

# STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION



## THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

STATION NEWS  
*PUTTING SCIENCE TO WORK FOR  
SOCIETY*

The mission of The Connecticut Agricultural Experiment Station is to develop, advance, and disseminate scientific knowledge, improve agricultural productivity and environmental quality, protect plants, and enhance human health and well-being through research for the benefit of Connecticut residents and the nation. Seeking solutions across a variety of disciplines for the benefit of urban, suburban, and rural communities, Station scientists remain committed to "Putting Science to Work for Society", a motto as relevant today as it was at our founding in 1875.



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## DEPARTMENTAL NEWS

### ADMINISTRATION

**DR. THEODORE ANDREADIS** attended the Invasive Plant Council Meeting held at the Department of Agriculture in Hartford (October 29) and presented an invited seminar entitled, *West Nile Virus: The Emergence and Spread of an Exotic Mosquito-Borne Disease in the Western Hemisphere*, at the New Haven County Cooperative Extension Center in Hamden (12 attendees) (October 30).

### ANALYTICAL CHEMISTRY

**MS. TERRI ARSENAULT** was an Instructor for the FDA LB508 FERN training class entitled "Drug and Poisons Screen using Acidic and Basic Extraction with Gas Chromatography and Mass Selective Detection" in Richmond, VA (10 attendees) (October 28-31).

**DR. BRIAN EITZER** participated in conference call of the NACRW (North American Chemical Residue Workshop) Organizing Committee (October 10).

**MR. JOSEPH HAWTHORNE** attended the 10th International Phytotechnologies Conference in Syracuse NY and gave a poster presentation entitled "Trophic Transfer Potential of Cerium Oxide Nanoparticles Through a Terrestrial Food Chain" (October 1-4); met with Tim Hollister of EMD Millipore to coordinate the installation of our new ultrapure water filtration system (October 15); and met with Ms. Yanyan Zhang, a student working in the research group of **DR. JOSEPH PIGNATELLO**, to discuss sample analysis by GC-MS (October 18).

**DR. CHRISTINA ROBB** attended the webinar "Profiling Trace Metals with ICP-MS and Mass Profiler Professional (MPP) in the Wine Industry" by Dr. Helene Hopner of the UC Davis Department of Viticulture and Enology (October 8).

**DR. JASON C. WHITE** attended the 10<sup>th</sup> International Phytotechnologies Conference in Syracuse NY, gave a plenary session presentation entitled "Plant-Nanoparticle Interactions" (220 attendees), and a poster presentation entitled "Nanoparticle Co-exposure Alters the Toxicity and Accumulation of Persistent Pesticides in Agricultural Crops" (October 1-4); hosted the annual Editorial Board meeting of the *International Journal of Phytoremediation* in Syracuse NY (October 3); as President of the International Phytotechnology Society hosted the annual Officer's meeting (October 3); attended the monthly Laboratory Preparedness Advisory Group Meeting at the CT Department of Public Health Laboratory in Rocky Hill CT and gave a lecture entitled "Nanotechnology use in agriculture: Benefits and potential risks (25 attendees) (October 7); hosted Professor Stephen Ebbs of Southern Illinois University and discussed ongoing and future collaborative research (October 8-9); along with **DR. BRIAN EITZER, MS. KITTIPATH PRAPAYOTIN-RIVEROS, MS. TERRI ARSENAULT, MR. CRAIG MUSANTE, MR. MICHAEL CAVADINI, DR. CHRISTINA ROBB, MR. JOSEPH HAWTHORNE, DR. ROBERTO DE LA TORRE ROCHE, MR. JOHN RANCIATO, AND DR. WALTER KROL** participated in a 2.5 day in house accreditation training session entitled "ISO/IEC 17025:2005, Internal Auditing and Root Cause Analysis" given by A2LA and focused on overall FDA-sponsored accreditation activities (October 15-17); participated in a conference call hosted by Professor Jason Unrine of the University of Kentucky on an upcoming session at the Sustainable Nanotechnology Conference where we will be giving a co-presentation on nanoparticle cerium interactions with plants and preparing a review manuscript for submission to a new journal called *Environmental Science: Nano* (October 25); and along with **MS. KITTIPATH PRAPAYOTIN-**



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**RIVEROS, MS. TERRI ARSENAULT, MR. MICHAEL CAVADINI** participated in a conference call entitled "Sampling Agreement: ISO and MFRPS Grantees" by FDA ORA (October 29).

## ENTOMOLOGY

**MR. MARK H. CREIGHTON** was the keynote speaker and gave a presentation titled "The History of Beekeeping in Connecticut, Past and Present" for the Middlesex County Farm Bureau (45 members and guests attended) (October 9).

**MS. KATHERINE DUGAS** along with **MS. ROSE HISKES** treated two forest pest volunteers to lunch in Windsor (October 22) and with **DR. GALE E. RIDGE**, participated in the Bridgeport Health Fair at the University of Bridgeport educating citizens about human bed bugs (over 500 visitors came to the display) (October 31).

**MS. ROSE HISKES** met with Dr. Jane O'Donnell, Invertebrate Collections Manager, University of Connecticut, to go through Cooperative Agricultural Pest Survey (CAPS) trap catches from state lands to see if any state listed species were caught. No state listed species were found. Several carabid beetles were sent to Dr. Bill Krinsky for identification (October 8). Gave a talk on Butterfly Gardening and Forest Pests to the Burlington Garden Club in Burlington (31 attendees) (October 10); participated in the Cooperative Agricultural Pest Survey Regional State Survey Coordinators conference call (October 17); staffed a forest pest table and gave a brief talk on the Asian longhorned beetle, the Emerald ash borer, and Don't Move Firewood at the Knox Park Tree Planting at Colt Park in Hartford (52 attendees) (October 19); with **MS. KATHERINE DUGAS**, treated two forest pest volunteers to lunch in Windsor (October 22); gave a talk on the Asian longhorned beetle, Emerald ash borer, and Don't Move Firewood to the Insect Pests of Turf and Ornamentals class at Naugatuck Valley Community College in Waterbury (17 attendees) (October 23); participated in the Connecticut Invasive Plant Working Group steering committee meeting at the Connecticut Forest and Park Association in Middlefield (October 24); and staffed a forest pest table at the Connecticut Urban Forest Council Conference in Southington (37 people were directly contacted) (October 30).

**DR. CHRIS T. MAIER** was interviewed about the brown marmorated stink bug by Nancy Crevier of the Newtown Bee (October 18) and was interviewed about research on 17-year periodical cicadas by Steve Grant, freelance writer and contributor to the Hartford Courant (October 28).

**DR. GALE E. RIDGE** spoke about bed bugs to teachers, maintenance staff, and students at Quinnipiac University in Hamden (60 attendees) (October 17); spoke about the behavior and biology of bed bugs and the psychological price of dealing with bed bugs to teachers, maintenance staff, and students at the New Haven Jobs Corps Center (over 200 attendees) (October 30); and with **MS. KATHERINE DUGAS**, participated in the Bridgeport Health Fair at the University of Bridgeport educating citizens about human bed bugs (over 500 visitors came to the display) (October 31).

**DR. CLAIRE E. RUTLEDGE** taught the "Insects that Attack Trees" class for the CTPA's Arboriculture 101 course in New Haven (35 adult attendees) (October 2); gave a guest lecture on the Emerald ash borer to an Ecology class at Middlesex Community College in Middletown (25 adult attendees) (October 9); gave a guest lecture on the Emerald ash borer for the Invasive Species symposium at Wesleyan University in Middletown (24 adult attendees) (October 17); and taught the "Tree Conditions Laboratory" for the CTPA's Arboriculture 101 course in New Haven (35 adult attendees) (October 30).





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**Dr. Gale Ridge** and **Ms. Katherine Dugas** educating citizens about human bed bugs at the Bridgeport Health Fair.

**DR. VICTORIA L. SMITH**, with **MS. TIA BLEVINS**, participated in a Systems Approach to Nursery Certification (SANC) Exercise, in cooperation with the Horticultural Inspection Society-Eastern chapter. The exercise was held in and around Chatsworth, New Jersey, and included visits to a blueberry plant nursery, a cranberry bog, and a cranberry propagation facility. Inspectors from eight northeastern states participated (October 15-17). Participated in a workshop "Disease and Pest Management in the Landscape," sponsored by UConn-Extension and the Northeastern Division of The American Phytopathological Society, held at the Heritage Resort in Southbury, with a talk titled "Two Years Later—the CT Boxwood Blight Experience" (approx. 100 participants) (October 25).

**DR. KIRBY C. STAFFORD III** participated in a Board Meeting of the Connecticut Coalition Against Bed Bugs (5 attendees) (October 3); submitted the Station's Affirmative Action Plan to CHRO in Hartford (October 22); with **DR. LAURA HAYES**, met with Mason Kauffman from US Biologic to discuss tick research (October 23); and spoke on tick-borne diseases and tick management at a Department of Entomology, Penn State University, seminar series in State College, PA (50 attendees) (October 25).

**DR. KIMBERLY A. STONER** was interviewed for an article on pollinators by Myrna Watanabe for BioScience magazine (American Institute of Biological Sciences), and also sent her photographs by **MR. MICHAEL THOMAS** and **MS. JESS GAMBEL** (seasonal worker) for the article (September 18); participated in a meeting of the Urban Agriculture Working Group held at City Hall in New Haven (October 10); participated in a panel on Pest Management Policy, focusing on policies for pest management on municipal and school outdoor properties, sponsored by the North Haven Conservation Commission at the North Haven Public Library (40 attendees) (October 23); organized and led a meeting on lead and arsenic in soils in New Haven, working on best practices to mitigate or avoid these contaminants in urban agriculture with **MR. THOMAS RATHIER** of the Valley Laboratory and Dawn Pettinelli of the Soil Testing Laboratory at the University of Connecticut and representatives of New Haven agricultural and environmental groups (7 attendees and several more participating by e-mail) (October 24).



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## ENVIRONMENTAL SCIENCES

**MR. GREGORY BUGBEE** spoke at a meeting of the Fence Rock Lake Association in Guilford on “Control of Brazilian waterweed with herbicides, grass carp and drawdown.” (approx. 30 attendees) (October 10).

**DR. GOUDARZ MOLAEI** met with Mason Kauffman, US BIOLOGIC CEO, regarding incorporating “Lyme Shield” a Lyme disease vaccine for reservoir rodents into our ongoing CDC-funded project and a proposal for additional funding for consideration by US BIOLOGIC (October 23); and met with Dr. Stephen Dellaporta of Yale University, Department of Molecular, Cellular and Developmental Biology, to discuss collaboration and finalization of a grant application on population genetic studies of the main vector of eastern equine encephalitis virus (October 16).

**DR. JOSEPH PIGNATELLO** gave an invited seminar at Department of Civil and Environmental Engineering, University of Connecticut, Storrs on novel interactions of organic molecules and ions at the interfaces of environmental solids (October 11); met with Prof. Dr. Mark van Loosdrecht, Delft University, Netherlands, the Association of Environmental Engineering and Science Professors (AESSP) Distinguished Lecturer at Chemical and Environmental Engineering Department, Yale University (October 21) to discuss mutual research interests; and met with Prof. David Sedlak, University of California, Berkeley, the Henske Distinguished Lecturer at Chemical and Environmental Engineering Department, Yale University to discuss mutual research interests (October 30).

**MR. MICHAEL C. THOMAS** co-instructed lab field trip to Archbold Biological Research Station, Lake Placid, Florida for the Yale University EEB Terrestrial Arthropods that was (attended by eight students) (October 23-27); and presented recommended changes to the State Endangered Species list to the Taxonomic Advisory Committee on Rare and Endangered Insects at the DEEP Eastern District Headquarters in Marlborough (October 29).

## FORESTRY AND HORTICULTURE

**MR. JOSEPH P. BARSKY** met with Sarah Williams and Ted Mankovich of the Guilford Conservation Land Trust to assess native habitat restoration efforts and invasive plant species control measures (October 25) and attended the Connecticut Urban Forest Council Annual Conference and Forest Forum in Plantsville, CT (October 30).

**DR. ABIGAIL MAYNARD** assisted biology students with their projects at Hamden Hall Country Day School (15 students) (1 adult) (October 10) and discussed farming at Lockwood Farm to Pre-Kindergarten and Third grade students at Hamden Hall Country Day School (32 students) (4 adults) (October 15).

**MR. MICHAEL R. SHORT** presented a poster entitled “Evaluation of Eight Repellents in Detering Eastern Cottontail Herbivory in Connecticut” at The Connecticut Urban Forest Conference & The Connecticut Forest Forum in Southington (200 attendees) (October 20).

**DR. SCOTT WILLIAMS** met with University of New Haven graduate student Moises Torrent to initiate master’s project further investigating the role of deer in seed dispersal, New Haven, CT. (October 1); attended a graduate committee meeting of University of Connecticut master’s candidate Megan Floyd, Storrs, CT. (October 3); organized and attended the 25th Annual Conference on Urban and Community Forestry and the 9th Annual Forest Forum and moderated the session “Wildlife Habitat Enhancement Using Forest Management Tools”, Plantsville, CT (80 attendees) (October 30); and participated in a the meeting of The Connecticut Agricultural Experiment Station’s Institutional Animal Care and Use Committee (October 31).



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**DR. JEFFREY WARD** interviewed about fall colors by Mary Ellen Godin of the Meriden Record Journal (October 7); spoke on invasive species control to a combined meeting of the Litchfield, Goshen, Morris, and Cornwall Land Trusts in Litchfield (65 attendees) (October 10); spoke on "A short history of the Connecticut forest" to Bethany Garden Club (27 attendees) (October 15); met with Dave Goodson, Manager of Vegetation Management at Northeast Utilities, to discuss roadside forest management (October 21); spoke on "Impacts of invasive control and herbivory reduction on plant communities" at the Society of American Foresters National Convention in Charleston, SC (15 attendees) (October 24); gave invited talk "Precommercial crop tree release at canopy closure benefits oaks saplings" at the SAF Oak Silviculture: Noteworthy Advances, Looming Challenges special session in Charleston, SC (50 attendees) (October 26); participated in a Connecticut Invasive Plant Council meeting in Hartford (October 29); moderated a session on wind and roadside forests at the Connecticut Urban Forest Conference in Southington (100 attendees) (October 30); and spoke on "Crop tree management - managing a forest one tree at a time" at the Yale Forestry Forum (23 attendees) (October 31).

## PLANT PATHOLOGY AND ECOLOGY

**DR. SANDRA L. ANAGNOSTAKIS** visited the site of the former R. T. Morris estate, Merriebrook, in Stamford/Greenwich, which is now Mianus River Park, with Morris' granddaughter and the author of Morris' biography. They had hoped to find some of the chestnut trees planted by Morris near his house, but found none remaining (October 4); gave a talk titled "The History of Chestnut Work at The Connecticut Agricultural Experiment Station" at the 30<sup>th</sup> Annual Meeting of The American Chestnut Foundation held in Herndon, VA (October 19).

**DR. SHARON M. DOUGLAS** attended the Annual Meeting of the Northeastern Division of The American Phytopathological Society held at the Heritage Resort in Southbury and participated in the Extension/Industry Meeting and assisted with judging the Graduate Student Research Award (64 attendees) (October 23-25).

**DR. WADE H. ELMER** presented a seminar titled "Sudden Vegetation Dieback: A Tripartite Interaction Between a Plant, Fungus, and Crab" to the Biology Department at Southern CT State University in New Haven as part of their seminar series (17 students, 4 adults attended) (October 9); presented a talk titled "Biochar, Earthworms, and Soil Health" at the Annual Meeting of the International Biochar Institute held at the University of Massachusetts in Amherst, MA (28 attendees) (October 15); attended the Annual Meeting of the Northeastern Division of The American Phytopathological Society (NED-APS) held in Southbury and participated in the Extension/Industry Meeting (October 23); and the business meeting (October 24), and co-sponsored a joint NED-APS/UCONN Landscape Management and Care Symposium (120+ growers attended) (October 25).

**DR. FRANCIS J. FERRANDINO** delivered a paper titled "Epidemiological Time Scales: A Self-Similar Approach" at the Annual Meeting of the Northeastern Division of The American Phytopathological Society held in Southbury (30 attendees) (October 23-25).

**MS. MARY K. INMAN** spoke on "Fruit Trees in the Home Garden" to the Caudatowa Garden Club of Ridgefield (30 adult attendees) (October 8).

**DR. YONGHAO LI** presented a talk titled "Disease Update for the 2013 Season" at the Extension/Industry Meeting at the Annual Meeting of the Northeastern Division of The American Phytopathological Society in Southbury (30 attendees) (October 23-25) and staffed the "hands-on" table with tree diseases for Arboriculture 101 in Hamden (25 attendees) (October 30).

**DR. ROBERT E. MARRA** joined fellow members of the Steering Committee of the Connecticut Conference on Natural Resources in a phone conference to plan the upcoming 2014 CCNR in March (October 7) and hosted and attended the Annual Meeting of the Northeastern Division of The American Phytopathological Society held at the Heritage Resort in Southbury (64 members attended) (October 23-25).





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## VALLEY LABORATORY

Thank you note from Lorie Reardon from Charter Oak Health Center to FoodShare. The Valley Laboratory sent pumpkins to Foodshare and they were widely distributed.

*To:* Dom Piccini and Gloria McAdam (Food share)

*From:* Lorie Reardon (Charter Oak Health Center)

Just want to thank you and your staff (Fran, Danny...) for your efforts in honoring my request for pumpkins!!! My patients will all be able to leave with a pumpkin after learning how to make homemade pumpkin pie in nutrition class. Gloria's Dream Team came through again and I am grateful again...



**DR. CAROLE CHEAH** was interviewed by Robert Miller of the Danbury New Times on the status of hemlocks and resurgence of hemlock woolly adelgid in Connecticut (September 5) and together with Donna Ellis of University of Connecticut, spoke to 6<sup>th</sup> graders and their science teacher from the Independent Day School, Middlefield, on biological control of the invasive mile-a-minute weed during weevil activity monitoring at the 2012 release site, (September 12).

**DR. RICHARD COWLES** participated in a town forum on pesticides by presenting "The pesticide ban on school grounds: Has the ban been a good idea?", North Haven (20 attendees plus public access TV audience) (October 23); presented "Insect pests: Choosing appropriate management tools," to an American Phytopathological Society Northeast Division workshop, Southbury (102 attendees) (October 25); and spoke at the regional spotted wing drosophila research and extension workshop on "Trap improvements, phagostimulants, and behavioral control," Bridgeton, NJ (30 attendees) (October 30).

**DR. JAMES LAMONDIA** conducted a tour of Valley Laboratory research plots and discussed Station research with delegates from the Zhongkai China University of Agriculture and Engineering (3 attendees) (September 3); met with Brandon Settje and Fredy Santos of Altadis to discuss tobacco research and integrated pest management (September 5); welcomed participants, gave a Station update and spoke about Boxwood blight research and management options during the Nursery and Landscape Research Tour held at the Valley Laboratory (40 attendees) (September 10); examined candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven (September 11); participated in a boxwood blight research group conference call to present research results and future objectives (12 attendees) (September 24); 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 attendees) (September 25); and spoke



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about research results at the annual meeting of the Northeast Regional Multistate Nematology Technical Committee (NE-1040) held in Geneva NY (15 attendees) (October 2-4).

**DR. DEWEI LI** hosted a four-member delegation of from Zhongkai University of Agriculture and Engineering and Guangdong Ocean University, China (September 3). The delegation included Prof. Zaohe Wu, Vice President of Zhongkai University of Agriculture and Engineering (ZUAE), Prof. Gang Chen, Associate Dean of Fisheries College, Guangdong Ocean University, Prof. Shengmei Yao, Director of Foreign Affairs of ZUAE, Prof. Wenhong Zhao, Food Science and Engineering, College of Light Industry and Food Science, ZUAE. DeWei also hosted a visit by Dr. Haisheng Yuan, Associate Professor of State Key Laboratory of Forest and Soil Ecology, Institute of Applied Ecology, Chinese Academy of Sciences (September 3-4). Dr. Yuan specializes in the biosystematics of Poriales and is currently a visiting professor at Dr. Don Pfister's lab at Harvard University. During his visit, forays were made to Salmon River State Forest and Natchaug State Forest to collect specimens. Dr. DeWei Li spent a month of sabbatical leave at Nanjing Forestry University conducting collaborative research with Drs. Jianren Ye and Xiaoqin Wu on relationship of rhizospheric fungi and pine wood nematode disease from September 21-October 20. During his visit DeWei gave a presentation "Principles of Research Paper Writing and publication" with 42 people in audience. Dr. Xiuguo Zhang, Professor and mycologist of Department of Plant Pathology, Shandong Agricultural University and three of his Ph.D. students visited DeWei at Nanjing Forestry University (October 14) to discuss current developments and future direction of research on hyphomycete taxonomy and the possibility of collaboration in the future.

**DR. TODD L. MERVOSH** organized the meeting and gave a talk on "New weeds and herbicide issues" at the Nursery & Landscape Research Tour at the Valley Laboratory in Windsor (35 attendees) (September 10); spoke about management of swallowworts and other weeds at the fall meeting of the Conn. Christmas Tree Growers Assoc. in Brooklyn (50 attendees) (September 21); and talked about invasive plants at a National Public Lands Day event at Hilltop Farm in Suffield (10 adults and 10 children) (September 28); met with officials at Loomis-Chaffee School in Windsor regarding management of invasive weeds and conversion of fields to pastures (October 2); participated in a board meeting of the Northeastern Weed Science Society in Philadelphia, PA (October 14-15); participated in a Connecticut Invasive Plant Working Group steering committee meeting in Middlefield (October 24); and presented an invasive plants display at the Suffield Garden Club's flower show in Suffield (October 25-26).

**DR. TODD L. MERVOSH** and **MS. DIANE RIDDLE** were interviewed at the Valley Laboratory by freelance writer Geof Fowler about soil testing, lawn fertilization, and control of weeds and grubs for his article "Lawn care tips: soil testing" posted on the TRACTOR.COM website (September 19).

### NURSERY AND LANDSCAPE RESEARCH TOUR AT VALLEY LABORATORY

The Nursery and Landscape Research Tour was held on September 10, 2013 at the CAES Valley Laboratory in Windsor. After welcoming remarks from Dr. James LaMondia and Dr. Todd Mervosh, the following talks were presented outdoors: "Boxwood blight: research and management options" by Dr. LaMondia, "Water use: best management practices" by Mr. Thomas Rathier, and "Spread and containment of running bamboo" by Dr. Jeffrey Ward. After Dr. Mervosh presented tributes to Dr. Louis Magnarelli and Dr. John Ahrens, the following talks were presented in the Gordon S. Taylor Conference Room: "New weeds and herbicide issues" by Dr. Mervosh, "Disease update for 2013" by Dr. Yonghao Li, "Regulatory status of boxwood blight" by Dr. Victoria Smith, "Insect update for 2013" by Ms. Rose Hiskes, "Emerald ash borer (EAB) biology, distribution, biocontrol" by Dr. Claire Rutledge, and "Protecting ash trees from EAB" and "Management of armored scales" by Dr. Richard Cowles.

Twenty-eight nurserymen and landscapers attended the meeting, and total attendance including CAES personnel was about 45 people. Thanks to Mr. James Preste, Valley Laboratory's farm manager, for preparing the grounds and conference room for this meeting.





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## JOURNAL ARTICLES APPROVED OCTOBER 2013

**Peterson, R.B.**, Oja, V., Eichelmann, H., Bichele, I., and Laisk, A. Occurrence and implications of invariant chlorophyll fluorescence distinct from photosystem I emission in developing C3 and C4 leaves. *Photosynthesis Research*.

Rapp, M., Schein, J., Hunt, K.A., Mourad, G.S., and **Schultes, N.P.** Zea mays and Setaria viridis nucleobase cation symporter 1 (NCS1) redefine plant-specific solute recognition profile for NCS1. *Journal of Plant Physiology*.

## GRANT AWARDS JANUARY-OCTOBER 2013

**DR. THEODORE ANDREADIS** and **DR. PHILIP ARMSTRONG** have been awarded an Epidemiology and Laboratory Capacity for Infectious Diseases (ELC) Cooperative Agreement Grant from the Federal Centers for Disease Control and Prevention and the Connecticut Department of Public Health to support the Mosquito/West Nile Virus Surveillance Program (\$125,000).

**DR. JOSEPH J. PIGNATELLO** "Investigating Coagulant Aid Alternatives to polyDADMAC Polymers," Funding is a sub-contract to William A. Mitch (Stanford U.) and Joseph J. Pignatello of a larger grant awarded to David A. Cornwell, et al. of ENVIRONMENTAL ENGINEERING AND TECHNOLOGY INC; source, Water Resources Foundation; period, July 1, 2013 to June 30, 2014; (our share, \$100,000).

*Executive Summary:* We have brought together a Team that includes entities from engineering, utility, university, and manufacturing to address this important issue of finding cost effective and available alternatives to polyDADMAC and Epi-DMA polymers. We have four manufacturers on our Team. *Kemira* is a leading producer of synthetic polymers and will advise and supply internal research products on alternate polyDADMAC structures. *Ingredion* is a national starch company that has been actively pursuing production and research on natural polymers altered by adding functional groups to corn starch. Similarly, *Western Polymer Corporation* has been doing the same thing with potato based starches. Both have agreed to supply appropriate cationic starch polymers. *Dungeness Development Associates* is a major supplier of chitosan and will supply and work with us on the application of chitosan. We are also fortunate to have nine utility participants all of whom will supply water for bench testing: MWD, EBMUD, Thornton, Gulf Coast, Cincinnati, Newport News, Henrico, Louisville, and Ann Arbor. Four of the utilities will conduct field pilot studies: MWD, EBMUD, Newport News, and Henrico. Our effort is aimed at evaluating and finding polymers that can have immediate application as replacements for polyDADMAC. Our approach includes: 1) Evaluate reducing polyDADMAC dose to balance treatment performance and nitrosamine production. This will clearly have some limitations to success. 2) Evaluate and determine limitations of changing to a high charge density or mid-charge density polyacrylamide (PAM). These polymers are readily available but have some limitations as a polyDADMAC replacement. 3) Evaluate a major manufacturer's internal effort at modifying polyDADMAC to make it less prone to form nitrosamines. 4) Evaluate already manufactured and readily available potato starch polymer; corn starch polymer; and chitosan. 5) Evaluate a novel approach to modifying polyDADMAC by changing N-group to Pgroup. This product would be less readily available but if successful opens up a new area for manufacturers to explore in both the coagulation area and also for modification to anion resins which also promote nitrosamine formation. An additional outcome of this work will be the start of a database on nitrosamine reduction as a result of changing polymer. Currently researchers have developed several case studies that indicate for a given source water, treatment method, polymer type, chloram-



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ination method, etc. there is a certain NDMA level. This research will have a database for 10 water sources on the impact changing polymer has on nitrosamine formation. Our final report will contain a utility applications section that will include information on: How to evaluate the alternate polymers; What engineering changes are needed to the chemical feed infrastructure to make the change; What are the capital and operating cost implications?

**DR. GOURDARZ MOLAEI, DR. KIRBY C. STAFFORD AND DR. SCOTT WILLIAMS** An Integrated and Individual Tick Management Program to Reduce Risk of Lyme Disease in a Residential Endemic Area, \$900,000 for 3 years (September 2012- September 2015) (a renewal was awarded in 2013); Center for Disease Control and Prevention (CDC).

*Executive Summary:* Lyme disease (LD) is the most important tick-associated disease in the United States. A variety of prevention and control methods, including personal protective measures, habitat modification, applications of biological and natural compounds, and host-targeted control measures, have been examined for reducing tick abundance and risk for LD. The primary aim of this proposal is to develop, implement, and evaluate individual and integrated tick management (ITM) approaches to reduce the entomological risk of LD. In addition, an enhanced LD decision support system will be constructed by incorporating the new findings obtained from the proposed project. The practical application of an effective tick bite protection program requires easy public access to decision support tools for promoting widespread usage of tick control strategies. We propose to examine the efficacy and associated costs of several existing and new tick control measures individually as well in the framework of the ITM approach to reduce the number of infected ticks in the inland LD endemic neighborhoods. An economic cost-benefit analysis for tick management and LD will involve costs associated with medical expenses for diagnosis, treatment, and productivity losses versus costs of prevention and control. The proposed ITM approach is a novel combination of applications of biological (insect pathogenic fungus) and natural less-toxic compounds, pesticides, habitat modification, and host reduction. We will improve upon the timing and frequency of spray applications by analyzing the residual activity of natural compounds in comparison with synthetic products. In addition, we have developed molecular techniques to identify hosts of tick vectors to directly estimate vector-contact with different vertebrate species, which is essential for evaluating their relative importance as reservoir hosts for LD and other tick-associated diseases. Furthermore, by taking advantage of a molecular epidemiological approach, we will track the temporal distribution of the LD-causing spirochetes and other pathogens in tick populations and reservoir hosts in conjunction with our tick management program. In short, by adapting a novel ITM strategy, we will examine and compare shared and dissimilar components of an ITM approach for LD control. By incorporating entomological data and other information acquired by the proposed project into our decision support system, we will provide guidance on the most effective control measures that will help stakeholders to protect themselves in an environmentally safe manner. The approach and findings generated from this project will easily be extended to other LD endemic regions.

The proposed Integrated Tick Management project will be conducted in the Town of Redding in Fairfield County, Connecticut; an area highly endemic for Lyme disease (LD). This project combines the expertise of researchers at The Connecticut Agricultural Experiment Station (CAES), Yale University (Yale), the University of Rhode Island (URI), and White Buffalo, Inc. (WBI). We will provide quantitative assessment of the reduction in the prevalence of ticks infected with the LD agent, and other pathogens by the application of synthetic and least-toxic compounds for tick control, landscape management through the control of Japanese barberry, and reduction of white-tailed deer population density. In order to evaluate the various strategies for managing disease risk, we will conduct a cost-benefit economic analysis that builds on existing science, new information from the project, and the economics associated with the disease. A LD decision support system will be developed to provide residents guidance on determining the best individual and ITM approaches.



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**MR. GREGORY BUGBEE** Aquatic Vegetation Monitoring and Remediation Options for Moodus Reservoir, East Haddam, CT; source, Town of East Haddam; \$5,000; 2013. CAES Invasive Aquatic Plant Program (IAPP) will survey Upper and Lower Moodus Reservoir, East Haddam for aquatic vegetation. The survey will be used to develop aquatic plant management strategies and fits within the overall research goals of the CAES IAPP. The aquatic vegetation in Upper and Lower Moodus Reservoir will be determined by traversing the lakes littoral zone and recording plant locations on a bathymetric map. Both visual observation and geospatial technology will be used. Data will be uploaded to a geographic information system and digitized maps will be created. A specimen of each plant species from each water body will be obtained and mounted in the CAES IAPP online herbarium for future reference. Quantitative invasive and native aquatic plant abundance information will be gathered from 12 previously established reference transects in Lower Moodus Reservoir and 17 new reference transects in Upper Moodus Reservoir. Water will be tested at georeferenced positions for Secchi transparency, temperature, dissolved oxygen, pH, alkalinity, conductivity, and total phosphorus. A report will be prepared to include aquatic plant survey maps, transect data, water chemistry information, and aquatic plant management strategies.

**MR. GREGORY BUGBEE** Invasive Plant Monitoring for Lakes Candlewood, Lillinonah and Zoar; source: FirstLight Power Resources; \$39,500; 2013. CAES IAPP will survey Lakes Candlewood, Lillinonah and Zoar for invasive aquatic plants. The proposed research will be consistent with the objectives listed in the *FERC Project No. 2576 Nuisance Plant Monitoring Plan*, which satisfies *FERC License Article 409*, and fits within the overall research goals of the CAES IAPP. CAES IAPP will determine the boundaries of all invasive aquatic plants in Lakes Candlewood and Lillinonah using geospatial technology, with sub-meter accuracy. Georeferenced underwater imagery will be used when necessary. In Lake Zoar the survey will be limited to 10 reference transects. Each stand of invasive plants will be assigned a qualitative density ranking and the water depth will be measured. Data will be uploaded to a geographic information system (GIS) and digitized maps will be created. Quantitative invasive and native aquatic plant abundance information will be obtained on previously established reference transects in all three lakes. Water will be tested at georeferenced positions for Secchi transparency, temperature, dissolved oxygen, pH, alkalinity, conductivity, and total phosphorus. CAES IAPP will prepare a report to include; aquatic plant survey maps, data, and a detailed description of our protocols. Invasive plant areas and mean patch size will be quantified. Suggestions on improving invasive aquatic plant management will be included. A draft report will be provided to the Technical Advisory Committee and their comments will be addressed in the final report to be provided to FirstLight Power Resources within 30 days. Subsequently, all information acquired as part of this study, including the contents of the final report, will be publicly available on the CAES IAPP website and by hard copy upon request.

**MR. GREGORY BUGBEE** Spot treatment of variable milfoil in Bashan Lake, East Haddam, CT with 2, 4-D; source, Bashan Lake Association, Town of East Haddam; \$8,450; 2013. We are in the 13<sup>th</sup> year of research involving the use of spot applications of the herbicide 2, 4-D to control variable watermilfoil (*Myriophyllum heterophyllum*) in Bashan Lake, East Haddam. We have largely restored the lake to preinfestation conditions; however, regrowth requires yearly surveys and modest retreatments. We will survey Bashan Lake for variable watermilfoil using underwater video equipment integrated with global positioning system technology. The milfoil will be treated in late September with granular 2, 4-D ester.

**MR. GREGORY BUGBEE** Control of Eurasian watermilfoil in Twin Lake North with diquat; source, Nod Brook Association; \$1,060; 2013. Twin Lakes are located in the State owned Nod Brook Management Area in Simsbury. The lakes are used for hunting dog field trails and training. The site hosts national events that are seen on ESPN TV. In 2013, CAES IAPP was asked to help find a solution to a Eurasian watermilfoil (*Myriophyllum spicatum*) problem that is interfering with use. A late spring application of diquat will be applied and pre and post treatment vegetation surveys will be compared.





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**DR. JAMES A. LAMONDIA** Trap Crop And Biocontrol Agents As Alternatives To Methyl bromide For Eradication Of *Globodera Pallida*- Methyl Bromide Transitions Program – J. A. Lamondia with collaborators Dandurand, L.-M., Knudsen, G., and Caplan, A. from the University of Idaho. Plant parasitic nematodes such as the white potato cyst nematode *Globodera pallida* can cause up to 80% yield loss of potatoes and undermine the economic security of rural farms throughout the country. To date, management has meant putting nematode-infested fields and their surroundings under a Federal Domestic Quarantine Order (USDA-APHIS) and treating them with methyl bromide. The goal of this research program is to identify and improve upon effective biological alternatives to this environmentally damaging chemical. This project will: 1) assess the ability of selected biocontrol fungi to reduce nematode reproduction in greenhouse and field conditions, 2) uncover the underlying mechanism for this control in order to develop culture and application conditions that maximize its effectiveness, 3) assess the ability of *Solanum sycambriifolium* and other trap crops to draw cyst nematodes into ineffective and ultimately terminal infestations, 4) uncover the underlying physiological pathways governing this ability in order to identify ways to augment them or ultimately transfer them to other plants, and finally, 5) establish agricultural conditions that would combine the use of fungal biocontrol agents and trap crops to eradicate nematode populations as effectively as the chemicals these treatments are intended to replace. The basic aspects of our research will add to our general knowledge of cyst nematode ecology, plant defense biology, and microbial ecology. The implementation protocols that we are developing against *Globodera pallida* may be robust enough to use against other plant parasitic nematodes that infect crops in addition to potatoes.

**DR. JAMES A. LAMONDIA** and **DR. ABIGAIL MAYNARD** CT Department of Agriculture Specialty Crop Block Grant: Enhancing the competitiveness of hops as a new specialty crop in Connecticut. Hops will be evaluated for growth, yield, and disease resistance on high and low trellis systems in Windsor and Hamden CT.

**DR. JAMES A. LAMONDIA, DR. ROBERT E. MARRA** and **DR. SHARON M. DOUGLAS** Boxwood Blight Mitigation Research – USDA APHIS Farm Bill Suggestion. Boxwood blight is a new disease in the USA and has caused millions of dollars of losses in CT. Research will address early detection, the efficacy of fungicide management and sanitation to reduce spread.

**DR. CAROLE CHEAH** McIntire-Stennis Project: Evaluation of Volatiles as Possible Attractants for *Sasajiscymnus tsugae*, Introduced Predator of the Hemlock Woolly Adelgid (CONH00814). Involves the evaluation of plant and insect volatiles for the identification of attractive compounds that might be used for integration into a monitoring system for attracting, trapping and detecting *S. tsugae* in the field. The ultimate goal of this project is to develop an effective attractant-based monitoring tool that can be implemented in forest and landscape settings to detect *S. tsugae*

**DR. CAROLE CHEAH** Potential augmentative biological control of elongate hemlock scale (EHS) damaging eastern hemlock stands in Connecticut. APHIS Cooperative Agreement 13-8209-0850-CA. renewal. Research will continue to develop optimal laboratory methods to mass rear suitable scale cultures on butternut squash as alternate hosts to rear the native scale coccinellid predator, *Chilocorus stigma*; evaluate adaptability of *C. stigma* to laboratory culture, and continue field surveys for current distribution and densities of EHS in CT hemlock forest.

**DR. CAROLE CHEAH** APHIS new coop: Project title: Biological control of mile-a-minute weed, *Persicaria perfoliata*, with *Rhinoncomimus latipes*. This new project for 2014 is a continuation of a 5 year project which implemented the weevil in CT in collaboration with UCONN. Monitoring for establishment and impact by the weevil will continue at 18 selected sites (a total of 29 sites have been implemented in CT 2009-2013) and new sites for release are planned if weevils are made available.



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### **Farm Bill Suggestion Section 10201 Plant Pest and Disease Management and Disaster Prevention--FY13.**

**Douglas, S. M., J. A. LaMondia, and R. E. Marra**  
**Boxwood Blight Mitigation Strategies \$223,916**

This project supports the Farm Bill's goals of "Enhanced Mitigation Capabilities" and "Safeguarding Nursery Production" through (1) the development of integrated management tools that will minimize the incidence, severity and spread of boxwood blight disease caused by *Calonectria pseudonaviculata* (*Cps*); (2) expanding the potential list of management tools in the United States and providing guidance to growers on when best to utilize management tools; (3) developing rapid molecular diagnostic tool to aid in identifying early infections and fungicide-resistant genotypes; and (4) enabling growers to continue to grow and sell their crops.

Boxwood blight was first described in the United Kingdom during the 1990s and is now considered endemic throughout Europe. In the U.S., boxwood blight rapidly emerged as a destructive pathogen of boxwood during the end of 2011, quickly impacting major boxwood nursery production regions over a period of less than four months. The rapid spread of boxwood blight caught the nursery and landscape sectors of U.S. agriculture unaware and ill-equipped to effectively manage the disease.

Boxwood is a mainstay plant in U.S. landscapes. The current wholesale market value for boxwood nursery production is estimated at be \$103 million annually (USDA-NASS, Census of Horticulture, 2010). Boxwood blight is a devastating disease leading to plant death, often hastened by secondary invaders. Boxwood plants may be rapidly defoliated by the disease, rendering plants unsuitable for commercial sale, or destroying established landscape plantings. Although some boxwood species and cultivars appear to be more susceptible to *C. pseudonaviculata* than others, the disease has been reported from numerous cultivated boxwood species. Current U.S. states reporting the presence of boxwood blight include NC, CT, MD, VA, RI, MA, OR, NY, PA, and OH. In Canada, the provinces of British Columbia, Ontario, and Quebec have also reported infections. The pathogen is suspected to have been present for at least one year, possibly more, but without causing significant disease until the warm, wet weather pattern of 2011.

*The specific objectives of this research project are:*

- Identification of best management practices for boxwood blight in the U.S. using an integrated toolbox of conventional fungicides and genetic resistance.
- Development and implementation of a rapid molecular diagnostic tool for the identification of the fungicide-resistant G2 genotype.
- Development of outreach tools to educate growers on these best management practices.
- Outcomes from these goals will allow growers to more effectively manage this devastating disease in the field, eliminate pathogen spread, and minimize the potential for economic losses through crop destruction.

*Key milestones include:*

- Identify efficacious fungicides in laboratory, greenhouse and field experiments to refine best management practices.
- Identify boxwood cultivars with reduced susceptibility.
- Develop and validate a realtime PCR allelic discrimination assay, based on SNPs, that distinguishes G1 (fungicide-sensitive) and G2 (fungicide-resistant) genotypes.
- Determine if fungicide-resistant G2 genotypes are present in the U.S.
- Expand outreach tools to refine best management practices for educating professionals about boxwood blight.



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## **Internal Decay and Carbon Loss in Living Trees**

**Marra, R. E.**

**NSF EaGER Award \$155,990.00**

**Executive Summary:** The objective of this proposal is to develop, through testing and validation, a novel and potentially powerful approach to the nondestructive quantification of extent and rate of internal decay in living trees. Sonic and electrical impedance tomography (SoT and EIT, respectively) will be used to capture cross-sectional images that represent variations in density and electrical resistivity. After tomographic imaging, trees will be felled and cross-sections cut in order to determine the level of accuracy of the tomographic imaging, and, using dendrochronological methods, to establish the period of time, in years, over which decay occurred. The volume of decaying wood will be determined by three-dimensional integration of serial, cross-sectional tomographic images. Based on the proportional relationship between wood density and C content, gas chromatographic elemental analysis (GCEA) will be used to measure C content as a function of volume, in order to determine the accuracy with which tomography can estimate C content. Finally, tomography, GCEA, and dendrochronology will be used to estimate the total C lost to decay over the lifetime of the tree. The project will focus on the three principal northern hardwood species: sugar maple, yellow birch, and American beech. Savoy Mountain State Forest, a mature northern hardwood forest in northwestern Massachusetts, has been chosen as the study site because it contains a range of diameter classes of these three target species, making it representative of a late-successional northern hardwood forests.

**Intellectual Merit:** Although internal decay in living trees may be the most prevalent of disturbances in forests, compared to more conspicuous phenomena (e.g., those caused by wind, wildfire, and insects), it has received comparatively little attention. The work proposed here focuses on a novel approach with significant potential to (1) transform studies addressing the dynamics of C cycling in forests, and (2) motivate research into the largely unexplored science of internal decay. While this project will involve the destructive sampling of trees in order to validate the approach, the ultimate goal is an accurate *nondestructive* method that permits an estimate of the *extent* and *rate* of internal decay, two important metrics missing from C cycle models that assess the role of forests in C sequestration. As forests are increasingly looked upon to sequester and store atmospheric C, it is essential that all components of C cycling be considered in C balance models. The results of this project will constitute an important first step in the PIs' long-term goals of addressing these critical missing components, and contributing data that will be relevant to other ecologists and carbon balance modelers.

**Broader Impacts:** This project will benefit from the collaboration of two forest pathologists, whose complementary backgrounds and expertise in forestry, forest ecology, and mycology will facilitate this novel line of research on internal tree decay in forests. Expertise in dendrochronology will be provided by a recognized expert in this field, whose experience in aging trees with internal decay will be critical to the project's success. Two student interns from the Stockbridge School of Agriculture (University of Massachusetts) Internship program will be trained in techniques that include forest pathology, dendrochronology, tomography, as well as classic forestry skills; their participation will enhance their understanding of forest processes, including C dynamics. In contrast to Europe, where SoT and EIT have become important tools in arboriculture, the technology has yet to be embraced by arborists in the United States; nor has it been applied to forest ecology research. Because of their public outreach responsibilities, PIs Marra and Brazee will utilize affiliations with forest ecologists, arborists, urban foresters and land managers to demonstrate the utility and value of this technology to promote tree preservation and health, to demonstrate the role of decay in forests, and the role that forests play in carbon cycling. Additionally, data produced from this research on rate and extent of internal decay will contribute to the development of forest management strategies aimed at mitigating the effects of increased atmospheric CO<sub>2</sub> by maximizing rates of C sequestration. Results from this project will be used to promote among the lay public a broader understanding of the complex dynamics of the forest, and its role in mitigating climate change, through the numerous established interfaces both PIs have with their constituency, including public outreach venues such as science museums, schools, and public events.





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### **NPDN (National Plant Diagnostic Network)**

**Douglas, S. M. and Y. Li**

**USDA-NIFA \$14,000**

**Executive Summary:** The Connecticut Agricultural Experiment Station (CAES) and its Plant Disease Information Office (PDIO) is a participant in the National Plant Diagnostic Network (NPDN). The PDIO is a full service plant diagnostic facility that handles a substantial number of plant samples for commercial and professional clientele and homeowners in Connecticut. The breadth of the samples and inquiries handled by this facility has allowed the CAES to develop databases that document the prevalence, severity, and location of plant health problems within the state. This facility has an effective working relationship with Connecticut state regulatory personnel and USDA-APHIS-PPQ for detection and diagnosis of select agents and plant pathogens of national regulatory concern.

States in the Northeast Region of the National Plant Diagnostic Network host about six percent of the nation's farms on less than three percent of the country's total farm acreage. However, with increased interest in various crops as sources of biofuels, some marginal lands are being returned to cultivation and the region's contribution to the nation's economy in this area is increasing. Furthermore, states in the region are also home to some of the most active ports in the U.S., including those in Wilmington, Baltimore, Philadelphia, Newark, New York, and Boston. Millions of tons of foreign agricultural goods and hundreds of thousands of people enter the U.S. through those ports each year. Unfortunately, history has taught us that not all transcontinental movement of plants and animals is beneficial or benign. In fact, some can have dramatic and historic consequences. Recent introductions of the emerald ash borer, Asian longhorned beetle, Sirex woodwasp, soybean aphid, and soybean rust coupled with historic catastrophes resulting from introductions of gypsy moths, Dutch elm disease, and chestnut blight are vivid testimony to the destructive power of plant pests and diseases carelessly transported across natural boundaries to new ecosystems.

In the Northeast, the regional center is at Cornell University in Ithaca, New York. Other participating laboratories are at Rutgers University, Penn State University, West Virginia University and the Universities of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, Rhode Island, and Vermont. The Connecticut Agricultural Experiment Station is also a formal partner in the program. Staff at the regional center have developed close working relationships with counterparts at each of the state labs, each partner lab is as well-equipped and has well-trained staff with the ability to identify plant pathogens and share findings with others, and the Northeast Regional Network is meeting the challenge as a functional gatekeeper to protect agricultural interests in the region.

The CAES PDIO also continues to work with the Office of the State Entomologist for Connecticut and USDA-APHIS-PPQ for detection and diagnosis of select agents and plant pathogens of state (e.g., Boxwood Blight) and national regulatory concern (e.g., Plum Pox Virus, Chrysanthemum White Rust, *Ralstonia solanacearum* race 3 biovar 2, and *Phytophthora ramorum*). For example, in 2012, CAES staff processed 236 samples for the National USDA APHIS-PPQ CAPS Nursery Survey *Phytophthora ramorum*, as well as trace-back and aquatic baiting samples. The CAES PDIO had a critical role in detecting and confirming *P. ramorum*.

Continuing with their lead in boxwood blight detection and research, the CAES PDIO identified the first natural infection of pachysandra by *Calonectria pseudonaviculata*, the boxwood blight pathogen in July 2012. On boxwood, this disease has already resulted in over \$5.5 million in losses in Connecticut alone and more losses are expected in the future. In response to requests from growers in the state, CAES PDIO staff wrote a series of Best Management Practices (BMPs) for boxwood blight, which were used as a model for ANLA BMPs.

**Diagnostics:** Maintain the integrity and infrastructure of existing NPDN diagnostic laboratories through the establishment of the NPDN Laboratory Accreditation System. Guidelines for accreditation will be issued sometime early in the 2012-13 fiscal year and we will review those guidelines and begin to prepare our laboratory for eventual review. In addition, we will:

- Accept, diagnose, and document plant disease and pest samples.
- Record symptoms using digital images.



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- Participate in collaborative digital diagnostic efforts.
- Collaborate in establishing needed diagnostic resources.
- Communicate unusual disease or pest outbreaks.
- Educate appropriate clientele.
- Participate in scenario exercises.
- Continue to develop a comprehensive, state-of-the-art website.



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DEPARTMENTAL RESEARCH UPDATES JANUARY-OCTOBER 2013

**Ahrens, J., and T. L. Mervosh.** 2013. Pre and Post Budbreak Applications of Indaziflam in Field-Grown Conifers. Weed Science Society of America Abstracts, Vol. 5. <http://wssaabstracts.com/public/index.php?conf=17>

**ABSTRACT:** We conducted field experiments in 2012 to evaluate the herbicide indaziflam (Alion 1.67SC) for safety to three conifer species. Research plots were established in Enfield, CT in commercial Christmas tree fields of Fraser fir [*Abies fraseri* (Pursh) Poir.] planted in 2010, eastern white pine (*Pinus strobus* L.) planted in 2010, and Colorado spruce (*Picea pungens* Engelm.) planted in 2011. Most trees were 1.5 to 2.5 ft tall prior to bud break in 2012. Soil texture is a fine sandy loam. Each plot consisted of four to five trees spaced 5 ft apart in a row. Tree rows were 6 ft apart. Herbicide treatments and the untreated control were replicated four times in a RCB design. Each plot was treated once. Herbicides were applied over the top of trees using a CO<sub>2</sub>-pressurized sprayer equipped with two Teejet 8003VS nozzles and calibrated to deliver 30 gallons per acre at a pressure of 32 psi. The following treatments were applied on March 30 (pre bud-break / dormant): indaziflam at 1.14 oz ai / A (0.08 kg ai / ha), indaziflam at 2.28 oz ai / A (0.16 kg ai / ha), glyphosate alone, glyphosate plus indaziflam at 1.14 oz ai / A, and glyphosate plus indaziflam at 2.28 oz ai / A. Glyphosate doses were 0.75 lb ae / A (0.84 kg ai / ha) for Fraser fir and Colorado spruce, and 0.375 lb ae / A (0.42 kg ai / ha) for white pine. The following treatments were applied on May 23 (post bud-break / active growth): indaziflam at 1.14 oz ai / A and indaziflam at 2.28 oz ai / A. Plant injury and weed control were evaluated on several dates. The most severe injury occurred on Fraser fir treated with indaziflam on May 23. Symptoms of chlorotic, stunted new needle growth were not observed at 2 weeks after treatment (WAT) but were obvious at 5 WAT and beyond. The only other lasting injury occurred on white pine treated on March 30 with glyphosate plus indaziflam at 2.28 oz ai / A. Colorado spruce was tolerant of all treatments. Indaziflam applied on March 30 provided much better weed control than when applied on May 23. Pre-emergent control of large crabgrass [*Digitaria sanguinalis* (L.) Scop.] was excellent at both doses, but control of yellow foxtail [*Setaria glauca* (Poir.) Roemer & J.A. Schultes] was not as complete or consistent. Indaziflam activity on horseweed [*Conyza canadensis* (L.) Cronq.] and common ragweed (*Ambrosia artemisiifolia* L.) was in the range of suppression rather than control. Indaziflam stunted growth of some perennial weeds, such as hemp dogbane (*Apocynum cannabinum* L.) and common milkweed (*Asclepias syriaca* L.).

**Andreadis, T. G., H. Takaoka, Y. Otsuka, C. R. Vossbrinck.** 2013. Morphological and molecular characterization of a microsporidian parasite, *Takaokaspora nipponicus* n. gen., n. sp. from the invasive rock pool mosquito, *Ochlerotatus japonicus japonicus*. *J. Invert. Pathol.*: 161-172.

**ABSTRACT:** A new genus and species of Microsporidia, *Takaokaspora nipponicus* n. gen., n. sp. is described from *Ochlerotatus japonicus japonicus* (Theobald) and *Ochlerotatus hatorii* (Yamada) based on light microscope and ultrastructural morphology, developmental features, transmission cycles and comparative sequence analyses of the small subunit ribosomal DNA (SSU rDNA). The microsporidium is both vertically and horizontally transmitted, exhibits dimorphic development alternating between diplokaryotic and monokaryotic stages and produces two morphologically distinct spores, one in larvae and another in adult females. Horizontal transmission of infection to larval mosquitoes occurs via direct oral ingestion of uninucleate spores that are produced in vertically-infected larval hosts. Development in horizontally-infected hosts is diplokaryotic following karyokinesis of uninucleate schizonts and binary fission to produce small (4.3  $\mu$ m  $\times$  2.0  $\mu$ m) membrane free, ovoid, binucleate spores that are confined to adult female reproductive tissues (ovariole sheath and oviducts). Vertical transmission of the microsporidium from adult females to larval progeny takes place via surface contamination of the egg





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(transovum). Microsporidian development in vertically-infected larvae is haplophasic with unpaired nuclei throughout, producing rosette-shaped sporogonial plasmodia contained within a thin non-persistent sporophorous vesicle and culminating in the formation of membrane free, uninucleate, conical spores (7.0  $\mu\text{m}$   $\times$  2.8  $\mu\text{m}$ ). Development is confined to host fat body tissue which appears as swollen white masses in the thorax and selected segments of the abdomen causing larvae to appear abnormally distorted and results in death during the third and fourth instar stages. The SSU rDNA sequences obtained from the two morphologically identical microsporidia isolated from *Oc. j. japonicus* and *Oc. hatorii* were nearly identical and unique when compared with GenBank entries of all other mosquito-parasitic species. Phylogenetic trees constructed by Maximum Parsimony, Maximum Likelihood and bootstrap analyses using the Neighbor Joining search parameter yielded similar typologies. In each case, the novel microsporidium was the sister group to the clade containing *Parathelohania* species from Anopheles mosquitoes and the monotypic *Novothelohania ovalae* from *Ochlerotatus caspius* showing approximately 10–13% sequence divergence to those two genera providing strong support for establishment as a separate genus.

**Armstrong, P. M. and T. G. Andreadis.** 2013. Eastern equine encephalitis virus: an old enemy but a new threat. *NE. J. Med.* 368:1670-1673.

**ABSTRACT:** Eastern equine encephalitis (EEE) virus is the most deadly mosquito-borne pathogen in North America with an estimated human case-fatality rate of 35 to 75%. EEE virus activity is most common in and around freshwater hardwood swamps in the Atlantic and Gulf Coast states and in the Great Lakes region where the primary mosquito vector *Culiseta melanura* resides. Since the discovery of EEE virus in the 1930s, outbreaks in temperate regions have been sporadic, both temporally and spatially, highly focal, and largely unpredictable. However, over the last decade, we have witnessed a sustained resurgence of EEE virus activity within long-standing foci in the northeastern US and unprecedented northward expansion into new regions where the virus had been historically rare or previously unknown, including northern New England and eastern Canada. This has resulted in severe disease in humans (46 cases with 16 fatalities) and domestic animals (173 cases). The factors responsible for reemergence of EEE are largely unknown but are likely complex reflecting ongoing changes in the ecology and epidemiology of this virus. Long-term changes in land-use, including wetlands restoration and suburban development, and increases in human population density near critical habitats may be important components. Weather conditions associated with climate change are also likely to be critical factors. These include mild winters, hot summers and extremes in both precipitation and drought that increase vector abundance and distribution, elongate the virus transmission season, and increase the intensity of virus transmission by increasing the frequency of blood feeding and rate of virus replication within mosquitoes. These and other underlying factors associated with the introduction, amplification, persistence, and range expansion of EEE virus in the region are examined.

**Becnel, J. J., R. H. Scheffrahn, C. R. Vossbrinck., B. Bahder.** 2013. *Multilamina teevani* gen. et. sp. nov. a microsporidian pathogen of the termite *Uncitermes teevani*. *J. Invert. Pathol.* 114: 100-105.

**ABSTRACT:** A new genus and species of microsporidia is described from adults of the termite *Uncitermes teevani* (Emerson) (n. comb., formerly *Armitermes teevani*), collected in Ecuador. Masses of elongate, ovoid, uninucleate spores were localized to the coelomic cavity of adult workers and measured 6.29  $\times$  3.33  $\mu\text{m}$  (fresh) and 5.83  $\times$  3.00  $\mu\text{m}$  (fixed). These spores were individually contained within a multi-layered sporophorous vesicle and contained an isofilar polar filament with 24–28 coils. Blast-n analysis revealed that the small subunit ribosomal DNA (ssrDNA) sequence of this new species exhibited 85% identity with that of a *Varimorpha* species from the fire ant, *Solenopsis richteri*, and slightly less (78–85% identity) to a large clade of microsporidian parasites



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from mosquitoes and microcrustacea. The morphological and sequence data support the conclusion that *Multilamina teevani* gen. et sp. nov. is a novel microsporidium and distinct from any previously described genera or species.

Burkett-Cadena, N. D., C. J. W. McClure, **L. K. Estep**, M. D. Eubanks. 2013. Host or habitat? What drives the spatial distribution of mosquitoes? *Ecosphere* 4(2): art30.

**ABSTRACT:** Understanding the factors that influence the distribution of vectors is critical to assess the risk of disease transmission across landscapes. For mosquitoes, existing spatial models use only habitat elements (hydrologic and floristic) to predict the distribution of disease vectors within the landscape, ignoring the potential importance of the distribution of hosts. We tested the hypothesis that the distribution of hosts would better explain the spatial distribution of mosquitoes than habitat variables using Information Theory and Poisson Regression. We analyzed the abundance of ectotherm-biting mosquitoes and their hosts from 37 points over a 28-km<sup>2</sup> area in Tuskegee National Forest, Alabama, USA. We compared models built using information regarding habitat, hosts, or both for their ability to explain the abundance of *Culex peccator* and *Culex territans*, two mosquito species that specialize on reptiles and amphibians. Models built using both host and habitat information were the best models for both species, suggesting that information regarding the distribution of mosquito hosts greatly improves models of mosquito distributions. Moreover, when differences in habitat makeup among stations were accounted for, mosquitoes were found to be significantly more abundant at locations with greater host abundance. Since most mosquitoes feed on only a limited range of hosts and successful blood feeding is one of the most crucial bottlenecks in the life cycle of mosquitoes, it follows that mosquitoes would aggregate in areas of greatest host density. Habitat influences the availability of suitable larval development sites, and to some extent, distribution of hosts. Our analysis, however, shows that within the landscape the distribution of host animals is a crucial factor in determining the spatial distribution of vectors. This has clear and important implications for determining which areas are at a greater risk for zoonotic arboviruses and is a potentially transformative paradigm for understanding the factors that influence the spatial distribution of disease vectors.

Cao, X., J. E. Birdwell, M. Chappell, Y. Li, **J. J. Pignatello**, and J. Mao. 2013. Characterization of Oil Shale, Isolated Kerogen, and Post-pyrolysis Residues Using Advanced <sup>13</sup>C Solid-state Nuclear Magnetic Resonance Spectroscopy. *AAPG Bulletin (Amer. Assoc. Petroleum Geologists)*, 97(3): 421–436.

**ABSTRACT:** Characterization of oil shale kerogen and organic residues remaining in post-pyrolysis spent shale is critical to understanding the oil generation process and approaches to dealing with issues related to spent shale. The chemical structure of organic matter in raw oil shale and spent shale samples was examined in this study using advanced solid-state <sup>13</sup>C nuclear magnetic resonance (NMR) spectroscopy. Oil shale was collected from Mahogany zone outcrops in the Piceance Basin. Five samples were analyzed: (1) raw oil shale; (2) isolated kerogen; (3) oil shale extracted with chloroform; (4) oil shale retorted in an open system at 500 °C to mimic surface retorting; and (5) oil shale retorted in a closed system at 360 °C to simulate in situ retorting. NMR methods applied included quantitative direct polarization with magic angle spinning at 13 kHz, cross polarization with total sideband suppression, dipolar dephasing, CH<sub>n</sub> selection, <sup>13</sup>C chemical shift anisotropy filtering, and <sup>1</sup>H-<sup>13</sup>C long-range recoupled dipolar dephasing. The NMR results showed that, relative to the raw oil shale, (1) bitumen-extraction and kerogen isolation by demineralization removed some oxygen-containing and alkyl moieties; (2) unpyrolyzed samples had low aromatic condensation; (3) oil shale pyrolysis removed aliphatic moieties leaving behind residues enriched in aromatic carbon; and (4) oil shale retorted in an open system at 500 °C contained larger aromatic clusters and more protonated aromatic moieties than oil shale retorted in a closed system at 360 °C, which contained more total aromatic carbon with a wide range of cluster sizes.



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Chen, C.-Y. and **J. J. Pignatello**. 2013. Catalytic Oxidation for Elimination of Methyl Bromide Fumigation Emissions Using Ceria-Based Catalysts,;\* *Applied Catalysis B: Environmental* 142-143: 785-794.

**ABSTRACT:** Methyl bromide (CH<sub>3</sub>Br, MB) is an effective chemosterilant in quarantine and pre-shipment (QPS) chamber fumigation applications. Efficient methods to destroy or capture and reuse spent MB in QPS operations are required owing to the recognized ozone depleting potential of MB. Oxidation of 34000 ppmv MB in simulated QPS airstreams was examined over catalysts composed of Pt, Pd, Fe<sub>2</sub>O<sub>3</sub>, CuO, or PbO nanoparticles on oxide (Al<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, and TiO<sub>2</sub>) or mixed-oxide (CeO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>, CeO<sub>2</sub>-SiO<sub>2</sub>, and CeO<sub>2</sub>-TiO<sub>2</sub>) supports, and by self-assembled core-shell catalysts (Pd@SiO<sub>2</sub> and Pd@10%CeO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>). The most effective support by far was ceria. The effect of noble metal doping was modest; Pt was more active than Pd in CeO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> based catalysts, while Pd was more active than Pt in TiO<sub>2</sub> based catalysts. The most effective catalyst tested was 1%Pt/30%CeO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>, with 100%CeO<sub>2</sub> being only slightly less effective. Using 1%Pt/30%CeO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>, MB was completely oxidized at 400°C, independent of airstream humidification, to give HBr, which was oxidized with the same catalyst to Br<sub>2</sub> (Deacon-type reaction) in a separate step. The selectivity for Br<sub>2</sub> in MB decomposition increased with temperature, maximizing at ~90% at ~350°C, and was slightly less favored in a humidified air stream. Bromide builds up on the catalyst at temperatures below 300°C, but burns off at higher temperatures. Catalytic oxidation by ceria-based catalysts appears to be a promising approach for eliminating MB emissions from QPS fumigation operations.

Davis, R. E., Y. Zhao, E. L. Dally, I.-M. Lee, R. Jomantiene, and **S. M. Douglas**. 2013. 'Candidatus Phytoplasma pruni', a novel taxon associated with X-disease of stone fruits, *Prunus* spp.: multilocus characterization based on 16S rRNA, *secY*, and ribosomal protein genes. *International Journal of Systematic and Evolutionary Microbiology* 63:766-776.

**ABSTRACT:** X-disease is one of the most serious diseases known in peach (*Prunus persica*). Based on RFLP analysis of 16S rRNA gene sequences, peach X-disease phytoplasma strains from eastern and western United States and eastern Canada were classified in 16S rRNA gene RFLP group 16SrIII, subgroup A. Phylogenetic analyses of 16S rRNA gene sequences revealed that the X-disease phytoplasma strains formed a distinct subclade within the phytoplasma clade, supporting the hypothesis that they represented a lineage distinct from those of previously described 'Candidatus Phytoplasma' species. Nucleotide sequence alignments revealed that all studied X-disease phytoplasma strains shared less than 97.5% 16S rRNA gene sequence similarity with previously described 'Candidatus Phytoplasma' species. Based on unique properties of the DNA, we propose recognition of X-disease phytoplasma strain PX11CT1R as representative of a novel taxon, 'Candidatus Phytoplasma pruni'. Results from nucleotide and phylogenetic analyses of *secY* and ribosomal protein (*rp*) gene sequences provided additional molecular markers of the 'Ca. Phytoplasma pruni' lineage. We propose that the term 'Ca. Phytoplasma pruni' be applied to phytoplasma strains whose 16S rRNA gene sequences contain the oligonucleotide sequences of unique regions that are designated in the formally published description of the taxon. Such strains include X-disease phytoplasma and - within the tolerance of a single base difference in one unique sequence - peach rosette, peach red suture, and little peach phytoplasmas. Although not employed for taxon delineation in this work, we further propose that *secY*, *rp*, and other genetic loci from the reference strain of a taxon, and where possible oligonucleotide sequences of unique regions of those genes that distinguish taxa within a given 16Sr group, be incorporated in emended descriptions and as part of future descriptions of 'Candidatus Phytoplasma' taxa.

De Graaf, D.C., A. M. Alippi, K. Antunez, K. A. Aronstein, G. Budge, D. Dekoker, L. De Smet, **D. W. Dingman**, J. D. Evans, L. J. Foster, A. Funfhaus, E. Garcia-Gonzalez, A. Gregoric, H. Human,





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K. D. Murray, B. Nguyen, L. Poppinga, M. Spivak, D. Vanengelsdorf, S. Wilkins, E. Genersch. 2013. In V. Dietemann, J. D. Ellis and P. Neumann (Editors) 2013 Book Chapters:

"Standard methods for *Apis mellifera* pests and pathogens",

"Selected techniques and protocols in American foulbrood research",

The COLOSS BEEBOOK, Volume II, <http://coloss.org/beebook> .

**De La Torre-Roche, R., J. Hawthorne, C. Musante, B. Xing, L. A. Newman, X. Ma, J. C. White.** 2013. Impact of Ag nanoparticle exposure on p,p'-DDE bioaccumulation by *Cucurbita pepo* (zucchini) and *Glycine max* (soybean). *Environ. Sci. Technol.* 47:718–725.

**ABSTRACT:** The effect of nanoparticle (NP), bulk or ionic Ag exposure on dichlorodiphenyldichloroethylene (p,p'-DDE; DDT metabolite) accumulation by *Glycine max* L. (soybean) and *Cucurbita pepo* L. (zucchini) was investigated. The plants were grown in 125-mL jars of vermiculite amended with 500 or 2000 mg/L of bulk or NP Ag; ion controls at 5 and 20 mg/L were established. During 19 d of growth, plants were amended with solution containing 100 ng/mL of p,p'-DDE. Total shoot p,p'-DDE levels in non-Ag exposed *G. max* and *C. pepo* were 500 and 970 ng, respectively; total root DDE content was 13,700 and 20,300 ng, respectively. Ag decreased the p,p'-DDE content of *G. max* tissues by up to 40%, with NP exposure resulting in less contaminant uptake than bulk Ag. Total Ag content of exposed *G. max* ranged from 50.5-373 µg; NP-exposed plants had 1.9-2.2 times greater overall Ag than corresponding bulk particle treatments and also significantly greater relative Ag transport to shoot tissues. Bulk and NP Ag at 500 mg/L suppressed DDE uptake by *C. pepo* by 21-29%, although Ag exposure at 2000 mg/L had no impact on contaminant uptake. Similar to *G. max*, *C. pepo* Ag whole plant content ranged from 50.5-182 µg, with tissue element content generally being greater for NP exposed plants. These findings show that the Ag may significantly alter the accumulation and translocation of co-contaminants in agricultural systems. Notably, the co-contaminant interactions vary both with Ag particle size (NP vs bulk) and plant species. Future investigations will be needed to clarify the mechanisms responsible for the co-contaminant interactions and assess the impact on overall exposure and risk.

**De La Torre-Roche, R., J. Hawthorne; Y. Deng, B. Xing, W. Cai, L. A. Newman, Q. Wang, X. Ma, H. Hamdi, J. C. White.** 2013. Multiwalled carbon nanotubes and C60 fullerenes differentially impact the accumulation of weathered pesticides in four agricultural plants. *Environ. Sci. Technol.* DOI: 10.1021/es4034809

**ABSTRACT:** The effect of multiwalled carbon nanotubes (MWCNT) or C60 fullerenes on the uptake of weathered chlordane or DDX (DDT+metabolites) by *Cucurbita pepo* (zucchini), *Zea mays* (corn), *Solanum lycopersicum* (tomato) and *Glycine max* (soybean) was investigated. The plants were grown in 50-g of soil with weathered chlordane (2,150 ng/g) and DDX (118 ng/g) that was amended with 0-5000 mg/kg MWCNT or C60. After 28-d, the root and shoot content of chlordane components and DDX was determined by GC-MS. Zucchini and tomato growth were unaffected by carbon nanomaterial co-exposure, although C60 at 500 mg/kg reduced corn and soybean biomass by 36.5-45.0%. Total chlordane content ranged from 1,490 (tomato) to 4780 (zucchini) ng; DDX amounts ranged from 77.8 (corn) to 395 ng (zucchini). MWCNT co-exposure decreased chlordane and DDX accumulation 21-80% in a concentration dependent fashion for all crops, depending on species and nanotube concentration. Conversely, C60 had species- and contaminant-specific effects on pesticide uptake, ranging from complete suppression of DDX uptake (corn/tomato) to 34.9% increases in chlordane accumulation (tomato/soybean). The data show that pesticide accumulation varies greatly with crop species and carbon nanomaterial type/concentration. These findings have implications for food safety and for the use of engineered nanomaterials in agriculture.



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**Douglas, S. M. and M. K. Inman.** 2013. Seed germination and purity analysis 2013. CAES Technical Bulletin #9. 15 p. [http://www.ct.gov/caes/lib/caes/documents/publications/technical\\_bulletins/tb9.pdf](http://www.ct.gov/caes/lib/caes/documents/publications/technical_bulletins/tb9.pdf)

**ABSTRACT:** Summary of germination and purity analyses of official samples of vegetable, crop, and lawn seeds submitted to The Connecticut Agricultural Experiment Station, the official seed testing laboratory for Connecticut. Samples are taken by the Bureau of Regulation and Inspection of the Connecticut Department of Agriculture. Tests are required for compliance with the Connecticut Seed Law Regulations and the Federal Seed Act.

Dreyer, G.; and **J. S. Ward.** 2013. Right tree, right, place. Connecticut Gardener. 19(1): 20-22.

**Elmer, W. H.** 2013. Fusarium biology and epidemiology, Pages 11-19, In: *Fusarium wilts of greenhouse vegetable and ornamental crops*. Eds., Angelo Garibaldi, Jaacov Katan, and M. Lodovica Gullino. APS Press ST. Paul, MN. 243p

**BOOK CHAPTER:** The chapter described the different propagates of Fusarium and their role in dispersal and infection of greenhouse plants. The chapter then develops a framework for understanding how Fusarium diseases might enter and spread in the greenhouse.

**Elmer, W. H.** 2013. Cultural management of Fusarium, Pages 67-84, In: *Fusarium wilts of greenhouse vegetable and ornamental crops*. Eds., Angelo Garibaldi, Jaacov Katan, and M. Lodovica Gullino. APS Press ST. Paul, MN. 243 p.

**BOOK CHAPTER:** This chapter highlighted areas where cultural management of Fusarium disease can reduce disease. Sanitation through greenhouse clean ups, seed disinfection, culture-indexing, and use of sterilants along with lowering temperature and nutrient management care presented to provide cultural control strategies for Fusarium diseases in the greenhouse.

**Elmer, W. H.,** and M. L. Daughtrey. 2013. Fusarium wilt of cyclamen, Pages 213-219, In: *Fusarium wilts of greenhouse vegetable and ornamental crops*. Eds., Angelo Garibaldi, Jaacov Katan, and M. Lodovica Gullino. APS Press, St. Paul, MN. 243.

**BOOK CHAPTER:** The chapter describes Fusarium wilt of cyclamen (*Cyclamen L.*), a devastating disease in cyclamen production worldwide. The biology, epidemiology, and control strategies are presented.

**Elmer, W. H.,** and R. J. McGovern. 2013. Epidemiology and management of Fusarium wilt of China aster. Plant Disease 97: 530-536 <http://dx.doi.org/10.1094/PDIS-05-12-0445-RE>.

**ABSTRACT:** The epidemiology and strategies for management of Fusarium wilt of China aster were studied in Connecticut and Florida, USA by examining seed contamination, on farm disease incidence, sanitation, host resistance, and various soil treatments. Five out of 25 commercial seed packages from three separate distribution companies had seeds contaminated with the pathogen, *Fusarium oxysporum* f. sp. *callistephi*. Farm surveys of cut-flower farms in Connecticut had disease



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incidences of 32-58%, while the incidence of the disease ranged from 0.002-71.2% in flower farms in Florida. All pathogenic isolates from seed and symptomatic plants in Connecticut were vegetative compatible suggesting a common origin. Florida isolates, nonpathogenic isolates, and non-heterokaryon-forming isolates fell into different vegetative compatibility groups and may have had another origin. Sodium hypochlorite solutions (1%) eliminated the fungus from seeds and Styrofoam when applied as a soak or spray, respectively. Soil fumigation with methyl bromide + chloropicrin, 1,3-dichloropropene + chloropicrin or metam sodium maintained Fusarium wilt at low levels at a Florida cut-flower production facility. Evaluations of disease resistance of 44 cultivars in the greenhouse identified eight cultivars with moderate resistance. Four cultivars were identified with moderate resistance in field trials and thus could serve as a source of resistant germplasm for future breeding programs. These findings should encourage growers to use sanitation protocols to prevent entry of the pathogen into their field and to choose commercially available cultivars that have intermediate resistance.

**Elmer, W. E.,** S. Useman, R. Schneider, **R. E. Marra,** J. LaMondia, I. Mendelssohn, M. Jimenez-Gasco, F. Caruso. 2013. Sudden Vegetation Dieback in Atlantic and Gulf Coast Salt Marshes. *Plant Disease* 97(4): 436-445.

**ABSTRACT:** The occurrence of Sudden Vegetation Dieback (SVD) in multiple marshes over large areas makes it of considerable ecological and societal importance. The ramifications of salt marsh loss in a vulnerable coastline are readily evident following coastal destruction by hurricanes. From 1999 to 2004, SVD has occurred sporadically from Maine to the Gulf Coast. The lack of a good working hypothesis for the cause of SVD initially hampered ecologists from distinguishing it from other disturbances in salt marshes. A key signature of SVD is that it occurs quickly (within one season), with little to no recovery the next year. In southern marshes, it appeared that drought-mediated changes in soil chemistry precipitated the initial stress that led to the SVD event (brown marsh) in 1999. The possible role of *Fusarium* in causing SVD led to the discovery of a new species, *Fusarium palustre*, which has been associated with SVD sites from Maine to Louisiana. It may have an endophytic association with *S. alterniflora* similar to other *Fusarium* species and their hosts, e.g., *F. verticilloides* and corn, *F. thapsinum* on sorghum, or *F. proliferatum* on asparagus. Although the endophytic fusaria on *S. alterniflora* are probably not primary causal agents, they may function as pathogens in plants predisposed by stressors. The role of root-knot nematodes is still unclear. The unique obligate relationship that they maintain with living plants is problematic in attempts to determine their role in SVD sites. Herbivory by marsh crabs and snails continues to affect the recovery of salt marshes undergoing stress, but the difficulty of completing an analogous set of Koch's Postulates in healthy marshes with these herbivores precludes the assumption of causality. It is possible that stressors, such as eutrophication and/or sea level rise, may have made marsh plants more susceptible to temporary drought, which may explain why sudden dieback has not been reported previously. The increased reports of dieback in recent years may have the same etiology, but it is not clear if these recent events are extensions of the original SVD or precipitated by new unidentified stressors. Alternatively, it may be that SVD is reported more frequently because people are more attuned to recognizing the phenomenon. Many questions still remain as to the cause and nature of SVD, and remediation efforts, including development of varieties of *S. alterniflora* with resistance or tolerance to biotic and abiotic stressors, will be greatly stymied until we obtain some clarity with regard to causation.

**Estep, L. K.,** M. Zala, N. P. Anderson, K. E. Sackett, M. Flowers, B. A. McDonald, C. C. Mundt. 2013. First report of resistance to QoI fungicides in North American populations of *Zymoseptoria tritici*, causal agent of Septoria tritici blotch of wheat. *Plant Disease* 97(11): 1511.

**ABSTRACT:** The G143A mutation in *cytb* (cytochrome b gene) is associated with high levels of resistance to quinone outside inhibitor (QoI or strobilurin) fungicides that upt electron transport during cellular respiration (1). The G143A mutation in *Zymoseptoria tritici* (synonyms: *Mycosphaerella graminicola* and *Septoria tritici*), the causal agent of septoria tritici blotch of wheat (*Triticum aestivum*), was first reported in Europe in 2001 (1). Although *Z. tritici* has a global distribution (3), G143A mutants of *Z. tritici* have not been reported outside of Europe. We used PCR-RFLP (4) to



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estimate the frequencies of G143A mutants in *Z. tritici* populations at two locations in the Willamette Valley of western Oregon: the Hyslop Crop Science Field Research Laboratory (Hyslop Farm, HF), Benton County (44°37'52.85" N, 123°11'55.19" W) and research plots planted in a commercial wheat field in Washington County (45°33'58.53" N, 123°00'11.78" W) (North Valley Farm, NVF). Isolates originated from flag leaf collections from two cultivars ('Bobtail' and 'Tubbs 06') made in April and June of 2012 from plants in a replicated fungicide-treatment experiment, with isolates collected from both sprayed and unsprayed plots. Sixteen of the 169 isolates (9.5%) from HF possessed the G143A mutation (7 of 132 isolates from plots not receiving a QoI fungicide and 9 of 37 isolates collected from plots receiving two applications of the QoI azoxystrobin). One hundred forty six of the 175 isolates (83.4%) from NVF were G143A mutants (101 of 129 isolates from plots receiving no QoI fungicide and 45 of 46 isolates from plots receiving two applications of azoxystrobin). Results of phenotypic assays of a subset of 10 isolates from each location (5 mutants, 5 wild types from each location; 20 isolates altogether) supported a high level of resistance to azoxystrobin only in the G143A mutants. All 10 G143A mutants developed colonies after 8 days of growth on YMA plates amended with SHAM (2), and either 1 ppm or 10 ppm azoxystrobin, with nine and eight G143A mutant isolates developing colonies on plates amended with 1 ppm and 10 ppm azoxystrobin, respectively. None of the wild-type isolates developed colonies on plates amended with SHAM and 1 ppm azoxystrobin, nor on plates amended with SHAM and 10 ppm azoxystrobin. All 20 isolates developed colonies on YMA plates lacking azoxystrobin, and treatments produced identical results across three replicates. These results are consistent with findings of higher levels of azoxystrobin resistance in G143A mutants compared to wild types in European populations (1). Isolates from HF and NVF differ in their previous exposure to QoI fungicides. The majority of the wheat area at HF is planted to breeding plots that are not sprayed with fungicide. Plots at NVF were planted in a commercial wheat field in a county where most wheat fields were treated with two to three applications of strobilurins each year over the past 4 years. Future monitoring for G143A mutants of *Z. tritici* throughout its range in North America will be necessary to assess whether strobilurin resistance will spread via wind-dispersal of ascospores or emerge de novo in treated fields. In Europe, strobilurins were first applied to wheat in 1996. G143A mutants of *Z. tritici* emerged de novo several times (4) and were widespread by 2007.

**Estep, L. K.,** C. J. W. McClure, P. Vander Kelen, N. D. Burkett-Cadena, S. Sickerman, J. Hernandez, J. Jinright, B. Hunt, J. Lusk, V. Hoover, K. Armstrong, L. M. Stark, G. E. Hill, T. R. Unnasch. 2013. Risk of exposure to eastern equine encephalomyelitis virus increases with the density of northern cardinals. PLoS ONE 8(2): e57879.

**ABSTRACT:** For a variety of infectious diseases, the richness of the community of potential host species has emerged as an important factor in pathogen transmission, whereby a higher richness of host species is associated with a lowered disease risk. The proposed mechanism driving this pattern is an increased likelihood in species-rich communities that infectious individuals will encounter dead-end hosts. Mosquito-borne pathogen systems potentially are exceptions to such "dilution effects" because mosquitoes vary their rates of use of vertebrate host species as bloodmeal sources relative to host availabilities. Such preferences may violate basic assumptions underlying the hypothesis of a dilution effect in pathogen systems. Here, we describe development of a model to predict exposure risk of sentinel chickens to eastern equine encephalitis virus (EEEV) in Walton County, Florida between 2009 and 2010 using avian species richness as well as densities of individual host species potentially important to EEEV transmission as candidate predictor variables. We found the highest support for the model that included the density of northern cardinals, a highly preferred host of mosquito vectors of EEEV, as a predictor variable. The highest-ranking model also included *Culiseta melanura* abundance as a predictor variable. These results suggest that mosquito preferences for vertebrate hosts influence pathogen transmission.

**Ferrandino, F. J.** 2013. Relating the progeny production curve to the speed of an epidemic. Phytopathology 103:204-215. (doi: <http://dx.doi.org/10.1094/PHYTO-04-12-0093-R>).

**ABSTRACT:** The dependence of the initial infection rate,  $r$ , on the basic reproductive number,  $R_0$ ,





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and the temporal moments of the progeny production curve are examined. A solution to the linearized Kermack-McKendrick equation is presented and used to analyze a variety of theoretical models of pathogen reproduction. The solution yields a relation between  $r$  and the basic reproductive number,  $R_0$ ; the mean time between pathogen generations,  $\mu$ ; and the standard deviation about this mean,  $\sigma$ . A transformation using the dimensionless variables  $r\mu$  and  $r\sigma$  is introduced, which maps the solution onto a one-dimensional curve. An approximation for the value of  $r$  in terms of  $R_0$  and the first four temporal moments of the reproductive curve is derived. This allows direct comparison of epidemics resulting from theoretical models with those generated using experimentally obtained reproduction curves. For epidemics characterized by a value of  $r\mu < 5$ , the value of  $r$  is well determined (<2%) by this fourth-order expansion regardless of the functional form of the reproduction curve.

Geiser, D. M., T. Aoki, C. W. Bacon, S. E. Baker, M. K. Bhattacharyya, M. E. Brandt, D. W. Brown, L. W. Burgess, S. Chulze, J. J. Coleman, J. C. Correll, S. F. Covert, P. W. Crous, Cuomo, G. S. De Hoog, A. Di Pietro, **W. H. Elmer**, L. Epstein, R. J. N. Frandsen, S. Freeman, A. E. Glenn, T. R. Gordon, K. E. Hammond-Kosack, L. E. Hanson, M. del Mar Jiménez-Gasco, S. Kang, C. Kistler, G. A. Kulda, J. F. Leslie, A. Logrieco, G. Lu, E. Lysøe, L. Ma, S. P. McCormick, Q. Migheli, A. Moretti, F. Munaut, K. O'Donnell, L. Pfenning, R. C. Ploetz, Proctor, S. A. Rehner, V.A.R.G. Robert, A. P. Rooney, A. P., B. bin Salleh, M. M. Scandiani, J. Scauflaire, E. Steenkamp, H. Suga, B. A. Summerell, D. E. Sutton, U. Thrane, F. Trail, A. Van Diepeningen, H. D. VanEtten, A. Viljoen, C. Waalwijk, T. J. Ward, M. J. Wingfield, J. R. Xu, X. B. Yang, T. Yli-Mattila, and N. Zhang. 2013. One Fungus, One Name: Defining the genus *Fusarium* in a scientifically robust way that preserves longstanding use. *Phytopathology* 103:400-408.

**ABSTRACT:** In this letter, we advocate recognizing the genus *Fusarium* as the sole name for a group that includes virtually all *Fusarium* species of importance in plant pathology, mycotoxicology, medicine, and basic research. This phylogenetically guided circumscription will free scientists from any obligation to use other genus names, including teleomorphs, for species nested within this clade, and preserve the application of the name *Fusarium* in the way it has been used for almost a century. Due to recent changes in the International Code of Nomenclature for algae, fungi, and plants, this is an urgent matter that requires community attention. The alternative is to break the longstanding concept of *Fusarium* into nine or more genera, and remove important taxa such as those in the *F. solani* species complex from the genus, a move we believe is unnecessary. Here we present taxonomic and nomenclatural proposals that will preserve established research connections and facilitate communication within and between research communities, and at the same time support strong scientific principles and good taxonomic practice.

**Hiskes, R. T.** 2013. Light Brown Apple Moth (*Epiphyas postvittana*) CAES Factsheet. [http://www.ct.gov/caes/lib/caes/documents/caps/2013/light\\_brown\\_apple\\_moth\\_2013.pdf](http://www.ct.gov/caes/lib/caes/documents/caps/2013/light_brown_apple_moth_2013.pdf)

**Hiskes, R. T.** 2013. Pesticide Guide Toward Integrated Pest Management for Connecticut Arborists.

**Hiskes, R. T.** 2013. Pesticide Guide Toward Integrated Pest Management for Connecticut Nurseries.

Huang, C-H, G. L. R. Roberts, **W. H. Elmer**, and L. E. Datnoff. 2013. Population structure of *Fusarium oxysporum* f. sp. *radicis-lycopersici* in Florida inferred from vegetative compatibility groups and microsatellites. *European Journal of Plant Pathology* 136:509-521.



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**ABSTRACT:** *Fusarium* crown and root rot caused by *Fusarium oxysporum* f. sp. *radicis-lycopersici* (FORL) is a serious soilborne disease reducing tomato yields in Florida, a leading state in fresh market tomato production in the United States. One hundred and twenty five isolates of FORL were collected from the three main tomato-growing counties in Florida between 2006 and 2008. Vegetative compatibility groups (VCGs) and ten microsatellite loci were used to infer the population structure of FORL. Up to 69.8% of the isolates could be assigned to one of three VCGs, 0094, 0098 or 0099, with frequencies of 38.6, 24.4, and 6.8% respectively. A medium level of population differentiation ( $F_{st} = 0.159$ ) was detected, but the discriminant analysis of principal components did not unambiguously assign FORL isolates to single populations from which they were likely derived. Migration probably played an important role in shaping the population structure of FORL since repeated VCGs and multilocus genotypes were observed in the three counties. Considerable migrants ( $> 1.33$  migrants per generation) were also detected between the three counties, resulting in an increase in the effective population size and genetic diversity of *F. oxysporum* f. sp. *radicis-lycopersici*. Although migration is an important evolutionary force, mutation and parasexual recombination could not be completely ruled out as contributing to the cause of the genetic diversity of FORL. Limiting migration of FORL, such as excluding infected materials, is necessary to reduce its evolutionary potential in Florida.

Huang, S., D. J. Smith, **G. Molaei, T.G. Andreadis**, S. E. Larsen and E. F. Lucchesi. 2013. Prevalence of Dog Heartworm (*Dirofilaria immitis*) Infection in *Aedes*, *Culex* and *Culiseta* Mosquitoes from North San Joaquin Valley, California, USA. *Journal of Medical Entomology*. (in press)

**ABSTRACT:** *Canine heartworm* is one of the most serious infections primarily affecting domestic dogs, but will also infect cats and wild canids. To evaluate potential of mosquitoes as vectors of dog heartworm, *Dirofilaria immitis* (Leidy) in San Joaquin County, California, we collected mosquitoes in 2011, and analyzed for infection with heartworm by using polymerase chain reaction (PCR) method. Of 3,000 mosquito pools (total number of specimens = 36,554), *Dirofilaria immitis* DNA was detected in 97 pools of 7 species, and the overall minimum field infection rate (MIR) for all mosquito species was 2.69: *Culex pipiens* L. (n = 40; MIR = 3.66), *Culex tarsalis* Coquillett (n = 25; MIR = 1.89), *Culiseta incidens* (Thomson) (n = 11; MIR = 2.81), *Aedes vexans* (Meigen) (n = 7; MIR = 2.18), *Aedes melanimon* Dyar (n = 5; MIR = 4.64), *Culex erythrothorax* Dyar (n = 5; MIR = 3.96), and *Culiseta inornata* (Williston) (n = 4; MIR = 2.65). *Culex pipiens* and *Cx. tarsalis* had the highest number of *D. immitis* infection and collectively, accounted for 67% of all positive pools. *Aedes melanimon*, *Ae. vexans* and *Cx. erythrothorax* were found infected with *D. immitis* only in rural and agriculture areas, whereas infections in other species were identified in both rural and agriculture and urban settings. The majority of positive pools were identified from June through November, and peaked during August through October. This is the first report of *D. immitis* infection in *Ae. melanimon*, *Cx. erythrothorax*, *Cx. tarsalis*, *Cs. incidens* and *Cs. inornata*. The frequent detection of *D. immitis* in field-collected *Cx. pipiens* and *Cx. tarsalis* in concert with their seasonal abundance and widespread distribution suggest a central role for these species in dog heartworm transmission. Other species including *Ae. vexans*, *Ae. melanimon*, *Cs. incidens*, *Cs. inornata* and *Cx. erythrothorax* may play secondary role in transmission.

Isleyen, M., P. Sevim, **J. Hawthorne, W. Berger, J. C. White**. 2013. Inheritance profile of weathered chlordane and p,p'-DDTs accumulation by *Cucurbita pepo* hybrids. *Int. J. Phytorem.* 15, 861-876.

**ABSTRACT:** *Cucurbita pepo* ssp *pepo* (zucchini) accumulates significant levels of persistent organic pollutants in its roots, followed by unexpectedly high contaminant translocation to the stems. Most other plant species, including the closely related *C. pepo* ssp *ovifera* (squash), do not have this ability. To investigate the mechanism of contaminant accumulation, two cultivars each of parental zucchini and squash, as well as previously created first filial (F1) hybrids and F1 backcrosses (BC) of those parental cultivars, were grown under field conditions in a soil contaminated with weathered chlordane (2.29  $\mu\text{g/g}$ ) and DDX residues (0.30  $\mu\text{g/g}$ ; sum of DDT, DDE, DDD). The parental zuc-



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chini had stem-to-soil bioconcentration factors (BCF, contaminant ratio of stem to soil) for chlordane and DDX of 6.23 and 3.10; these values were 2.2 and 3.7 times greater than the squash, respectively. Chlordane and DDX translocation factors, the ratio of contaminant content in the stems to that in the root, were 2.1 and 3.2 times greater for zucchini than for squash. The parental zucchini and squash also differed significantly in chlordane component ratios (relative amounts of trans-nonachlor [TN], cis-chlordane [CC], trans-chlordane [TC]) and enantiomer fractions for the chiral CC and TC. Hybridization of the parental squash and zucchini resulted in significant differences in contaminant uptake. For both the three separate component ratios (CR) and two sets of enantiomer fraction (EF) values, subspecies specific differences in the parental generation became statistically equivalent in the F1 hybrid zucchini and squash. When backcrossed (BC) with the original parental plants, the zucchini and squash F1 BC cultivars reverted to the statistically distinct CR and EF patterns. This pattern of trait segregation upon hybridization suggests either single gene or single locus control for persistent organic pollutant (POP) uptake ability by *C. pepo* ssp *pepo*.

Jie, C-Y, K. Geng, Y-L. Jiang, J-J. Xu, K. Hyde, E. C. McKenzie, T-Y Zhang, A. Bahkali, **D. W. Li**, Y. Wang. 2013. *Stachybotrys* from soil in China, identified by morphology and molecular phylogeny. *Mycological Progress* 12 (4):693-698. doi:10.1007/s11557-012-0878-y.

**ABSTRACT:** Four *Stachybotrys* strains were isolated from soil in China. One was identified as a novel species by morphological characters of phialides and conidia. It produced cylindrical conidia with irregular striations and smooth, hyaline conidiophores. Phylogenetic analysis of three DNA markers, the internal transcribed spacer region of rDNA (ITS1–5.8S–ITS2), the translation elongation factor 1 alpha (*tef1*) and RNA polymerase II subunit (*rpb2*), supported the morphological results. The correlation between morphological and molecular-based clustering demonstrated that the studied isolate was a new species. Two other isolates were identified as *S. cf. elegans*.

Kelsey, J. W., **J. C. White**. 2013. Effect of C60 fullerenes on the accumulation of weathered p,p'-DDE by plant and worm species under single and multi-species conditions. *Environ. Toxicol. Chem.* 32:1117-1123.

**ABSTRACT:** The use of engineered nanomaterials has increased dramatically in recent years but an understanding nanomaterial fate and effects in the environment is lacking. In particular, the interaction of nanomaterials with co-existing organic contaminants and the subsequent implications for sensitive biota is almost completely unknown. Here, the effect of C60 fullerenes on the accumulation of weathered dichlorodiphenyldichloroethylene (p,p'-DDE; DDT metabolite) by *Cucurbita pepo* (pumpkin) and *Eisenia fetida* (earthworm) was determined under single and multi-species conditions. The plants, in the presence or absence of earthworms, were grown in soil containing weathered DDE (200 ng/g) and 0 or 1,670 mg/kg C60 fullerenes. Plants and earthworms were added either simultaneously or sequentially (earthworms after plants). Neither DDE nor C60 had an impact on survival or biomass of plants and earthworms, although fullerenes significantly decreased (29.6-39.0%) the relative root mass. Under single or multi-species conditions, C60 had little impact on DDE bioaccumulation by either species. DDE concentrations in non-fullerene exposed shoots, roots and earthworms were 181, 7400, and 8230 ng/g, respectively; upon fullerene exposure, the DDE content was non-significantly lower at 163, 7280, and 7540 ng/g, respectively. In the presence of the earthworms, C60 significantly decreased the shoot DDE content (28.6%) but no impact on root concentrations was observed. Root DDE content was unaffected by the presence of fullerenes and decreased by 21.6-37.5% during co-exposure with earthworms. Earthworm DDE content was decreased by plant presence. Earthworms added to soils after plant harvest accumulated more DDE but were unaffected by the C60 exposure. Additional work is necessary but these findings suggest that fullerenes may have minimal impact on the bioaccumulation of weathered co-contaminants in soil.

Kumar, K., K. Mosa, S. Chikkara, **C. Musante, J. C. White**, O. Parkash. 2013. Two rice plasma membrane intrinsic proteins, OsPIP2;4 and OsPIP2;7, are involved in boron transport and tolerance. *Planta* DOI 10.1007/s00425-013-1969-y.



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**ABSTRACT** Boron (B) toxicity is responsible for low cereal crop production in a number of regions worldwide. In this report, we characterized two rice genes, OsPIP2;4 and OsPIP2;7, for their involvement in B permeability and tolerance. Transcript analysis demonstrated that the expression of OsPIP2;4 and OsPIP2;7 were downregulated in shoots and strongly upregulated in rice roots by high B treatment. Expression of both OsPIP2;4 and OsPIP2;7 in yeast HD9 strain lacking Fps1, ACR 3, and Ycf1 resulted in an increased B sensitivity. Furthermore, yeast HD9 strain expressing OsPIP2;4 and OsPIP2;7 accumulated significantly higher B as compared to empty vector control, which suggests their involvement in B transport. Overexpression of OsPIP2;4 and OsPIP2;7 in Arabidopsis imparted higher tolerance under B toxicity. Arabidopsis lines overexpressing OsPIP2;4 and OsPIP2;7 showed significantly higher biomass production and greater root

length, however there was no difference in B accumulation in long term uptake assay. Short-term uptake assay using tracer B (10B) in shoots and roots demonstrated increased 10B accumulation in Arabidopsis lines expressing OsPIP2;4 and OsPIP2;7, compare to wild type control plants. Efflux assay of B in the roots showed that 10B was effluxed from the Arabidopsis transgenic plants overexpressing OsPIP2;4 or OsPIP2;7 during the initial 1-h of assay. These data indicate that OsPIP2;4 and OsPIP2;7 are involved in mediating B transport in rice and provide tolerance via efflux of excess B from roots and shoot tissues. These genes will be highly useful in developing B tolerant crops for enhanced yield in the areas affected by high B toxicity.

**LaMondia, J. A.** 2013. Reduced sensitivity of *Peronospora tabacina*, causal agent of tobacco blue mold, to dimethomorph fungicide in Connecticut. Tobacco Science 50:19-24. <http://www.tobaccoscienceonline.org/doi/pdf/10.3381/13-025R.1>

**ABSTRACT:** Tobacco blue mold, caused by *Peronospora tabacina*, may be difficult to manage in commercial tobacco crops despite repeated dimethomorph (DMM) fungicide applications. To investigate whether this could be due to reduced efficacy, we compared fungicide efficacy in replicated field trials in certain years from 2002 to 2011 and in *in vitro* assays to evaluate sporangial germination, infection, disease and sporulation. In 2002 and 2004, DMM fungicide was as efficacious against blue mold as DMM plus mancozeb. In 2009 and 2011, however, DMM was intermediate to mancozeb and untreated controls. In 2002, sporangial germination on 1.2 or 12 mg/L DMM-amended media was 87.0% and 9.1%, respectively, of germination on 0 mg/L media. No germination occurred at 120 mg/L DMM. In 2011, normalized sporangial germination on 1.2, 12, and 120 mg/L DMM-amended media was 86.2, 12.3, and 3.0%, respectively. There were no significant differences in germination between 2002 and 2011. In 2002, researchers in NC, using detached leaf assays, determined that the baseline sensitivity to DMM was less than 1 mg/L, with no sporulation observed. In 2011, using the same assay, we determined that 37% of leaf disks floating on 1.2 mg/L DMM were diseased, with both sporangiophores and sporangia produced. Based on these data, efficacy of DMM against *P. tabacina* appears to have been partially reduced over time.

**LaMondia, J. A., D. W. Li.** 2013. First report of *Calonectria pseudonaviculata* causing leaf spot and stem blight of *Pachysandra procumbens*. Plant Health Progress <http://www.plantmanagementnetwork.org/sub/php/brief/2013/alleggheny>

**ABSTRACT:** The boxwood blight pathogen, *Calonectria pseudonaviculata*, was demonstrated to cause disease on Allegheny spurge, *Pachysandra procumbens*, in controlled greenhouse experiments. Circular lesions (1-4 mm-diameter) were evident on leaves within seven days after inoculation. Leaf lesions were necrotic and often had darker margins and a chlorotic area around the lesion. Elongate necrotic lesions were also observed running vertically along the stems. All inoculated plants developed lesions within seven days, and no lesions were observed on non-inoculated plants. Leaves and stems with lesions were surface sterilized in 0.5% NaOCl for 30 seconds, rinsed twice in sterile distilled water and lesion margins plated onto water agar or ½PDA. The pathogen was re-isolated from all plants. This pathogen has now been shown to infect all common ornamental species in the Buxaceae grown in North America. *Pachysandra procumbens*, while not as common as





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*P. terminalis*, typically grows in environments conducive for the development of disease and may also serve as a reservoir of inoculum for the boxwood blight pathogen in cultivated landscapes and in nature. In addition, *P. procumbens* is listed by the USDA Natural Resources Conservation Service as endangered in states such as Florida and Indiana and *C. pseudonaviculata* leaf spot and stem blight may further threaten this species in its native habitat.

Li, X., **J. J. Pignatello**, Y. Wang, and B. Xing. 2013. New Insight into the Mechanism of Adsorption of Ionizable Compounds on Carbon Nanotubes, *Environ. Sci. Technol.*, 47, 8334–8341.

ABSTRACT: We studied the pH-dependent adsorption of benzoic acid (BA), phthalic acid (PA) and 2,6-dichloro-4-nitrophenol (DCNP) by hydroxylated, carboxylated, and graphitized carbon nanotubes (CNTs). Adsorption is contributed by formation of a charge-assisted H-bond (-)CAHB between a carboxyl group on the solute and a phenolate or carboxylate group on the surface having a comparable  $pK_a$ . This exceptionally strong H-bond is depicted as  $(RCO_2)_{\times\times\times}H_{\times\times\times}O$ -CNTs. Over a limited pH range the free anion undergoes proton exchange with water concurrent with adsorption, releasing hydroxide ion in a stoichiometry of up to 1.0 for BA, 1.7 for PA, and 0.5 for DCNP. Little hydroxide is released upon adsorption by the O-sparse graphitized CNTs. Anion exchange and ligand exchange reactions as a source of hydroxide release were ruled out. The higher stoichiometry for PA indicates involvement of both carboxyl groups with adjacent surface oxyl groups. The lower stoichiometry for DCNP is consistent with steric inhibition of H-bonding by the ortho chlorines. Formation of (-)CAHB helps overcome the unfavorable free energy of proton exchange with water, and results in an upward shift in the  $pK_a$  in the adsorbed state compared to the dissolved state from 0.9 to 3.1 units. The proposed mechanism is further supported by additional structure-activity considerations. The findings provide new understanding of the interactions between ionizable organic compounds and carbonaceous surfaces, which has implications for non-covalent derivatization of CNTs, fate of ionizable pollutants, and associations of natural organic matter with CNTs and other carbonaceous materials in the environment.

Li, Y. H. 2013. Anthracnose of Tomato. The Connecticut Agricultural Experiment Station Fact Sheet. [http://www.ct.gov/caes/lib/caes/documents/publications/fact\\_sheets/plant\\_pathology\\_and\\_ecology/anthracnose\\_of\\_tomato\\_04-01-13.pdf](http://www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/plant_pathology_and_ecology/anthracnose_of_tomato_04-01-13.pdf).

ABSTRACT: Anthracnose is a common fungal disease on ripe tomato fruit that develops in the field or after harvest. The disease primarily impacts the fruit, which causes significant losses in yield and marketability, especially during humid, wet conditions. This fact sheets discusses how to recognize and manage this common disease.

Li, Y. H. 2013. Powdery Mildew of Tomato. The Connecticut Agricultural Experiment Station Fact Sheet. [http://www.ct.gov/caes/lib/caes/documents/publications/fact\\_sheets/plant\\_pathology\\_and\\_ecology/powdery\\_mildew\\_of\\_tomato\\_04-01-13.pdf](http://www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/plant_pathology_and_ecology/powdery_mildew_of_tomato_04-01-13.pdf).

ABSTRACT: Powdery mildew of tomato has become an important worldwide disease problem in both field and greenhouse production since it was first reported in the early 1990's. The pathogen primarily infects leaves, which results in yellowing, drying, necrosis, and premature defoliation. Losses in commercial fruit production can be as high as 50% in regions where the disease is severe. This fact sheets discusses how to recognize and manage this disease.

Lin, H., L. Niu, **N. A. McHale**, M. Ohme-Takagi, K. S. Mysore and M. Tadege. 2013. An Evolu-



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tionarily Conserved Repressive Activity of WOX Proteins Mediates Leaf Blade Outgrowth and Development of Floral Organs in Plants. *Proc. Natl. Acad. Sciences* 110 (1): 366-371.

**ABSTRACT:** The WUSCHEL related homeobox (WOX) genes play key roles in stem cell maintenance, embryonic patterning, and lateral organ development. WOX genes have been categorized into three clades—ancient, intermediate, and modern/WUS—based on phylogenetic analysis, but a functional basis for this classification has not been established. Using the classical bladeless *lam1* mutant of *Nicotiana sylvestris* as a genetic tool, we examined the function of the *Medicago truncatula* WOX gene, *STENOFOLIA* (STF), in controlling leaf blade outgrowth. STF and LAM1 are functional orthologs. We found that the introduction of mutations into the WUS-box of STF (STFm1) reduces its ability to complement the *lam1* mutant. Fusion of an exogenous repressor domain to STFm1 restores complementation, whereas fusion of an exogenous activator domain to STFm1 enhances the narrow leaf phenotype. These results indicate that transcriptional repressor activity mediated by the WUSbox of STF acts to promote blade outgrowth. With the exception of WOX7, the WUS-box is conserved in the modern clade WOX genes, but is not found in members of the intermediate or ancient clades. Consistent with this, all members of the modern clade except WOX7 can complement the *lam1* mutant when expressed using the STF promoter, but members of the intermediate and ancient clades cannot. Furthermore, we found that fusion of either the WUS-box or an exogenous repressor domain to WOX7 or to members of intermediate and ancient WOX clades results in a gain-of-function ability to complement *lam1* blade outgrowth. These results suggest that modern clade WOX genes have evolved for repressor activity through acquisition of the WUS-box.

Liu, H., G. Pan, B. Luo, T. Li, Q. Yang, **C. R. Vossbrinck**, B. A. Debrunner-Vossbrinck, Z. Zhou. 2013. Intraspecific polymorphism of rDNA among five *Nosema bombycis* isolates from different geographic regions in China. *J. Invert. Pathol.* 113:63-69.

**ABSTRACT:** The microsporidian *Nosema bombycis* is the causative agent of pébrine, a highly infectious disease of the silkworm *Bombyx mori*. Three regions of the multicopy rDNA gene were examined in order to investigate the relationships among five *Nosema* isolates from various regions of China. Ribosomal DNA alleles are present on each of the 18 chromosomes of *N. bombycis* and show a high degree of variation. In this study the small subunit (SSU) rDNA, internal transcribed spacer (ITS) and intergenic spacer (IGS) regions for up to 10 different rDNA copies from each *N. bombycis* isolate were cloned and sequenced. As expected we see greater polymorphism in the ITS region (88 variable sites in 179 nucleotides) and IGS (200 variable sites in 279 nucleotides) than in the SSU rDNA (24 variable sites in 1232 nucleotides). Phylogenetic analysis shows greater differences between alleles within an isolate than between the same alleles from different isolates. The data reveal two very different groups, one from the Sichuan province and the other with a broad distribution including four provinces in southeast China and Japan. The Sichuan isolate does not have any rDNA alleles with sequences identical to those in the other isolates, implying that it is a separate, non-intermixing, population or perhaps a separate species from the other isolates. In light of the polymorphic nature of the rDNA alleles in *N. bombycis* and their presence on every chromosome, the rDNA gene may be useful for understanding the movement and ultimately the source of pébrine infections.

Ma, C., S. Chhikara, B. Xing, **C. Musante, J. C. White**, O. Parkash Dhankher. 2013. Physiological and molecular response of *Arabidopsis thaliana* to nanoparticle cerium and indium oxide exposure. *ACS Sustain. Chem. Eng.* 1:768-778.

**ABSTRACT:** The effects of cerium oxide (CeO<sub>2</sub>) and indium oxide (In<sub>2</sub>O<sub>3</sub>) nanoparticle (NPs) exposure on *Arabidopsis thaliana* were investigated. After inoculation in ½ strength MS medium amended with 0-2000 ppm CeO<sub>2</sub> and In<sub>2</sub>O<sub>3</sub> NPs for 25 days, both physiological and molecular responses were evaluated. Exposure at 250 ppm CeO<sub>2</sub> NPs significantly increased plant biomass but at 500-2000 ppm, plant growth was decreased by up to 85% in a dose dependent fashion. At 1000 and 2000 ppm CeO<sub>2</sub> NPs, chlorophyll production was reduced by nearly 60% and 85%, respectively, and anthocyanin production was increased 3-5 fold. Malondialdehyde (MDA) production, a



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measure of lipid peroxidation, was unaffected by exposure to 250-500 ppm CeO<sub>2</sub> NPs, but at 1000 ppm, MDA formation was increased by 2.5-fold. Exposure to 25-2000 ppm In<sub>2</sub>O<sub>3</sub> NPs had no effect on *Arabidopsis thaliana* biomass and only minor effects (15%) on root elongation. Total chlorophyll and MDA production were unaffected by In<sub>2</sub>O<sub>3</sub> NPs exposure. Molecular response to NP exposure as measured by qPCR showed that both types of elements altered the expression of genes central to the stress response such as the sulfur assimilation and glutathione (GSH) metabolic pathway; a series of genes known to be significant in the detoxification of metal toxicity in plants. Interestingly, In<sub>2</sub>O<sub>3</sub> NPs exposure resulted in a 3.8-4.6 fold increase in glutathione synthase (GS) transcript production whereas CeO<sub>2</sub> NPs yielded only a 2-fold increase. It seems likely that the significantly greater metabolic response upon In<sub>2</sub>O<sub>3</sub> NPs exposure was directly related to the decreased phytotoxicity relative to CeO<sub>2</sub> treatment. The use of NP rare earth oxide elements has increased dramatically, yet knowledge on fate and toxicity has lagged behind. To our knowledge, this is the first report evaluating both physiological and molecular plant response from exposure to these important nanoparticles.

**Magnarelli, L. A., S. C. Williams, S. J. Norris, and E. Fikrig.** 2013. Serum antibodies to *Borrelia burgdorferi*, *Anaplasma phagocytophilum*, and *Babesia microti* in recaptured white-footed mice. *Journal of Wildlife Diseases* 49:294-302.

**ABSTRACT:** A mark-release-recapture study was conducted during 2007 through 2010 in six tick-infested sites in Connecticut (USA) to assess changes in antibody titers for *Borrelia burgdorferi* sensu stricto, *Anaplasma phagocytophilum*, and *Babesia microti* in *Peromyscus leucopus* (white-footed mice). There was an overall recapture rate of 40%, but only four tagged mice were caught in two or more years. Whole-blood samples were obtained from 557 mice. Sera were analyzed for total antibodies to *B. burgdorferi* and *A. phagocytophilum* by using whole-cell or recombinant (VIsE or protein 44) antigens in a solid-phase enzyme-linked immunosorbent assay (ELISA) or to whole-cell *B. microti* by indirect fluorescent antibody staining methods. Seropositivity rates were highly variable for *B. burgdorferi* (56% to 98%), *A. phagocytophilum* (11% to 85%), and *B. microti* (11% to 84%), depending on the site and time of sampling. Of the 463 seropositive mice, 206 (45%) had antibodies to all three pathogens. There were changes in antibody status for some mice from negative to positive (117 seroconversions) or from positive to negative (55 reversions). Prevalence of seroconversions was 10.1% of 417 mice for *B. burgdorferi*, 18% of 306 mice for *A. phagocytophilum*, and 6.6% of 304 mice for *B. microti*; reversion rates were 5.3%, 5.9%, and 4.9%, respectively. Antibodies to all pathogens tended to persist in some mice over several weeks, suggesting possible continued infections. In other individuals, the marked declines in titration end points to negative status may indicate possible elimination of a certain pathogen, such as *A. phagocytophilum*, or that mouse immune systems ceased to produce antibodies despite an existing patent infection.

**Maier, C. T.** 2013. Return of the periodical cicadas. *Giant News*. 104: 6-7.

**Mervosh, T. L., C. A. Cheah, and D. R. Ellis.** 2013. BIOLOGICAL CONTROL PROGRAM FOR MILE-A-MINUTE WEED (*PERSICARIA PERFOLIATA*) IN CONNECTICUT. *Weed Science Society of America Abstracts*, Vol. 53. <http://wssaabstracts.com/public/index.php?conf=17>

**ABSTRACT:** Mile-a-minute weed (MAM) [*Persicaria perfoliata* (L.) H. Gross] (Polygonaceae) is a rapidly growing herbaceous vine native to eastern Asia. In temperate climates, MAM has an annual life cycle. Since its accidental introduction in the 1930s at a southeastern Pennsylvania nursery, MAM has spread across PA and into several nearby states. The presence of MAM in Connecticut was confirmed in 2000 when a population was found at the southwestern corner of the state. In subsequent years, MAM has invaded many locations in CT. Some MAM populations are along streams or in dense thickets where mechanical or chemical control methods may be impractical or inappropriate. Fortunately, a biological control option for MAM is available. The biocontrol agent is a tiny weevil species (*Rhinoncomimus latipes* Korotyaev) native to China. *R. latipes* is highly host specific for MAM. Adults (~2 mm long) feed on MAM leaves and growing tips. Females lay eggs on



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stems and underside of leaves. Hatching larvae bore into a node and feed within the stem, mature larvae drop to the ground to pupate, then adults emerge and fly to MAM plants to feed. Generation time during the summer is about 4 weeks, and adults overwinter in the ground. Beginning in 1996, extensive testing by USDA-APHIS and other labs determined that this weevil depends solely on MAM as its food source. The first field releases of *R. latipes* were approved in 2004 in Delaware and New Jersey, and weevils have been released in several other states since 2005. Following protocols established by USDA Forest Service and the University of Delaware, we initiated a biocontrol program in 2009 for MAM in Connecticut. The Philip Alampi Beneficial Insects Laboratory in Trenton, NJ has provided us with *R. latipes* adults. The first weevil release in CT occurred on July 2, 2009 in a MAM stand in Quinnipiac River State Park (North Haven); we released 500 weevils at each of two locations within the park. Through 2012, we have released 24,000 *R. latipes* adults at 25 MAM sites within 12 towns in CT. Release sites include river banks, floodplains, open meadows, utility rights of way, town and state parks, nature preserves, residential properties, neighborhood open space, and a golf course. Property owners and managers have been cooperative and often have assisted with our evaluations. At each release site, we have monitored several times per year for weevil numbers, feeding activity by adults and larvae, damage to MAM and production of fruits. No feeding by *R. latipes* has been observed on any other plants, including native species of Polygonaceae. The weevils have survived a variety of winter conditions and flooding at some sites. They have demonstrated a keen ability to locate MAM plants in outlying areas. We have found *R. latipes* adults on MAM up to 2 miles away from the nearest release site. Control in terms of reducing growth and reproduction of MAM has been better at some locations than at others. The greatest growth in weevil numbers, feeding damage and reduction in MAM fruit production has been at one of the Newtown sites, a sunny open space not subject to flooding.

**Mervosh, T. L., and J. Ahrens.** 2013. INDAZIFLAM GRANULES AND DIMETHENAMID-P SPRAYS FOR CONTAINER-GROWN ORNAMENTALS. Weed Science Society of America Abstracts, Vol. 53. <http://wssaabstracts.com/public/index.php?conf=17>

**ABSTRACT:** Two separate experiments were conducted in 2012 at the Valley Laboratory in Windsor, CT to evaluate herbicides applied over the top of ornamentals grown in nursery containers. Plants were potted in 1-gallon containers in late May to early June 2012. A granular formulation of indaziflam was the focus of Experiment 1. Dimethenamid-p in sprayable form was evaluated in Experiment 2. For Experiment 1, plants were hosta (*Hosta* 'Gold Standard'), daylily (*Hemerocallis* 'Stella de Oro' and 'Happy Returns'), azalea (*Rhododendron* 'Delaware Valley White'), hydrangea (*Hydrangea macrophylla* 'Endless Summer'), and common lilac (*Syringa vulgaris*). Each plot contained three pots of each species. Treatments were replicated four times in a RCB design. Granules were applied with a calibrated auger-feed drop spreader over the top of dry foliage. Treatments consisted of indaziflam (0.0224G) granules applied at one of three doses: 0.0448, 0.0896 or 0.179 lb ai / A (50, 100 or 200 g ai / ha). Granules were applied on June 18 (T-1) and again on July 31 (T-2). At 2 h after treatment application, all plants were watered with overhead sprinklers for 45 min. Plant injury (0 to 10 scale) was evaluated several times. The hydrangeas were extremely sensitive to indaziflam. By July 17 (4 WAT-1), hydrangeas treated with indaziflam, even at the lowest dose, were dead or nearly dead. All treated hydrangeas died before the second application. No significant injury was observed on any of the other plants after the first treatment application. By September 5 (5 WAT-2), injury was observed on azalea, hosta, and 'Happy Returns' daylily, but only on those plants treated with the highest dose of indaziflam. Lilac and 'Stella de Oro' daylily were tolerant of indaziflam. Weeds were counted and pulled from all containers on July 31 prior to T-2. At all doses, indaziflam provided excellent control of annual weeds present.

For Experiment 2, plants and plot layout were the same as above, except lilacs were not included. Dimethenamid-p (5.9EC) treatments were applied in a volume of 100 gallons per acre by spraying over the top of dry foliage at 50 gal / A twice. A CO<sub>2</sub>-pressurized spray boom with Teejet 8004VS tips was used. Treatments consisted of dimethenamid-p at one of three doses [0.97, 1.94 or 3.88 lb ai / A (1.09, 2.17 or 4.35 kg ai / ha)] applied once on June 27. Overhead irrigation for 45 min began 20 min after treatment application. Plant injury was evaluated several times on a 0 to 10 scale. On August 2 (5 WAT), an average injury rating of 2.5 was recorded for hydrangeas treated with the highest dose of dimethenamid-p. All other plant injury ratings were less than 2. Daylilies





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and hostas exhibited tolerance to all doses. Prostrate spurge [*Chamaesyce humistrata* (Engelm. ex Gray) Small] was the most prevalent weed that emerged in containers. The high dose of dimethenamid-p provided excellent control of spurge, but the low and medium doses only suppressed the number of spurge seedlings. The medium and high doses provided adequate control of other weeds.

**Molaei, G., T. G. Andreadis, P. M. Armstrong, M. C. Thomas, T. Deschamps, E. Cuebas-Incle, W. Montgomery, M. Osborne, S. Smole, P. Matton, W. Andrews, C. Best, F. Cornine III, E. Bidlack, and T. Texeira.** 2013. Vector-host interactions and epizootiology of eastern equine encephalitis virus in Massachusetts, USA. *Vector-Borne Zoonotic Dis.* 13:312-323.

**ABSTRACT:** Eastern equine encephalitis (EEE) virus is a highly pathogenic mosquito-borne zoonosis that is responsible for outbreaks of severe disease in humans and equines, resulting in high mortality or severe neurological impairment in most survivors. In the northeastern United States, EEE virus is maintained in an enzootic cycle involving the ornithophilic mosquito, *Culiseta melanura* (Coquillett) and passerine birds in freshwater swamp habitats. To evaluate the role of *Cs. melanura* and *Culiseta morsitans* (Theobald) in recent episodes of EEE virus activity in Massachusetts, we collected blood-fed mosquitoes between June, 2007, and October, 2008, from virus foci in 6 counties, and identified the source of blood meals by PCR amplification of mitochondrial cytochrome b gene and sequencing. Analysis of 529 *Cs. melanura* and 25 *Cs. morsitans* revealed that nearly 99% and 96% of mosquitoes, respectively, acquired blood meals solely from avian hosts. American Robin, *Turdus migratorius* Linnaeus was identified as the most common vertebrate host for *Cs. melanura* (21.7%, n = 115), followed by Tufted Titmouse, *Baeolophus bicolor* (L.) (8.7%, n = 46), Black-capped Chickadee, *Poecile atricapillus* (L.) (8.5%, n = 45), Scarlet Tanager, *Piranga olivacea* (Gmelin) (6.8%, n = 36), Field Sparrow, *Spizella pusilla* (Wilson) (6.2%, n = 33), Northern Cardinal, *Cardinalis cardinalis* (L.) (5.7%, n = 30), and other mostly Passeriformes birds. Mammalian-derived blood meals were identified as white-tailed deer, *Odocoileus virginianus* Zimmermann, domestic cow, *Bos Taurus* L., and human, *Homo sapiens* L. There were 4 isolations of EEE virus, West Nile virus, and Highland J virus from *Cs. melanura*. Our results in conjunction with other lines of evidence, including reservoir competency, prevalence of antibody, and infection in nature, suggest that the American Robin, Tufted Titmouse, Black-capped Chickadee, and a few other passerine birds may play key roles in supporting EEE virus transmission in Massachusetts. Infrequent blood feeding of *Cs. melanura* on mammalian hosts, including humans, also indicates that this mosquito may occasionally contribute to epidemic/epizootic transmission of EEE virus in this region

**Nguyen, H. N. and J. J. Pignatello.** 2013. Laboratory Tests of Biochars as Adsorbents for Use in Recovery or Containment of Marine Crude Oil Spills. *Environ. Engineer. Sci.*, 30(7): 374-380.

**ABSTRACT:** The absorption capacity of biochar for crude oil and the mineralization potential of the absorbed oil in seawater were determined in laboratory-scale experiments. Texas, South Louisiana, or Qua-Iboe Nigeria crude oils were contacted with four commercial hardwood biochars or synthesized biochars in seawater from the Gulf of Mexico and Long Island Sound (U.S.). The synthesized biochars were made anoxically from maplewood at different heat treatment temperatures (HTT) from 300 to 700 °C. The oil absorption capacity of the biochars determined in dip tests using oil on seawater ranged from 3.6 to 6.3 g/g. The oil-imbibed biochar particles are buoyant. Seawater typically had little effect on capacity, but oil was less effectively absorbed in the form of weathered water-in-oil emulsion ('mousse') than in as-received form. Absorption capacity peaked at HTT about 400 °C and correlated poorly with % C, H/C ratio, O/C ratio, surface area, microporosity and total porosity, indicating that swelling and macropore filling are responsible for the high capacities. In biometer tests, CO<sub>2</sub> evolution from sub-capacity levels of Texas crude in biochar suspended in seawater was stimulated relative to oil in the absence of biochar in three of four tests, but in all tests biochar had no inhibitory effect. Thus, biochar may prime biodegradation by providing a favorable solid support and an interstitial reservoir of hydrocarbons for degrader biofilms. While less absorptive than many experimental high-tech absorbents, biochar may serve as an inexpensive alternative for recovery of marine oil spills in a form suitable as a fuel, or as an aid to natural attenuation.



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**Peterson, R.B. and N. P. Schultes.** 2013. Light-harvesting complex B7 shifts the irradiance response of photosynthetic light-harvesting regulation in leaves of *Arabidopsis thaliana*. *Journal of Plant Physiology*. Published online 10 October 2013. <http://dx.doi.org/10.1016/j.jplph.2013.09.007>

**ABSTRACT:** The nuclear LHCb7 gene is common in higher plants, encodes a transcript that is well expressed in a subset of leaf mesophyll cells, and is associated with a protein product that is homologous to pigment-binding components of the photosystem (PS) II peripheral antenna complex. We compared the physiological properties of wild type and LHCb7-deficient leaves DNA insertion, *Arabidopsis thaliana* (At ecotype Columbia) in terms of pigment content, CO<sub>2</sub> exchange, *in vivo* transmittance at 810 nm, and chlorophyll fluorescence. The latter two techniques are functional indicators for PSI and PSII, respectively. Key features of the mutant phenotype were confirmed using antisense technology and a hemizygote of two independent AtLHCb7 DNA insertion lines. Growth, leaf pigment composition, white light absorbance, and levels of AtLHCb1-6 were not significantly different in the mutant compared to wild type. Likewise, neither intrinsic PSII light capture efficiency nor partitioning of absorbed radiation to PSII was affected by the mutation. The absence of AtLHCb7 is associated with lower rates of light-saturated photosynthesis and a diminished irradiance threshold for induction of photo-protective non-photochemical quenching. Overall, the pattern of change in light utilization parameters and plastoquinol level indicated that loss of AtLHCb7 expression led to slower Rubisco turnover characterized by pH-dependent balancing of electron transport to reduced carbon assimilation capacity (photosynthetic control). No effect of AtLHCb7 genotype on xanthophyll deepoxidation state was detected suggesting that factors in addition to luminal pH influence zeaxanthin accumulation.

**Peterson, R. B., H. Eichelmann, V. Oja, A. Laisk, E. Talts, and N. P. Schultes.** 2013. Functional aspects of silencing and transient expression of PsbS in *Nicotiana benthamiana*. *Amer. Journal of Plant Sciences*. 4(7): 1521-1532.

**ABSTRACT:** MicroRNA-based gene silencing is a functional genomics tool for a wide range of eukaryotes. As a basis for broader application of virus-induced gene silencing (VIGS) to photosynthesis research, we employed a tobacco rattle virus (TRV) vector to silence expression of the nuclear *psbS* gene in *Nicotiana benthamiana*. The 22-kiloDalton psbS protein is essential for xanthophyll- and H<sup>+</sup>-dependent thermal dissipation of excitation in higher plants widely known as nonphotochemical quenching (NPQ). Controls treated with the TRV-VIGS vector containing a bacterial chloramphenicol resistance gene as the silencing target were included to test for non-silencing effects of the viral vector system. PsbS protein was undetectable and both *psbS* mRNA transcript levels and NPQ capacity were dramatically reduced in new leaf tissue of VIGS-*psbS* plants only. Photosynthetic performance in TRV-VIGS-treated and uninfiltreated plants was assessed by application of CO<sub>2</sub> exchange, chlorophyll fluorescence, and *in vivo* absorbance changes at 810 nm. TRV-VIGS caused a mild stress based on pigment content and light absorption characteristics in some cases. To assess transient complementation of NPQ, the endogenous *psbS* gene was silenced using only the transit sequence in the TRV vector followed by *Agrobacterium*-mediated transient expression of a modified gene consisting of an altered transit sequence fused to the native mature protein sequence. Nevertheless, NPQ in infused fully expanded leaves that expressed this re-introduced form was not fully restored indicating the possible importance of psbS incorporation prior to formation of grana stacks.

**Pignatello, J. J.** 2013. Adsorption of Organic Compounds by Black Carbon from Aqueous Solution, In: "Molecular Environmental Soil Science," Jianming Xu and D.L. Sparks (Edits.); *Progress in Soil Science Series*; Springer; pp 359-385.

**ABSTRACT:** Black carbon is the carbonaceous product of pyrolysis or incomplete combustion of biomass or fossil fuels. Due to its widespread occurrence in atmospheric aerosols, soils and sediments, and its intrinsic strength as an adsorbent, black carbon potentially plays an important role in the partitioning of organic pollutants from water and air to natural solids, especially at low pollutant concentration. The adsorptive strength of black carbon depends greatly on pyrolysis time, tempera-



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ture and other formation conditions, as well as subsequent weathering in the environment. The predominant property of black carbon governing its adsorptive strength is its small-pore porosity. The filling of micropores and mesopores of molecular dimensions eliminates the need for the cavity penalty that otherwise accompanies partitioning of molecules into bulk nonporous phases such as organic liquids, polymers and natural organic matter to accommodate incoming molecules. However, the filling of these small pores exhibits a steric effect due to size exclusion at pore throats. The polyaromatic (graphite-like) surface of black carbon serves as a strong p-electron donor in the formation of p-p electron donor-acceptor complexes with strong p-deficient aromatic systems, for example, polynitroaromatics and charged aromatic amines. Polar functional groups on the rims of polyaromatic sheets attracts water clusters that crowd out adsorbates, regardless of polarity. Nevertheless, compounds such as phenols, carboxylic acids and others that are capable of forming especially strong hydrogen bonds with carboxyl or phenoxy groups on the surface may interact strongly. In the environment, the adsorptive strength of black carbon becomes quickly attenuated by fouling with humic substances, which block pores and compete for adsorption sites. Quantifying the contribution of native black carbon to retention of a contaminant in a given natural sample is a challenge due to the lack of reliable methods for determining black carbon content in geosolids, the difficulty of separating black carbon particles from the sample, the absence in most cases of a basis for choosing an appropriate reference standard, and a poor quantitative understanding of the weathering process. Adding to the challenge is the strong hysteresis that is often seen to accompany adsorption to black carbon materials, but that is poorly unpredictable and poorly understood mechanistically.

Ran, Y., Y. Yang, B. Xing, **J. J. Pignatello**, S. Kwon, W. Su, and L. Zhou. 2013. Evidence of Micropore-filling for Sorption of Nonpolar Organic Contaminants by Condensed Organic Matter. *J. Environ. Qual.* 42: 806–814.

**ABSTRACT:** Although microporosity and surface area of natural organic matter (NOM) are crucial for mechanistic evaluation of the sorption process for nonpolar organic contaminants (NOCs), they have been underestimated by the  $N_2$  adsorption technique. We investigated the  $CO_2$ -derived internal hydrophobic microporosity ( $V_o$ ) and specific surface area (SSA) obtained on dry samples, and related them to sorption behaviors of NOCs in water for a wide range of condensed NOM samples. The  $V_o$  is obtained from the total  $CO_2$ -derived microporosity by subtracting out the contribution of the outer surfaces of minerals and NOM using  $N_2$  adsorption-derived parameters. The correlation between  $V_o$  or  $CO_2$ -SSA and fractional organic carbon contents ( $f_{OC}$ ) is very significant, demonstrating that much of the microporosity is associated with internal NOM matrices. The average  $V_o$  and  $CO_2$ -SSA are, respectively, 75.1  $\mu L/g$ -OC and 185  $m^2/g$ -OC from the correlation analysis. The rigid aliphatic carbon significantly contributes to the microporosity of the Pahokee peat. A strong linear correlation is demonstrated between  $V_o/f_{OC}$  and the OC-normalized sorption capacity at the liquid or sub-cooled liquid state water solubility calculated via the Freundlich equation for each of four NOCs (phenanthrene- Phen, naphthalene- Naph, 1,3,5- trichlorobenzene- TCB, and 1,2- dichlorobenzene- DCB). It is concluded that micropore-filling ("adsorption") makes a sizable contribution to NOC sorption by condensed NOM, but the exact contribution requires knowing the relationship between the dry-state,  $CO_2$ -determined microporosity and the wet-state, NOC-available microporosity of the organic matter. The findings offer new clues for explaining the often-observed nonideal sorption behaviors of NOCs.

**Ridge, G. E.** 2013. Connecticut Bed Bug Pest Management Professionals (PMP) 2013 List. CAES Fact Sheet. [http://www.ct.gov/caes/lib/caes/documents/bed\\_bugs/connecticut\\_pest\\_management\\_professionals\\_bed\\_bug\\_listing\\_2013.pdf](http://www.ct.gov/caes/lib/caes/documents/bed_bugs/connecticut_pest_management_professionals_bed_bug_listing_2013.pdf)

**Ridge, G. E.** 2013. Delusory Parasitosis. The Belief of Being Lived on by Arthropods or other Organisms. CAES Fact Sheet [http://www.ct.gov/caes/lib/caes/documents/2013/delusions\\_of\\_parasitosis\\_2012\\_pdf.pdf](http://www.ct.gov/caes/lib/caes/documents/2013/delusions_of_parasitosis_2012_pdf.pdf)

**Ridge, G. E.** and **K. A. Stoner.** 2013. Ground-nesting Bees. CAES Factsheet.



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**ABSTRACT:** Many species of bees nest in the ground, including bumble bees (*Bombus*), mining bees (Andrenidae), cellophane bees (Colletidae), and some sweat bees (Halictidae). These bees are important pollinators and should not be treated with insecticides. Some cultural methods of discouraging ground-nesting bees from nesting in lawns are given. [http://www.ct.gov/caes/lib/caes/documents/ground\\_nesting\\_bees.pdf](http://www.ct.gov/caes/lib/caes/documents/ground_nesting_bees.pdf)

**Ridge, G. E.** and multiple authors. 2013. EPA FIFRA Scientific Advisory Panel report. Draft Product Performance Data Needs Assessment for Products Claiming Efficacy Against Invertebrate Pests. Authored Appendix 1, Tables 1 and 2 identifying international and national pests of significant public health importance, and international wood-destroying insects.

**Rutledge, C. E.,** M. K. Fierke, P. D. Careless, T. Worthley. 2013. First detection of *Agrilus planipennis* in Connecticut made by monitoring *Cerceris fumipennis* (Crabronidae) colonies. *J. Hymenoptera Res.* 32:75–81.

**ABSTRACT:** Smoky winged beetle bandits, *Cerceris fumipennis* Say, digger wasps in the family Hymenoptera: Crabronidae: Cercerini, provision their underground nests with adult metallic wood-boring beetles (Coleoptera: Buprestidae). Researchers, as well as engaged community volunteers, in several states have monitored female wasps returning to their nests as a means to detect invasive buprestid species. In this paper, we report the first detection of emerald ash borer (*Agrilus planipennis* Fairemore), an invasive beetle responsible for killing millions of ash trees in North America, in Connecticut by *C. fumipennis* and discuss its relationship to *A. planipennis* survey efforts by other modalities in the state. We also report detections of *A. planipennis* by *C. fumipennis* in Illinois, New York and Ontario; all of which were made after it was known the beetle was in the area. These findings support the use of *C. fumipennis* as a biomonitoring tool and bolster the use of engaged volunteers.

Schein, J., K. A. Hunt, J. Minton, **N. P. Schultes**, and G. S. Mourad. 2013. The nucleobase cation symporter 1 from *Chlamydomonas reinhardtii* and the evolutionary distant *Arabidopsis thaliana* share function and establish a plant specific solute transport profile. *Plant Physiol. and Biochem.* 70:52-60.

**ABSTRACT:** The single cell alga *Chlamydomonas reinhardtii* is capable of importing purines as nitrogen sources. An analysis of the annotated *C. reinhardtii* genome reveals at least three distinct gene families encoding for known nucleobase transporters. In this study the solute transport and binding properties for the lone *C. reinhardtii* nucleobase cation symporter 1 (CrNCS1) are determined through heterologous expression in *Saccharomyces cerevisiae*. CrNCS1 acts as a transporter of adenine, guanine, uracil and allantoin, sharing similar – but not identical – solute recognition specificity with the evolutionary distant NCS1 from *Arabidopsis thaliana*. The results suggest that the solute specificity for plant NCS1 occurred early in plant evolution and are distinct from solute transport specificities of single cell fungal NCS1 proteins.

**Smith, V. L.** 2013. Winter Moth: A New Survey Target. *The Connecticut Arborist* XXIV:1-3.

**Stoner, K. A.** and **B. D. Eitzer.** 2013. Using a hazard quotient to evaluate pesticide residues detected in pollen trapped from honey bees (*Apis mellifera*) in Connecticut. *PLoS ONE* 8(10): e77550, doi:10.1371/journal.pone.0077550.





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**ABSTRACT:** Analysis of pollen trapped from honey bees as they return to their hives provides a method of monitoring fluctuations in one route of pesticide exposure over location and time. We collected pollen from apiaries in five locations in Connecticut, including urban, rural, and mixed agricultural sites, for periods from two to five years. Pollen was analyzed for pesticide residues using a standard extraction method widely used for pesticides (QuEChERS) and liquid chromatography/mass spectrometric analysis. Sixty pesticides or metabolites were detected. Because the dose lethal to 50% of adult worker honey bees ( $LD_{50}$ ) is the only toxicity parameter available for a wide range of pesticides, and among our pesticides there were contact  $LD_{50}$  values ranging from 0.006 to >1000  $\mu\text{g}$  per bee (range >166,000X), and even among insecticides  $LD_{50}$  values ranged from 0.006 to 59.8  $\mu\text{g}/\text{bee}$  (>10,000X); therefore we propose that in studies of honey bee exposure to pesticides that concentrations be reported as Hazard Quotients as well as in standard concentrations such as parts per billion. We used both contact and oral  $LD_{50}$  values to calculate Pollen Hazard Quotients ( $\text{PHQ} = \text{concentration in ppb} \div \text{LD}_{50}$  as  $\mu\text{g}/\text{bee}$ ) when both were available. In this study, pesticide Pollen Hazard Quotients ranged from over 75,000 to 0.01. The pesticides with the greatest Pollen Hazard Quotients at the maximum concentrations found in our study were (in descending order): phosmet, imidacloprid, indoxacarb, chlorpyrifos, fipronil, thiamethoxam, azinphos-methyl, and fenitrothion, all with at least one Pollen Hazard Quotient (using contact or oral  $LD_{50}$ ) over 500. At the maximum rate of pollen consumption by nurse bees, a Pollen Hazard Quotient of 500 would be approximately equivalent to consuming 0.5% of the  $LD_{50}$  per day. We also present an example of a Nectar Hazard Quotient and the percentage of  $LD_{50}$  per day at the maximum nectar consumption rate.

**Stoner, K. A.** 2013. Planting Flowers for Bees in Connecticut. CAES Factsheet. We made timed observations of bees visiting 84 species of flowers on 10 diversified vegetable farms in Connecticut. This publication presents the most flowers most frequently visited by bees (including bumble bees and other bees species as well as honey bees) among the herbs, ornamental and cut flowers, cover crops and legumes, wildflowers and weeds, and vegetable crops allowed to go to seed that we observed.

**Stoner, K. A.** 2013. Bees on Alternative Flowering Plants on Vegetable Farms in Connecticut. CAES Factsheet. We collected 98 species of bees on flowering herbs, ornamental and cut flowers, cover crops, wildflowers and weeds, and vegetables allowed to go to seed on 10 diversified vegetable farms in Connecticut. This publication presents information from the scientific literature about which bee species are known visitors to flowers fruiting vegetables and to fruit trees, and those flowers on which we found at least 8 individual bees of one species.

Teixido, M., C. Hurtado, **J. J. Pignatello**, J. L. Beltran, M. Granados, and J. Peccia. 2013. Predicting Contaminant Adsorption in Black Carbon (Biochar)-Amended Soil for the Veterinary Antibiotic Sulfamethazine, *Environ. Sci. Technol.*, 47 (12): 6197–6205.

**ABSTRACT:** Commercial hardwood biochars ranging in  $\text{N}_2$  specific surface area of 0.1 – 427  $\text{m}^2/\text{g}$  were added to an agricultural soil at 0, 1, or 2% levels to determine whether they would predictably reduce the pore water concentration of sulfamethazine (SMT). The soil and biochar-soil mixtures were pre-weathered under mild (2 d, 20 °C) or more severe (28 d, 40 °C) conditions before spiking. The carbon-normalized biochar-water distribution coefficient ( $K_{\text{BC}}$ ) of the biochars varied by a factor of up to  $10^4$ , depending on biochar properties and SMT concentration. Except for the fast-pyrolysis biochar,  $K_{\text{BC}}$  greatly exceeded the soil organic carbon-water distribution coefficient  $K_{\text{OC}}$ . Sorption in the mixtures increased as expected with biochar and dose. However, sorption was dramatically over-predicted (by up to  $10^{2.5}$ ) by the sum of sorption to the individual components, indicating a strong weathering effect even under the mild conditions. The soil-subtracted weathered biochar-water isotherms were more linear, and the  $K_{\text{BC}}$  values approached or lay within the range of  $K_{\text{OC}}$  values reported for SMT in 19 soils. Biochars both in intimate contact with soil and placed in a membrane bag suspended in the solution showed reduced  $\text{N}_2$ -B.E.T. surface area after weathering, implicating fouling of the biochar surface by humic substances transferred through water. The results indicate that only highly surfaceous, carbonaceous biochars would be useful for stabilizing soil



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contaminated with compounds such as SMT. They also suggest that weathering may attenuate the contribution of native (environmental) black carbon to sorption of such compounds in soils and sediments.

**Ward, J. S.;** and **S. C. Williams.** 2013. Treating Japanese barberry (*Berberis thunbergii*) during the dormant season. P. 182-191 *In* Proceedings 18th Central Hardwood Conference. USDA Forest Service General Technical Report NRS-P-117. 531 p. [CD-ROM].

**ABSTRACT:** Japanese barberry is an invasive shrub that can suppress forest regeneration and increase the risk of exposure to Lyme disease. In 2008, we began a study in central Connecticut to examine the efficacy of treating barberry infestations during the dormant season (Oct-Mar). Techniques included basal spray (triclopyr in oil) and clearing saw cutting with a 'wetblade' application of triclopyr. Dormant season techniques were compared with a glyphosate foliar spray during September. Foliar application resulted in a greater reduction of barberry cover than basal spray and wetblade treatments, 94, 84, and 74 percent reductions, respectively. Treatment effectiveness did not differ among months for either of the dormant season techniques. Labor costs did not differ among techniques - averaging 0.13 hours/acre/percent cover; i.e., 3.9 hours for a 1-acre stand with 30 percent barberry abundance. There was a large difference among treatments in amount of herbicide applied: 0.6 ( $\pm 0.1$ ), 1.4 ( $+0.4$ ), and 2.8 ( $\pm 0.4$ ) ounces/acre/percent cover for wetblade clearing saw, foliar spray, and basal spray applications, respectively. While not as effective as foliar spraying, wetblade clearing saw and basal spray applications provide an opportunity to control barberry during the dormant season. Wetblade clearing saw technique can reduce the amount of applied herbicide.

**Ward, J. S., S. C. Williams,** and T. E. Worthley. 2013. Japanese barberry control methods reference guide for foresters and professional woodland managers. Connecticut Agricultural Experiment Station Special Bulletin - February 2013. 12p.

**ABSTRACT:** This reference guide provides an overview of the ecological and health risks associated with Japanese barberry (*Berberis thunbergii*) infestations, along with an extensive comparison of the advantages, disadvantages, effectiveness, and costs of various control techniques.

**Ward, J. S.** 2013. Influence of disturbance on stand development during deciduous forest succession in Connecticut. P. 93-104 *In* Proceedings 18th Central Hardwood Conference. USDA Forest Service General Technical Report NRS-P-117. 531 p. [CD-ROM].

**ABSTRACT:** Eighty years of stand development on thirty-nine strip transects was used to elucidate the influence of disturbance on forest composition. Transects were measured at 10-yr intervals between 1927 and 2007, except for 1947, and includes records of 35,953 stems. Disturbances included a wildfire in 1932, single-year defoliations (1964, 1972, 1981), and multi-year defoliation episodes (1961-1963, 1971-1972, 1981). Wildfire reduced basal area by 46 percent. During the first defoliation period, oak basal area mortality averaged 36 (multi-year) and 12 percent (single-year). In 2007, oak density (stems per acre) on burned transects in 2007 was twice that observed on unburned transects, 90 and 42; while maple density was higher on transects that had had only single-year defoliations (190) compared with multi-year defoliation (119). In contrast, birch density was lower on transects with single-year defoliations (97) compared to multi-year defoliation (198). Oak ingrowth was highest following wildfire, 244 stems per acre per decade ( $SA^{10}$ ), and was negligible during subsequent decades, 6  $SA^{10}$ . Transects with multi-year defoliations averaged 80 birch  $SA^{10}$  compared with 44 maple  $SA^{10}$  between 1967-1997. During that same period, maple ingrowth averaged  $SA^{10}$  and birch ingrowth 14  $SA^{10}$  following single-year defoliations. Disturbance type has a long-term impact on forest composition.



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**Ward, J. S.** 2013. Using vegetation to date clandestine graves. *Forensic Magazine*. May 2013 [[http://www.forensicmag.com/articles/2013/05/using-vegetation-date-clandestine-graves#.UcmJfTjD\\_cs](http://www.forensicmag.com/articles/2013/05/using-vegetation-date-clandestine-graves#.UcmJfTjD_cs)]

**ABSTRACT:** Determining the postmortem interval (PMI) is a critical component of clandestine grave investigations. If investigators are able to find the grave within 24 hours of death, then pathologists can estimate the time of death. For shallow graves, forensic entomologists may be able to use insect succession and development to estimate PMI. Forensic anthropologists can assist with estimating the PMI for longer internments based on rate of decay and condition of the remains. Investigators may also be familiar with the potential of using biological matter such as pollen as a tool to estimate the season when a clandestine grave was created<sup>1</sup> or DNA to identify plant fragments.<sup>2</sup>

It is less appreciated that the vegetation above and within the grave can also provide information on when a grave was created. However, the care taken to minimize postmortem trauma to the remains could inadvertently destroy this botanical evidence. The focus of this article will be to inform readers of potential botanical evidence that might be present at a site along with suggestions on proper documentation and preservation.

**Williams, S. C., A. J. DeNicola, T. Almendinger, and J. Maddock.** 2013. Evaluation of traditional hunting as an overabundant deer management technique in suburban landscapes. *Wildlife Society Bulletin* 37:137-145.

**ABSTRACT:** Hunting has been the primary white-tailed deer (*Odocoileus virginianus*) management tool for decades. Regulated hunting has been effective at meeting management objectives in rural areas, but typical logistical constraints placed on hunting in residential and urban areas can cause deer to become overabundant and incompatible with other societal interests. Deer-vehicle collisions, tick-associated diseases, and damage to residential landscape plantings are the primary reasons for implementing lethal management programs, often with objectives of <10 deer/km<sup>2</sup>. There are limited data demonstrating that hunting alone in suburban landscapes can reduce densities sufficiently to result in adequate conflict resolutions or a corresponding density objective for deer. We present data from 3 controlled hunting programs in New Jersey and one in Pennsylvania, USA. Annual or periodic population estimates were conducted using aerial counts and road-based distance sampling to assess trends. Initial populations, some of which were previously subjected to regulated unorganized hunting, ranged from approximately 30–80 deer/km<sup>2</sup>. From 3 years to 10 years of traditional hunting, along with organized hunting and liberalized regulations, resulted in an estimated 17–18 deer/km<sup>2</sup> at each location. These projects clearly demonstrate that a reduction in local deer densities using regulated hunting can be achieved. However, the sole use of existing regulated hunting techniques in suburban areas appears insufficient to maintain deer densities <17 deer/km<sup>2</sup> where deer are not limited by severe winter weather. Additional measures, such as sharpshooting or other strategic adjustments to regulations and policies, may be needed if long-term deer-management objectives are much below this level.

**Williams S. C. and M. R. Short.** 2013 . Effectiveness of rabbit repellents in Connecticut. *Connecticut Gardener Magazine*, May/June 2013.

Xu, W., **J. J. Pignatello**, and W. A. Mitch. 2013. The role of black carbon conductivity in mediating hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) degradation on carbon surfaces by nucleophilic substitution in the presence of sulfides. *Environ. Sci. Technol.* 47 (13): 7129–7136.

**ABSTRACT:** Recent research has demonstrated that black carbons catalyze the transformation of a range of nitrated explosives sorbed to the carbon surfaces in the presence of sulfides. Although surface oxygenated functional groups, particularly quinones, and electrical conductivity have both been hypothesized to promote these reactions, the importance of these properties has not been tested. In this work, the importance of electrical conductivity was addressed by producing chars of increasing electrical conductivity via pyrolysis of wood shavings at increasing temperature. The reactivity of



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chars with respect to transformation of the explosive RDX in the presence of sulfides correlated with electrical conductivity. Oxygenated functional groups were apparently not involved, as demonstrated by the elimination of reactivity of an activated carbon after ozone treatment or sorption of model quinones to the activated carbon surface. Although RDX transformation correlated with char electrical conductivity, no RDX transformation was observed when RDX was physically separated from sulfides but electrically connected through an electrochemical cell. RDX transformation occurred in the presence of a surface-associated sulfur species. The correlation with char electrical conductivity suggests that sulfides are oxidized on carbon surfaces to products that serve as potent nucleophiles promoting RDX transformation.

Zhao, G-H, **D-W. Li**, G-J Xi. 2013. Studies on the symptoms and *Phyllactinia populi* on Italian hybrid poplars and *Populus deltoides* cv. Zhonghua hongye. *Journal of West China Forestry Science* 42: 1-6.

**ABSTRACT:** A powdery mildew on Poplars was studied for its occurrence, damage, and distribution in Jiangsu and Shandong provinces. Results showed that the powdery mildew was able to infect a number of species hybrids, and cultivars of *Populus* and caused premature defoliation. According to its morphological characters, the pathogen occurred in the two provinces was identified as *Phyllactinia populi*. It was reported for first time on Italian hybrid Poplar cultivars: I-69, I-72, I-107, and *Populus deltoides* cv. Zhonghua hongye. Its co-occurrence with uredia of *Melampsora lari-ci-populina* and *Marssonina brunnea* on the same leaf was reported for first time also.



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