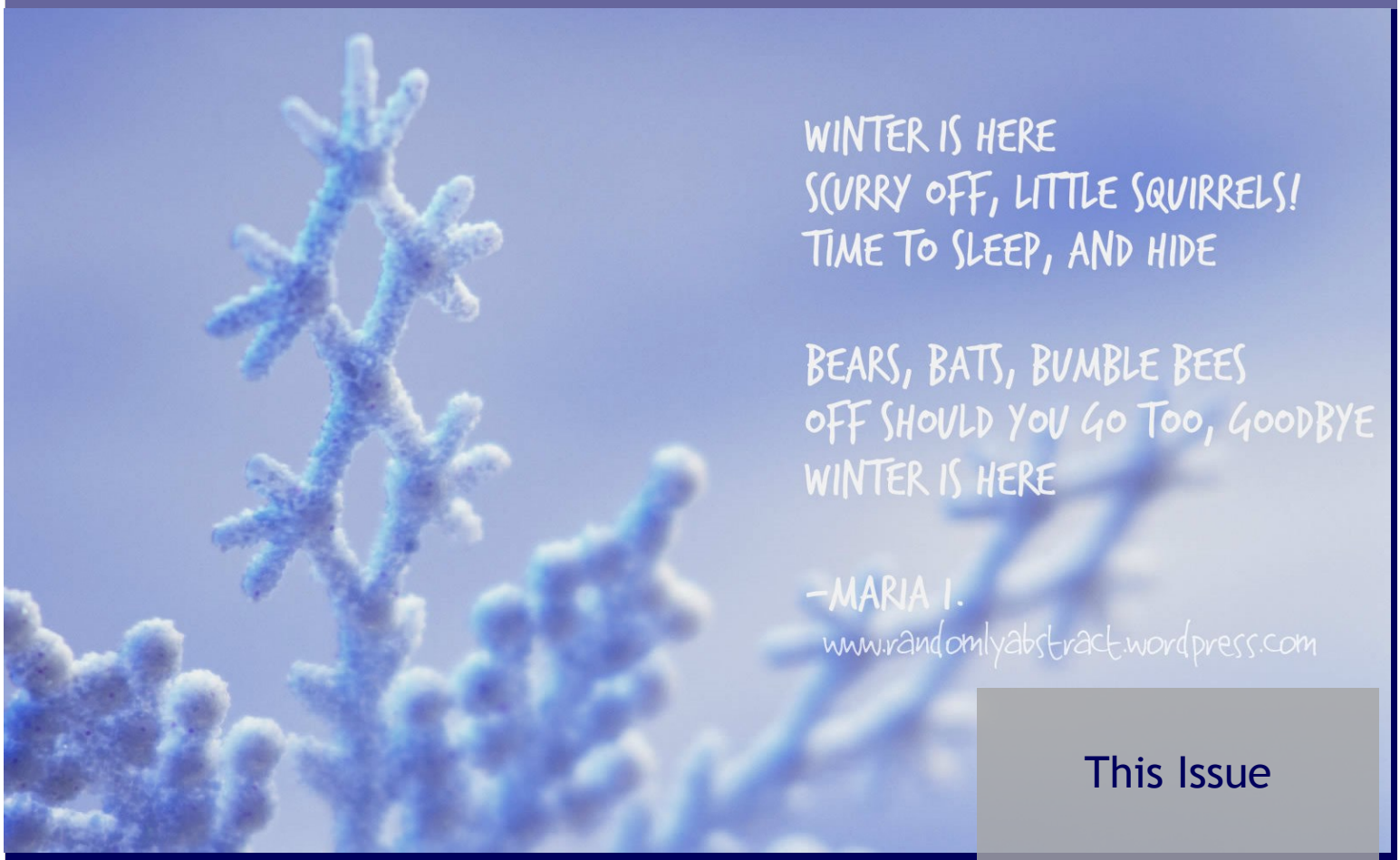
Station News

The Connecticut Agricultural Experiment Station
Volume 7 Issue 12 December 2017



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

This Issue

ADMINISTRATION

DR. THEODORE ANDREADIS attended the 65th Annual Meeting of the Entomological Society of America and presented an invited symposium talk entitled "*Evolutionary strategies and adaptations for survival among mosquito-parasitic microsporidia: evidence for coevolution and host switching*" and attended an Editorial Board Meeting of the Journal of Medical Entomology held in Denver, CO (November 5-8); participated in a meeting of Connecticut's Invasive Plant Council held in Hartford (November 14); and attended the annual meeting of the Connecticut Farm Bureau held in Wallingford (November 17).

ANALYTICAL CHEMISTRY

DR. JASON C. WHITE along with **MS. KITTY P.-RIVEROS** participated in the FDA AFRPS Quarterly teleconference call (November 2); attended the 6th annual Sustainable Nanotechnology Organization (SNO) Conference and presented a lecture entitled "Nanotechnology and the food supply: Assessing the balance between applications and implications" (20 attendees) and chaired a session entitled "Food/Agriculture" (November 5- 8); spoke by phone with Prof. Greg Lowry of Carnegie Mellon University regarding an upcoming grant submission to the USDA SCRI program (November 8,9); spoke by phone with Prof. Robert Hamers of the University of Wisconsin regarding CAES hosting an upcoming bi-annual meeting of the Center for Sustainable Nanotechnology (CSN) (November 9); along with **MR. CRAIG MUSANTE, MS. TERRI ARSENAULT, MS. KITTY P.-RIVEROS,** and **DR. BRIAN EITZER** participated in the monthly FDA FERN cCAP teleconference call (November 10); participated in the Center for Sustainable Nanotechnology monthly All Faculty teleconference call (November 10); met with Lockwood Lecturer Dr. Zeyaur R. Khan (November 13); spoke by WebEx with Ms. Miriam Krause of the Center for Sustainable Nanotechnology (CSN) about hosting a REU/REV student in the summer of 2018 (November 14); attended the Working Lands Alliance annual luncheon at the Capitol building (November 15); spoke by phone with Prof. Navid Saleh (University of Texas Austin) and Prof. Markita del Carpio Landry (University of California Berkeley) about a joint grant submission to NSF (November 17); participated in the FDA AFRPS 2018 Face-to-Face Agenda Planning Committee WebEx (November 17); participated in a Center for Sustainable Nanotechnology WebEx for the "Nanotechnology in Agriculture" seed grant (November 20); and participated in an FBI WMD, CT Civil Support Team, and US EPA Table Top Exercise in Windsor Locks (November 28).

DR. CHRISTINA S. ROBB attended the Eastern Analytical Symposium in Plainsboro, NJ (November 12-16), attended the board meeting on (November 12), ran the program planning meeting (November 14), and performed the duties of vice -chair of the EAS program committee.

DR. BRIAN EITZER, along with **DR. CHRISTINA ROBB, DR. WALTER KROL** and **DR. NUBIA ZUVERZA-MENA,** visited Dr. Michael Rickenbach and Dr. Robert Lockwood at the State of CT - Department of Emergency Services & Public Pro-

tection, Division of Scientific Services laboratory in Meriden CT to discuss the use of high resolution liquid chromatography – high resolution mass spectrometry as a tool for the analysis of samples related to drugs (November 6); was a participant in the conference call meeting of the North American Chemical Residue Workshop's organizing committee (November 9); and the quarterly call of the principal investigators on the SCRI -Protecting Pollinators with Economically Feasible and Environmentally Sound Ornamental Horticulture grant (November 15).

DR. NUBIA ZUVERZA-MENA presented the talk "Nanoscale nutrients suppress plant disease and increase crop yield" (20 attendees) at the Materials Research Society (MRS) symposium "Materials Innovation for Sustainable Agriculture and Energy" in MA.

ENTOMOLOGY

DR. KIRBY C. STAFFORD III, with **DR. GOUDARZ MOLAEI**, co-organized a symposium titled *The Challenge of Tick-Borne Diseases* and presented a talk on "Habitat and winter survival of *Ixodes scapularis* and *Amblyomma americanum,*" while attending the annual meeting of the Entomological Society of America in Denver, CO (70 attendees) (November 5-8); and was visited by Prof.dr. Frans Jongejan from Utrecht University in the Netherlands (November 29-30).

MS. KATHERINE DUGAS staffed a Forest Pest booth at the annual CT Association of Conservation and Inland Wetlands Commissions (CACIWC) meeting held in Cromwell (November 18); and attended the CT Pomological Society meeting in Middletown (November 28).

MR. MARK H. CREIGHTON assisted Marlese Lessing, University of Connecticut, on filming a short documentary about the state of Connecticut's bees and how Colony Collapse Disorder would affect the bees on and around campus (November 2); met with staff at the Darien Nature Center to review/upgrade maintenance of their observation hive (November 13); and participated in a panel discussion on honeybees at the University of Connecticut to provide an educational opportunity to students and help celebrate UConn's Bee Campus USA status (45 student attendees) (November 17).

DR. CHRIS T. MAIER discussed recent research on periodical cicadas at a meeting of the Connecticut Entomological Society at Wesleyan University in Middletown (November 17); and distributed written information on the brown marmorated stink bug at the Annual Meeting of the Connecticut Pomological Society in Middletown (November 28).

DR. GALE E. RIDGE spoke about Delusions of Parasitosis at the National Pest Management Association regional conference in Taunton, MA (300 attendees) (November 3); presented a talk on mosquitoes, ticks, and bed bugs at the Connecticut Environmental Council conference in Plainville (268 attendees) (November 21); and was interviewed by Amina Wilson from the Discovery Network, Los Angeles, CA about arthropods and dermatitis (November 30).

DR. CLAIRE E. RUTLEDGE presented a talk on "Bronze birch borer, *Agrilus anxius* (Coleoptera: Buprestidae)," while attending the annual meeting of the Entomological Society of America in Denver, CO (November 5-8).

DR. VICTORIA L. SMITH participated in a meeting of the Yale Biosafety Committee, held at 135 College Street, New Haven (20 participants) (November 16); and participated in a joint seminar, with USDA-APHIS-Plant Protection and Quarantine and USDA-APHIS-Veterinary Services, held at Yale University Environmental Health and Services meeting room, at 135 College Street, New Haven, on the regulatory and permitting process (20 participants) (November 29).

DR. KIMBERLY A. STONER spoke at the CT Audubon Center in Glastonbury on "Planting for the Bees' Needs" (20 attendees) (November 6); organized a tour of the Bee Laboratory and Wade Elmer's laboratory and greenhouse for the Greenhouse Management class from the Naugatuck Valley Community College (8 students and one teacher, Chris Tuccio, participated) (November 8); organized and led a meeting of the Connecticut Native Plants for Pollinators and Wildlife Working Group at the Yale Peabody Museum (7 participants) (November 8); made a farm visit to Ellie Lowell at Stonewooe Farm in Willington to discuss pollinator habitat (November 20); and made a visit to a potential site for pollinator habitat at Edgerton Park with George Davis, a member of the board of the Friends of Edgerton Park (November 27).

ENVIRONMENTAL SCIENCES

DR. JOSEPH PIGNATELLO met with Yale seminar speaker, Prof. Young-Shin Jun, Washington State University (November 8); and met with Lockwood Lecturer, Prof. Zeyaur R. Khan, International Centre of Insect Physiology and Ecology, Nairobi, Kenya (November 13).

DR. PHILIP ARMSTRONG gave the talk "Northern Range Expansion of the Asian Tiger Mosquito (*Aedes albopictus*): Analysis of Mosquito Data from Connecticut USA 1997-2006" (approx. 100 attendees), and organized a symposium "New and Young Investigators in Medical Entomology" at the Annual Meeting of the American Society of Tropical Medicine and Hygiene in Baltimore, MD (November 6-7).

MR. GREGORY BUGBEE gave a seminar entitled "Plant Management in Farm Ponds" as part of the University of New Hampshire, Farm Irrigation Pond Management Meeting Series in Goffstown, New Hampshire (approx. 25 attendees) (November 28); presented the results of the 2017 CAES Aquatic Plant Survey of Pachaug Pond to the Pachaug Pond Association at the Griswold Town Hall (approx. 60 attendees) (November 29); and with Abigail Wiegand, presented the results of the 2017 CAES Aquatic Plant Survey of Lake Housatonic at a meeting of the Lake Housatonic Authority at the New Haven Rowing Club in Oxford (approx. 20 attendees) (November 30).

DR. GOUDARZ MOLAEI was interviewed by News 8 WTNH on the tick season in Connecticut (http://wtnh.com/2017/11/02/tick-season-is-still-going-strong-in-connecticut/) (November 2); co-moderated the symposium, "*The Challenge of Tick-borne Diseases*"; presented a talk, "*Four decades of ticking in Connecticut and the plague of Lyme and other tick-associated diseases*" (approx. 70 attendees), and co-presented another talk "*Habitat and winter survival of Ixodes scapularis and Amblyomma americanum*" (approx. 70 attendees) at the annual meeting of the Entomological Society of America in Denver, CO (November 4-8); and met with Dr. Frans Jongejan, Faculty of Veterinary Medicine, Utrecht Center for Tick-borne Diseases, The Netherlands (November 30).

DR. JOHN SOGHIGIAN gave an invited talk entitled "Convergence in habitat specialization and morphology in *Aedes* mosquitoes" at the 2017 Entomological Society of America Annual Meeting in Denver, CO (approximately 30 attendees) (November 8).

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD, with **MR. JOSEPH P. BARSKY**, met with Steve Johnson, Milford Natural Resource Agent, to discuss control of invasive species including running bamboo (November 2); participated in the Society of American Foresters House Society of Delegates annual meeting in Albuquerque, NM (November 14-15); presented the poster "Influence of Invasive Shrubs and Deer Browsing on Regeneration in Temperate Deciduous Forests" at the Society of American Foresters annual convention in Albuquerque, NM (November 16); and with **MR. JOSEPH P. BARSKY**, met with Will Hochholzer and Kyle Arvisais (CT DEEP Forestry) at Pleasant Valley to discuss oak regeneration (November 30).

DR. ABIGAIL A. MAYNARD assisted lower school students at Hamden Hall Country Day School on plants (5 teachers, 63 students) (November 3,8,15,20,29); discussed the New Crops Program with Robert Bagg in East Haven (November 6); and attended the Annual Meeting of the Connecticut Pomological Society in Middletown (November 28).

DR. SCOTT C. WILLIAMS as Executive Treasurer, participated in the 29th Annual Connecticut Urban Forest Council Conference and 13th Annual Forest Forum in Plantsville (November 7); as a graduate committee member, participated in the successful oral defense of Kelsey Schwenk's master's degree from the University of Connecticut in Storrs (November 16); with **MR. JOSEPH P. BARSKY**, **MR. MICHAEL R. SHORT**, and **MS. MEGAN LINSKE**, hosted the FFA Forestry Career Development Event at Lockwood Farm (36 students, 9 teachers) (November 17); as a graduate committee member, participated in the successful Ph. D. dissertation defense of **DR. MEGAN LINSKE** from the University of Connecticut in Storrs (November 27).

MR. JOSEPH P. BARSKY participated in a STEM panel group presentation during the Cheshire High School Career Day (61 students) (November 14).

MR. MICHAEL R. SHORT, with **MR. JOSEPH P. BARSKY** and **MS. MEGAN LINSKE**, staffed the CAES booth at the 29th Annual Connecticut Urban Forest Council Conference and 13th Annual Forest Forum in Plantsville (200 attendees) (November 7).

PLANT PATHOLOGY AND ECOLOGY

DR. DONALD E. AYLOR was a judge for the Connecticut Tech Challenge held in Bristol where teams of engineering students from colleges throughout Connecticut competed by designing a technological solution to reduce waste in the farm-to-table food delivery chain (50 undergraduate students participated) (November 16).

DR. WADE ELMER moderated the Graduate Student Award session of the Annual meeting of the Northeastern Division of the American Phytopathological Society in Québec City, Québec, CANADA (62 attendees) (November 1-3) and spoke about Sudden Vegetation Dieback and The Role of Nanoparticles in Plant Pathology to Dr. Chris Tuccia's Greenhouse Management Class of Naugatuck Valley Community College (10 attendees) (November 8).

DR. YONGHAO LI attended the APS Northeastern Division Annual Meeting in Quebec City, Canada, and presented "2017 Plant Disease Updates" (40 adults) (November 1); presented "Plant Disease Information Office and Plant Disease Diagnostics" to Naugatuck Valley Community College students during the CAES tour in New Haven (8 adults) (November 8); presented "National Plant Diagnostic Network" to faculty and students at the Northeast Agricultural University, Harbin, China (60 adults) (November 13); and visited the Northeast Forestry University in Harbin, China and met with Dr. TingBo Jiang and his graduate students to discuss drought tolerance in trees (6 adults) (November 14).

DR. ROBERT E. MARRA presented "Tropical Storms, Hurricanes, and Superstorms: Impact and Influence on Tree Diseases" for the Bethany Garden Club in Bethany (25 adults) (November 13).

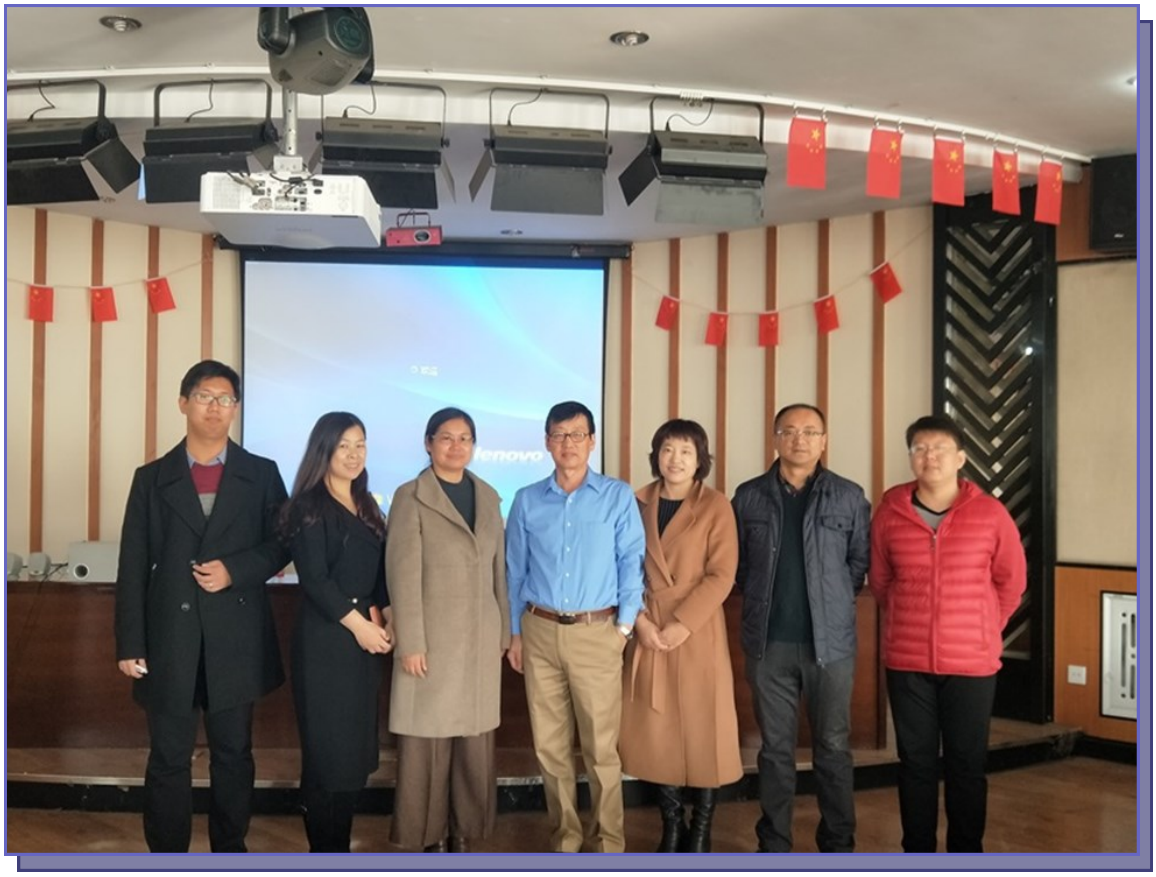
DR. NEIL SCHULTES presented a short talk entitled "Functional analysis of *Erwinia amylovora* nucleobase cation symporter 2 transporters" at the 77th Annual Meeting of the Northeastern Division of The American Phytopathological Society in Quebec City, Canada (90 attendees) (November 1-3); gave a seminar entitled "Nucleobase Transporters in Plants and Microbes" for the Dr. Henry Voegeli Seminar Series at the Department of Biology and Environmental Sciences, University of New Haven in West Haven (50 attendees) (November 9); attended the Connecticut Pomological Society Annual Meeting in Middletown (November 28).

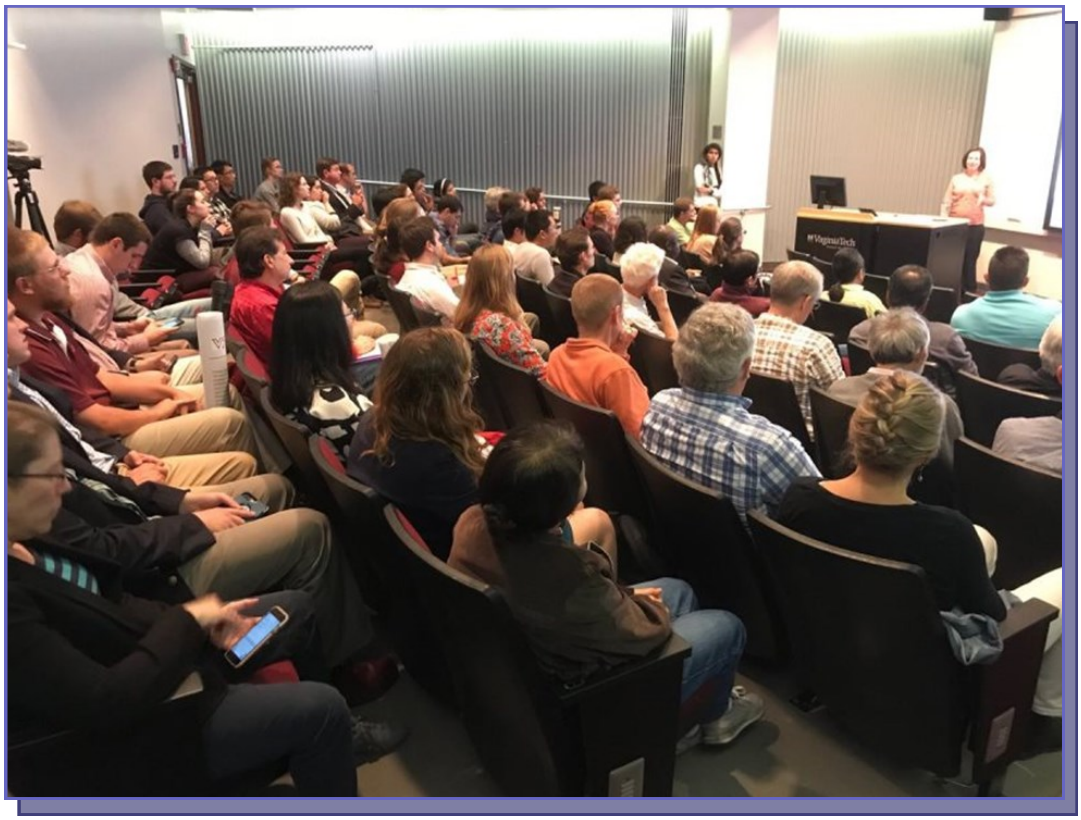
DR. LINDSAY TRIPLETT presented "Self-killing turned outward: a new role for toxin-antitoxin systems in bacterial infection" as the keynote speaker at the

Graduate Research Symposium in the Department of Plant Pathology, Physiology and Weed Science at Virginia Tech (40 attendees) (November 6); was a guest instructor for the MCDB380/680 course at Yale (Topics in Plant Molecular Biology), giving three lectures and leading three paper discussions on molecular plant-microbe interactions between October 6 and November 3, and grading one essay assignment. There were 11 undergraduate and graduate students in the class.

DRS. QUAN ZENG and **BLAIRE STEVEN** were interviewed by Ms. Kate Prengaman from Good Fruit Grower Magazine about the recently funded USDA-NIFA project (November 9); hosted Dr. Jie Wang from Michigan State University who gave a seminar at CAES on November 7 (35 adults), and attended the Connecticut Pomological Society Annual Meeting in Middletown (November 28).

DR. YONGHAO LI and faculty members in the Department of Plant Pathology at the Northeast Agricultural University





Dr. Lindsay Triplett presents her research as a keynote speaker at the Graduate Research Symposium in the Department of Plant Pathology, Physiology, and Weed Science at Virginia.

VALLEY LABORATORY

DR. JATINDER S. AULAKH participated in the Connecticut Invasive Plant Working Group steering committee and Invasive Plant Council meetings held at the Valley Laboratory in Windsor (November 14).

DR. RICHARD COWLES presented "Cyclical, emerging, and disappearing pests," at New England Grows, Boston, MA (400 attendees) (November 30).

MS. ROSE HISKES gave a guest lecture on Invasive Insects to the Pest Control Class at Naugatuck Valley Community College in Waterbury (25 attendees) (November 8); and participated in the Symposium Planning Committee meeting of the Connecticut Invasive Plant Working Group in Windsor (November 14).

DR. JAMES LAMONDIA attended the Annual Meeting of the Northeastern Division of the American Phytopathological Society held in Quebec City to present "*Calonectria pseudonaviculata* dispersal mechanisms and implications for boxwood blight management" (60 attendees) (November 1-3) and participated in the NED Business meeting as the Division Forum Representative; chaired the quarterly American Phytopathological Society Division Forum conference call meeting (November 7); and presented research results during the potato cyst nematode multi-agency research call (20 participants) (November 14).

DEPARTMENTAL RESEARCH UPDATES NOVEMBER 2017

Ma, C.; **White, J.C.**; Zhao, J.; Zhao, Q.; Xing, B. 2018. Uptake of engineered nanoparticles by food crops: Characterization, mechanisms, and implications. *An. Rev. Food Sci. Technol*. 9:1.

Abstract- With the rapidly increasing demand for and use of engineered nanoparticles (ENPs) in agriculture and related sectors, concerns over the risks to agricultural systems and to crop safety have been the focus of a number of investigations. Significant evidence exists for NP accumulation in soils, including potential particle transformation in rhizosphere and within terrestrial plants, resulting in subsequent uptake by plants that can yield physiological deficits and molecular alterations that directly undermine crop quality and food safety. In this review, we document in vitro and in vivo characterization of NPs in both growth media and biological matrices; compare the NP uptake patterns, biotransformation, and the underlying mechanisms of nanotoxicity; and summarize the environmental implications of NP presence in agricultural ecosystems. A clear understanding of nano-impacts (advantages and disadvantages) on crop plants will help to optimize the safe and sustainable application of nanotechnology in agriculture for the purposes of enhanced yield production, disease suppression, and food quality.

Zhang, W.; Schwab, P.**; White, J.C.**; Ma, X. Adsorption of cerium oxide nanoparticles on sand and kaolin: Impact of nanoparticle surface properties. *J. Environ. Qual*. doi: 10.2134/jeq2017.07.0284.

Abstract- Soil texture has been found to be a critical factor in regulating the fate and transport of CeO2NPs in the terrestrial environment. However, the underlying mechanisms for the interactions between two CeO2NPs types and different components of soil are still poorly understood. Adsorption between CeO2NPs and two essential components of soil (sand and kaolin) in batch experiments were investigated to provide insight into the retention and bioavailability of CeO2NPs in soil. The results demonstrated that surface properties of CeO2NPs, including surface charge and surface coating condition, had a strong impact on the adsorption process. Positively charged CeO2NPs (CeO2NPs(+)) displayed the greatest adsorption onto kaolin, while the negatively charged CeO2NPs (CeO2NPs(-)) showed poorest adsorption onto sand. The adsorption between CeO2NPs and kaolin was significantly greater than with sand, irrespective ofsurface charge. Homoaggregation of CeO2NPs occurred during the adsorption process and increased the size of CeO2NPs on the surface of sand and kaolin. The steric repulsion between soil particles and CeO2NPs and among separate CeO2NPs increases rapidly with the increase of maximum surface concentration of PVP. Extended Derjaguin-Landau-Verwey-Overbeek (XDLVO) calculations agreed with the experimental observations that surface charge and coating condition of CeO2NPs played a pivotal role in the homoaggregation and adsorption of CeO2NPs. Adsorption isotherm fitting indicated that the adsorption of CeO2NPs onto sand and kaolin can be properly described by the Dubinin-Radushkevich isotherm.

Feng Xiao*, Alemayehu H. Bedane, Julia Xiaojun Zhao, Michael D. Mann, **Joseph J. Pignatello**. 2017. Thermal air oxidation changes surface and adsorptive properties of black carbon (char/biochar)" Science of the Total Environment, 618, 276–283.

Abstract- In this study, we systematically investigated the effects of thermal air oxidation on the properties of biomass-derived BC made at carbonization temperatures (HTTs) of 300–700 °C. BC produced by including air in the carbonization step was found to have a low surface area and underdeveloped pore structure. Substantial changes of BC were observed after post-pyrolysis thermal air oxidation (PPAO). Well-

carbonized BC samples made anoxically at relatively high HTTs (600 and 700 ˚C) showed, after PPAO, significant increases in N2 BET surface area (SA) (up to 700 times), porosity (< 60 Å) (up to 95 times), and adsorptivity (up to 120 times) of neutral organic species including two triazine herbicides and one natural estrogen. Partially carbonized BC made at a lower HTT (300 or 400 ˚C) showed moderate increases in these properties after PPAO, but a large increase in the intensity of Fourier transform infrared spectroscopy bands corresponding to various oxygen-containing functional groups. Well-carbonized BC samples, on the other hand, were deficient in surface oxygen functionality even after the PPAO treatment. Adsorption of the test organic compounds on BC generally trended with BET SA when it was less than 300 m2/g, but BET SA was poorly predictive of adsorption when it was greater than 300 m2/g. Overall, our results suggest that thermal reactions between molecular oxygen and BC 1) increase surface oxygen functionality more effectively for low-HTT than for high-HTT BC samples; 2) increase SA and porosity (< 60 Å) especially for high-HTT BC samples; and 3) create new adsorption sites and/or relieve steric restriction of organic molecules to micropores, thereby enhancing the adsorptivity of BC. These results will prove useful not only for understanding the fate of environmental BC but also in devising strategies for improving the practical performance of the engineered form of BC (i.e., biochar).

Williams SC, KC Stafford III, G Molaei, MA Linske, "Integrated control of Ixodes scapularis: Effectiveness of white-tailed deer reduction, the entomopathogenic fungus Metarhizium anisopliae, and fipronil-based rodent bait boxes," Vector-Borne and Zoonotic Diseases, DOI: 10.1089/vbz.2017.2146

Abstract- Pathogens transmitted by ticks are the leading cause of arthropod-associated human diseases in the United States and managing the risk of exposure to potentially infected ticks is of vital public health importance. A three-year integrated tick management program to control blacklegged ticks, Ixodes scapularis, the primary vector for the pathogenic agents of Lyme disease, human anaplasmosis, and babesiosis, was implemented in the town of Redding in southwestern Connecticut beginning in 2013. Combinations of white-tailed deer, Odocoileus virginianus, reduction, area application of the entomopathogenic fungus Metarhizium anisopliae, and fipronil- based rodent bait boxes were evaluated for their ability to reduce nymphal I. scapularis over 3 years. Interference from local hunters prevented sufficient, sustained deer removal previously reported to negatively impact I. scapularis abundances (i.e., <5 deer/km2). The combination of fipronil-based bait boxes and broadcast application of M. anisopliae had the most impact of any treatment combination; questing nymphs were reduced 78-95% within each year and Borrelia burgdorferi-infected questing nymphal I. scapularis encounter potential was reduced by 66% as compared with no treatment in the third year of the study. A combination of the broadcast application of M. anisopliae and small rodent-targeted fipronil-based bait boxes is an effective low- toxicity integrated approach that significantly reduced encounters with B. burgdorferi-infected questing nymphal I. scapularis on individual properties.

Gloria-Soria A, **Armstrong PM**, Powell JF, and Turner PE. 2017. Infection rate of Aedes *aegypti* mosquitoes with dengue virus depends on the interaction between temperature

and mosquito genotype." Proc. Biol. Sci. 284: 20171506.

Abstract- Dengue fever is the most prevalent arthropod-transmitted viral disease worldwide, with endemic transmission restricted to tropical and subtropical regions of different temperature profiles. Temperature is epidemiologically relevant because it affects dengue infection rates in Aedes aegypti mosquitoes, the major vector of the dengue virus (DENV). Aedes aegypti populations are also known to vary in competence for different DENV genotypes. We assessed the effects of mosquito and virus genotype on DENV infection in the context of temperature by challenging Ae. aegypti from two locations in Vietnam, which differ in temperature regimes, with two isolates of DENV-2 collected from the same two localities, followed by incubation at 25, 27 or 32°C for 10 days. Genotyping of the mosquito populations and virus isolates confirmed that each group was genetically distinct. Extrinsic incubation temperature (EIT) and DENV-2 genotype had a direct effect on the infection rate, consistent with previous studies. However, our results show that the EIT impacts the infection rate differently in each mosquito population, indicating a genotype by environment interaction. These results suggest that the magnitude of DENV epidemics may not only depend on the virus and mosquito genotypes present, but also on how they interact with local temperature. This information should be considered when estimating vector competence of local and introduced mosquito populations during disease risk evaluation.

Skaff NK, **Armstrong PM**, **Andreadis TG**, and Cheruvelil. 2017. Wetland characteristics linked to broad-scale patterns in *Culiseta melanura* abundance and eastern equine encephalitis virus infection. Parasites & Vectors 10:501.

Abstract- Eastern equine encephalitis virus (EEEV) is an expanding mosquito-borne threat to humans and domestic animal populations in the northeastern United States. Outbreaks of EEEV are challenging to predict due to spatial and temporal uncertainty in the abundance and viral infection of Cs. melanura, the principal enzootic vector. EEEV activity may be closely linked to wetlands because they provide essential habitat for mosquito vectors and avian reservoir hosts. However, wetlands are not homogeneous and can vary by vegetation, connectivity, size, and inundation patterns. Wetlands may also have different effects on EEEV transmission depending on the assessed spatial scale. We investigated associations between wetland characteristics and Cs. melanura abundance and infection with EEEV at multiple spatial scales in Connecticut, USA. Our findings indicate that wetland vegetative characteristics have strong associations with Cs. melanura abundance. Deciduous and evergreen forested wetlands were associated with higher Cs. melanura abundance, likely because these wetlands provide suitable subterranean habitat for Cs. melanura development. In contrast, Cs. melanura abundance was negatively associated with emergent and scrub/shrub wetlands, and wetland connectivity to streams. These relationships were generally strongest at broad spatial scales. Additionally, the relationships between wetland characteristics and EEEV infection in Cs. melanura were generally weak. However, Cs. melanura abundance was strongly associated with EEEV infection, suggesting that wetland-associated changes in abundance may be indirectly linked to EEEV infection in Cs. melanura. Finally, we found that wet hydrological conditions during the transmission season and during the fall/winter preceding the transmission season were associated with higher Cs. melanura abundance and EEEV infection, indicating that wet conditions are favorable for EEEV transmission. These results expand the broad-scale understanding of the effects of wetlands on EEEV transmission and help to reduce the spatial and temporal uncertainty associated with EEEV outbreaks.

Ward, J.S., **S.C. Williams** and **M.A. Linske**. 2017. Influence of invasive shrubs and deer browsing on regeneration in temperate deciduous forests. *Canadian Journal of Forest Research*. 1 November 2017 https://dx.doi.org/10.1139/cjfr-2017-0208.

Abstract: While both chronic white-tailed deer (*Odocoileus virginianus* Zimmermann) overbrowsing and invasive shrubs have been linked to native regeneration failure in temperate hardwood forests, little is known of their relative importance and possible synergistic effects. Therefore, we established three study areas in Connecticut to examine the interaction of three levels of invasive shrub control and absence or presence of deer herbivory on forest regeneration over 9 years. Five observations suggest that obtaining forest regeneration requires a comprehensive management strategy. First, competitive interference by invasive shrubs in intact thickets continued to impede forest regeneration, especially taller seedlings, after deer were excluded. Second, density of small seedlings increased following removal of the competitive interference by invasive shrubs. Third, deer browsing depressed growth of small seedlings into taller height classes. Fourth, preferential browsing reduced species richness, especially in taller seedling classes, by favoring growth of low palatability species such as beech. Lastly, if a disturbance (e.g., cutting) does not kill the root system of the invasive shrubs, the window of forest regeneration recruitment may be narrow because invasive shrubs can quickly recover. In stands with both established shrub thickets and high deer densities, invasive shrub control and multiyear reduction of deer densities are both recommended to obtain adequate forest regeneration.

Williams, S.C., **K.C. Stafford, III**, **G. Molaei**, and **M.A. Linske**. 2017. Integrated control of nymphal *Ixodes scapularis*: effectiveness of white-tailed deer reduction, the entomopathogenic fungus *Metarhizium anisopliae*, and fipronil-based rodent bait boxes. *Vector-Borne and Zoonotic Diseases*. 27 November 2017. https://doi.org/10.1089/vbz.2017.2146.

Abstract: Pathogens transmitted by ticks are the leading cause of arthropod-associated human diseases in the United States and managing the risk of exposure to potentially infected ticks is of vital public health importance. A 3-year integrated tick management program to control blacklegged ticks, *Ixodes scapularis*, the primary vector for the pathogenic agents of Lyme disease, human anaplasmosis, and babesiosis, was implemented in the town of Redding in southwestern Connecticut beginning in 2013. Combinations of white-tailed deer, *Odocoileus virginianus*, reduction, area application of the entomopathogenic fungus *Metarhizium anisopliae*, and fipronil-based rodent bait boxes were evaluated for their ability to reduce nymphal *I. scapularis* over 3 years. Interference from local hunters prevented sufficient, sustained deer removal previously reported to negatively impact *I. scapularis* abundances (i.e., <5 deer/km2). The combination of fipronil-based bait boxes and broadcast application of *M. anisopliae* had the most impact of any treatment combination; questing nymphs were reduced 78–95% within each year and *Borrelia burgdorferi*-infected questing nymphal *I. scapularis* encounter potential was reduced by 66% as compared with no treatment in the third year of the study. A combination of the broadcast application of *M. anisopliae* and small rodent-targeted fipronil-based bait boxes is an effective low-toxicity integrated approach that significantly reduced encounters with *B. burgdorferi*-infected questing nymphal *I. scapularis* on individual properties.

Maurer, K., A. B. DeFrancesco and **J. A. LaMondia** 2017. Evaluation of hop cultivation feasibility in Connecticut. Acta Horticulturae doi:10.17660/ActaHortic.2017.1174.51

Abstract- Interest in hop cultivation in the Northeast of the USA has risen in recent years because of the popularity of microbrew culture, local brewpubs, home brewing, and the demand for regional products. This study examined the feasibility of hop cultivation regarding yield, growing characteristics, and susceptibility to diseases and pests in Connecticut. Five cultivars: AlphAroma, Cascade, Newport, Summit, and Perle were evaluated in low and high trellis systems at two locations over 3 years. 'Cascade' and 'Summit' were identified as well suited for Connecticut and the high trellis system resulted in better growth and yield with the exception of the semi-dwarf cultivar Summit. 'Perle', a German breeding line, had the weakest growth and lowest yield. Downy mildew, the most damaging disease in the Northeast, spider mites, and potato leafhoppers were observed, but could be well controlled by intensive scouting and IPM measures. This study demonstrated the feasibility of hop production in Connecticut by using proper varieties, cultural practices, and a well-established integrated pest and disease management program.

Monteiro, T. S. A, J. A. Brito, S. J. S. Vau, W. Yuan **J. A. LaMondia**, L. G. Freitas, and D. W. Dickson 2017. First report of matricidal hatching in *Meloidogyne hapla*. Nematoda 4:e092017. http://dxdoi.org/10.4322/nematoda.00917

Abstract-Matricidal hatching occurs when embryogenesis and egg hatching take place within the nematode uterus. This phenomenon is known to occur within entomopathogenic and free-living nematodes, but it is very uncommon among plant-parasitic nematodes. Matricidal hatching was observed in a population of *Meloidogyne hapla*, originally collected in Connecticut, USA and reared on tomato 'Rutgers' maintained at 24 °C for 60 days in a growth room. Out of 974 females examined, only 14 (1.4%) showed this phenomenon. Second-stage juveniles (J2) were clearly observed inside of the female body cavity. The highest numbers of J2 and eggs observed per female were 57 and 350, respectively. However, the average number of J2 per female was 13, whereas the average number of eggs per female was 90. These findings suggest that this phenomenon is not common in the population.

Li, De-Wei, Schultes Neil P., Chen Jing-Yuan, Wang Yi-Xun & Castañeda-Ruiz Rafael Felipe. 2017. *Circinotrichum sinense*, a new asexual fungus from Hubei, China. Botany. 95: 1099–1108. 10.1139/cjb-2017-0132

Abstract—A setose hyphomycete was collected as part of a recent expedition to search for microfungi in the Duheyuan National Nature Reserve in Hubei, China. The conidia are typical of *Circinotrichum* Nees, being curved or falcate, single-celled, colorless, smooth with a setula at the apical end, and similar to *Circinotrichum rigidum*. *Circinotrichum sinense* has a longer setula only at the apical end and verrucose setae, while *C. rigidum* has a setula on both ends and smooth setae. Phylogenetic analyses using ITS and LSU DNA sequence data and examination of the morphological characters showed that this fungus cannot be identified as any previously described species of *Circinotrichum*. Thus, a new fungal taxon is described. A key to recognized species of *Circinotrichum* is also provided.

Wang Qing-Hai, Kun Fan, **De-Wei Li**, Shan-Guang Niu, Li-Qun Hou, Xiao-Qin Wu. 2017. Walnut anthracnose caused by *Colletotrichum siamense* in China. Australian Plant Pathology. 46 (6) 585–595. DOI https://doi.org/10.1007/s13313-017-0525-9

Abstract—The genus *Colletotrichum* includes a number of important plant

pathogens, which cause anthracnose diseases on a broad range of hosts in the world. In recent years, walnut has been severely damaged by anthracnose disease in China with significant yield losses. Thus, it is necessary to verify the etiology of anthracnose on walnut using both morphological and molecular approaches. In 2014, walnut fruits with anthracnose symptoms were collected from five walnut orchards in Shandong Province, China, and 24 isolates were isolated. Among them, six similar single-spore isolates obtained were used for pathogenicity testing of walnut anthracnose. Acervuli were brown, circular and the average size was 50.4–101.8 µm. Conidiophores were hyaline, septate, not branched or branching at the base, conidiogenous cells were enteroblastic, phialidic, hyaline, cylindrical, ampulliform. Conidia were single celled, smooth-walled with a large guttule, colorless, fusiform to cylindrical, and had obtuse to slightly rounded ends. The size of conidia was (11.6-)13–15(–16.2) × (4.1-) 4.6–5.6(–6) µm. Appressoria were brown, ovoid to ellipsoid or slightly irregularly to irregularly shaped, and the average size was 6.8–9 × 5.1–6.5 µm. Pathogenicity of the isolates to fruits and leaves were compared, and genes from all six isolates were sequenced. The isolates were identified as *C. siamense* based on four-gene phylogenetic analyses (ribosomal DNA-ITS, GAPDH, ACT and CHS-1) and morphological as well as cultural characters. This is the first report of *C. siamense* as a causal agent of anthracnose of walnut in China.

Li, D-W, N. P. Schultes, J-Y Chen, Y-X Wang, R. F. Castañeda-Ruiz 2017

Circinotrichum sinense, a new asexual fungus from Hubei, China 2017.*Botany*, 2017, 95(12): 1099-1108, https://doi.org/10.1139/cjb-2017-0132

Abstract-A setose hyphomycete was collected as part of a recent expedition to search for microfungi in the Duheyuan National Nature Reserve in Hubei, China. The conidia are typical of *Circinotrichum*Nees, being curved or falcate, single-celled, colorless, smooth with a setula at the apical end, and similar to *Circinotrichum rigidum*. *Circinotrichum sinense* has a longer setula only at the apical end and verrucose setae, while *C. rigidum* has a setula on both ends and smooth setae. Phylogenetic analyses using ITS and LSU DNA sequence data and examination of the morphological characters showed that this fungus cannot be identified as any previously described species of *Circinotrichum*. Thus, a new fungal taxon is described. A key to recognized species of *Circinotrichum* is also provided.

Zeng, Q., Cui, Z., Wang, J., Childs, K. L., Sundin, G. W., Cooley, D. R., Yang, C.-H., Garofalo, E., Eaton, A., **Huntley, R. B.**, Yuan, X., and **Schultes N. P.** (2018) Comparative genomics of Spiraeoideae-infecting *Erwinia amylovora* strains revealed higher genetic diversity and identified genetic cause of a low virulent strain. Mol. Plant Path. DOI: 10.1111/mpp.12647

Abstract-*Erwinia amylovora* is the causal agent of fire blight, one of the most devastating diseases of apple and pear. *E. amylovora* is thought to have originated in North America and has now spread to at least 50 countries worldwide. Understanding the diversity of the pathogen population and the transmission to different geographical regions is important for the future mitigation of this disease. In this research, we performed a comprehensive comparative genomic study of the Spiraeoideae-infecting (SI) *E. amylovora* population in North America and Europe. We discovered that although still highly homogeneous, the genetic diversity of 30 *E. amylovora* genomes examined is about 30 times higher than previously determined. These isolates belong to four distinct clades, three of which display geographical clustering and one of

which contains strains from various geographical locations (Widely Prevalent clade). Furthermore, we revealed that strains from the Widely Prevalent clade displayed a higher level of recombination with strains from a clade with strains strictly from Eastern United States, which suggests that the Widely Prevalent clade probably originated from Eastern U.S. before it spread to other locations. Finally we detected variations in virulence in the SI *E. amylovora* strains on immature pears, and identified the genetic basis of one of the low-virulent strains as being caused by a single nucleotide polymorphism in *hfq*, a gene encoding an important virulence regulator. Our results provide insights into the population structure, distribution, and evolution of the SI *E. amylovora* in North America and Europe.

Li, Y., Sletten, P., and Patrick, P. Seed Germination and Purity Analysis 2017. *CAES Technical Bulletin.*

Abstract- A total of 277 official seed samples were collected by inspectors from the Bureau of Regulation and Inspection of the Connecticut Department of Agriculture for testing in 2017 as mandated by the Connecticut Seed Law Regulations and the Federal Seed Act (FSA). Details can be obtained from the following link http://www.ct.gov/caes/lib/caes/documents/publications/technical_bulletins/tb17.doc.pdf

JOURNAL ARTICLES APPROVED NOVEMBER 2017

Cui, Zhouqi, X. Yuan, C.-H. Yang, **Regan B. Huntley**, W. Sun, J. Wang, G. W. Sundin, and **Quan Zeng**. Developing a method of monitoring gene expression in single bacterial cells during the interaction with plants and use it to study the expression of T3SS in single cells of *Dickeya dadantii* in potato. *Applied and Environmental Microbiology*

Flores, C., C. Zarate, **Lindsay Triplett**, V. Maillot-Lebon, V. Verdier, B. Szurek, and I. Robene. Development of a duplex PCR for differential diagnosis of *Xanthomonas axonopodis* pv. *manihotis* and *Xanthomonas cassavae* in cassava (*Manihot escuelenta*). *Physiological and Molecular Plant Pathology*

Li, Yonghao, **Pamela Sletten**, and **Lindsay Patrick**. Seed germination and purity analysis 2017. *CAES Technical Bulletin*

Sundin, G. W., L. F. Castiblanco, and **Lindsay R. Triplett**. Regulation of effector delivery by type III secretion chaperone proteins in *Erwinia amylovora*. *Frontiers in Plant Science*

Zhang, H., W. Chen, X. Zhang, F. Wu, **Jason C. White**, S. Tao, and X. Wang. Carbon nanomaterials differentially impact oxidative response and bioaccumulation of phenanthrene and methyl derivatives in geophagous earthworms (*Metaphire guillelmi*) under multi-contaminant exposure. *Environmental Science: Nano*

ARTICLES OF INTEREST NOVEMBER 2017

2017 Connecticut-FFA Forestry Career Development Event

On November 17th the Department of Forestry & Horticulture hosted the Connecticut-FFA Forestry Career Development Event (CDE) at the Lockwood Farm Pavilion. This marks the 6th year that CAES has hosted this event. This years' Forestry CDE evaluated students' knowledge of forest management practices, forest mensuration, knowledge of forest and tree disorders, forestry related equipment, timber stand improvement, and tree identification.

Thirty six students from 9 State FFA Chapters participated in this years' event, with the 4-student team from E.O. Smith High School Agricultural Education Program taking first place. Students from E.O Smith FFA will represent The State of Connecticut in regional and national competition at the 2018 Eastern States Exposition and the 2018 National FFA Convention in Indianapolis IN.

We would like to thank Gerry Milne and Jill Humphreys from DEEP-Forestry for their assistance.

DR. SCOTT WILLIAMS, MR. MICHAEL SHORT, MR. Joseph P. BARSKY of the Department of Forestry & Horticulture, and **MS. MEGAN LINSKE** of the Department of Entomology organized and oversaw the event.

CAES

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The Connecticut Agricultural Experiment Station

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