

# Station News

The Connecticut Agricultural Experiment Station  
Volume 7 Issue 9 September 2017



## This Issue

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.



# CAES

The Connecticut Agricultural Experiment Station

*Putting Science to Work for Society since 1875*

Administration	2
Analytical Chemistry	2
Entomology	4
Environmental Sciences	4
Forestry and Horticulture	5
Plant Pathology and Ecology	6
Valley Laboratory	8
Dept. Research Updates	9
Journal Articles Approved	11
Articles of Interest	12
Grants Received	13

## ADMINISTRATION

**DR. THEODORE ANDREADIS** presided over a quarterly meeting of the Station's Board of Control held at Lockwood Farm (August 2); participated in a press conference held at the Station with Senator Richard Blumenthal concerning ticks and rising incidence of tick-borne diseases in Connecticut (August 9); was interviewed about the current status of ticks and tick-borne diseases in the state and the Station's Tick Testing Program by Matt McFarland WFSB, Hartford (August 9); was interviewed about the Station's research, surveillance, and diagnostic services and programs by Eric Clemons, Comcast Newsmakers (August 9); met with Dr. Sonny Ramaswamy, director of the National Institute of Food and Agriculture (NIFA) at UCONN in Storrs, and gave an overview of the Station's research, regulatory and public service programs (September 14); was interviewed about the prevalence of Lyme disease and other tick related human disease cases in Connecticut by Greg Hladky, Hartford Courant (August 15); hosted a group of physicians from the Department of Emergency Medicine Yale School of Medicine, and gave an overview of the Station's research, regulatory and public service programs (12 attendees) (August 23); and attended a reception for Sonny Perdue, US Secretary of Agriculture, held at Prides Corner Farms in Lebanon (August 31).

## ANALYTICAL CHEMISTRY

**DR. JASON C. WHITE** held a teleconference call with collaborators at NIST and several other institutions regarding preparation of a joint review article on measuring nanoparticle toxicity (August 1); participated in a teleconference call for the FDA Method Coordination Committee regarding evaluation of method validation package for a new LC-MS toxin/poison method (August 4); gave an invited lecture entitled "Nanomaterials and the food supply: Assessing the balance between applications and implications" at Zhejiang University as part of a new 111 Project entitled "Crop Produce Quality and Safety" which was awarded this summer from the Chinese Ministry of Education and the State Administration of Foreign Experts Affairs (August 7-11); spoke by phone with Mr. Dave Rejeski, who is the Director, Technology, Innovation and the Environment Project at the Environmental Law Institute in Washington, DC, about the potential application of nanotechnology to agriculture and food production (August 16); attended a strategic planning meeting in Minneapolis, MN for Principal Investigators of the Center for Sustainable Nanotechnology (August 17-18); met with staff of the CT Department of Agriculture regarding a new sampling agreement for year three of the FDA-funded program on animal feed safety (AFRPS) (August 22); spoke with Professor Philip Demokritou of the Harvard University School of Public Health about collaborative research and the potential of funding a Harvard Post-doc at CAES (August 28); along with **DR. THEODORE ANDREADIS** and **MR. MICHAEL LAST**, met with the Commissioner of Agriculture and his staff regarding a new FDA program called the Produce Safety Rule (August 30); and along with **DR. THEODORE ANDREADIS** attended a

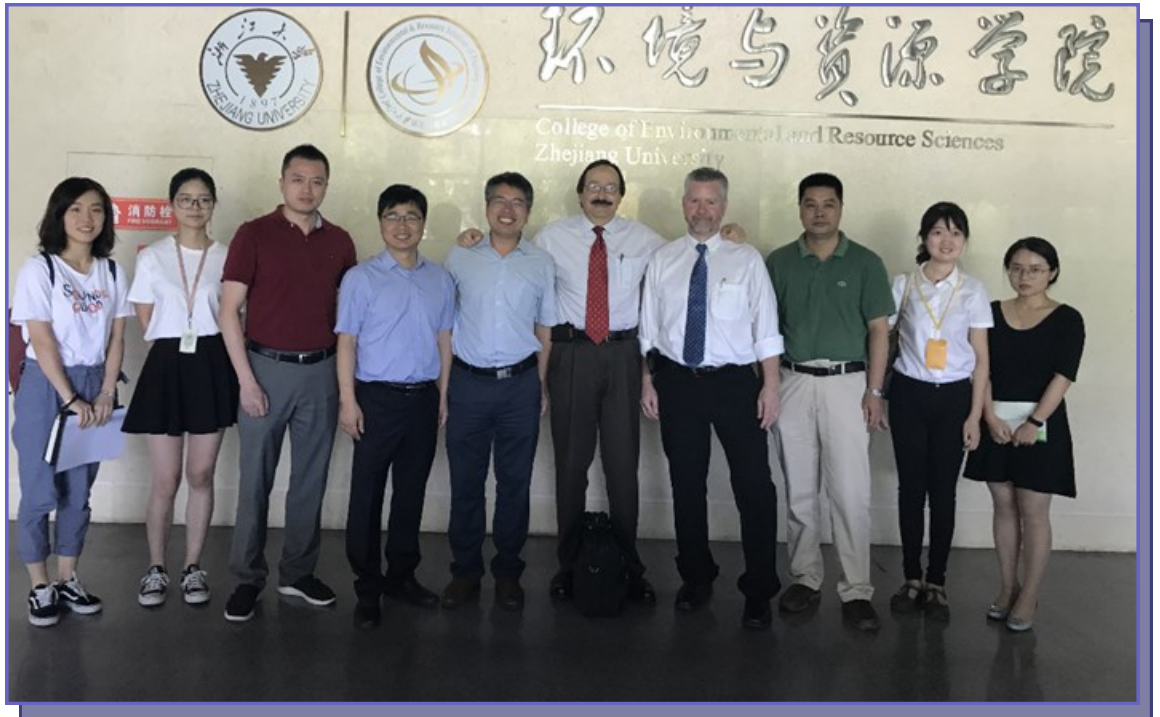
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# STATION NEWS

meeting at Prides Corner Farms in Lebanon with the US Secretary of Agriculture, Mr. Sonny Perdue, as part of the Secretary's "listening tour" (August 31).



Dr. Jason C. White and Prof. Jorge Gardea-Torresdey, along with faculty and graduate students of the College of Environmental and Resource Sciences of Zhejiang University. Dr. White and Prof. Gardea-Torresdey are international advisors in the University's new 111 Project entitled "Crop Produce Quality and Safety" which was awarded this summer from the Chinese Ministry of Education and the State Administration of Foreign Experts Affairs.

## ENTOMOLOGY

**DR. VICTORIA L. SMITH** participated in a meeting of Gypsy Moth Program managers, sponsored by the US Forest Service via conference call in, to report on gypsy moth conditions in CT (approx. 25 participants) (August 8).

**DR. KIMBERLY A. STONER** was interviewed by John Burgeson of the CT Post about bee health and pollination (during Plant Science Day) (August 2); presented a poster, “Connecticut Native Plants for Bees” as part of a Department of Transportation lunch time session during a conference on transportation design for Departments of Transportation nation-wide at CT Department of Transportation Headquarters, Newington (August 7); and presented a workshop, “Planting for the Bees’ Needs” at the NOFA Summer Conference, Hampshire College, Amherst, Massachusetts (63 attendees) (August 13).

## ENVIRONMENTAL SCIENCES

**DR. PHILIP ARMSTRONG** was interviewed by WNPR and News Channel 8 about the rapid increase and spread of West Nile virus activity in Connecticut (August 24).

**MR. GREGORY BUGBEE** attended a meeting of the Northeast Aquatic Nuisance Species (NEANS) Panel via conference call (August 1); gave the talk “Pond Weed Management” at a symposium on irrigation water for nursery crops sponsored by UCONN Extension Service and held at the Valley Laboratory (approx. 50 attendees) (August 15); and was interviewed by the CT Post on aquatic weed problems in Lake Zoar (August 18).

**DR. GOUDARZ MOLAEI** hosted Dr. Heather Ruff, Clinical Fellow at the Yale School of Medicine, and provided her with information on the CAES services and research activities on mosquito- and tick-borne pathogens of human diseases (August 9); was interviewed by Darien News CT on “*Tick population, Lyme disease infections surge as predicted*”, <http://www.dariennews.com/news/article/Tick-population-Lyme-disease-infections-surge-as-11742109.php> (August 14); hosted Yale School of Medicine residents in the CAES Tick Testing laboratory and discussed services and research on mosquito- and tick-borne pathogens of human diseases (12 attendees) (August 23); was interviewed by Record-Journal, Meriden “*Ticks carry more than just Lyme disease, scientist says*” <http://www.myrecordjournal.com/news/wallingford/wallingfordnews/10777146-154/ticks-carry-more-than-just-lyme-disease-scientist-says.html> (August 25); and

gave a short talk on research at the Department of the Epidemiology of Microbial Diseases, EMD Seminar Series-Orientation Session, Yale School of Public Health, (50 attendees) (August 31).

**MR. JOHN SHEPARD** was interviewed by WTNH News8 about mosquito trapping and West Nile Virus (August 24).

## FORESTRY AND HORTICULTURE

**DR. JEFFREY S. WARD** was interviewed about fall foliage by Matt Ormseth of the Hartford Courant (August 21); spoke about Japanese barberry control and relationship to tick densities at the Lyme disease: Restoring balance in the body workshop in Tolland (14 attendees) (August 27); and along **MR. JOSEPH P. BARSKY**, participated in a Connecticut Society of American Foresters field meeting in Voluntown (August 30).

**DR. ABIGAIL A. MAYNARD** visited Rose's Berry Farm in Glastonbury to discuss okra culture and varieties (August 31).

**DR. SCOTT C. WILLIAMS** with **MR. MICHAEL SHORT** and **MS. MEGAN LINSKE**, spoke with Yale medical students and residents about ticks and tick-borne disease ecology (14 students, 1 professor) (August 23); and was interviewed by Taylor Shortal of the Columbia Missourian newspaper about over-abundant suburban deer management (August 14).

**MS. JOAN L. BRAVO** was interviewed about the effect of weather on when grapes ripen by WTNH Connecticut (August 25).

## PLANT PATHOLOGY AND ECOLOGY

**DR. WADE ELMER** attended the Annual meeting of the American Phytopathological Society meeting in San Antonio, chaired the Widely Prevalent Fungi List Committee and attended the Academic Unit Forum meeting (August 5-9); and was an invited lecturer to the 50<sup>th</sup> Congress of the Brazilian Phytopathological Society in Uberlandia, Brazil, where he presented the talk “Using nanoparticles of micronutrients to suppress root disease and enhance plant health” (150 attendees) (August 23).

**DR. YONGHAO LI** presented “Foliar Diseases of Christmas Trees and Their Management” at the CCTGA twilight meeting in Easton (35 adults) (August 29).

**DR. LINDSAY TRIPLETT** presented two posters at the annual meeting of the American Phytopathological Society, San Antonio, Texas: “Survey of toxin-antitoxin system distribution and diversity among genomes of plant-associated bacteria,” and “Cofactor engineering as a novel pathogenesis strategy: a *Xanthomonas* secreted effector modifies NAD *in planta*.” She also participated in a meeting of the APS Bacteriology Committee, serving as co-chair (100 attendees) (August 5-9).

**DR. QUAN ZENG** was interviewed by John Burgeson, Connecticut Post, about biological controls of fire blight (August 2); interviewed on the WSHU Public Radio by Charlotte Webber, about fire blight management and development and application of antisense antimicrobials for plant agriculture (August 29); attended the 2016 Annual Meeting of American Phytopathological Society in San Antonio, TX (August 5-9), gave poster presentation of “Exploration of using PNA-CPP as a novel antimicrobials against *Erwinia amylovora* and control of fire blight” (100 attendees) (August 6); and chaired the APS Bacteriology Committee meeting (80 attendees) (August 5).

Ten undergraduate summer interns of the Plant Health and Protection internship program presented a table display of their group field project, “The effects of nanoparticles on Fusarium wilt of Chrysanthemum” to visitors at Plant Science Day (August 2). They presented their individual summer projects at a lunch symposium (40 attendees) (August 3).



Student interns at Plant Science Day along with mentors from Southern Connecticut State University



A lecture by Dr. Meredith Blackwell (Louisiana State University) entitled “Leading Women in Fungal Biology” was given in Utrecht University in August 30-31, honoring Dr. Johanna Westerdijk, the discoverer of Dutch Elm disease. Dr Blackwell presents Dr. Anagnostakis along with two other CAES geneticists, Dr. Peter Day and Dr. John Puhalla, as The Fathers and one Mother: the beginning of genetics.

**DR. JATINDER S. AULAKH** conducted a demonstration on non-native Invasive plants and answered the weed identification and management inquiries at Plant Science Day in Hamden (August 2); and gave a talk on management of perennial weeds at the Connecticut Christmas Tree Growers Twilight meeting at Keneally Christmas Farm, Easton (August 29).

**DR. CAROLE CHEAH** was interviewed by Bob Miller of the Danbury New Times on the renewal of the biological control of HWA program in Connecticut through small scale releases of *Sasajiscymnus tsugae*, donated from Tree-Savers, PA (July 24); with summer research assistant, Emmett Varricchio, toured the New London Naval Submarine Base and recorded weevil activity and damage at the biological control of mile-a-minute sites with Michael Brown, Director of the Environmental Division (August 30); and with Donna Ellis, Senior Extension Educator of UConn, Alton Blodgett (retired CT Dept. of Agriculture and volunteer) and summer research assistant, Emmett Varricchio, visited and monitored 2 biological control of mile-a-minute sites in Sprague (August 31).

**DR. RICHARD COWLES** displayed “Soil pH affects health of Christmas trees,” coauthored by **Dr. J. A. LaMondia**, and had a hands-on station for children to learn about pH at Plant Science Day (August 2); presented “Bees and the neonicotinoid controversy” as a short talk at Plant Science Day (220 attendees); represented a large collaborative project by presenting “Systemic insecticide risk assessment for pollinators in ornamental horticulture crops,” coauthored by Cristi Palmer, James Bethke, Juang-Hong Chong, **Dr. Brian Eitzer**, Daniel Potter, David Smitley, and Nishanth Thayaril, at a Pollinator Risk Assessment Symposium session of the American Chemical Society National Meeting in Washington, D.C., (60 attendees) (August 21); and participated in discussing insect pests in the twilight meeting of the CT Christmas Tree Growers Association, Easton (40 attendees) (August 29).

**DR. JAMES LAMONDIA** presented a poster about research titled “*Calonectria pseudonaviculata* microsclerotia viability after exposure to fungicides,” and participated in the APS Division Forum Representatives meeting at the annual meeting of the American Phytopathological Society in San Antonio, Texas (August 6-10); presented a poster entitled “Effects of resistant or susceptible tobacco (*Nicotiana tabacum*), eastern black nightshade (*Solanum ptychanthum*), and litchi tomato (*Solanum sisymbriifolium*) on reproduction of the tobacco cyst nematode *Globodera tabacum*” at the Society of Nematologists meeting held in Williamsburg, VA (August 13-17); participated in Ayse Adams Masters thesis research proposal meeting at Central Connecticut State University (August 28); and spoke about research and services and conducted a tour of the Valley Lab Research Farm for participants in a Farm Credit East Customer Service Council meeting held at the Station (August 29).

**DR. DE-WEI LI** organized and hosted the Pan-American Aerobiology Association 2017 annual meeting and Spore Camp held at the Valley Laboratory in Windsor (August 4-6).



Deng, R.; Lin, D.; Zhu, L.; Majumdar, S.; White, J.C.; Gardea-Torresdey, J.L.; Xing, B. 2017. Nanoparticle interactions with co-existing contaminants: Joint toxicity, bioaccumulation and risk. *Nanotox.* 11:591-612.

**Abstract-** With their growing production and application, engineered nanoparticles (NPs) are increasingly discharged into the environment. The released NPs can potentially interact with pre-existing contaminants, leading to biological effects (bioaccumulation and/or toxicity) that are poorly understood. Most studies on NPs focus on single analyte exposure; the existing literature on joint toxicity of NPs and co-existing contaminants is rather limited but beginning to develop rapidly. This is the first review paper evaluating the current state of knowledge regarding the joint effects of NPs and co-contaminants. Here, we review: 1) methods for investigating and evaluating joint effects of NPs and co-contaminants; 2) simultaneous toxicities from NPs co-exposed with organic contaminants, metal/metalloid ions, dissolved organic matter (DOM), inorganic ligands, and additional NPs; and 3) the influence of NPs co-exposure on the bioaccumulation of organic contaminants and heavy metal ions, as well as the influence of contaminants on NPs bioaccumulation. In addition, future research needs are discussed so as to better understand risk associated with NPs-contaminant co-exposure.

Shidore, T. and L.R. Triplett, 2017. Toxin-Antitoxin systems: Implications for plant disease. *Annual Review of Phytopathology* 55: 161-179.

**Abstract-** Toxin-antitoxin (TA) systems are gene modules that are ubiquitous in free-living prokaryotes. Diverse in structure, cellular function, and fitness roles, TA systems are defined by the presence of a toxin gene that suppresses bacterial growth and a toxin-neutralizing antitoxin gene, usually encoded in a single operon. Originally viewed as DNA maintenance modules, TA systems are now thought to function in many roles, including bacterial stress tolerance, virulence, phage defense, and biofilm formation. However, very few studies have investigated the significance of TA systems in the context of plant-microbe interactions. This review discusses the potential impact and application of TA systems in plant-associated bacteria, guided by insights gained from animal-pathogenic model systems.

LaMondia, J. A. and N. Shishkoff. 2017. Susceptibility of boxwood accessions from the National Boxwood Collection to boxwood blight and potential for differences between *Calonectria pseudonaviculata* and *C. henricotiae*. *HortScience* 52:873-879.

**Abstract-** Forty *Buxus* accessions from the U.S. National Arboretum National Boxwood Collection were evaluated as potted plants and detached leaves for susceptibility to *Calonectria pseudonaviculata* (Crous & al.) L. Lombard & al. and nine boxwood cultivars were evaluated against both species of *Calonectria* causing boxwood blight, *C. pseudonaviculata* and *C. henricotiae*. Accessions of *B. harlandii* Hance, *B. sinica* (Rehder & E.H.Wilson) M.Cheng and *B. microphylla* Siebold & Zucc. had less disease than *B. microphylla* × *sempervirens*, and all had fewer lesions per plant than the 20 *B. sempervirens* L. accessions evaluated. Variation within species was observed. Of the individual accessions, *B. sinica* var. *aemulans* (accession 60705\*H), *B. sempervirens* (36365\*J) and *B. harlandii* (18834\*H) were least susceptible, with < 10 lesions per plant. *B. sempervirens* 'Scupi' (9548\*H), *B. microphylla* 'Compacta' (4899\*CH), *B. sempervirens* 'Arborescens' (57953\*H), *B.*

*sinica* var. *insularis* 'Pincushion' (51898\*H) and *B. microphylla* var. *japonica* 'Jim Stauffer' (72213\*H) each had < 20 lesions. These rankings differ from previous studies that used detached leaf and unrooted cutting assays. Normalizing to account for plant size effects on inoculation and disease increased variability for individual accession rankings, but did not result in significant differences in the most and least susceptible accessions or species ranking. Nine boxwood cultivars evaluated against both pathogen species exhibited a range of susceptibility against four pooled isolates each of *C. pseudonaviculata* and *C. henricotiae*. Although small differences in disease severity were observed on boxwood inoculated with the two pathogens, there was no interaction of cultivar and pathogen species, suggesting that a cultivar rated resistant to one species was resistant to the other. These results may aid boxwood breeders to develop resistance to boxwood blight.

**Gent, M.P.N., W.H. Elmer.** 2017. Partial saturation ebb and flow irrigation and silicon to suppress *Pythium* root rot of poinsettia. *Crop Protection* 101:95-102

**Abstract-** A greenhouse equipped with two flooded floors with separate reservoirs was used to determine if partial saturation versus more complete saturation of the root medium, with and without silicon addition, could suppress *Pythium* root rot of poinsettias. The partial saturation floor was designed to deliver and drain water quickly. The control floor operated with longer watering to achieve close to full saturation. The partial saturation floor used approximately 25% less water than the control floor over the life of a crop. Rooted poinsettias were grown on each floor in 2010, 2011, and 2014. A K<sub>2</sub>SiO<sub>3</sub> solution was added to the root medium several times in each season. Controls received K<sub>2</sub>CO<sub>3</sub>. In 2010 and 2011, fifteen plants were artificially inoculated with *Pythium aphanidermatum* and placed randomly on each floor. In 2014, one half of the plants were artificially inoculated with *Pythium aphanidermatum*. Disease was monitored by evaluating plant weights, uptake, and retention of silicon, and by rating the root systems for percent root rot. In 2010 and 2014, disease was significantly reduced under partial saturation compared to control watering. There were some effects of silicon, but it never halted the onset of symptoms or reduced the damaging effect of disease on plant growth. There were no interactions of effects of watering and silicon on progress of disease. Plants were smaller and more compact under partial saturation than under control watering. These findings should encourage growers to adopt partial saturation on their flooded floors in order to reduce damage from disease after inoculum has been accidentally introduced.

## JOURNAL ARTICLES APPROVED AUGUST 2017

Castañeda-Ruiz, R. F., X.-G. Zhang, De-Wei Li, L. F. Pascholati Gusmão, S. Pérez-Martínez, and D. Sosa. Notes on *Vamsapriya* and *V. camagueyensis* comb. nov. *Mycotaxon*

Galán, C., A. Ariatti, M. Bonini, B. Clot, B. Crouzy...De-Wei Li, et al. Recommended terminology for aerobiological studies. *Aerobiologia*

Gent, Martin P. N. Factors affecting relative growth rate of lettuce and spinach. *Journal of the American Society for Horticultural Science*

Hiskes, Rose. Norway spruce shoot gall midge, (*Piceacecis abietiperda*) Diptera: Cecidomyiidae. *CAES Fact Sheet*

Hsieh, Hsin-Se and Joseph J. Pignatello. Modified carbons for enhanced nucleophilic substitution reactions of adsorbed methyl bromide. *Applied Catalysis B: Environmental*

Li, Yonghao. Red thread of turfgrass. *CAES Fact Sheet*

Li, Yonghao. Volutella blight of boxwood. *CAES Fact Sheet*

Liao, Y.-Y., A. Strayer-Scherer, Jason C. White, A. Mukherjee, Roberto De La Torre-Roche, et al. Nano-magnesium oxide: a novel bactericide against copper-tolerant *Xanthomonas perforans* causing tomato bacterial spot. *Phytopathology*

Marko, M. D. and Jason C. White. Direct comparison of herbicidal or biological treatment on *Myriophyllum spicatum* control and biochemistry. *Frontiers in Plant Science*

Monteiro, T. S. A., J. A. Brito, S. J. S. Vau, W. Yuan, James A. LaMondia, L. G. Freitas, and D. W. Dickson. Matricidal hatching in *Meloidogyne hapla*: a case study. *Nematoda*

Sampson, B., M. Miller-Butler, B. Smith, J. Adamczyk Jr., T. Mann, B. Layton, Richard S. Cowles, DeWei Li, and S. Darq. Spotted wing drosophila flies killed by a fungal disease in Mississippi. *Mississippi Vaccinium Journal*

Uchimiya, M., Joseph J. Pignatello, Jason C. White, S.-L. Hu, and P. J. Ferreira. Surface interactions between gold nanoparticles and biochar. *ACS Sustainable Chemistry & Engineering*

Zeng, Quan, Zhouqi Cui, J. Wang, K. Childs, G. W. Sundin, D. Cooley, C.-H. Yang, A. Eaton, Regan B. Huntley, X. Yuan, and Neil P. Schultes. Comparative genomics of Spiraeoideae-infecting *Erwinia amylovora* strains revealed higher genetic diversity and suggested origin of global dispersal. *Molecular Plant Pathology*

Zhang, Y., Joseph J. Pignatello, and S. Tao. Bioaccessibility of PAHs and PAH derivatives in a fuel soot assessed by an in vitro digestive model with absorptive sink: effects of aging the soot in a soil-water mixture. *Science of the Total Environment*

## ARTICLES OF INTEREST AUGUST 2017

*The Biology of Arid Soils*. In: Life in Extreme Environments Series. 2017. Blaire Steven, Edit. Publisher: Walter de Gruyter GmbH & Co KG (10 chapters). <https://www.degruyter.com/view/product/455617>

Soils have been called the most complex microbial ecosystems on Earth. A single gram of soil can harbor millions of microbial cells and thousands of species. However, certain soil environments, such as those experiencing dramatic change exposing new initial soils or that are limited in precipitation, limit the number of species able to survive in these systems. In this respect, these environments offer unparalleled opportunities to uncover the factors that control the development and maintenance of complex microbial ecosystems. This book collects chapters that discuss the abiotic factors that structure arid and initial soil communities as well as the diversity and structure of the biological communities in these soils from viruses to plants.

Chapters in the book:

**Steven, B.** (2017) An Introduction to Arid Soils and Their Biology. In: *The Biology of Arid Soils*. Steven B (ed). : Walter de Gruyter GmbH & Co KG. pp. 1-15.

**Steven, B, McHugh TA, Reed S.** (2017) The Response of Arid Soil Communities to Climate Change. In: *The Biology of Arid Soils*. Steven B (ed). : Walter de Gruyter GmbH & Co KG. pp. 139-159.

**Cheah, C. and Ellis, D.** 2016 Biological control of Mile-a-Minute weed (MAM) in Connecticut available online at <http://mam.uconn.edu/wp-content/uploads/sites/1170/2015/02/MAM-biocontrol-2016-Poster-Cheah-.pdf>.

**Russo, N.J., Cheah, C.A. S-J., Elphick, C.S. and Tingley, M. W.** 2017. Avian Spring Migration as a Dispersal Mechanism for an Invasive Insect Pest. Abstract for an oral presentation at the 2017 Northeast Natural History Conference, 22-23 April 2017, Cromwell, CT Available online at: [https://www.eaglehill.us/NENHC\\_2017/program/NENHC2017-oral-abstracts.pdf](https://www.eaglehill.us/NENHC_2017/program/NENHC2017-oral-abstracts.pdf)

**Maurer, K. and J. A. LaMondia.** 2017. Guidelines for integrated pest management for hops in Connecticut. CAES Bulletin 1050 [http://www.ct.gov/caes/lib/caes/documents/publications/bulletins/ipm\\_of\\_hops\\_in\\_ct1.pdf](http://www.ct.gov/caes/lib/caes/documents/publications/bulletins/ipm_of_hops_in_ct1.pdf)

## GRANTS RECEIVED AUGUST 2017

**Collaborative Research: Air-Oxidation of Biomass Chars—Structural Changes and Implications for Retention and Reactions of Contaminants.** J. J. Pignatello, K. Schmidt-Rohr (Brandeis Univ.), and JD Mao (Old Dominion Univ.); Award No. 1709532; National Science Foundation, Chemistry Division; August 7, 2017; \$292,391 (CAES).

**Abstract:** Char particles are ubiquitous components of soil and aquatic sediments as a result of natural and deliberately-set fires. Also, char products such as activated carbon and biochar have attracted interest as beneficial soil additives for use in agriculture and environmental management. Important attributes of chars include their ability to strongly bind pollutants and to catalyze certain chemical reactions of the bound pollutants. Air may be present or absent during the charring process and is usually present during the weathering of chars in the environment. The oxygen in air can have major effects on the physical and chemical properties of chars that can impact their functions as adsorbents and catalysts. This project will determine such effects and impacts in carefully controlled experiments at both high and ambient temperature. This project will provide benefits to society by contributing to an understanding of how biomass chars affect the fate of pollutants in the environment, and by providing valuable information that may be useful in efforts to tailor activated carbons and biochars for specific applications in agriculture or contaminated site cleanup. The project is expected to clarify many ongoing issues in the field of research and open up avenues for future research. The project has strong outreach and education components directed at engaging prospective scientists among historically disadvantaged groups.

Chars will be made from wood and switchgrass. The test compounds are phosphate, arsenate, arsenite, selenite, aquatic herbicides (diquat and paraquat), and model organic compounds. Advanced solid-state NMR spectroscopy will be employed to identify and quantify changes in functional group composition and fused aromatic ring size, and to detect signals associated with exceptionally-strong hydrogen bond formed between surface groups and weak acid adsorbates. NMR sensitivities will be enhanced by the use of  $^{13}\text{C}$ -enriched switchgrass as biomass precursor and  $^{13}\text{C}$ -labelled compounds as adsorbates. In NMR and other experiments the project will investigate the consequences of air oxidation on the formation of exceptionally strong hydrogen bonds, cation exchange interactions, dissolved organic matter competition for adsorption sites, oxidation-reduction reactions mediated by chars, and the concentrations of persistent free radicals formed by the pyrolysis process. The findings will be novel and have important implications for char structure and weak acid solute behavior in the environment.

**Drs. J. Aulakh, C. Cheah, R. Cowles, J. LaMondia and D. Li** each received \$500 grants from the Connecticut Christmas Tree Growers Association for research on Christmas Trees.



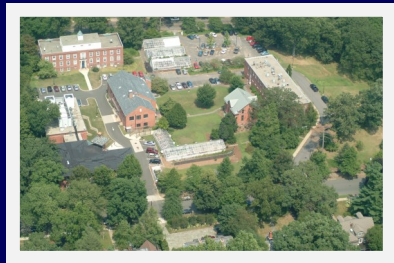
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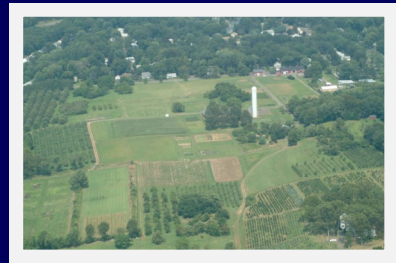
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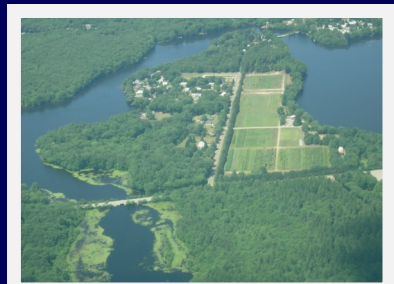
Main Laboratories, New Haven



Lockwood Farm, Hamden

Lockwood Farm  
890 Evergreen Avenue  
Hamden, CT 06518-2361  
Phone: 203-974-8618

Griswold Research Center  
190 Sheldon Road  
Griswold, CT 06351-3627



Griswold Research Center, Griswold



Valley Laboratory, Windsor

Valley Laboratory  
153 Cook Hill Road  
Windsor, CT 06095-0248  
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## The Connecticut Agricultural Experiment Station

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Station News was prepared and edited by Dr. Theodore G. Andreadis, Ms. Vickie Bomba-Lewandoski, Ms. Sandra Carney, and Ms. Brandi Marks.

Volume 7 Issue 9  
September 2017

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