 inches higher in 2006, and vines were transplanted in spring 2007 to vineyards at Lockwood Farm and Westport, Massachusetts. Vines have been evaluated for bud fruitfulness, winter freeze damage, and crown gall incidence and severity beginning in 2008. Yield and fruit quality were evaluated beginning in 2009.

**Impact: Yields on high-grafted vines were much greater than those of low-grafted vines in 2009, the first year of production. This increase in yield, even if only for one year, may offset the increased cost of plant material. Vines with crown gall typically require replacement at some point. Planting on rootstocks more resistant to winter damage can result in savings of \$7.60 for each year of lost production per vine, plus \$3.75 replacement cost per vine plus labor for vine removal and replanting. High-grafted vines may result in significant reduction in such losses, which would be approximately \$2,150 plus labor for each 10% of vine mortality. This practice has not yet been adopted by most Connecticut growers pending the long-term results from these experiments and the two-year period required between ordering custom-grafted plants and their availability for planting in the vineyard. Funding for this project was obtained from the Viticulture Consortium East for 2006 and 2008-2010.**

*Training and pruning effects on vine performance of hybrid cultivars:* Grapevines in most older vineyards in Connecticut are planted on six-foot spacing and trained to a vertically shoot-positioned system. This has generally worked well for most vinifera cultivars and some hybrids. Recently released hybrid cultivars that are rapidly finding

favor frequently have different growth habits that make them unsuitable for this traditional spacing and training.

Within-row spacing of grapevines in the vineyard is one of the most critical decisions to be made at planting. Too close spacing results in excessive competition and excessive vegetative growth, leading to reduced yields of poor quality fruit. Spacing that is too far apart results in unproductive utilization of valuable vineyard space. The choice of spacing is permanent. However, errors made at planting can sometimes be partially remedied by dividing the canopy to accommodate vine growth. Divided canopies can increase yield per unit of linear row length, but are more difficult and labor-intensive to establish and maintain.

To evaluate spacing and training systems for new cultivars, **Dr. Nail** established a new planting of the hybrid cultivars St. Croix and Cayuga White in May, 2005 at a private grower's vineyard in Wallingford. These cultivars are among the most popular hybrids for new plantings. They have different growth habits and management issues than vinifera cultivars, which may involve fundamental issues both before and after planting. Plants of both cultivars were planted at six and eight foot spacings, and were trained to four different training systems beginning in 2009: Vertically Shoot Positioned (VSP), Hudson River Umbrella (HRU), Geneva Double Curtain (GDC), and Scott Henry. Those on six-foot spacing will also be pruned to both cane and cordon systems in future years.

**Impact: In 2009, the first year of data collection, vines trained to Scott Henry had the highest yields, approximately 19% higher than VSP. HRU and GDC had much lower yields, as the vines had not yet become permanently established on the relatively high wires required for these systems. This could be very important for growers striving for maximum productivity early in the life of a vineyard. However, the long-term effects of the various training systems, once the HRU and GDC systems are well established, have yet to be determined. The results of this study will allow both new and existing growers to help maximize their production, as well as possibly demonstrating that some systems are not efficient in Connecticut for certain cultivars. Approximately 12 acres of newly planted St. Croix and approximately 7 acres of newly planted Cayuga White are being trained to high wire training systems (GDC and HRU) based on the preliminary results of these experiments.**

*Pruning systems:* Most grapevines in Connecticut have traditionally been cane pruned. Cane pruning requires skilled labor, which is increasingly in short supply. Spur pruning to a cordon system requires skilled labor, which is increasingly in short supply. Spur pruning to a cordon system requires less skilled labor and lends itself to mechanization. A planting of the hybrid cultivars Chambourcin, Seyval Blanc, Villard Blanc, and Villard Noir at Lockwood Farm was rejuvenated in 2004, and vines were either cordon or cane pruned in 2005 through 2009 to compare the relative efficiencies of these pruning methods. Yield and fruit quality parameters were determined beginning in the 2005 harvest season.

**Impact:** Cordon pruning is a viable alternative to the cane pruning method used in most Connecticut vineyards. Skilled labor costs, essential to cane pruning, are approximately 30% higher than unskilled labor costs. Of equal importance is the increasing unavailability of skilled labor. Over the course of this experiment, there were no differences in yield, fruit quality, or any measured vegetative parameters measured between cane and cordon pruned vines. Therefore, cordon pruning can reduce pruning costs by approximately 30% for growers. Approximately 45 acres of vinifera and hybrid winegrapes have been converted to cordon training to reduce cost and efficiency for growers.

*Cultivar and clonal evaluation:* Beginning in 2004, Dr. Nail has evaluated previously established experimental plots at Lockwood Farm and a private grower's vineyard in Shelton. The planting at Lockwood Farm contains the white hybrid cultivars Seyval Blanc and Villard Blanc and the red hybrid cultivars Chambourcin and Villard Noir. The white cultivars have consistently had higher yields than the red cultivars (7.9 vs. 3.7 tons/acre, respectively). However, red grapes are usually in higher demand due to the cool-climate conditions in Connecticut. The private vineyard plot consists of the red Bordeaux cultivars Cabernet Franc, Cabernet Sauvignon, and Merlot. Cabernet Sauvignon has displayed high vine mortality and relatively poor fruit quality due to lack of maturity. Growers have generally agreed that this cultivar is unsuitable for Connecticut conditions, and no significant new plantings are being established. Cabernet Franc and Merlot have both consistently produced good quality fruit, although yields in Merlot were slightly lower (4.3 vs 4.0 tons/acre, respectively). While there have sometimes been differences among clone and rootstock performance, growing season effects were more significant.

New cultivar trials were established at Lockwood Farm and the Valley Laboratory in spring, 2008, in conjunction with the national project "NE-1020: Multistate Evaluation of Winegrape Cultivars and Clones". This project involves over 50 scientists from over 30 states, allowing for evaluation of regional comparisons of vegetative and fruit qualities. The planting at Lockwood Farm is the third largest planting in the Eastern United States. Both plantings contain established cultivars whose characteristics have been documented, as well as unreleased and untested cultivars whose performance in Connecticut are unknown. Data collection on these vines began with pruning results in spring 2010, and will continue for several years.

**Impact:** The white hybrid cultivars in question had approximately 50% higher yields than the red cultivars. However, high quality red winegrapes are in greater demand, so they may command a price high enough to justify their production for growers planning to sell their fruit. While Cabernet Sauvignon is not a viable cultivar option, both Cabernet Franc and Merlot have produced good yields of high quality fruit suitable for premium wines. Five acres of Cabernet Sauvignon have been replaced with 3.5 acres of Cabernet Franc and 1.5 acres of Merlot, which should produce their first crops in 2011. There have been no new plantings of Villard Blanc or Villard Noir since 2006, and only seven additional acres of Seyval, while Chambourcin acreage has increased by 16 acres during the past four years.

**The NE-1020 plots will provide Connecticut growers with valuable information on the suitability of new cultivars to the area. Viticultural and fruit quality characteristics are important when a new cultivar is introduced into a region. The results of these trials will allow growers to make informed decisions as to the selection of appropriate new cultivars, if and when they are released, and their cultural requirements.**

The unbalanced age class distribution of the oak-hickory forest, and most individual forest stands, presents a challenge to both private and public forest landowners wishing to implement sustainable forest management. Three factors are driving the necessity of developing innovative alternatives to “high-grading” or initiating regeneration harvests in these stands: obtaining a more balanced age-structure, increased public desire for partial cutting, and increased parcelization of ownership. Crop-tree management has been proven successful in younger oak stands and could be a viable alternative in older oak sawtimber stands where maintaining high forest cover and non-commodity attributes are important considerations.

*Crop-tree management:* In 2003, **Dr. Jeffrey Ward** began a study to determine if crop tree management would increase growth of large, mature oak sawtimber (> 18 inches diameter) without a loss in bole quality and stand growth rates in cooperation with CT DEP-Division of Forestry, Metropolitan District Commission, and Torrington Water Company. Six study sites were established in fully-stocked, mature oak forests. The mature red oak sawtimber stands had no prior management, were 80-112 year-old, and diameters of upper canopy oaks averaged 17.2 inches. Each study site has three treatment areas of approximately 5 acres. Treatments are 1) an uncut control; 2) crop trees released from upper canopy competition on three or four sides, no other trees cut; and 3) crop trees released on one or two sides as part of a crown thinning to 60 ft<sup>2</sup>/acre of basal area.

Treatments were randomly assigned after crop tree selection. At least twenty-five crop trees (~10/acre) were selected on each treatment area. Selection criteria for crop trees were: red oak group (*Quercus rubra*, *Q. velutina*, or *Q. coccinea*), codominant or dominant crown class, at least 17 ft to first fork, diameter > 18 inches, and potential grade 1 buttlog. Crop trees were banded with orange paint. Tree measurements were completed following the 2004 growing season. A 50x50m plot was located within each treatment area to monitor changes in stand volume growth. All trees with diameters > 4 inches were banded with red paint. A total of 2613 trees have been measured. Harvesting has been completed on four of the study areas. Tree diameters have been measured annually and a preliminary assessment of treatment effects was completed in late 2009.

Basal area was reduced from 138 ft<sup>2</sup>/acre prior to harvest to 77 and 72 ft<sup>2</sup>/acre on the B-level and crop tree management plots, respectively. For all size classes combined, basal area growth over the next 5 years was greatest in the crop tree plots, followed by B-level thinning, and finally unmanaged controls. Concurrently, sawtimber basal area growth did not differ among treatments and averaged 1.3 ft<sup>2</sup>/acre/year suggesting management can maintain stand volume growth rates. Relative to 5-yr diameter growth of upper canopy

oaks on unmanaged plots (0.9 inches), diameter growth increased by 29 percent on B-level thinning and 54 percent on crop tree management plots to 1.1 and 1.3 inches, respectively. Diameter growth increase was related to degree of crown release. Completely released trees grew more than partially released trees, which in turn, grew more than trees that were not released.

**Impact: Crop-tree release provides a management tool to develop stands with a balanced age structure in public forests and for private forest owners for whom high forest cover and non-commodities attributes are important considerations. Connecticut Department of Environmental Protection, Forestry Division incorporated this research in the 96 acres of TSI treatment during 2009-2010.**

Two major threats to natural preserves and managed forests are exotic plant species and browsing by overabundant white-tailed deer (*Odocoileus virginianus*). Therefore, scientists in the Department of Forestry and Horticulture are examining both effects of these two threats, and possible strategies to minimize their impacts and thereby enhance forest ecosystem services.

*Japanese barberry control:* Japanese barberry is listed as invasive in 20 states and 4 Canadian provinces and is associated with enhanced population densities of blacklegged ticks that can transmit the causal agent of Lyme disease. **Drs. Ward and Williams** continued their studies of alternative methods to control Japanese barberry begun in 2006. This research both evaluated the effectiveness and relative costs among treatment combinations to control Japanese barberry, and by monitoring individual clumps across a range of size classes, assessed whether treatment prescriptions are dependent on clump size.

Beginning in March 2007, a two-step process to control barberry was studied at six study areas. Two study areas were established on a Regional Water Authority (RWA) watershed in North Branford, CT. Two study areas were established on the Centennial Watershed State Forest in Redding, CT that is jointly managed by the Connecticut Department of Environmental Protection, The Nature Conservancy, and the Aquarion Water Company of Connecticut. One study area was established on The Nature Conservancy lands in Salisbury, CT. The sixth study area was established in Storrs, CT on the University of Connecticut Experiment Forest. All study areas had extensive stands of mature Japanese barberry. Initial treatments in spring 2007 (prescribed burning, mechanical mowing with a brush saw or drum chopper) reduced the size of established barberry clumps. Follow-up treatments in mid-summer 2007 to kill new ramets that developed from surviving root crowns were foliar application of triclopyr or glyphosate, directed heating with a propane torch, and untreated controls. Mortality was defined as the absence of ramets from a root crown and not the mortality of individual ramets of a given clump.

Within each subplot, percent barberry cover was measured utilizing a 0.5 m<sup>2</sup> sampling instrument which consisted of a 4 x 4 grid with which percent barberry cover was determined by presence/absence within each cell. There were 100 sample points for each

treatment combination for a total of 4400 points. Labor hours, fuel, chemical and material costs, and equipment and purchase expenses were tracked for all initial and follow-up treatments.

Surviving barberry with no follow-up treatment recovered to half the original coverage by the end of the first growing season. Reductions in percent barberry cover were significant for plots receiving follow-up treatments compared to no follow up after two growing seasons. There was no significant difference in percent cover reduction between follow-up treatments; all treatment combinations reduced Japanese barberry cover by an average of 96%. Excellent cover-reduction of Japanese barberry can be achieved using either propane torches or herbicides as follow-up treatments in a two-step process where barberry is initially treated by mechanical means. Although requiring a greater labor-time investment, propane torches provide a non-chemical alternative in parks, nature preserves, forests, or other ecologically sensitive areas where herbicide use is restricted and where barberry infestations are still light.

**Developing a cost-effective method of controlling Japanese barberry will allow forest owners to maximize the area treated each year. This research has been partly funded by Aquarion Water Company, Regional Water Authority, The Nature Conservancy, Norcross Wildlife Foundation, Town of Greenwich, Town of Mansfield, Propane Education and Research Council, Propane Gas Association of New England, and USDA NRCS. Additional support has been provided by Great Mountain Forest, Guilford Land Conservation Trust, Joshua's Land and Historic Trust, Providence (RI) Water, and White Memorial Foundation. Our cooperators collectively manage over 85,000 acres that include extensive areas of barberry.**

**Impact: Last year, invasive plants were treated on over 450 acres in Connecticut. Propane torches have been purchased to control barberry on lands managed by Connecticut DEP-Wildlife Division (22,000 acres), Colebrook Land Conservancy (566 acres), Northern Connecticut Land Trust (435 acres), New Hartford Conservation Commission (171 acres), and numerous private forest owners. Requests for information about this technique have also been received from the USDA Forest Service (Pennsylvania and New Hampshire), NRCS (Connecticut and Rhode Island), New York City – DEP Bureau of Water Supply, Moosehorn National Wildlife Refuge (Maine), Anacostia Watershed Society (Maryland), private natural resource managers, and the general public.**

*Japanese Barberry Infestations Serve as a Refuge for Blacklegged Ticks:* In many Connecticut forests with an overabundance of white-tailed deer (*Odocoileus virginianus*), Japanese barberry (*Berberis thunbergii*) has become the dominant understory shrub. This exotic invasive shrub provides habitat favorable to blacklegged tick (*Ixodes scapularis*) and white-footed mouse (*Peromyscus leucopus*) survival. To determine mouse and larval tick abundances at five replicate sites, **Drs. Williams and Ward** have been trapping mice since 2007 in unmanipulated dense barberry infestations, areas where barberry was controlled, and areas where barberry was minimal or absent. The number of feeding larval ticks/mouse was recorded. Adult and nymphal ticks were sampled along permanent



draglines in each treatment, retained, and were tested for the presence of *Borrelia burgdorferi*, the causal agent of Lyme disease in humans and pets.

The number of captured mice did not differ between treatments. However, the average number of feeding larval ticks per mouse was highest on mice captured in dense barberry (7.5 larvae/mouse). Adult tick densities in dense barberry (125/acre) were higher than in both controlled barberry (64/acre) and no barberry (21/acre) areas. Ticks sampled from full barberry infestations and controlled barberry areas had similar infection overall prevalence with *B. burgdorferi*, 52 and 53% respectively. Adult tick infection prevalence with *B. burgdorferi* varied widely between treatments and study areas, but was lowest in areas where barberry was absent and generally lower where barberry was controlled. This in concert with the overall reduction in the adult tick cohort in areas where barberry was controlled resulted in 113 *B. burgdorferi*-infected ticks/acre in dense barberry, 49/acre where barberry was controlled, and 12/acre where barberry was absent.

Results indicate that managing Japanese barberry will have a positive effect on public health by reducing the number of *B. burgdorferi* infected blacklegged ticks that can develop into motile life stages that commonly feed on humans. Mouse trapping and tick sampling efforts will continue for several more years to monitor long-term effects of controlling Japanese barberry.

**This research is not only of interest from an ecological perspective, but also serves to scientifically document the potential negative impacts an invasive plant can have on human health. This research has been featured on gardening websites and multiple forest land managers have used it to strengthen their argument for the increased need to control invasive plants. Results from this research will lead to improved interest in the control of invasives, and ultimately, a reduction in the number of ticks capable of causing Lyme disease in humans and domesticated animals. Various entities within the towns of Redding, Weston, Easton, Guilford, Greenwich, Hampton, and Mansfield and in the states of Massachusetts, Rhode Island, and New York have used these results in part to justify equipment purchase and initiate or reinvigorate invasive plant control programs**

*Interaction of Deer Browse and Barberry Infestations:* The Japanese barberry (*Berberis thunbergii*) control study provided the unique opportunity to superimpose, at minimal expense, a study examining the separate and interactive effects of deer browsing and alien invasive species on native herbaceous vegetation and tree regeneration. At the North Branford, Redding, and Storrs study areas, **Drs. Williams and Ward** erected deer exclosures in May 2007 on plots that were treated with the Fecon mower, plots treated with the Fecon mower with propane torch follow-up, and on plots where the barberry was not treated. Each of the three treatments had an adjacent unfenced plot. For each treatment (total of six), regeneration and herbaceous vegetation was sampled using ten 4-m<sup>2</sup> circular plots (sixty plots total/study area) in fall 2007, spring 2008, fall 2008, spring 2009, and spring 2010. Vegetation will be continually sampled over multiple growing seasons. This study will determine whether it is white-tailed deer, Japanese barberry, both, or neither limiting native species regeneration throughout Connecticut.

Initial treatment	Follow-up treatment	Deer protection?	No. of plots
Fecon	None	Yes	10
Fecon	None	No	10
Fecon	Propane	Yes	10
Fecon	Propane	No	10
None	None	Yes	10
None	None	No	10

**Impact: Both white-tailed deer and Japanese barberry negatively affect forest regeneration. This in turn will negatively affect the future of the timber industry and native wildlife populations in Connecticut. By scientifically documenting the impacts that deer, barberry, and their interaction have on native forest regeneration, the timber industry, land managers, and other conservation entities will have sound data which with to both illustrate and immediately address these threats to the health of Connecticut’s forests for future generations.**

*The Japanese Barberry Infestation Microclimate:* In Spring 2008, two additional Japanese barberry management plots were established in Redding and North Branford, CT. Each plot was approximately 5 acres in size and Japanese barberry was controlled by **Drs. Williams and Ward** and **J. P. Barsky** using 400,000 btu propane torches. This control strategy differs from previous efforts in that dead Japanese barberry plants remained standing instead of being removed altogether. Based on previous results, **Dr. Ward** hypothesized that dense Japanese barberry infestations may retain humidity, resulting in increased abundances of blacklegged ticks, which require stable and humid conditions to survive. To investigate this hypothesis, temperature/relative humidity sensors were deployed from June-December 2008, 2009, and again in 2010 in areas where barberry was controlled, areas where barberry was not controlled, and areas where barberry was virtually absent. In addition, blacklegged ticks and white-footed mice have been continually sampled during sensor deployment in 2008, 2009, and presently in 2010. Sensor data analysis from 2008 and 2009 has revealed that unmanaged Japanese barberry infestations provide excellent habitat for blacklegged tick survival because, due to their closed canopy-like growth form, they retain more of the humidity from the previous night throughout the following day than do areas where barberry was controlled or absent. In addition, the Japanese barberry canopy buffers temperature and relative humidity swings throughout the day, providing a more stable microclimate than areas where barberry was controlled or absent. Because blacklegged ticks have a relatively high surface area to volume ratio, they are prone to desiccation, and as a result, need a continually humid and stable microclimate to survive, which the exotic invasive Japanese barberry appears to provide. Sensors will be retrieved at the end of 2010 and ticks and mice will continue to be sampled.

**This research investigates the causal mechanism behind the increased abundances of blacklegged ticks found in Japanese barberry infestations. By understanding this relationship, land managers can better target problem areas where Japanese**

**barberry is most prevalent, which will ultimately lead to a reduction in the number of ticks capable of causing Lyme disease in humans and domesticated animals.**

*Deer Browse Exclosure Study:* One method to study the impact of deer on natural ecosystems is to compare growth rates and species diversity of vegetation protected from white-tailed deer (*Odocoileus virginianus*) browse to unprotected plots. **Drs. Williams and Ward** are collecting vegetation data within sixteen deer exclosures and sixteen adjacent control plots throughout the state. Deer exclosures prevent deer from accessing vegetation within. Growth rates and species diversity of enclosed vegetation are compared with that of an adjacent control plot, where deer have access to vegetation. The project is a collaborative effort with The Nature Conservancy to maintain and sample twelve deer exclosures (and adjacent control plots), at Burnham Brook Preserve in East Haddam, the Bingham Easement in Salem, and Devil's Den Preserve in Weston. We are also including four of our own exclosures on South Central Connecticut Regional Water Authority property in North Branford. Plots have been sampled for herbaceous species cover in spring of 2006, 2007, 2008, 2009, and 2010. Late summer sampling was conducted in 2005, 2006, 2007, 2008, and 2009 and included all woody and herbaceous plants. Preliminary data analyses indicate that herbaceous cover within exclosures is greater than control plots. Density of tree seedlings at least two feet tall is twice as high within exclosures compared to control plots. All locations will be resampled for both woody and herbaceous vegetation in late summer 2010. Results from this study will reveal plant species composition and growth rates in the absence of browsing deer.

**Overabundant herds of white-tailed deer negatively affect forest regeneration by repeated browsing. This in turn will negatively affect the future of the timber industry and other wildlife populations in Connecticut. By scientifically documenting the impacts that deer have on native forest regeneration, the timber industry, land managers, and other conservation entities will have sound data which with to both illustrate and immediately address this threat to the health of Connecticut's forests for future generations. The Nature Conservancy in Connecticut uses these data to justify and document results of their deer management program.**

*Deer Vehicle Collisions in Connecticut:* Annually, the Department of Environmental Protection receives approximately 3,000 reports of vehicle collisions with deer on Connecticut roadways. But because of poor reporting rates, the DEP estimates there are an estimated 18,000 that occur annually. Regardless of the exact number, it is evident that deer pose a significant threat to Connecticut motorists' health and personal property. There has been abundant research on different strategies of reducing deer-vehicle collisions by altering either motorist or deer behavior, which has met with limited success. However, there is limited research on the behaviors of deer proximate to roadways and how deer integrate roads into their home ranges. In the interest of discovering deer behaviors that could be targeted in an attempt to reduce collisions with vehicles, **Dr. Williams** is initiating a new deer capture program in Fairfield County, which annually records the highest number of deer-vehicle collisions. Captured deer will be fitted with ear-tags and global positioning system collars, which record precise

locations of deer throughout the year. Once data are obtained from GPS collars, an analysis of deer movements across different seasons, times of day, during different weather events, etc. can be conducted to better understand how, when, and where deer cross roads. Capture efforts will begin in fall 2010.

**State Farm Insurance estimates that the likelihood of a deer collision in Connecticut is 1 in 297. A better understanding of seasonal deer behaviors proximate to roadways will allow engineers and public transportation agencies to better target deer-vehicle collision abatement attempts which will then decrease the odds of motorists striking a deer and sustaining injury or death while traveling on Connecticut roadways.**

## *GRANTS AND CONTRACTS OFFICE*

The Grants Office is in its third year. Tess Foley is the Grants and Contracts Manager. In this capacity, she assists Station scientists to identify, prepare, submit, and track grant submissions. Tess works to establish relationships with government, corporate, and private foundations on behalf of the Experiment Station.

In the first eight months of 2010, Ms. Foley has assisted Station scientists in preparing and submitting 42 grant proposals to a variety of government, corporate, and foundation funding sources. Thus far, from grant submissions, experiment station scientists have received \$1,196,982 in competitive grant funding. Additionally, ongoing funding relationships are still in place with the Propane Education Research Council and Webster Bank. Competitive grant proposals are being submitted from all departments.

In September, Tess Foley managed the first announcement letter campaign for the CAES Research Foundation, the Experiment Station's non-profit 501c (3) organization. During this campaign, 400 letters were sent to Connecticut-based businesses informing them of the agricultural, environmental, and public health research of experiment station scientists. As public awareness increases, we are now beginning to receive contributions from corporate foundations and individuals.

This year, several grant-funded projects came to life at the experiment station. The CAES Research Foundation received a grant from the New Haven Community Foundation for a "Girls and Science Mentorship Program." During the period of November 2009 to April 2010, Ms. Foley assisted the mentorship program's manager, Dr. Sharon Douglas, in the administration and management of hosting six middle school girls from New Haven's most disadvantaged neighborhoods. There was a one-on-one mentorship with female Station scientists. At the end of the mentorship, Ms. Foley assisted the participating girls as they each presented their own project to their science class at each of their schools.

Another grant-funded program, administered by the CAES Research Foundation, is with Webster Bank; the "Food Donation Program" contributes fresh fruit and vegetables, grown on the research farms, to hunger relief organizations in Connecticut. The funding helps to cover the cost of seed and fertilizer. As the growing season draws to a close for 2010, our Food Donation Program has contributed over 27,000 pounds of fresh produce to Connecticut's leading hunger relief organizations.

Tess Foley is working to generate awareness and funding for the research of the CAES food crop scientists, and hosted the CT Department of Agriculture's "Farm to Chef" program at the Experiment Station, where each scientist presented their research on improving crop production for CT farmers.

Tess Foley also promoted the CAES Research Foundation to the Connecticut Tobacco Growers Association.

During the past year, Station scientists successfully received grant funding from the United States Department of Agriculture (USDA), Connecticut Department of Agriculture, USDA Forest Service, Centers for Disease Control and Prevention, USDA/Natural Resources Conservation Service, Cooperative State Research, Education and Extension Service (CSREES), Propane Education Research Council, Norcross Wildlife Foundation, First Light Power Resources, The Nature Conservancy, and the Conservation, Food, and Health Foundation.

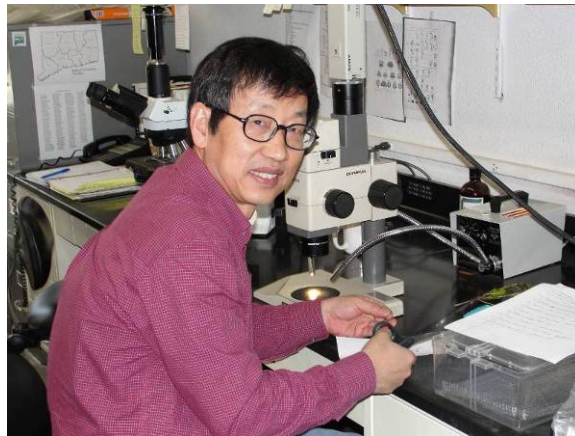
The CAES Research Foundation looks forward to continuing to develop strong relationships to advance the research of Station scientists.

## *DEPARTMENT OF PLANT PATHOLOGY AND ECOLOGY*

The Department of Plant Pathology and Ecology conducts research to understand the biology and ecology of plant pathogens and their interactions with plants and the environment. Staff members also diagnose plant health problems for our stakeholders. Our mission is to manage plant health problems using innovative methods that minimize impact on the environment, ensure a safe food supply, and maintain a healthy landscape for Connecticut.

Scientists in the Department of Plant Pathology and Ecology are involved in both service and research activities. Our service efforts focus on the diagnosis of plant health problems for all Connecticut residents, including homeowners, plant care professionals (e.g., arborists, landscapers, garden centers), and commercial growers (e.g., greenhouse, vegetable, nursery, orchard, and vineyard crops). We work closely with professionals and homeowners to develop disease management programs that require minimal use of pesticides and are compatible with the environment. The Department of Plant Pathology and Ecology has an active outreach program, which offers fact sheets, disease management guides, web-based information, workshops, and presentations for grower groups, garden and horticultural clubs, special interest groups, and students. Our research efforts include original, basic investigations in many areas of plant pathology, including the ecology and genetics of plant pathogens, new and emerging diseases, and models for predicting the spread of plant pathogens. These studies focus on, but are not limited to, the needs of Connecticut stakeholders.

In February 2010, **Dr. Yonghao Li** joined the department as the plant pathologist responsible for the *Plant Disease Information Office*. He has expertise in cellular responses in host-pathogen interactions, resistance mechanisms, and epidemiology of fungal, bacterial, and viral diseases. He also has experience in disease diagnostics and pathogen identification using traditional and molecular techniques, which will enhance the department's diagnostic capabilities.



Dr. Yonghao Li at the microscope in the laboratory of the *Plant Disease Information Office*.

## RESEARCH ACTIVITIES

### *Biochar Research*

#### Effect on allelochemicals and root disease

Biochar is a fine-grained, charcoal-like carbonaceous byproduct that is resistant to decomposition. It is produced from the pyrolysis of plant and waste feedstocks at temperatures between 400 and 700 C. Biochar possesses tremendous absorptive capacities for organic compounds and certain nutrients. The addition of biochar to soil increases its retention of nutrients as well as its water-holding capacity. Studies on the effects of biochar on crops have had variable outcomes, with some reporting positive effects and others reporting no or even deleterious effects on plants. Nonetheless, the ability of biochar to absorb allelochemicals in soil has generated much interest in its potential use in replant situations. Rotting asparagus crowns release allelopathic toxins, mostly phenols like coumaric, caffeic, and ferulic acids. Asparagus is also susceptible to Fusarium crown and root rot caused by *Fusarium oxysporum* and *F. proliferatum*. These two factors contribute to the asparagus decline problem and to the subsequent replant problem that occurs when old asparagus fields are replanted with asparagus. These toxins have been shown to inhibit many other beneficial microorganisms, such as vesicular arbuscular mycorrhizae (VAM); the result is a reduction in plant vigor and an increase in susceptibility to Fusarium crown and root rot. The effect of biochar on asparagus in soil was studied in greenhouse trials using soil naturally infested with *Fusarium* spp. and artificially supplemented with allelochemicals. Biochar (CQuest®, Dynamotive Energy Systems Corp., McLean, VA) was applied at the rate of 0, 1.5, and 3.0% (w/w). The addition of biochar to *Fusarium*-infested asparagus soil that had been drenched with allelochemicals increased asparagus plant weights and suppressed disease, but the allelochemicals had no significant effects on either. The effect was linearly proportional to the biochar rate. The allelochemicals significantly reduced colonization by VAM, but this effect was reversed when biochar was added. Rhizosphere densities of fluorescent pseudomonads and the rhizosphere pH were also significantly increased at the higher rate of biochar (3%) when compared to the control, but densities of *Fusarium* spp. in the rhizosphere or in the bulked soil samples were not affected by biochar rate.



An experimental field plot treated with biochar.

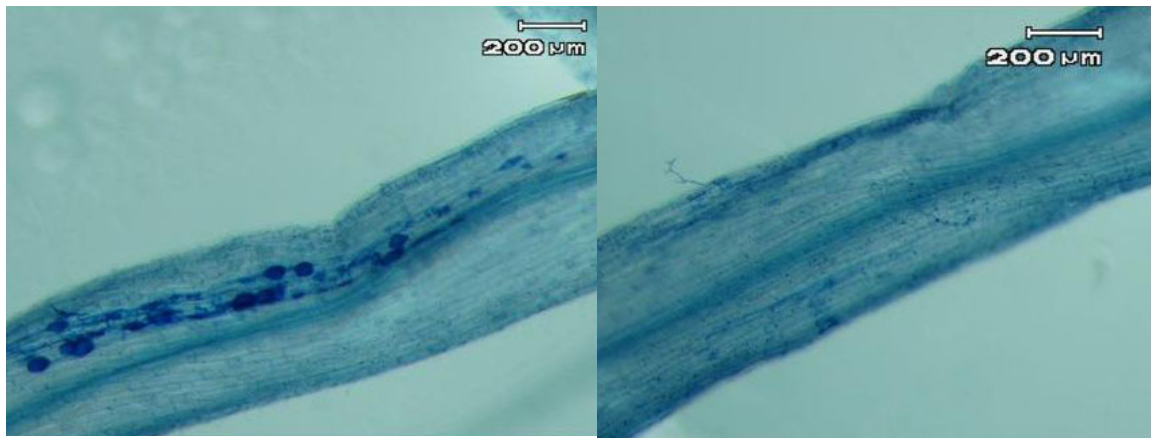
#### Effect of biochar brands on disease

Another series of experiments compared different types of biochar for their effect on asparagus growth. CQuest®, Agrichar® (Best Energies, Inc., Madison, WI), and Soil



Reef<sup>®</sup> (EcoTechnologies Group, LLC, Berwyn, PA) were compared in asparagus soil augmented with dried asparagus roots and naturally infested with the *Fusarium* pathogens. Biochar was added at increasing rates and asparagus was planted in the amended soil. CQuest<sup>®</sup> biochar was superior to Agrichar<sup>®</sup> and to Soil Reef<sup>®</sup> in increasing root weights and reducing disease. Root colonization by VAM increased sharply with CQuest<sup>®</sup> and Agrichar<sup>®</sup>. Soil Reef<sup>®</sup> was not tested for its effect on VAM. These results are difficult to explain since analyses conducted by **Dr. Joseph Pignatello** have shown the CQuest<sup>®</sup> biochar is the least absorptive of all three biochars.

In 2010, field plantings were established to examine the effect of biochar combined with and without earthworms on asparagus. The effect of these treatments on VAM colonization, disease, and yield will be monitored over the next five years.



Roots treated with some types of biochar resulted in increased colonization by vesicular arbuscular mycorrhizae (VAM) (left) and were more vigorous and more resistant to disease. Roots not colonized by VAM (right) had poor vigor and were more susceptible to disease.

**Impact:** The development and production of biochar may eventually serve to provide fuel, reduce atmospheric CO<sub>2</sub>, and enhance crop health and production in contaminated soils.

### ***Ornamental Disease Research***

#### **Fusarium corm rot of gladiolus**

Fusarium corm rot is a ubiquitous disease of gladiolus caused by *Fusarium oxysporum* f. sp. *gladioli*. It is by far the most destructive gladiolus root disease. Ongoing research by **Dr. Elmer** found that a 20-min soak of corms in solutions of specific chemicals could provide season-long suppression of Fusarium corm rot. In 2009, we found that resistance to Fusarium corm rot was proportional to the rate of Actigard 50 WP. Combining Actigard with a nonpathogenic strain of *Fusarium oxysporum* (CS-20) did not provide additional benefit. Corms were dug, stored, and then planted in May 2010, in order to determine if any residual resistance to Fusarium corm rot can be detected.

**Impact:** Many gladiolus growers in Connecticut and elsewhere have adopted the practice of pre-treating corms with a 20-min soak in the registered fungicide Terraguard

(triflumizol). In addition, Syngenta Crop Protection, Inc. has included a specific corn soak on their 2010 fungicide label for Medallion (fludioxonil) to allow growers to begin using this product as a pre-treatment.

### ***Suppressing Pythium Root Rot with Partial Soil Saturation in a Flooded Floor Greenhouse.***

Ebb & flow recycled watering systems have been used with increasing frequency in Connecticut greenhouses over the past decade. A major disadvantage of recycled watering is the potential for disease outbreaks and the development of fungicide-resistant pathogens. Although sub-irrigation is very efficient and allows water to be recaptured in reservoirs and re-used, conventional ebb & flow watering characteristically has long periods when root media are saturated with water. As a consequence, it is difficult to control the amount of water taken up in each pot. In addition, a water-saturated medium promotes the development of root disease and allows the spread of motile *Pythium* spores in water that leaches from saturated pots. This water can also contain diluted fungicides that flow back into the reservoir tanks, potentially promoting the emergence of fungicide-resistant strains of pathogens.

A joint project involving **Dr. Elmer, Dr. Martin Gent, Dr. Richard McAvoy** (University of Connecticut), and Joe Geremia (Geremia Greenhouse, Yalesville, CT) resulted in the construction of a flooded floor greenhouse at Lockwood Farm. This greenhouse has two floors with different reservoirs that can be drained at different rates. The objective of the joint research project was to control the amount of water each pot receives with the goal of conserving water, limiting fertilizer use, and suppressing disease without any loss in crop value or in post-harvest quality. One floor had a “W” shape or slope and was flooded for 4 min (Partial Saturation), while the other floor had a more typical “V” shape and was flooded for 16 min (Standard). A series of experiments with poinsettias, geraniums, and chrysanthemums was conducted in the winter, spring, and fall, respectively, in 2007, 2008, and 2009. Within each crop, approximately 30 plants were inoculated with a *Pythium* pathogen and kept in a water-saturated state to allow the disease to begin. The non-inoculated plants (>200) on each floor were monitored for symptoms of disease over the course of each experiment. At the end of the experiment, plants were removed from their pots and the root systems were rated for the percentage of diseased roots.

**Impact:** Partial saturation offers great value to growers who use ebb & flow irrigation systems by reducing the amount of fertilizers and fungicides used on crops, and by producing more marketable plants with longer shelf lives. Growers in Connecticut, Massachusetts, and New Jersey are currently using ebb & flow irrigation systems in commercial operations.



Poinsettia with healthy, white roots.



Poinsettia with brown, mushy roots infected with *Pythium* root rot.

### ***Sudden Vegetation Dieback***

Sudden Vegetation Dieback (SVD) has continued to appear along Connecticut's Long Island Sound in 2009. New sites and expansion of old sites were noted. Surveys and greenhouse experiments with *Spartina alterniflora* (SA) have not provided evidence to explain the source of SVD. A three-year survey between CT and MA (Sea Grant) found the incidence of *Fusarium* spp. was consistently higher in SVD sites than in marshes where no SVD occurred. **Dr. Elmer's** collaborative work with **Dr. Robert E. Marra** found that pathogenic isolates of *Fusarium* were closely related, and have been described as a new species, *Fusarium palustre* (see ***Phylogenetics***). Additionally, in collaboration with **Dr. James A. LaMondia** of CAES, a root-knot nematode (RKN) was found in SVD and interactions with *F. palustre* have been found to result in more damage than either pathogen alone. However, it could not be demonstrated that *F. palustre* combined with or without nematodes could cause plant mortality, and may not be causal to SVD.

Grazing pressure by the purple marsh crab, *Sesarma reticulatum*, may be affecting recovery from SVD. Although a causal relationship was never demonstrated between the crab and SVD, their presence in SVD sites is intriguing, and suggests the current working hypothesis that *S. reticulatum* may hinder recovery from SVD. Since many terrestrial arthropods (insects) are visually attracted to stressed plants, we questioned whether marine arthropods (crabs) are similarly attracted to stressed SA. In 2009, the presence of *S. reticulatum* and *Uca* spp. were monitored in pitfall traps in two classes of SVD site, those that were recovering and those where no recovery has been observed for the past five years. Our 2009 findings found no differences between *S. reticulatum* in these sites, but more *Uca* spp. were observed in SVD sites that never recovered. This suggests that *S. reticulatum* density is not associated with recovery, but *Uca* spp. may be associated. A thorough understanding of how plant pathogens and herbivores interact might yield information that could improve recovery from SVD.



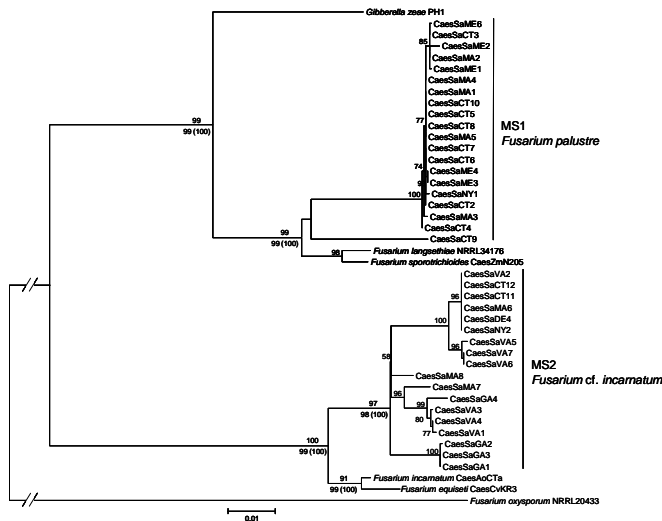
Purple marsh crab, *Sesarma reticulatum*.



Blue marsh crabs feeding on *Spartina alterniflora* transplants in captivity. (Photos by Peter Thiel)

***Phylogenetics of Fusarium Species Isolated from Spartina alterniflora and Associated with Sudden Vegetation Dieback (SVD) in Marshes.***

The majority of *Fusarium* isolates obtained by **Dr. Elmer** from *Spartina alterniflora* in SVD sites ranging from Georgia to Maine could not be assigned to known species of *Fusarium*, and therefore have been analyzed phylogenetically by **Dr. Robert E. Marra**. Pathogenicity tests conducted by Dr. Elmer on *S. alterniflora* in greenhouse experiments resulted in these isolates being identified as either pathogens or nonpathogens. In order to determine the phylogenetic placement of these isolates, Dr. Marra sequenced three nuclear genes –  $\beta$ -tubulin, calmodulin, and translation-elongation factor 1- $\alpha$  – in 20 pathogenic and 18 nonpathogenic isolates representing the breadth of geographic distribution of the study sites. The analysis included nine outgroup species, four of which did not have sequences for these genes available on Genbank; therefore, Dr. Marra obtained these sequences directly. Dr. Marra edited and aligned these sequences, then performed bootstrapped Maximum Parsimony (using MEGA4 software) and Maximum Likelihood (using PhyML) analyses on the aligned sequence datasets for each gene individually as well as on the combined gene dataset. Finding no topological discordance between the individual gene trees and the combined gene trees demonstrates that the data are robust, and that it is reasonable to conclude that the pathogenic isolates (MS1 in the figure below) represent a new previously undescribed *Fusarium* species that is likely closely related to *F. langsethiae* and *F. sporotrichioides*. Drs. Elmer and Marra have named this new species *Fusarium palustre*, in a manuscript accepted for publication in the journal *Mycologia*. The nonpathogenic isolates may be a single species or one or more closely related species, as a group closely related to *F. incarnatum* and *F. equiseti*.



Maximum Likelihood phylogenetic analysis of the combined three gene ( $\beta$ -tubulin, calmodulin, and translation-elongation factor 1- $\alpha$ ) dataset from pathogenic (MS1) and nonpathogenic (MS2) *Fusarium* species isolated from *S. alterniflora* in SVD sites. Numbers below the branches indicate the relative support, expressed in percentages, for the clade. Both Maximum Likelihood and Maximum Parsimony analyses resulted in nearly identical groupings, with strong (>80%) bootstrap support at the nodes. *Fusarium palustre* is a newly named species, described in publication.

**Future Outlook:** This research will provide insight into the critical factors associated with marsh grass recovery in SVD sites and lay the framework for understanding the relevant contribution of herbivores and plant pathogens to an ecosystem-based approach for restoration and management.

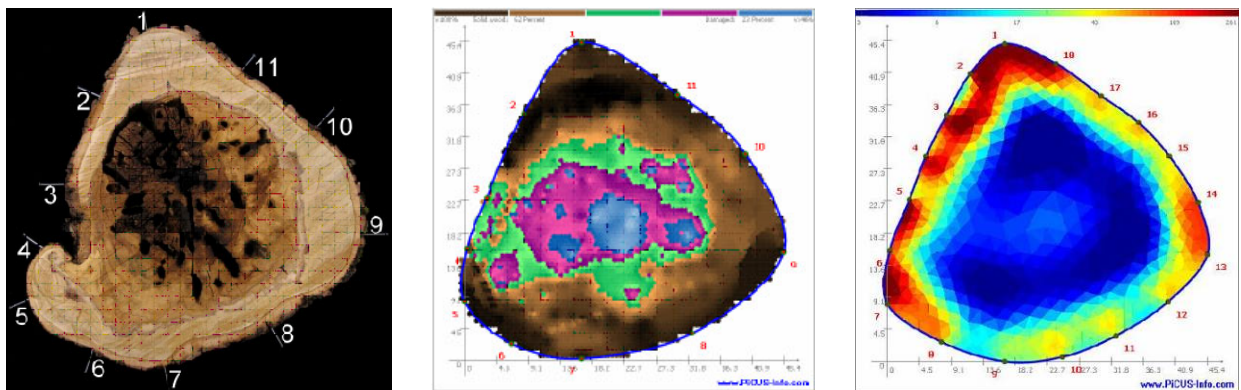
### ***Internal Decay and Carbon Loss in Living Trees of Northern Hardwood Forests.***

**Dr. Robert E. Marra** has initiated research on the critical role that forests play in sequestering carbon in the form of woody biomass, through the acquisition of CO<sub>2</sub> during photosynthesis. This has been the focus of much scientific, and popular, attention in the past decade or so, as the buildup of CO<sub>2</sub> in the atmosphere becomes a threat of growing exigency. One component of the carbon balance equation that has received little attention to date is the role that decay fungi play, principally through the metabolism of cellulose and lignin, in counteracting carbon sequestration. Most of the attention paid to decay fungi has focused on the impact they have on the timber industry, and for good reason: one study conducted in British Columbia estimated that two to three million cubic meters of merchantable timber are lost to *Armillaria* species alone.

Because decay fungi often live inside of, and continue to decompose, living trees for years and even decades, their role in carbon cycling is far from trivial, particularly given the interest at state and national levels to preserve and promote older-aged forests, which are dominated by canopy-dominant hardwood species. Recent analyses of carbon balance in old-growth forests have shown that these forests continue to act as global sinks for carbon, storing significant amounts of carbon in live and dead woody tissues as well as in the soil. As attention shifts towards old-growth forests as major sinks of global carbon, decay fungi must be considered, as fungi become most prominent in older forests. Because of the difficulties in estimating the extent of decay in living trees, these data have been absent from carbon cycle models.

Dr. Marra and Nicholas Brazee, Ph.D. candidate from University of Massachusetts at Amherst, have been experimenting with methods that allow for a nondestructive, but accurate, assessment of the extent of internal decay. The most promising technology involves the tomographic measurement of sound waves and electrical currents as they travel through the tree. The measurements are taken at designated cross-sectional points,

with the possibility of taking multiple measurements at different heights along the main stem. To determine if sonic and electrical impedance tomography could effectively detect decay within living trees, 22 cross-sectional measurements were captured from nine trees (four *Acer rubrum*, three *Betula lenta*, and two *Fagus grandifolia*) in two Connecticut forests. Sampling took place from April 11 - 14, 2010 at Sessions Woods Wildlife Management Area, Burlington, CT, and West Rock Ridge State Park, Hamden/New Haven, CT. With the assistance of Mr. Joseph P. Barsky, eight trees were felled and 19 stem disks cut for comparison with the tomographic results. Sonic and electrical impedance tomography were very accurate in depicting the volume of decay present. For one black birch (BB4) with extensive trunk rot from *Inonotus obliquus* (sterile conk rot), tomography accurately depicted the area of cavities and area of decay (see figure below). Specifically, sonic tomography estimated the area of cavity at 23% (actual area from cross-section = 22%), and electrical impedance tomography estimated the area of high conductivity due to fungal decay at 62% (actual area = 65%).



Cross-section (left), sonic tomograph (SoT) (middle), and electrical impedance tomograph (EIT) (right) for black birch #4 (BB4) bottom section. Numbers on stem disc correspond to sensor numbers on SoT. Within the SoT, blue and purple areas are damaged wood, while within the EIT the blue area has a relatively higher electrical conductivity, illustrating a buildup of moisture due to decay from the trunk rot fungus *Inonotus obliquus*.

As forests become better recognized for their important role in mitigating against the buildup of carbon dioxide in the atmosphere through its sequestration into woody biomass, scientists have focused on modeling carbon sequestration rates, and in evaluating the differences in rates among different ages and types of forests. One component of carbon cycling in forests that has received little attention thus far is the role played by decay fungi that inhabit living trees, particularly older trees, where the impact on carbon sequestration rates can be significant. As scientists strive to more accurately understand the dynamics of carbon cycling in forests, a more accurate assessment of the extent of internal decay in living trees is essential. To this end, the work described here is an important first step towards achieving this goal, and was used as essential preliminary data for a large grant proposal submitted to the National Science Foundation.

**Impact:** The Conservation Arboriculture workshop, which focused on sonic and electrical impedance tomography, increased the awareness of arborists, tree wardens, and others in the tree care industry about these cutting-edge techniques for detection of

internal decay in trees. Attendees participated in real-time demonstrations of these techniques, which are widely used in Europe, and have new options to save and sustain veteran and legacy trees in the landscape.

### ***Bacterial Spot of Stone Fruits***

**Dr. Marra** has assumed responsibility for a Sustainable Agriculture Research and Education (SARE) project on bacterial spot of stone fruits. This project focuses on the development of a biological control method against Bacterial Spot, caused by the bacterium, *Xanthomonas arboricola* pv. *pruni* (Xap), one of the prominent stone-fruit diseases of southern New England, particularly of peach and nectarine. The strategy to be tested is whether we can use a bacteriophage, a natural viral enemy of the pathogen, to protect plants from infection and reduce the severity of the disease. We used a collection of 23 Xap strains and 43 phage strains, isolated from 19 orchards in Connecticut, New York, and Massachusetts in the previous year. In order to determine the amount of genetic variability in both bacterial and bacteriophage collections, all 23 bacterial strains were infected with all 43 phage strains, to show that there was no difference in susceptibility among the bacterial strains, and no difference in virulence among the phage strains. To further test this, three bacterial strains were infected with ten viral strains, and from the resulting plaques (containing lysed bacterial cells), lysogenic strains were isolated. A lysogenic bacterial culture is one that has not been killed by the phage, but that rather has incorporated the phage DNA into its chromosome; thus transformed, the bacterial culture is now no longer susceptible to further infection by that same phage strain, but can still be infected by other phage strains if they are genetically different from the original infecting strain. Each of the 30 putatively lysogenic strains was then tested for susceptibility to all 43 phage strains, and the experiment repeated. Non-lysogenic (lytic) strains were used as positive controls. Because each lysogenic strain was resistant to all 43 phage strains, we concluded that all 43 phage strains were functionally equivalent. This absence of phage diversity may pose problems for long-term sustainability as a biocontrol, as the bacterium can become resistant fairly rapidly.

Sixty peach trees were planted in pots in the greenhouse, for use as host material in greenhouse trials. These peach trees are a variety, O'Henry, that is highly susceptible to Xap. Numerous efforts to infect trees in the greenhouse were unsuccessful, due to the inability to sustain suitable conditions of temperature and humidity. The peach trees have been moved to the Lockwood Farm for the summer, and we will attempt inoculation there, as well.

Three orchards of 49 trees each were planted at the three research farms, Lockwood, Windsor, and Griswold. The variety, Sweet Dream, is considered desirable in southern New England, but is too susceptible to Xap to be economically feasible. The trees will be allowed to grow for two years before field experiments are conducted on them to compare the use of phage to other disease control measures.

Bacterial Spot continues to be a major problem for peach growers in Connecticut and current control options are limited and expensive. A naturally occurring bacteriophage would qualify as organic disease control, making it a very desirable option for orchardists.

### ***Neonectria Canker Caused by Neonectria ditissima (prev. N. galligena)***

**Dr. Robert Marra's** research on Perennial Canker (also known as *Neonectria* canker) focuses on the ecology and genetics of the fungal pathogen, *Neonectria ditissima*, with the goal of gaining a fuller understanding of the life history, evolution, and population dynamics of the organism and its interactions with its hosts, particularly black birch (*Betula lenta*). Fundamental knowledge of the natural history of *N. ditissima* is lacking, yet is an essential prerequisite to the development of an effective control strategy for Perennial Canker. Field techniques and laboratory tools necessary to the study of this fungus and the disease it causes have been developed and are being used to elucidate mating structure and the ecology of spore dispersal. DNA from cultures obtained from infected bark and wood from various parts of Connecticut and the eastern United States are being analyzed using genetic markers in order to determine (1) if fruiting bodies are the result of outcrossing or self-fertilization, and (2) if outcrossed, the extent to which they are inbred or outbred. Understanding this aspect of the mating system will shed light on the fungus' dispersal patterns, a critical precedent to the development of a biocontrol program.

This research utilizes a set of 15 microsatellite markers that were shown in earlier work to be highly polymorphic within and among sites in Connecticut and Massachusetts. The microsatellite markers are now being used to study two research sites in West Rock Ridge State Park. Microsatellites are chains of repeating DNA motifs (e.g., acgacgacgacgacg) found throughout the genomes of most eukaryotes; variation in the number of motif repeats at a microsatellite locus underlies the length differences among alleles.

Due to its increasing abundance in Connecticut, black birch is a tree of growing importance and concern. Although trees infected with Perennial Canker can persist for decades, the extensive scarring caused by the cankers renders them of little value for lumber or veneer. Our efforts to more fully understand the biology and natural history of *N. ditissima* will contribute to the identification and utilization of control strategies.

### ***Ramorum Blight/Phytophthora ramorum***

**Dr. Marra** has been working with **Dr. Douglas** in supervising the implementation of USDA-mandated assays for detection of *P. ramorum* on nursery material shipped from California, Oregon, and Washington. Nursery surveys are conducted in cooperation with **Dr. Victoria Smith** and state inspectors. The process begins with a serological test called ELISA (enzyme-linked immunosorbent assay), which detects all *Phytophthora* species. The ELISA assays are performed by summer research assistants under the supervision of Dr. Balogh. If a sample tests positive by ELISA, Dr. Marra extracts DNA from the plant samples and then analyzes for *P. ramorum*-specific nucleotide sequences using real-time PCR assays.

The Molecular Plant Diagnostics Laboratory was given Provisional Approval Status for *P. ramorum* by APHIS-PPQ and in December of 2009, Dr. Marra was certified in the 2010 Proficiency Testing Program for two real-time PCR assays.

**Impact:** *P. ramorum* is a pathogen of growing concern in Connecticut because of the numerous species of plants and trees common in Connecticut that are known or suspected hosts. Much of this concern centers on Connecticut's significant nursery industry, which at over \$1 billion in annual production, ranks Connecticut among the ten largest in the country. Nurseries found to have plants infected with *P. ramorum* are effectively



quarantined to prevent potential spread of the pathogen until rigorously demonstrated to be clear of the pathogen, a process that can take several months. Therefore, Ramorum Blight, independent of its impact on our forests and landscapes, can have a significant impact on the state's economy. Many of the most susceptible hosts—eastern red oak, northern white oak, rhododendron, lilac, mountain laurel, and viburnum, to name a few—are significant parts of the nursery industry as well as Connecticut forests and landscapes. Given that the eastern United States, including Connecticut, is considered at high risk for *P. ramorum*, based on host distribution and climate, concern over the possible release of the pathogen into the environment is warranted. Through the Molecular Plant Diagnostics Laboratory, Dr. Marra's goal is to accelerate and refine our ability to identify *P. ramorum* in infected plants from the nursery, garden center, forest, and landscape, greatly increasing our chances of averting a Ramorum Blight epidemic. Additionally, the molecular diagnostic techniques being used and under development in the MPDL will continue to enhance the disease diagnostics services provided to Connecticut's stakeholders.

### ***Integrated Pest Management for Winegrapes in New England*** **Weather Monitoring**

**Dr. Francis J. Ferrandino** is continuing his work on diseases of winegrapes. This involves both an extension and a research component and is being accomplished through a collaboration of scientists and technicians at CAES, UMASS, UCONN, and URI. Between December 2008 and April 2009, seven cell phone-based remote access weather stations have been deployed in vineyards throughout southern New England (Hamden, CT; Windsor, CT; Griswold, CT; New Preston, CT; Colchester, CT; Newport, RI; and Deerfield, MA). These weather stations measure temperature, relative humidity, sunlight, wind speed and direction, rainfall, leaf wetness, and soil temperature every 15 minutes. The data are sent back to a central location once per hour, where they are accessible via the Internet. The resultant data are used to calculate disease risk assessment reports, which are made available to growers via Internet postings and direct email alerts. On-site weather station data are used to calculate disease risk assessments, which are delivered to the winegrape growers on a weekly basis.



Dr. Ferrandino checking sensor connections for a weather station deployed within a Chardonnay vineyard located in New Preston, CT.

In addition to collecting weather data, Dr. Ferrandino and collaborators are keeping track of maturation dates for various grape cultivars (Chardonnay, Vanessa) over

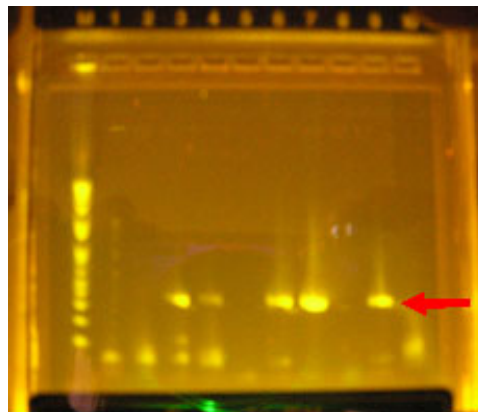
the study area, as well as the date of disease onset and epidemiological development of the various grape diseases.

Newport RI Powdery Mildew - Grape From 2010-07-01 To 2010-07-14							
Date	Temperature High	Temperature Mean	Hours 70-85	Hours >95	Wet Hours	Ascospore Infection	Conidial Index
07/01	76.9	70.2	9.3	0.0	0.0		
07/02	80.9	66.7	8.8	0.0	0.0		
07/03	82.8	70.4	12.8	0.0	5.5		60 Heavy
07/04	94.7	77.9	5.0	0.0	0.0		50 Medium
07/05	95.9	77.7	3.8	0.8	0.0		40 Medium
07/06	103.9	83.1	14.8	5.0	0.0		50 Medium
07/07	87.2	77.9	17.5	0.0	6.3		70 Heavy
07/08	81.0	74.4	19.5	0.0	9.0		90 Heavy
07/09	83.0	75.5	22.3	0.0	11.8		100 Heavy
07/10	84.7	76.4	24.0	0.0	7.8		100 Heavy
07/11	91.9	77.1	14.5	0.0	5.5	Heavy	100 Heavy
07/12	84.4	76.3	24.0	0.0	9.0		100 Heavy
07/13	83.3	76.4	24.0	0.0	13.8		100 Heavy
07/14	75.7	74.9	10.3	0.0	10.8	Heavy	100 Heavy

Sample of a disease-risk report to assist vineyardists in making decisions about whether or not to spray.

### Pathogen Detection

**Dr. Ferrandino** is continuing to use air samplers in infected vineyards to catch the spores that spread disease, particularly the fungus that causes powdery mildew of grapevines, *Erysiphe necator*. The collectors on these air samplers are microscopically examined to estimate the concentration of airborne spores. Because he has encountered difficulties with identifying spores by direct, microscopic examination, molecular techniques (PCR) have recently been employed to confirm the presence of *E. necator*. **Ms. Sletten** has assisted with this new method, which uses small plastic rods that are greased and placed in rotorod samplers. These samplers are deployed in vineyards and spin the greased plastic rods very rapidly, so that airborne spores are trapped on the greased surfaces. DNA from spores collected on the rods is extracted and tested for the presence of grape powdery mildew using PCR and electrophoresis. This technique is specific for grape powdery mildew, which produces a distinct molecular band. The PCR method is also more sensitive than microscopic examination: positive results are achieved with as little as 10 conidia on a rotorod.



Rotorod unit deployed in vineyard to catch powdery mildew spores. DNA extracted from spores of the powdery mildew fungus is amplified using PCR and produces a distinct molecular band (red arrow) after electrophoresis.

**Dr. Ferrandino** and collaborators have established three research vineyards at Hamden, CT; Windsor, CT; and at Griswold, CT. Crop growth and disease development are monitored in these vineyards for five winegrape cultivars: Chardonnay, Pinot Noir, Cabernet Franc, Chambourcin, and Vidal. These vineyards are not sprayed in order to evaluate disease pressure. This season, due to the hot, humid weather, grape anthracnose (caused by *Elsinoe ampilona*) became very damaging to certain cultivars.

**Impact:** Web postings and Email alerts reporting first instance of disease in unsprayed experimental vineyards alerted growers to the danger in their own vineyards. In 2010, powdery mildew of grape was observed on 4 June in Hamden CT and 10 June in Windsor CT, when grape flowers were in the early stages of setting fruit and most susceptible to this disease. In addition, a serious outbreak of anthracnose on grape (cv Vidal Blanc) was observed on 25 June in the Windsor plot and this information, as well as documenting photographs, were immediately Emailed to growers and posted on the CAES website within a few days. Three growers reported that they immediately scouted their vineyards, found the disease, and took corrective action.

#### ***Environmentally-Friendly Control of Powdery Mildew on Landscape Plants***

**Dr. Ferrandino** is continuing his work on environmentally-friendly controls of powdery mildew on common home landscape plants (e.g., lilac, deciduous azalea, monarda, phlox, peony, rudbeckia, and zinnia). The alternatives to conventional chemical controls include sprays of cow's milk, compost tea, horticultural oil, and potassium bicarbonate products. The results from 2008 and 2009 suggest that stylet oil (horticultural oil) offered the best protection for lilac--it delayed the time when 50% of the lilac leaves were infested by three weeks. This season, powdery mildew had been observed on monarda, phlox, and lilac by 8 July 2010, however disease levels were too low to evaluate the efficacy of the various sprays.

**Impact:** Use of efficacious, environmentally-friendly foliar sprays to control powdery mildew will reduce the chemical load on the environment. This is especially valuable around the home and many Connecticut residents have started to use these types of products in home gardens and landscapes as a result of our research.

#### ***Mathematical Models of Plant Disease Epidemics***

**Dr. Ferrandino** is continuing his theoretical investigations on the relation between the form of mathematical models describing plant disease development in time and plant disease spread in space. This work involves detailed investigations of the connections between sporulation progress curves and the temporal development of the resultant plant disease epidemic, as well as how the shape of the inoculum dispersal distribution affects the resultant spatial distribution of plant disease. The confirmation of theoretical models depends on detailed temporal and spatial sampling of plant disease. Dr. Ferrandino is continuing his spatio-temporal assays of grapevine powdery mildew and other pathogens in vineyards, powdery mildew in ornamental and vegetable crops, and spread of foliar blights in tomato plantings. Mathematical models of plant disease with parameters, which are directly determined using field data, are essential in

evaluating the efficacy and economic and environmental sustainability of IPM programs.

### ***Chestnut Breeding for Orchard and Timber Trees***

**Dr. Sandra L. Anagnostakis** is working with an American X Japanese tree [F1] in the New Hybrids at Lockwood Farm, which is now 17 years old, shows good resistance to chestnut blight and has good timber form. This tree was crossed with a CT American tree in the spring of 2010. Progeny of this kind of cross are known to segregate for resistance to ink disease (*Phytophthora cinnamomi*) and chestnut blight disease (*Cryphonectria parasitica*). The Japanese and the American parent trees of this hybrid are still alive and available for study (at the Chestnut Plantation at Sleeping Giant and at Lockwood Farm). Tissues of this hybrid and of the parent trees of this hybrid have been sent to J. Romero-Severson at Notre Dame University for DNA typing. Seed will be harvested in September, stored/vernalized, and planted at Forest-Keeling Nursery (MO) in January for further studies. All of the seedlings will be genotyped by Dr. Romero-Severson, and will then be divided for planting between Griswold (for blight resistance and timber/orchard form evaluation), Tennessee (University of Tennessee at Knoxville, for ink disease screening), and Missouri (University of Missouri at Columbia, for neutral site survival testing).

A total of 556 chestnuts were harvested from hand-pollinated crosses in the fall of 2009, and 527 open-pollinated nuts were collected. These include orchard and timber selections for planting at CAES and by collaborators. Open-pollinated seeds were collected from *Castanea henryi* (Chinese chinquapin) and some of its hybrids at The Chestnut Plantation at Sleeping Giant in the fall of 2009 for continuing studies of resistance to Asian Chestnut Gall Wasp, in collaboration with Stacy Clark, USDA/FS, and private orchard owners in Ohio where the wasp is now a serious threat to the nut crop.

Seedlings from hand pollinations between individual Ozark chinquapin trees at Lockwood Farm are being raised in the greenhouse for planting at Lockwood Farm in 2012 and testing for resistance to chestnut blight. A cooperative project with the Cherokee Nation in Oklahoma will allow planting of some of these trees on Cherokee land to determine survival potential.



Dr. Anagnostakis and Ms. Pamela Sletten bag chestnut flowers for hand pollination from a bucket truck.

Selected chestnut cultivars were grafted in the greenhouse in the spring of 2010, and were planted at Lockwood Farm to increase our cultivar collection. More grafts will be made in late September to compare grafting success with those done in the spring.

Maintenance of timber chestnut selections at Windsor and Griswold continues, and collections of seed in Windsor will be sent to Forest Keeling Nursery (MO) to produce seedlings for the Fairfield Garden Club's 2012 Centennial Project of planting 100 back-crossed timber chestnut trees on public land in Fairfield County. Future seedlings from Windsor and Griswold will be used for planting in areas in Connecticut and other northeastern forests where timber harvests have released native chestnut sprouts.

### ***Butternut Canker Research***

Trees in Connecticut reported to be butternuts (*Juglans cinerea*) have been examined by **Dr. Anagnostakis** over the past few years in a search for butternut canker disease caused by *Sirococcus clavignenti-juglandacearum*. To date, 180 trees have been examined and only one true butternut has been found. We have sent tissue samples of 176 Connecticut *Juglans* species to a colleague at Notre Dame University in Indiana for species confirmation using DNA markers. The butternut canker fungus was found twice on hybrids of butternut with Japanese walnut (*Juglans ailantifolia*). The fungus has been grown in the laboratory under various culture conditions, and compared to isolates from other parts of the U.S. One of our Connecticut isolates contains a double stranded RNA virus, and we will be testing the relative virulence of our two strains to see whether the virus reduces the virulence of the fungus. If this is the case, a biological control system such as that used for the chestnut blight disease might be possible. At Lockwood Farm, we have planted 150 seedling butternuts, Japanese walnuts, and hybrids for our tests of virulence, and one inoculation done last winter showed little difference between the trees in their resistance. A test this winter will involve use of the two Connecticut strains (one with a virus and one virus-free) to see if they behave differently in these small trees.



Pamela Sletten inoculates a small *Juglans* tree with the butternut canker fungus at Lockwood Farm.

Results on the relative virulence of the Connecticut strains of the butternut canker pathogen has the potential to identify a new biological control system for this important pathogen of landscape and forest trees.

### ***Noteworthy Diseases***

#### **Late Blight of Tomato and Potato**

**Dr. Sharon M. Douglas** reported an unusually early and widespread outbreak of late blight of tomato and potato that occurred throughout Connecticut and the Northeast in 2009. This outbreak affected tomatoes and potatoes in commercial fields, backyard gardens, greenhouses, and high tunnels. This devastating disease has historical significance for its association with the Irish potato famine of the 1840's, and it rapidly kills plants under favorable environmental conditions such as cool, cloudy, windy, wet weather—conditions that characterized May, June, and July 2009. Strain US-22 of the late blight pathogen, *Phytophthora infestans*, was responsible for most of the losses in the Northeast in 2009. This outbreak was unprecedented for a number of reasons. It occurred unusually early in the growing season and was initiated by widespread distribution and sale of infected tomato transplants by “big box” and chain stores throughout Connecticut and the Northeast. Once the infected transplants were set in the ground, they were exposed to favorable weather for disease development and spread--a recipe for a significant disease outbreak. Growers throughout Connecticut realized significant economic losses due to late blight infections.

Late blight is caused by the oomycete or fungus-like organism *Phytophthora infestans*. This pathogen is appropriately named and is derived from the Greek words “phyto” meaning plant, and “phthora” meaning destroyer, thus “plant destroyer.” There are several strains of *P. infestans* in the U.S., some of which are specialized on potatoes, some on tomatoes, and some are equally pathogenic on both hosts.

The host range for *P. infestans* includes plants in the Solanaceae family, primarily tomato and potato, although infections of eggplant and pepper have been reported. *P. infestans* has also been found to infect hairy nightshade (*Solanum sarachioides*) and bittersweet (*S. dulcamara*), as well as ornamental hybrid petunia. Because of the widespread outbreak of late blight this season, all tomato and potato plants should be considered at risk.

The late blight pathogen can attack all aboveground parts of tomatoes and potatoes, as well as potato tubers. Symptoms on stems and leaves of tomato and potato are very similar. They are readily visible to the naked eye and appear as water-soaked, olive-brown to black blotches or lesions on leaves and stems. On tomato, similar lesions

can develop on the fruit. After rainfall or heavy dew, white growth of the pathogen is visible on infected tissues.



General symptoms of collapse on tomato associated with late blight.



Typical olive-brown late blight lesions on tomato leaflet.



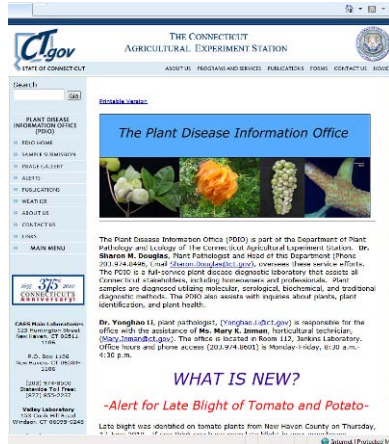
Infected fruit with white sporulation of the pathogen.

Sporadic outbreaks occur from year to year in Connecticut. However, they are usually attributed to wind-blown spores of the pathogen that are introduced into the state. Since these introductions occur late in the growing season, losses are usually limited.

*P. infestans* does not survive in the soil or in plant debris. However, it can survive in infected potato tubers located in cull or compost piles. *P. infestans* is not seed-borne in tomato. As a consequence of the severity of the 2009 outbreak, there was widespread concern about the potential for high levels of overwintering inoculum and new outbreaks for 2010. Fortunately, only one confirmed case of late blight was diagnosed on tomato in Connecticut as of 30 June 2010. Undoubtedly, the different weather patterns of the 2010 season have had a significant impact on disease.

#### New Web Site

This year marked the debut of the *Plant Disease Information Office Website* created by **Dr. Douglas**. The objective was to develop a comprehensive, state-of-the-art website to serve Connecticut residents and the agricultural community in two fundamental ways: provide timely, in-depth information on local plant health issues and provide guidelines for how to obtain accurate diagnosis of these problems. This website is still in development, but currently offers a location where information on management of plant health problems for all crops grown in the state is available. Growers and homeowners can also find presentations from meetings that are posted as color PDFs that can be reviewed and printed, as well as alerts on diseases that are of concern to the state. We are currently developing a searchable database by plant host (by common name or scientific name) or disease that will link to a gallery of high resolution images, short video clips, and plant health management information relating to hundreds of plant problems of concern for Connecticut crops.



Home page of the new *Plant Disease Information Office* website:  
[www.ct.gov/caes/pdio](http://www.ct.gov/caes/pdio).

## Disease Survey

**Dr. Yonghao Li, Dr. Sharon Douglas, Department Scientists and Mary Inman** diagnosed a wide range of plant health problems for homeowners, commercial growers, plant care professionals, and government and cooperative extension personnel during the past year. Fungal, bacterial, and physiological disorder diseases were prevalent, although viral diseases were also identified on many hosts.

Outbreaks of late blight on tomato and potato were associated with the cool and rainy conditions of summer 2009. The warmer and wet fall resulted in numerous winter injuries in woody ornamentals, fruit trees, and conifer species in the spring of 2010. Unusual warm and rainy weather in early spring provided favorable conditions for infections by many types of pathogens, including fungi, bacteria, and oomycetes (fungus-like organisms).

### Herbaceous and Woody Ornamentals:

A wide range of diseases was identified on perennials this season. Some herbaceous hosts and diseases were begonia, geranium, poinsettia, and chrysanthemum with bacterial leaf spot/blight; chrysanthemum with white rust; iris with *Heterosporium* leaf spot and tomato spotted wilt virus (TSWV); impatiens with downy mildew; chrysanthemum, peony, and daffodil with *Botrytis* blight; and peony with *Botryosphaeria* canker.



Downy mildew of impatiens





Bacterial leaf spot of poinsettia

Broadleaf woody ornamentals and their diseases were ash with rust, powdery mildew and anthracnose; azalea with leaf gall caused by *Exobasidium*; beech with anthracnose and *Nectria* canker; boxwood with *Volutella* blight; dogwood with anthracnose and powdery mildew; elm with black spot and Dutch elm disease; crabapple with scab, rust, frog-eye leaf spot, and fire blight; cherry with black knot, powdery mildew, and fungal leaf spot; euonymus with anthracnose and crown gall; filbert with eastern filbert blight; hydrangea with *Cercospora* leaf spot and powdery mildew; holly with rust, fungal leaf spot, and *Nectria* canker; lilac with *Pseudomonas* blight, anthracnose, and powdery mildew; maple with anthracnose, *Septoria* leaf spot, *Verticillium* wilt, and powdery mildew; oak with anthracnose, *Phytophthora* canker, and *Tubakia* leaf spot; pachysandra with *Volutella* blight; mountain laurel with *Cercospora* leaf spot, *Phomopsis* stem canker, and *Rhododendron* ring spot virus; rhododendron with *Phytophthora* root rot, fungal leaf spot, leaf gall caused by *Exobasidium*, and winter dieback; sedum and leucothoe with powdery mildew; rose with black spot; viburnum with fungal leaf spot and powdery mildew; willow with scab and black canker; and witch hazel with fungal leaf spot.

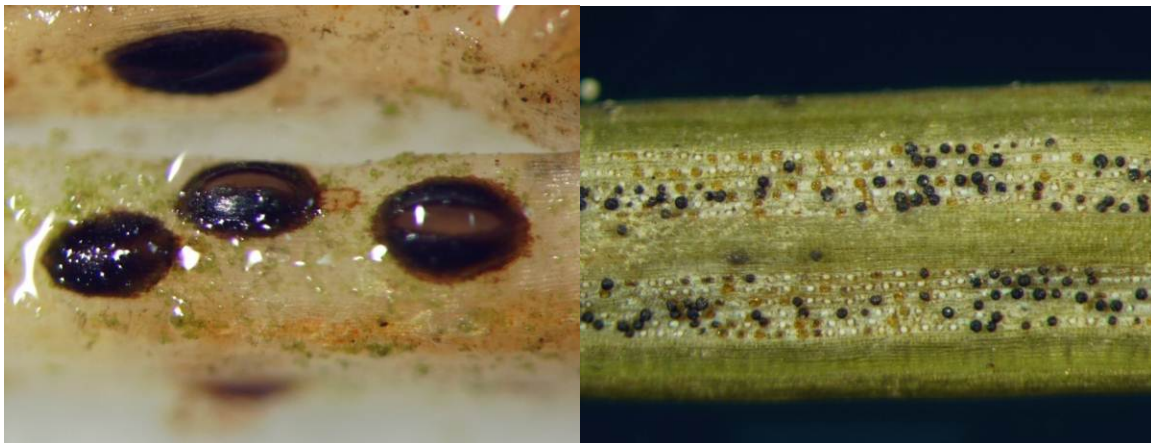


Leaf gall of rhododendron



Fungal leaf spot of witch hazel

Conifer species and some of their diseases were arborvitae with *Rhizoctonia* root rot and *Pestalotiopsis* dieback; cryptomeria with tip blight and *Pestalotia* needle blight; fir with *Phytophthora* root rot; Douglas-fir with *Rhabdocline* needlecast and swiss needlecast; juniper with *Phomopsis* tip blight, rust, *Pestalotia* needle blight, *Botryosphaeria* canker, *Kabatina* tip dieback, and *Lophodermium* needlecast; pine with *Canavirgella* needlecast, *Ploioderma* needlecast, *Diplodia* blight and *Nectria* canker; spruce with *Rhizosphaera* needlecast, *Sirococcus* blight, and repeating spruce needle rust.



*Lophodermium* needlecast of juniper

Swiss needlecast of Douglas fir

#### Vegetables:

Among common vegetable diseases diagnosed were bean with rust; basil with impatiens necrotic spot virus (INSV), downy mildew, and *Botrytis* blight; cucumber with downy mildew, powdery mildew, bacterial wilt, and anthracnose; pepper with *Xanthomonas* leaf spot and *Phytophthora* blight; pumpkin and squash with powdery mildew, *Choanephora* end rot, and downy mildew; potato with late blight and *Rhizoctonia* stem rot; tomato with late blight, *Septoria* leaf spot, early blight, bacterial leaf spot, bacterial wilt, gray leaf mold, cat-facing, blossom-end rot, and TOSPO viruses (TSWV and INSV).



Septoria leaf spot of tomato.



Bacterial spot of tomato.

#### Tree and Small Fruit:

Common tree and small fruit species and diseases were apple with black rot, frog-eye spot, fire blight, rust, and Nectria canker; blueberry with rust and bacterial leaf spot; grape with black knot, powdery mildew and downy mildew; nectarine with bacterial leaf spot, brown rot, and scab; peach with scab, X-disease, Fabraea leaf spot, and black knot; plum with brown rot and black knot.

#### Turf:

Common disease problems on residential lawns and golf courses were summer patch, red thread, yellow patch, Rhizoctonia brown patch, rust, and anthracnose.

#### Weeds:

Predominant weeds in turf and gardens were bentgrass, bindweed, crabgrass, ground ivy, mugwort, nutsedge, star-of-Bethlehem, wild violets, and wild garlic. Identification and control of true, running bamboos and Japanese knotweed, plants that often become invasive, continued to be significant problems for many Connecticut landowners. Poison ivy remained a key plant of great public concern. Increased public awareness of non-native invasive plants led to many inquiries regarding Mile-a-minute vine, garlic mustard, and Oriental bittersweet for identification.

**Impact:** Each year, information about the diseases that occur on plants in Connecticut is used by green industry professionals, arborists, nursery and greenhouse owners, farmers, orchardists, and homeowners throughout the state to help them manage, monitor, and assess diseases, as well as to predict potential disease problems for plants or future crops in the coming years. Members of the department communicate this information in timely ways to state residents through workshops, presentations, twilight meetings, web postings, and fact sheets. This information also helps to detect and assess new diseases or to identify potentially important emerging diseases on specific plants, which can then be monitored in the years that follow.

## SERVICE ACTIVITIES

Members of the Department of Plant Pathology and Ecology are involved in a wide range of service and public outreach activities. Some of these services involve presentations, publications, displays at meetings and other outreach events, tours of facilities, and interviews, in addition to being conducted in cooperation with other state agencies.

### ***Seed Testing: In cooperation with the Connecticut Department of Agriculture, Bureau of Regulation and Inspection***

Every year, inspectors from the Bureau of Regulation and Inspection of the Connecticut Department of Agriculture collect official samples of vegetable, crop, and lawn seeds for analysis. Samples are submitted to The Connecticut Agricultural Experiment Station since it is the official seed testing laboratory for Connecticut. The Department of Plant Pathology and Ecology performs the germination and purity analyses that are required for compliance with the Connecticut Seed Law Regulations and the Federal Seed Act. In 2010, 320 vegetable, 8 lawn, and 10 crop seed samples were submitted to **Dr. Douglas** for testing. **Ms. Inman** tests all seeds following strict protocols designated by the Association of Official Seed Analysts (AOSA). Seedlings are carefully examined, since they must appear “normal” (i.e., free from decay, have well-developed primary root systems, have well-developed and intact hypocotyls and/or epicotyls, and have healthy cotyledons). Of the 8 lawn seed samples tested, three met label claims for both purity and germination. Four samples passed label claims for germination, but did not meet claims for purity. One sample failed both purity and germination. Another component of the analysis is examination for prohibited noxious weed seeds. Of the 10 crop seed samples tested, nine samples met label claims for purity and germination and one sample failed both purity and germination. Of the 320 vegetable seed samples tested, twenty-one failed label claims for germination. They were not retested because of insufficient amounts of seed. None of these samples contained weed contaminants in 2010. A *Station Technical Bulletin* will be written to report the findings of this year’s results.

***Impact:*** Results of seed tests conducted by Station staff are reported to the Seed Control Official of the CT Department of Agriculture who has the authority to stop the sale of products that do not meet label claims or contain noxious weeds. In the short term, this program protects state residents from purchasing inferior seed and ensures that seeds comply with the Connecticut Seed Law Regulations and the Federal Seed Act. The long-term benefit of the seed testing program is to minimize the inadvertent introduction of noxious weed seeds that could potentially impact crops of economic importance and the state’s ecosystem.

### ***Samples for Analytical Chemistry and the Connecticut Department of Consumer Protection***

During the year, **Department Scientists, Dr. Li,** and **Ms. Inman** examined 27 samples from the Connecticut Department of Consumer Protection at the request of the Department of Analytical Chemistry of the Experiment Station.

### ***Samples for 2010 National Nursery Survey and Trace-Forward and Trace-Back Surveys for Phytophthora ramorum***

Connecticut participates in a national survey of nurseries to assess the presence of the Ramorum Blight (Sudden Oak Death) pathogen, *Phytophthora ramorum*, in our state. Connecticut also conducts trace-forward and trace-back surveys when requested by USDA-APHIS-PPQ. The objective is to survey nurseries at risk of harboring or distributing *P. ramorum*-infected plants or when appropriate, homeowners who have received possibly infected plants. **Drs. Douglas and Marra** supervise the USDA-mandated assays for testing. During the past year, **Dr. Victoria Smith** (Deputy State Entomologist) supervised the collection of 251 samples by CAES nursery inspectors and PPQ personnel. Samples were then tested for *P. ramorum*. At the time of this publication, no samples tested positive for *P. ramorum* in any of the 2010 surveys.

### ***Samples for Chrysanthemum White Rust***

In the Fall of 2009, there was another outbreak of Chrysanthemum white rust (CWR) in Connecticut. Since this is a disease of regulatory concern, the outbreak resulted in a cooperative effort between the Experiment Station and USDA-APHIS-PPQ. **Dr. Douglas** examined samples collected by CAES nursery inspectors and USDA-APHIS-PPQ personnel under the supervision of **Dr. Smith**. Inspectors examined 50,000 plants at a grocery store as part of a trace-back activity, but no plants with CWR were found. An additional 20,000 plants were inspected for another grower and 8,500 were found to be infected. They were destroyed by burial on site. At a third location, 93 symptomatic plants were identified and destroyed by disposal in the municipal waste stream. Middlesex County joined Hartford, New Haven, Litchfield, and Fairfield Counties with confirmed positive CWR outbreaks that were successfully eradicated. Many new cultivars were also found to be infected in 2009, such as 'Manakin Red,' 'Eureka Yellow,' and 'Hankie.'

**Impact:** Chrysanthemums grown in several Connecticut locations that were inspected, tested, and confirmed to be infected with Chrysanthemum white rust. Since this is a regulated pathogen, infected plants were destroyed as part of a cooperative regulatory effort.

### **Citizen Inquiries**

#### ***Plant Disease Information Office***

**Drs. Li and Douglas**, assisted by **Department Scientists** and **Ms. Inman**, answered 5462 inquiries about plant health from Connecticut citizens. Although the majority of inquiries were on ornamentals, trees, and shrubs (60%), other categories, such as food crops (23%) and turfgrasses (3%), were also well represented. The number of inquiries on food crops represents a 5% increase from the previous year, possibly due to recent increased interest in local production of food crops, in backyard and commercial gardens as well as the unusually severe outbreak of late blight of tomato and potato that occurred in 2009. A moderate percentage of inquiries fell into the miscellaneous category (14%), which included identification of plants and poison ivy control and identification. Although the majority of inquiries were from Connecticut homeowners (67%), the

number of the inquiries from commercial growers and plant care professionals (27%) showed a marked increase. Inquiries from cooperative extension, health, news, and agricultural personnel (6%) remained consistent with previous years. A further breakdown of inquiries showed that 44% of the samples came in by phone, 11% came in by mail, 4% came as email (Connecticut only), and 41% were brought in person. The number of physical samples handled by the PDIO (52%) continued to exceed the number of phone calls (44%)—this was a trend that was observed for the past 3 years. Over 700 letters and numerous email messages with attached files of fact sheets were sent from the PDIO. Many citizens opted to download fact sheets posted on the CAES website in lieu of letters since this gave them instant access to the information of concern. Most of the miscellaneous questions were concerned with identification, human toxicity, and control of poison ivy and other poisonous plants, identification of various plants and weeds, mushroom identification for health officials, and information about pesticides and their relationships to health and environmental concerns.

### *Additional inquiries*

**Dr. Anagnostakis** answered 663 questions, tested 11 samples, and made 8 site visits. **Dr. Elmer** made 9 site visits, answered 19 questions, and tested 13 samples. **Dr. Ferrandino** made 25 site visits, tested 5 samples, and answered 10 questions, and **Dr. Marra** made 1 site visit and tested 1 sample from stakeholders.

**Impact:** During the period covered by this Report, over 6227 Connecticut residents had plant disease problems accurately diagnosed by members of the Department of Plant Pathology and Ecology. In many cases, the plant health problems diagnosed did not require fungicides for control, contrary to the initial perception that fungicides would be required. Staff members worked to educate professionals and homeowners to develop disease management programs that were compatible with the environment that incorporated cultural practices, sanitation, and genetic resistance prior to pesticide use. Accurate diagnosis of plant health problems, educated citizenry, and implementation of integrated disease management strategies reduce pesticides introduced into the environment and water of Connecticut.

## **MEETINGS ORGANIZED BY THE DEPARTMENT OF PLANT PATHOLOGY AND ECOLOGY**

### **Meetings and Workshops**

**Dr. Wade H. Elmer** co-organized two Bedding Plant Meetings with Ms. Leanne Pundt and Dr. Richard McAvoy of the University of Connecticut. Topics covered included: Update on Managing Insects and Mites on Spring Crops, Update on Nutrition, Chemical Growth Regulators, and other Production Tips, Update on Emerging Diseases, Nutrition and New Fungicides for Spring Crops and Update on Pesticide Safety. One session was held at the Tolland Cooperative Extension Center in Vernon, CT and the second session was held at the University of Connecticut, Torrington campus, in Torrington, CT. Out of a total of 57 evaluations returned, 70% of the participants found the meeting “very useful” while 30% found it “useful.” (February 2010)

**Dr. Francis J. Ferrandino** sponsored an informational meeting about the Southern New England Grape Information Network (SNEGIN) at the Valley Lab. Station participants also included **Drs. Nail and Lamondia and Ms. Sletten**. Among the topics covered were progress in establishing a weather station network and delivering timely disease warnings to growers, the contribution of last season's weather to disease problems and delayed harvest, importance of fungicide resistance related to the last downy mildew outbreak and powdery mildew, new cultural methods and cultivars, and new techniques for disease-risk assessment using PCR. (April 2010)

**Dr. Robert E. Marra** organized a workshop on "Conservation Arboriculture," held at the CT-DEP Sessions Woods Wildlife Management Area. Presenters were Mr. Philip Van Wassenaer of Urban Forest Innovations, Mississauga, Ontario, Canada and Mr. Lothar Goecke of Argus Electronics, Germany. The all-day workshop also included an outdoor on-site demonstration of the Argus Electronics PiCUS<sup>®</sup> Sonic and Electrical Impedance Tomography. The workshop was co-hosted by the Connecticut Forest and Park Association. (April 2010)

**Drs. Wade H. Elmer and Sharon M. Douglas** co-organized with Ms. Leanne Pundt and Dr. Rich McAvoy of the University of Connecticut and the Connecticut Greenhouse Growers Association a "Plant Diagnostic Workshop" in Jones Auditorium. This was a hands-on workshop with over 30 plant samples with different problems. After an initial round at diagnosing the problems on the samples, participants heard several presentations that would help them sharpen their diagnostic skills. Topics included "Diagnosing plant health problems: How to get started," "How to identify & diagnose plant disease symptoms," "How to identify & diagnose plant nutrient disorders," "How to identify & diagnose insect-related disorders," and "Weed, algae & related problems." Out of a total of 48 evaluations returned, 84% of the participants found the meeting to be economically beneficial to their commercial operations. (June 2010)

#### **Lockwood Lectures**

**Dr. Wade Elmer** organized a Lockwood Lecture by Dr. Clive Edwards from Ohio State University. The title of the lecture was "The Use of Aqueous Solutions from Vermicomposts in the Suppression of Plant Diseases of Tomatoes and Cucumbers." (March 2010)

**Drs. Sharon M. Douglas and Robert E. Marra** co-organized a Lockwood Lecture by Dr. Kevin T. Smith, plant physiologist and forest pathologist with the US Forest Service, Durham, NH. The title of the lecture was "Tree Survival and Response to Injury, Infection, and Environmental Change." (May 2010)

#### **Conference Organizing**

**Dr. Robert E. Marra** served on a Steering Committee for *Connecticut Conference on Natural Resources* from 2005 to present. The conference was held this year on Monday, 8 March 2010, at the University of Connecticut, Storrs. The conference was attended by

243 people, including five scientists from CAES who presented two talks and two posters.



## VALLEY LABORATORY

The Valley Laboratory is a multidisciplinary Department that conducts research on insects, diseases, soil nutrition, mycology, integrated pest management and weeds of concern to commercial agriculture and homeowners in Connecticut. The Valley Laboratory was originally established by the Board of Control in 1921 to conduct tobacco research. While research on shade and broadleaf tobacco continues today, the mission of the Department has greatly expanded to reflect the diverse agriculture present in the State. In addition to research, Valley Laboratory scientists and staff diagnose insect and plant health problems, test soils for fertility and structural analyses, conduct outreach to growers and homeowners by speaking to professional and community groups, host informational meetings, and assist students.



### RESEARCH ACTIVITIES

*Activities on the farm:* There were a total of 59 experimental plots during the past year at the Windsor farm. Seven Windsor-based scientists had 32 of these plots; six New Haven-based scientists and a University of Connecticut graduate student were using 18 plots. The remaining plots were maintained by the Farm Manager as rotation crops or for seed collection. Valley Laboratory scientists also conducted experiments in many plots off site, such as in growers' fields and State forests. Farm Manager **James Preste** kept the farm and his equipment ready and in excellent shape. He expertly maintained the many field plots and addressed the specific needs of each scientist. He and his summer assistants did an outstanding job maintaining the extensive ornamental garden in cooperation with the Connecticut Nursery and Landscape Association. **Mr. Preste and**

**Dr. LaMondia** coordinated the Valley Laboratory effort to comply with EPA Worker Protection Standards for Agricultural Pesticides and organized and conducted training sessions for the staff.

### ***Biological Control of Hemlock Woolly Adelgid***

Eastern hemlock, *Tsuga canadensis*, is an important native conifer climax species, which provides essential wildlife habitat and cover, especially in winter. Hemlocks also protect watersheds and maintain critical cool stream temperatures for native trout species. In the garden landscape, it is a popular tree and a common component in Connecticut's state parks and forests. Since 1985, eastern hemlocks in Connecticut have been under attack by the non-native hemlock woolly adelgid (HWA), *Adelges tsugae*, an accidental introduction from southern Japan. Biological control using imported predators of the adelgid is a major long-term national strategy for reducing the impact and spread of HWA in our eastern forests. Projects 1-4 are funded by the USDA Forest Service.

#### ***1) Project: Biological Control of Hemlock Woolly Adelgid: Field assessments***

In Connecticut, research, release and evaluations of a tiny ladybeetle, *Sasajiscymnus tsugae*, imported from southern Japan in 1994 to predate on HWA have been ongoing for 16 years, supported by the USDA Forest Service. Over 176,000 *S. tsugae* have been released in 26 Connecticut forests and parks since 1995. **Dr. Carole Cheah** continued a multi-year study collecting annual crown data on hemlock health and adelgid population trends from September to December 2009 from 16 established 8-14 year release sites throughout the state and 7 uninfested hemlock plots to evaluate long-term effects of biological control releases and potential for hemlock recovery in infested stands. From March-April 2010, **Dr. Cheah** also collected adelgid-infested foliage from 10 sites throughout the state and determined the average winter mortality of 1000 HWA per hemlock site. The data are used to generate information on the overall condition of the state's hemlocks, predict subsequent trends of HWA populations in different regions of the state and advise homeowners and forest managers on strategies for control of HWA.

#### **Results:**

- The majority of hemlock stands where the beetle has been released and established continue to exhibit sustained crown recovery with little or no tree mortality, dispensing with the potential costs of tree removal of hazard or dying trees and preserving the quality of recreational use for Connecticut's citizens.
- Hemlock health was maintained in 75% of biological control release stands where the mean foliage transparency was not significantly different from healthy baseline stands. Of the 11 sites which are associated watershed areas, 82% maintained healthy crowns for watershed protection, which include 2 nationally designated "wild and scenic rivers".

- After a summer with consistently heavy rains in 2009 (99/115), only 25% of release sites (n = 4) had medium to heavy infestations of elongate hemlock scale, *Fiorinia externa*, while 37% of sites which had previously heavy infestations of scale now showed a decline in densities on new shoots.
- Annual assessments of winter mortality of adelgid in Connecticut since 2000 have been significantly correlated to minimum winter temperatures. The winter of 2010 was generally mild with minimum temperatures only dipping below 0 °F in the extreme northwest hills and only briefly for a few hours in January. Overall, the winter of 2010 ranked as 78/115. Field visits showed that statewide, HWA was actually scarce. Winter mortality was very low and averaged around 20% with more variability over all three climatic regions of Connecticut. The highest HWA winter mortality was experienced in the extreme northwest where HWA mortality was 41-51%. Mortality was negligible in urban and southern areas (< 10%).

**Impact:** As a consequence, homeowners were advised to implement control measures on landscape trees especially in the southern half of the state, although HWA populations in natural stands remained low through most of the state. There has been no significant hemlock mortality from HWA infestations in the last decade since implementation of biological control in 1995.

## **2) Project: Development of artificial diets for predators of hemlock woolly adelgid**

**Dr. Cheah** continued to maintain an experimental *S. tsugae* colony with lines originating from the first shipments from Osaka, Japan in 1994 and 1995 and a more recent line from a different location, Kobe, Japan, obtained in 2006. Current laboratory studies, in collaboration with Dr. Allen Cohen of Insect Diet and Rearing Research, LLC, and supported by the USDA Forest Service, are aimed at the development of an artificial diet and/or supplement to augment and improve the mass-rearing of adelgid predators for implementation of biological control in infested forests. Currently, all mass rearing of predators requires healthy HWA-infested foliage. Supplies of the latter are unpredictable and of variable quality and affected by drought, winter extremes and accessible collection areas. Artificial egg diets developed by Dr. Cohen have resulted in equal or superior results to existing diets used for emergency feeds for HWA predators such as *S. tsugae*, when abundant, high quality living adelgids are not available. Modifications with various yeast cultures and supplements were made to the base diet with the goal of improving larval development and optimizing adult survival and reproduction. In 2009-2010, research focused on developing modifications of the F100 egg diet and conducting preference side-by-side bioassays with *S. tsugae* and *Laricobius nigrinus* and developing techniques for encapsulation of diets.

**Results:** A total of 24 modified diets were tested in 2009-2010. New emergent *S. tsugae* showed a preference for a base diet modified with sweet whey. Both new and older reproductive adults did not show preferences for new diets modified with several new yeast cultures. Preference was shown for the unmodified base diet by both *S. tsugae* and *L. nigrinus*. Larvae of *S. tsugae* showed a distinct preference and robust initial feeding response to one of the modified diets, but the texture and presentation requires more

modification to allow for sustained feeding and survival. In 2010, survival of *L. nigrinus* was very high (81% and 100%; n = 70) for *L. nigrinus* feeding solely on a Cohen egg diet mixed with honey without access to HWA for 2 weeks, indicating the usefulness of this diet in times of HWA scarcity. IDRR has formulated and provided the basic diets FDFE3 and F100 to several researchers. In all cases, the use of these diets resulted in equal or superior results to existing diets used for emergency feeds for HWA predators when abundant, high quality living prey (HWA) are not available.

**Impact:** A superior adult supplement supporting enhanced adult predator survival would be highly beneficial and cost effective to the labor-intensive mass-rearing production in insectaries which produce HWA biological control agents.

### **3) Evaluation of Herbivore Induced Plant Volatiles as Possible Attractants for Predators of Hemlock Woolly Adelgid**

Plants under herbivore attack have been shown to produce volatiles that in turn attract natural enemies of the herbivores in question and many predator and parasitoid species respond to such volatiles. Many coccinellids exhibit positive olfactory responses to odors of their prey and/or host plant systems. *S. tsugae* is a highly dispersive species with excellent flight capabilities but this has obscured results from recovery sampling techniques which are mostly concentrated in the extreme lower canopy. Olfaction capabilities of *S. tsugae* have been questioned previously but did not investigate optimal environmental and physiological conditions for testing and validating insect responses to odor sources, such as preconditioning treatments of test subjects, reproductive states of individual test insects, appropriate airflow rates, humidity, ambient temperature, light intensity and balance. In this project, **Dr. Cheah** investigates all these factors as the response or non-response of a predator or parasitoid may also be influenced by biotic factors such as the insect's age and physiological state (eg. satiated or starved), level of foraging experience or abiotic factors such as light intensity, water stress etc. that may affect levels of volatiles produced by the plants.

**Results:** A custom-designed 2-way air-flow olfactometer was designed and constructed with chambers large enough to accommodate infested and uninfested seedlings, to enable testing of whole plants, novel extracts and mixtures of natural plant and host material. Light intensity levels and balance, ambient temperature and rates of airflow suitable for eliciting behavioral responses of *S. tsugae* and *L. nigrinus* have been established and optimized. Synthetic herbivore induced plant volatiles are also currently being tested for responses by reproductive and non-reproductive *S. tsugae*. In Y-tube olfactometer experiments, *S. tsugae* demonstrated significant odor perception of eastern hemlock (infested or not) seedlings over blanks. The responsiveness and detection of infested hemlock odors was also found to be influenced by the reproductive state of the individual. Older, reproductive females and males of *S. tsugae* were able to significantly discriminate between infested and non-infested hemlock seedling odors. Reproductive females were also significantly attracted to methyl salicylate odors. *L. nigrinus* adults showed no response to infested eastern hemlock seedling odors over blank controls but showed positive response to methyl salicylate although more replication is required.

**Impact:** Methyl salicylate-based attractants may be suitable for development in a monitoring system for HWA predators.

#### **4) Quality and Process Control for production of HWA predators**

Scientists in several laboratories (university, state, federal, and private businesses) mass rear predators of HWA. Often these predator releases have failed to provide the expected levels of HWA control, and mortality of predators produced has been high during the rearing process. It is not known if these failures are because of 1) inadequate numbers of predators being released, 2) problems in release techniques, or 3) the quality of the predators themselves 4) questionable quality of the adelgid prey used for rearing. The quality control system consists of several tiers of observation and decision-making: 1) behavioral, 2) biomass and linear measurements, 3) biochemical assessments, and 4) internal morphology. This project led by Dr. Allen Cohen of IDRR, LLC will develop product quality control techniques which will provide a basis for improvement of production and process control for HWA predators.

**Results:** Some of the most important quality and process parameters discovered in year 1 are as follows: protein content of predators and diet, free-radical scavenging capacity in predators and diets, lipid content, storage carbohydrate content, predator biomass, and predators' internal condition. A range of healthy weights for wild-caught *L. nigrinus* from Washington State has been established, and also for healthy colony-reared *S. tsugae*. Investigations have been initiated for the summer soil-pupation and dormancy period for *L. nigrinus*, which is the most vulnerable stage for high mortality and low emergent success.

**Impact:** Important parameters which influence the production quality of predators have and continue to be defined. The objective is to integrate these parameters into a system, which will enable early detection of production and quality problems to optimize the efficiency of predator production.

#### **5) Project: Establishment of a HWA predator field insectary**

A field insectary at the Lockwood Farm was established by **Dr. Cheah** with plantings of HWA-tolerant species of western, mountain and northern and southern Japanese hemlocks in May 2009 as a new method for eventually rearing *S. tsugae* acclimated to the northeast climate for biological control releases. This project is funded by USDA-APHIS PPQ.

**Results:** Three species grew well during the 2009 growing season and western, mountain and northern Japanese hemlocks produced the most lush new growth. However, winter survival of transplants was affected by winter desiccation in 2010. Northern Japanese hemlock, *Tsuga diversifolia*, proved the hardiest and adapted to Connecticut climate and

was able to produce replacement new shoots after a late frost killed a lot of shoot buds in all species. Southern Japanese hemlock (smaller original transplants) also survived the winter of 2010 but were less vigorous and produced fewer new shoots in the spring of 2010. Western hemlock suffered severe defoliation by March 2010 but was able to recover by putting out plentiful new shoots by June 2010. Mountain hemlocks were the least adapted, and were severely defoliated. Mountain hemlocks also had the highest winter mortality with little recovery. Artificial infestation of transplants was delayed due to the conditions of the recovering seedlings.

**Impact:** Northern Japanese hemlock would be a suitable landscape/garden alternative to the threatened native eastern hemlock which is susceptible to HWA.

### ***Chemical control of HWA***

**Dr. Richard Cowles** has continued to follow the responses of hemlock woolly adelgid to previous years' applications of systemic insecticides. The reduction in adelgid populations relative to the untreated checks, for trees treated in fall of 2007 and sampled in 2010 were: CoreTect product, 88 and 95% (low vs. high dosage); Merit soil injection, 99.4%; Safari trunk spray, 92%; and Safari soil injection 96%. These results are consistent with earlier experiments in demonstrating that a single insecticide application provides multiple years of benefits and permits hemlock trees to regain vigor. Bark applications in the form of trunk sprays proved to be surprisingly effective. Trees treated in August of 2008 with a trunk spray of 0.6 g of dinotefuran (Safari) active ingredient per inch of trunk diameter still had a 99% population reduction relative to the untreated checks when sampled in 2010. Adelgids could not be detected on trees treated with trunk sprays of imidacloprid or clothianidin, whereas adelgids were detected on trees treated with soil applications using same amount of product. The trunk spray method therefore is at least as effective as the standard shallow soil injection treatments, which should minimize soil contamination with these insecticides. Evidence of the effectiveness of these treatments may be observed in the row of hemlock trees along the side of the Griswold Research Farm on Sheldon Road.

### ***Impact:***

- All southeastern states with eastern hemlocks have adopted Special Local Needs labels for use of CoreTect, a slow-release tablet formulation of imidacloprid, and a trunk spray application method for Safari (dinotefuran). **Dr. Cowles** originated these approaches for protecting trees from hemlock woolly adelgids.
- The Greater Smoky National Park is adopting use of dinotefuran to preserve tens of thousands of hemlock trees from hemlock woolly adelgid. Choosing dinotefuran over imidacloprid appears necessary for maintaining the health of infested trees because warmer winters and drought stress has led to trees dying within 3 years of initial infestation. Application guidelines were developed by park staff in consultation with **Dr. Cowles**; evidence from his work will lead to approximately twice as many trees being preserved with the same amount of insecticide.

- The Delaware Water Gap National Park is using the minimum effective dosage treatment method to maximize the number of hemlocks they can preserve for the amount of funding available.
- Several arborists have adopted the trunk spray method for managing hemlock woolly adelgid and elongate hemlock scales for hemlocks in Connecticut, especially on sites with large numbers of trees. This treatment method is easily applied, precise, effective, and minimizes the contamination of soil with insecticides.

### ***Chemical insect pest management:***

Annual bluegrass weevil (ABW) continues to be the most difficult insect pest to manage on golf course turf. Pyrethroid resistance resulting from about 13 years of intensive selection have led to serious problems of cross resistance to other insecticides, due to enhanced metabolic detoxification. **Dr. Cowles** determined that Spinosad, a natural product insecticide, appears to be one of the most reliable products for targeting ABW larvae. A field dose-response experiment determined that the labeled application dosage of 52 fluid ounces per acre is necessary to obtain about 80% population reductions. Half of that dosage provides about 50% ABW mortality.

### ***Impact:***

- Golf course superintendents have become less reliant on pyrethroid insecticides, and are increasingly using biorational insecticides spinosad or indoxacarb to target larvae resulting in better control with reduced pesticide use.

### ***IPM for Nurseries***

**Dr. Hugh Smith** has collaborated with greenhouse and nurseries growers and biological control specialists to develop biological control programs of key arthropod pests of the Connecticut ornamental plant industry. He is developing training curriculum in Spanish and has offered a series of hands-on training in pest and beneficial identification to Spanish speaking nursery workers. Twenty nursery managers and five educators have received training in biological control of greenhouse and nursery pests. Forty-five Hispanic workers have received training in Spanish on biological control of key greenhouse pests. He has assisted in the establishment of a web-based IPM guide for arborists and provides training and IPM material in Spanish for Spanish speaking nursery workers. A series of updated fact sheets, including a monitoring fact sheet in Spanish, are now available on the Internet.

***Impact:*** Improved monitoring skills and accurate insecticide information enables nursery growers to reduce insecticide use. By providing IPM training to Spanish speaking nursery employees, these workers can also contribute to IPM programs and insecticide reduction.

### ***Strawberry sap beetle research***

**Dr. Smith** has begun screening softer insecticides as alternatives for pyrethroids for management of the strawberry sap beetle (*Stelidota geminata*). In addition, he is developing simple, inexpensive trapping methods so that growers can determine when the sap beetle is becoming established near strawberry fields. Trapping studies continued this year. He concluded that yellow sticky ribbon was not an effective tool for monitoring sap beetle migration into strawberry fields.

#### ***Impact:***

Strawberries are an important component of Connecticut's agricultural economy. Improved monitoring and least toxic approaches will help strawberry growers reduce insecticide use.

### ***Mycology Research:***

**Dr. DeWei Li** conducts research on indoor molds of human health concern, fungal succession on building materials, and infiltration of mushroom spores from outdoors into residences.

#### ***Airborne fungi:***

**Dr. Li** studied the effects of Christmas trees on airborne molds in residences during the Christmas season in 2008 and 2009. Results to date indicate that firewood and fireplace use may be the major source for elevated airborne fungi in residences during the Christmas season, rather than Christmas trees.

**Impact:** There has been recent negative publicity on the effects of Christmas trees on airborne molds and indoor air quality. Future research should focus on not only Christmas trees, but also, fireplace use and other human activities to determine the real source for elevated airborne spore concentrations during the Christmas season.

### ***Fungal taxonomy and systematics:***

**Dr. Li** arranged the loan of 15 fungal type specimens including the type specimen for the genus *Stachybotrys* from Kew Botanical Garden, the National Museum of the Czech Republic, the University of Wisconsin, the University of Illinois, and the Padova Botanical Garden in Italy. **Dr. Li** annotated the specimens based on the latest taxonomic information and determined that five currently accepted species are actually the same species (synonyms) and that two species were given invalid names.



**Impact:** Clarifying some controversies in five species of *Stachybotrys* will help researchers and health professionals attempting to put a correct name on a *Stachybotrys* in the future and assist with research.

***New fungal taxa:***

**Dr. Li** collected fungal specimens throughout the year from both indoor and outdoor environmentalists. Three species new to science (*Spadicoides subsphaerica*, *Scolecobasidium houhense*, and *Spadicoides wufengensis*) were described. One of them was collected during Plant Science Day in 2009 at Lockwood Farm.

**Impact:** Describing these new species is significant to the knowledge of fungal biodiversity and biosystematics. The role of each of these new species in their ecosystem and environments remain to be studied. Considering that Lockwood Farm is the place where *Spadicoides subsphaerica* was discovered and this site seems to be an unlikely place to find a new species due to its heavy human activities, it is easier to understand why so many fungi remain unknown to science.

***Red Bark Syndrome Study:***

**Drs. Cheah and Li** are conducting a preliminary study on the cause and distribution of red bark syndrome in hemlock. More and more people have noted that the bark of some trees in the Northeast has turned to red or orange in color. Red bark syndrome has become a rather significant phenomenon in the last three years and has rapidly spread to most of the states in New England. The causal agent, a green alga, has been identified as a *Trentepohlia* sp. that is not among the three species which have been previously recorded in CT. They conducted a survey that has found it distributed in most areas of Connecticut. At present, it is hypothesized that global warming could be associated with increased distribution for the alga.



Hemlock trees with red bark syndrome.

**Impact:** The ecological and economic impacts of this phenomenon to our ecosystem and forest are unknown. It is very important to study why, where, and how it happens.

### **Blight of Common Bean Caused by *Phytophthora capsici*:**

Phytophthora blight, caused by *Phytophthora capsici*, was first identified on pepper and is widespread in distribution infecting solanaceous and cucurbitaceous crops. It was first documented infecting a member of the bean genus *Phaseolus* (*P. lunatus*) in Delaware in 2002, snap beans (*Phaseolus vulgaris*) in the field in Michigan in 2003 and later on Long Island, NY in 2008. In 2009, **Drs. James LaMondia and Li** observed snap and wax beans in commercial production with water-soaked lesions on foliage, stems and pods. Thirty to forty acres were affected in the flood plain of the Connecticut River in central Connecticut. Weather conditions had been warm and very wet. Lesions displayed white mycelia and sporangia and *P. capsici* was isolated from surface sterilized tissue. Pathogenicity was confirmed against bean (cv. Valentino) and pepper (cv. Cayenne). Symptoms similar to those observed in the field on both bean and pepper developed on inoculated plants and the pathogen was re-isolated. Controls did not develop disease. The morphological characteristics of the *P. capsici* isolates were measured and used to confirm the pathogen's identity. To confirm the identity of our isolate genetically, Dr. C. Vossbrinck extracted DNA from one *P. capsici* isolate and the nuclear ribosomal internal transcribed spacer (ITS) region was amplified and sequenced. The ITS sequence was identical to sequences of *P. capsici* in GenBank and confirmed our identification of this new isolate as *P. capsici*. To our knowledge, this is the first report of *P. capsici* infecting *Phaseolus vulgaris* in Connecticut and New England. To help prevent serious losses in 2010, **Dr. LaMondia** worked with the CT DEP to obtain a Section 18 registration for Revus fungicide for control of Phytophthora blight in snap beans in Connecticut. Additional research is underway to identify bean varieties tolerant or resistant to infection by the pathogen.



Snap beans with Phytophthora blight, caused by *Phytophthora capsici*.

**Impacts:** The timely identification of a new pathogen in Connecticut and the initiation of research on management of the disease may protect farm sustainability by adding integrated pest management tools consisting of appropriate fungicides and host resistance or tolerance.

#### ***Tobacco disease research:***

The Connecticut Agricultural Experiment Station Valley Laboratory was established in 1921 (as the Tobacco Substation), to combat tobacco problems and diseases such as wildfire, a devastating disease caused by a bacterial plant pathogen. Wildfire was eventually eliminated by the development of plant resistance, and ever since, tobacco breeding to incorporate genetic plant resistance to plant pathogens has been ongoing. Plant resistance to major pathogens is the most economical, environmentally responsible, and often most effective way to control plant diseases. The development of plant resistance to Tobacco Mosaic Virus (TMV) in the 1950's, to ozone damage (weather fleck) in the 1960's, black shank in the 1970's, and Fusarium wilt in the 1980's and early 1990's effectively controlled serious diseases which each threatened to seriously impact or even wipe out cigar wrapper tobacco production in the Connecticut River Valley.

There are currently a number of pathogens that threaten the crop. **Dr. LaMondia** conducts a breeding program to develop resistance to the tobacco pathogens: *Fusarium oxysporum* (causing Fusarium wilt); *Globodera tabacum* (the tobacco cyst nematode - TCN); tobacco mosaic virus, and *Peronospora tabacina* (blue mold) for both shade and

broadleaf types. The tobacco cyst nematode was first discovered in Hazardville, CT in 1951 and has since spread throughout the Valley. It can cause significant losses in shade and broadleaf cigar wrapper tobaccos in Connecticut and Massachusetts. Chemical controls use toxic and expensive fumigants and nematicides, so **Dr. LaMondia** initiated a research project with the goal of breeding for TCN resistance as a high priority in 1987. In addition, all broadleaf tobacco lines need to be resistant to Fusarium wilt as that disease is widespread and readily kills susceptible plants. Fusarium wilt increased in severity during the 1980's and early 1990's, causing up to 20% crop losses on broadleaf tobacco. The development and release of wilt-resistant broadleaf cultivars has avoided at least \$5 million per year in losses due to this disease each year since 1992. Production of CAES wilt-resistant cultivars has reduced the spread of the pathogen and kept infested fields in production without soil fumigation. All advanced shade and broadleaf lines under development continue to be screened in the field for high levels of wilt resistance. Tobacco Mosaic Virus (TMV) is also a common pathogen that can persist in soils for years and can cause economic losses. From 2002 to 2007, tobacco mosaic virus (TMV) infection resulted in significant commercial losses (\$3 to \$5 million) due to green spot development on TMV-susceptible shade and broadleaf tobacco. **Dr. LaMondia's** research demonstrated the association of green spot with TMV, and determined that plant resistance was the single most important factor for reducing green spot. All new shade and broadleaf lines being produced are selected for resistance to TMV. Resistance to TMV is determined by a single dominant gene and resistance to Fusarium wilt is the result of accumulating a number of smaller-effect genes. Resistance to both pathogens can be transferred from adapted broadleaf tobacco and can be easily selected for. Resistance to the TCN is also a single dominant gene (determined as a result of CAES research) but the source of resistance was a wild tobacco type. Resistance was transferred to flue-cured tobacco resulting in poorly adapted and very different tobacco from our cigar wrapper types. Many generations, hard selection and some luck was required to transfer nematode resistance to broadleaf without the deleterious traits associated with it.

Initial crosses for cyst nematode resistance were made in 1987 between two flue-cured tobacco lines that were obtained from cooperators in Virginia. The lines were VA-81 and PD-4 (which each carried resistance to the Tobacco cyst nematode but were unmarketable as cigar wrapper tobacco, or even as flue-cured for that matter). Both lines were crossed with three selections of Connecticut broadleaf inbreds. These inbreds were made at the CAES between C2 and three agronomically desirable broadleaf inbreds that were susceptible to all diseases. C2 is a variety that was developed with resistance to Tobacco Mosaic Virus (TMV) that coincidentally carried resistance to Fusarium wilt. It was used as a source of wilt resistance in developing broadleaf lines such as C9. C2 was developed by the CAES and released in 1961.

The initial hybrids between CT and flue-cured types were backcrossed twice to CT broadleaf to restore broadleaf characteristics, and then inbred over 10 generations. Plants were selected for agronomic type under field conditions using a system of modified single seed descent in which only the top 2% of plants (20 plants of 1,000 grown) were selected for the next generation. Plants were additionally selected for TMV

and TCN resistance in greenhouse screens. The resulting inbred (F10 generation) was not of suitable quality, so it was backcrossed again to the broadleaf variety 'Scantic' (A7) and again selfed to an inbred using pedigree selection with field and greenhouse selection for resistance and agronomic broadleaf tobacco characteristics. The resulting inbreds were progeny tested to select plants with stable homozygous resistance to TMV and the TCN and were evaluated for Fusarium wilt and blue mold resistance.

The result of this breeding program was 27 generations of selection for broadleaf agronomic characteristics with 8 cycles of selection each for Fusarium wilt, TMV and TCN resistance. The male-sterile F1 hybrid B2 is highly resistant to Fusarium wilt, TMV and the TCN. An unexpected benefit that Dr. LaMondia discovered was that the TCN-resistant inbred parent used to make the B2 hybrid was fairly resistant to blue mold and the B2 hybrid itself was also moderately resistant to the disease. Blue mold leaf spot, caused by the downy mildew pathogen *Peronospora tabacina*, has been a recurring problem in Connecticut from 1997 through 2009, causing losses up to the tens of millions of dollars annually. As a result, growers must apply fungicides on a regular basis to protect against the disease. When compared to the highly resistant tobacco varieties NC 2000 and NC 2002 developed in North Carolina, the moderately resistant varieties KT 200 and KT 206 developed in Kentucky and Tennessee, and susceptible C9 broadleaf in the same experiment, B2 was intermediate to the highly resistant NC lines and moderately resistant KT lines. This resistance was likely conferred by the VA-81 or PD-4 parents and carried through the selection process along with TCN resistance. This may not be totally unexpected as resistance genes are often clustered together on certain chromosomes and can be carried along with selection for resistance to other diseases. For example, the Cuban dark-fired variety H2000 was bred for blue mold resistance but is also resistant to the TCN in our tests. Fusarium wilt resistance was carried into commercial tobacco (such as C2) from the wild tobacco parent along with TMV resistance, and TCN resistance was itself carried along unknowingly from a wild tobacco species to commercial tobacco types in association with resistance to wildfire bacteria.

Plant resistance is the only practical means of control for Fusarium wilt and TMV. The effects of TCN resistance are more economical and actually better than preplant soil fumigation (which costs approximately \$500 per acre) as tobacco cyst nematode populations that have been reduced by the fumigation subsequently increase as a result of growing a susceptible tobacco variety. TCN resistant B2 causes cyst nematodes to hatch, enter roots, and then die as a result of resistance, effectively reducing cyst nematode populations by more than 60% while still producing a tobacco crop. Blue mold resistance would act to reduce the number of fungicide applications required to control the disease and increase crop quality. Over several years at the CAES Valley Laboratory Research Farm and in small plots with cooperating growers, B2 wrapper leaf quality was consistently as good as or better than the current broadleaf standard inbred variety C9. The use of an inbred with growers saving seed from year to year often results in genetic drift and the loss of resistance to pathogens over time. The use of a male sterile hybrid that does not produce seed will result in a stable, uniform variety with no genetic drift over time.

**Impacts:** The development of a male-sterile hybrid broadleaf cigar wrapper tobacco with resistance to most of the major pathogens, including Fusarium wilt, TMV, the TCN and blue mold, should allow sustainable crop production with reduced losses to disease and much reduced pesticide inputs.

### ***Potato Virus Y Disease in Tobacco:***

In late June 2009, stunted shade and broadleaf cigar wrapper tobacco plants in Massachusetts were observed with veinbanding, mosaic, and leaf mottle symptoms. As leaves near the top of the plant matured, they often curled under on the edges and developed fleck or etch symptoms. Some plants developed veinal necrosis. Symptoms were consistent with Poty viruses and plants were tested using two types of enzyme-linked immunosorbent assay (ELISA), a broad ACP ELISA based on a monoclonal antibody (MAb) that detects all aphid-transmitted poty viruses, and a TSA ELISA with polyclonal (PAb) and MAb that acts as a universal detection probe specific for Potato Virus Y (PVY). Plants were also tested using PAb tests for Tobacco Etch Virus (TEV), and Tobacco Vein Mottle Virus (TVMV). Symptomatic plants were positive for Poty virus, PVY, TEV and/or TVMV. **Dr. LaMondia** transferred tobacco aphids (*Myzus nicotianae*) that had fed for one week upon symptomatic broadleaf tobacco plant to nonsymptomatic tobacco plants. Three weeks after aphid transfer, target plants were symptomatic and both source and target plants tested positive for Poty, PVY, TEV and TVMV. Nonsymptomatic plants without aphids were negative for viruses. Symptoms in tobacco were initially widespread and severe in the Connecticut River Valley in Massachusetts and eventually spread to northern Connecticut. At least 3000 acres of potatoes were present near the earliest affected area in Massachusetts and volunteer potato plants were found in high incidence in fields rotated from potato in 2008 to tobacco in 2009. Growers indicated that volunteer potato tubers survived overwinter in both 2008 and 2009. Early symptom development was greatest for tobacco in close proximity to potato crops. It is known that many species of aphids transmit these viruses in a nonpersistent manner. Soil temperatures recorded at 20 cm deep in Windsor CT were as low as -4.7 C in 2007, and only as low as -1.85 C in 2008 and 2009. Critical temperatures for potato tuber death were reported to be -2.8 C or lower, so temperatures were consistent with observations of volunteer tuber survival in 2008 and 2009. Solanaceous crops, such as potato, can serve as virus reservoirs, and volunteer tuber survival two years in a row may have increased virus incidence for early-season transmission by aphids. Severely affected tobacco crops were unmarketable as cigar wrapper tobacco and destroyed. Insurance claims on crop losses were evaluated by adjustors for type of loss and tobacco crops were tested for the presence of poty viruses by a commercial testing laboratory as a requirement for insurance claims. Loss adjustment took into consideration all causes of loss and adjusted tobacco crop damage for multiple causes (for example, 75% may have been due to virus infection and 25% due to excess precipitation). Insurance estimates were provided based on the unusual severity and concluded that over 600 acres of shade and broadleaf tobacco in Massachusetts and Connecticut were destroyed as a result of infection by one or more (often all three) of PVY, TEV, and TVMV poty viruses. Total indemnity due to poty virus infection was

over \$4,750,000 for crops that would have had a value of approximately \$10,000,000 if harvested and sold at typical crop values. Additional quality losses in harvested and cured tobacco further increased the impact of the disease on the 2009 crop. This is the first report of significant economic loss associated with Poty virus diseases in cigar wrapper tobacco in Massachusetts and Connecticut. **Drs. LaMondia, Smith** and Ferrandino monitored winter soil temperatures at different depths in Connecticut and Massachusetts and concluded that potato tuber overwinter survival would only occur in protected areas and not in large open fields as in the past two years. They also monitored early-season aphid movement into tobacco and tested for infection of plants with PVY.



PVY-infected (left) and healthy broadleaf tobacco plants (right).

**Impacts:** Information associating severe crop losses with PVY and the source of virus inoculum as well as the prediction of potato tuber survival based on soil temperatures and the magnitude of virus inoculum reservoirs for the 2010 season allowed growers to make informed decisions on planting and early season aphid management options.

### ***Tobacco IPM***

**Dr. Hugh Smith** conducted a survey of tobacco growers' pest management priorities in February. This was the first survey of its kind carried out in decades. Important information on grower-perceived insect pest priorities and pesticide use was gathered. Insecticide trials aimed at suppressing aphids and aphid-borne viruses were initiated at the Valley Lab in June 2010 and experimentation with insect-excluding shade material has also been initiated.

**Impact:**

Greater utilization of effective insecticides with improved environmental profiles will help tobacco growers reduce insecticide use and lessen environmental impacts.

**Rotation crops for nematode management**

Annual rotation crops of grain pearl millet (*Pennisetum glaucum*) cv. Tifgrain 102, rapeseed (*Brassica napus*) cv. Dwarf Essex, buckwheat (*Fagopyrum* spp.), *Camelina sativa*, *Rudbeckia hirta*, and *Sesame indica* were evaluated as rotation or green manure crops for suppression of dagger (*Xiphinema americanum*) and lesion (*Pratylenchus penetrans*) nematodes in orchard rotation plots in by **Dr. LaMondia** in Connecticut and cooperator Dr. J. Halbrendt in Pennsylvania. Field plots were established in both states. Camelina, rapeseed, buckwheat, grain millet and sesame were seeded, and *Rudbeckia hirta* plots were established using 5-week-old transplants. Nematodes were counted from soil samples taken pre-plant, mid-season and two weeks after incorporating the crops as green manure in August. Lesion nematodes were also extracted from cover crop roots mid-season in Connecticut. Following the green manure treatment, all plots were planted with cereal rye (*Secale cereale*) as a lesion nematode bait plant in September. Nematodes were extracted from soil samples taken in October in Pennsylvania and from rye roots collected in early December in Connecticut. There were no differences in preplant nematode densities in soil (lesion and dagger nematodes ranged from 0 to 8 and 0 to 61 in Connecticut and 0 to 17 and 0 to 37 in Pennsylvania per 100 cm<sup>3</sup> soil, respectively). The numbers of *Pratylenchus* recovered from rotation crop roots sampled just prior to crop incorporation were also not different. Lesion and dagger nematode population levels in soil sampled prior to crop incorporation did not differ between rotation crops. *Xiphinema* numbers in soil were lowest after incorporation of the Brassica crops *Camelina* and Dwarf Essex. Buckwheat, pearl millet and sesame appeared to be good hosts and *R. hirta* was a moderate host for dagger nematodes. *Pratylenchus* populations recovered from rye roots following sesame were higher than from all other rotation crops. Few lesion nematodes were detected in soil and none in the rye roots following *R. hirta* incorporation.

**Impacts:** Rotation crops offer an environmentally friendly alternative to chemicals for nematode control but as this research demonstrates, it is important to know which nematodes are present and what effect a rotation crop may have on the population. Rotation crops may effectively reduce plant parasitic nematode populations, but can have different impacts against different nematodes.





Rotation crops for nematode management.

### ***Weed research:***

**Dr. Todd Mervosh** conducts research on weed management in a variety of crop systems and at non-agricultural sites. In the past year, his projects included weed control experiments in ornamental plants grown in containers, Christmas trees, and pumpkins. These experiments were conducted at the CAES Valley Laboratory in Windsor and/or in growers' fields or nurseries. **Dr. Ahrens** is a research partner in some experiments involving ornamentals and Christmas trees. In addition, **Dr. Mervosh** has projects underway to find effective and environmentally sound methods to control the following (phragmites), pale swallowwort, giant hogweed and Japanese stiltgrass. **Dr. John F. Ahrens**, Plant Scientist Emeritus has completed almost 18 years of service at the Connecticut Agricultural Experiment Station's Valley Laboratory following his official retirement in 1992 after 35 years of service. By cooperating in the National IR-4 program and obtaining safety and efficacy data in experiments, he has helped to obtain federal and state registrations for all of the current herbicide tools that are available for use by Connecticut and regional growers.

### ***Invasive plants:***

Mile-a-minute vine, *Polygonum perfoliatum*, originated from Asia and was first discovered in the eastern U.S. in the 1930s and is classified as a noxious weed in Connecticut. It currently infests 9 eastern states and was first recorded in Connecticut in

1997. In Connecticut, 18 towns are currently infested and the number is rapidly increasing in 2009. This rapidly growing prickly and prolific vine is annual in its northern range but quickly forms dense thickets which displace native vegetation and reduces plant diversity. An introduced weevil, *Rhynoncomimus latipes*, has been successfully reared and released for control of this invasive species in the Mid-Atlantic States. However, weevil rearing is dependent on greenhouse propagation of the vine and the development of an artificial diet for mass rearing would be beneficial in improving efficiency, space required for mass production and enhancing survival during shipments. **Dr. Cheah** is collaborating with Dr. Allen Cohen on the development of an artificial diet for *R. latipes* in cooperation with the Phillip Allampi Beneficial Insect Laboratory (PABIL), New Jersey Department of Agriculture, Trenton, NJ, with funding support from the USDA Forest Service.



Mile-a-minute vine in Greenwich, CT.

### Results:

- **Dr. Cheah** and Dr. Cohen have developed several base nutritional diets and extracts (solid and liquid) from mile-a-minute vines (stems, leaves and combinations of stems and leaves) which elicit adult and larval *R. latipes* feeding and continue to work on refining and improving the palatability and texture of the best diets. In 2009, **Dr. Cheah** tested 5 diets from Dr. Cohen, using newly emerged adult *R. latipes* provided by NJDA. A few individuals were seen feeding on one modified diet with whey protein and there was 100% adult survival for one week on that diet alone. Survival was 75% at two weeks but at 3 weeks, there was 0% survival. During the first two weeks, weevils were also observed to be mating and defecating, and there a color change in adults from predominately black to speckled black and orange, indicating consumption of diet material. This

finding was encouraging as previous diets had not attracted adults to feed nor supported any prolonged survival in the absence of the host plant.

- **Dr. Cheah** has been developing laboratory methods to study adult weevil oviposition and feeding behavior, improve egg handling techniques for the study of diet response of immature stages. Behavioral observations of *R. latipes* feeding and oviposition in the laboratory indicate that weevils feed and deposit eggs on developing seed heads of *P. polygonum*.

**Impact:** A suitable artificial diet for *R. latipes* would enhance mass rearing for the expanding biological control program of mile-a-minute vine which is currently based on live plant cultures.

### ***Implementation of Biological Control of Mile-A-Minute Vine***

A collaboration between **Drs. Cheah and Mervosh** of the Valley Laboratory and Donna Ellis from the University of Connecticut, resulted in a release of 7,000 *R. latipes* with federal approval in Connecticut in 2009 for the first time in 5 towns: North Haven, Greenwich, Newtown, New Milford and Bridgewater, in cooperation with the University of Delaware, NJDA PABIL, DEP (CT) and with the support of USDA Forest Service and USDA APHIS PPQ. Weevils have survived the Connecticut winter and an intense March flooding and in all 2009 release sites, there were signs of overwintering survival, feeding damage to MAM, reproduction and a new generation of weevils in mid-June 2010. Additional releases of 6,000 *R. latipes* were implemented in mid-May 2010 in the towns of Stamford, Westport and Fairfield.



***Impacts:***

- Connecticut is now an active participant in the increasingly important arena of biological control research of invasive weeds with 13,000 weevils released to control mile-a-minute vine in the western portion of the state
- Establishment of biocontrols for mile-a-minute vine would provide a natural control to limit spread and range expansion of a noxious and prolific invasive weed, and reduce the need for chemical control, especially in watershed areas

***Christmas Trees***

**Dr. Cowles** tested dinotefuran used as a basal trunk spray in Christmas tree plantations to suppress armored scales demonstrated that this product can be useful, especially on trees 6 feet tall or shorter, for integrating chemical and biological control. A regression model from field data related in a single equation the degree of population suppression (probit scale) to the logarithm of the dosage and the cube of the height of the trees. Growers in CT, PA, and RI are now adopting this method to suppress scale populations in their plantings.

***Impact:***

- Many Christmas tree growers have adopted the dinotefuran basal trunk spray to suppress armored scales in their plantings. Other growers are continuing to use the foliar application of bifenthrin for the same purpose. Both approaches were developed by **Dr. Cowles**.

SERVICE ACTIVITIES

***Requests for information:***

A total of 6,011 inquiries were answered at the Valley Laboratory during the past year. The majority of these queries (75%) were answered by **Dr. Mervosh** (1,883), and **Ms. Rose Hiskes** (1,274) in the inquiry office, and by **Dr. LaMondia** (1,838). About 61% of the information requests were from the public sector; the remainder was from commercial growers and pest control operators.

Valley Lab scientists made 118 presentations to grower, professional and citizen groups, (approximately 5678 people), were interviewed 17 times and made 289 visits to commercial and municipal fields, nurseries, greenhouses, Christmas tree farms, forests and private landscapes to diagnose complex problems or conduct research projects.

**Dr. LaMondia** initiated and maintained the Blue Mold Information Line recorded phone message and a Connecticut River Valley Blue Mold Web Site to keep tobacco growers current with the progress of blue mold in North America, and the potential exposure and management options in the Valley. He worked with the CT DEP to obtain a Section 18 registration for Revus fungicide for control of Phytophthora blight in snap beans in CT.

***Soil testing:***

A total of 4,390 soil tests were expertly performed by **Ms. Diane Riddle** during the past year. About 56% were performed for commercial growers, 38% for homeowners, 4% for municipalities, and the remainder for Station research. Of the commercial samples submitted, 57% were for landscapers; 28% for tobacco growers; 3% for vegetable growers, 4% for nursery growers; 3% for golf course superintendents; 3% for fruit growers, 1% for Christmas tree growers; and the remainder for all other categories.

***Gordon S. Taylor Conference Room:***

Many agricultural organizations used the conference room at the Valley Laboratory regularly for their meetings. During the past year, 24 different groups used the room on 56 occasions. Our most frequent users were the Connecticut Rhododendron Society, Connecticut Invasive Plants Council, Connecticut Farmland Trust, Connecticut Invasive Plants Working Group, the CT Wine Association, Connecticut Chapter of the National Organic Farmers Association, Connecticut Department of Agriculture, and the Connecticut Nursery and Landscape Association. **Ms. Jane Canepa-Morrison** scheduled the appointments and **James Preste** arranged the furniture for scheduled meetings and ensured that the room was available after hours.

**SCIENTIFIC JOURNAL ARTICLES PUBLISHED BY OUR STAFF  
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