Station News

The Connecticut Agricultural Experiment Station
Volume 9 Issue 4 April 2019

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

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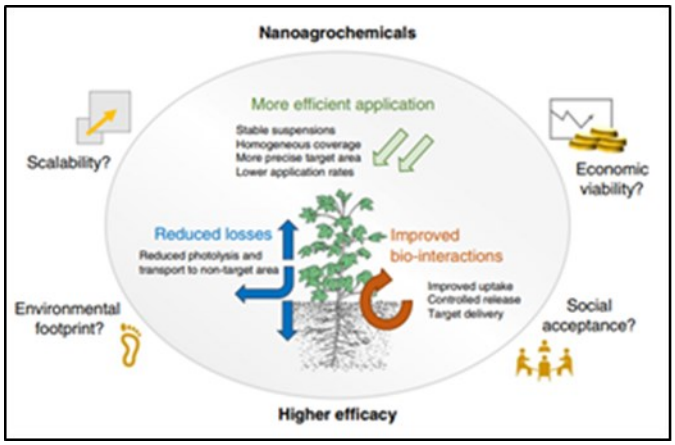
STATION NEWS

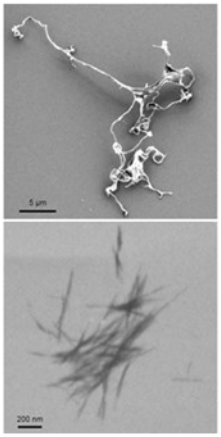
GRANTS RECEIVED MARCH 2019

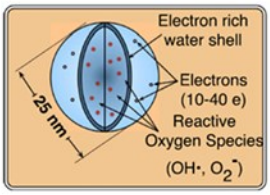
New Grant- "Nano-encapsulation of Agrichemicals for Sustainable Agriculture." Funded as part of the Nanyang Technological University (NTU) - Harvard T. H. Chan School of Public Health (HSPH) - Initiative for Sustainable Nanotechnology (NTU-HARVARD SUSNANO); CAES CoPI- JC White; CAES Funding $155,000. March 1, 2019-February 28, 2021.

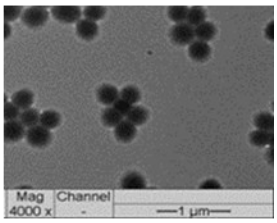
Abstract- With rapid population growth and increased environmental stresses (i.e., drought, extreme temperature fluctuations), it is a societal challenge to meet the increasing global demand on food in the 21st century. Massive systems-level inefficiencies across the "farm-to-fork" continuum currently exist in agri-food systems, jeopardizing food security, safety and quality. These include inefficient delivery of agrichemicals for food production (fertilizers and pesticides), leading to wasted energy and water, as well as negative impact on environmental health. It has been reported that 60-90% of applied pesticides and fertilizers are lost due to evaporation, deposition, environmental run-off, or degradation. Therefore, new and innovative techniques for more efficient, targeted and precision agrichemical delivery are eagerly needed to ensure sustainable food production while minimizing environmental impact. The development and deployment of new, advanced nanotechnology-based materials offer great opportunities towards sustainable agriculture for food security and safety.

This multidisciplinary project combines materials science, nanosafety, analytical chemistry and plant biology in order to address the above-mentioned issues in a systematic manner. The main effort here will be on the investigation of agrichemical nano-encapsulation using readily available natural and biodegradable polymers, effective synthesis strategies for the nano-carriers, and implementation of the targeted, "smart" release of chemicals in agriculture applications. The project is a foundational component of a larger effort focused on developing nanotechnology for sustainable agriculture, food security and safety. The project will develop nano-encapsulates from renewable and sustainable resources, which can be mass produced at low cost with minimal environmental impact. The abovementioned challenges will be tackled through the following work packages (1) functionalization of naturally derived polymers; (2) scalable synthesis strategies of nanoencapsulation; (3) targeted uptake and smart release study of nanoencapsulated chemicals, and their impact on plant growth, health and nutrition value. The study will be conducted in growth chambers, followed by greenhouse and field studies using selected crop species. The project will be carried out in collaboration with plant biologists and analytical chemists and will involve urban farming start-ups. The scientific knowledge gained and technologies developed in the project can ultimately impact more efficient farm practices and enhanced food security.









ADMINISTRATION

DR. THEODORE ANDREADIS participated in "*Ag Day*" at the Capitol in Hartford (March 20); presented a talk entitled "*Jamestown Canyon Virus Revisited: Are We Neglecting an Under Recognized Mosquito-Borne Disease"* at the 16th Arbovirus Surveillance and Mosquito Control Workshop and participated as Administrative Advisor in the annual meeting of Multi-State Project, NE-1443, *Biology, Ecology & Management of Emerging Disease* held in St. Augustine, FL (50 attendees) (March 26-28).

ANALYTICAL CHEMISTRY

DR. JASON C. WHITE was appointed as a Visiting Scientist in the Harvard University T.H. Chan School of Public Health (March 1); was recognized as an "Outstanding Reviewer" in 2018 by *Environmental Science: Nano* (March 2); attended the BILAT USA 4.0 Workshop entitled "Fostering EU-US Cooperation in Nanosafety" at Harvard University and presented a lecture entitled "Nanomaterials in agri-food systems: Potential environmental health implications" (30 attendees) (March 4-6); participated in a ZOOM call with collaborators at the University of Parma to discuss an ongoing research collaboration focused on the impact of engineered nanomaterials on crop species (March 7); participated in an FDA-led planning committee call for the upcoming AFRPS annual face-to-face meeting (March 7); spoke by phone with Prof. Juan Pablo Giraldo of the University of California Riverside about ongoing collaborative research on nano-enabled agriculture (March 8); participated in a Center for Sustainable Nanotechnology All Faculty ZOOM Call (March 12, 18); hosted the bi-weekly ZOOM call for the Center for Sustainable Nanotechnology Nano-agriculture group (March 12); participated in the weekly all-hands ZOOM call for the Center for Sustainable Nanotechnology (March 13, 20); along **with DR. BRIAN EITZER, DR. CHRISTINA ROBB, DR. WALTER KROL, MS. TERRI ARSENAULT, MR. CRAIG MUSANTE, MR. JOHN RANCIATO, AND MS. KITTY PRAPAYOTIN-RIVEROS,** participated in the monthly FDA FERN cCAP WebEx call (March 14); attended the Connecticut Conference on Natural Resources at the University of Connecticut and gave a presentation entitled "Nanotechnology and agriculture: A path to global food security?" (40 attendees) (March 18); hosted the quarterly CAES Safety Committee meeting (March 22); attended the Ph.D. Dissertation defense of Carlos Tamez at the University of Texas El Paso (March 24-26); was interviewed by Mico Tatolovic of *The Guardian* newspaper over the use of nanomaterials in food for a story that will run in mid-April (March 27); gave a presentation at the University of Connecticut Department of Nutritional Science entitled "Nanotechnology in agriculture: Assessing the balance between implications and applications" (20 attendees) (March 27); hosted the monthly CAES J-1 Visa recipient meeting (March 29); and co-chaired a session entitled "Nanotechnology at the Water-Agriculture-Energy Nexus" at the 2019 American Chemical Society Meeting in Orlando, FL and gave a presentation entitled "Engineered nanomaterials for the suppression of fungal and viral crop disease" (25 attendees) (March 30-31); and attended the Editorial Advisory Board meeting for *Environmental Science & Technology* and for *Environmental Science & Technology Letters* (March 31).

DR. BRIAN EITZER was a judge at the Connecticut Science & Engineering Fair held at Quinnipiac University, in Hamden (March 12-13); participated in the monthly conference call of the organizing committee of the NACRW (March 14); and presented a talk entitled "Tracking honey bee pesticide exposure at ornamental nurseries" at the 2019 American Chemical Society Meeting held in Orlando, FL (30 attendees) (March 30–April 3).

DR. WALTER J. KROL presented a talk entitled "Pesticide Residues in Food Sold in Connecticut from Old to ISO" at the local section meeting of the New Haven Section of the American Chemical Society (40 attendees) (March 27).

EU and US participants at the BILAT USA 4.0 Workshop entitled "Fostering EU-US Cooperation in Nanosafety" at Harvard University (March 4-6).

J.C. White with graduate students at the University of Texas El Paso Dept. of Chemistry

ENTOMOLOGY

DR. KIRBY C. STAFFORD III presented a talk entitled "New and Scary Ticks!" at the Forest Health Monitoring Workshop in Jones Auditorium (65 attendees) (March 5); spoke about the gypsy moth, emerald ash borer, and tree mortality at the Farmington Garden Club in Farmington (40 attendees) (March 11); and presented a talk on ticks, tick-borne diseases, and tick control at the Cherry Brook Garden Club in Canton (40 attendees) (March 12); participated in the Tick IPM Working Group conference call (March 13); with **DR. VICTORIA SMITH** and **DR. THEODORE ANDREADIS** with **MS. KATHERINE DUGAS** and USDA-APHIS-PPQ met to discuss the spotted lanternfly (March 19); spoke on gypsy moth at the Connecticut Trees in Trouble workshop held in Jones Auditorium (80 attendees) (March 25); welcomed the Landscape Design School to the Experiment Station (March 26); and presented a talk on ticks and tick-borne diseases in Trumbull, for videotaping for the health department's Healthy Town series (March 27).

MR. MARK H. CREIGHTON spoke about "Beekeeping Basics" at the Northern Connecticut Agricultural Summit held at Asnuntuck Community College (25 attendees) (March 2); spoke about best beekeeping management practices at a zoning meeting for the Town of East Lyme and answered questions on beekeeping related to regulations being considered to allow beekeeping in Niantic and East Lyme (March 21); while attending the Backyard Beekeepers Association in Weston, spoke to a group on our honey bee registration laws and collected twenty-five registrations (120 beekeepers) (26 March); and attended a lecture by Dr. Samuel Ramsey from the USDA Honeybee Research Laboratory who presented the results of his research documenting the varroa mites feed on fat bodies, not bee hemolymph.

MS. KATHERINE DUGAS gave a talk entitled "CAPS Program: Targets for 2019" at the annual Forest Health Monitoring Workshop held in Jones Auditorium (March 5); attended the Spotted Lanternfly Summit held in Harrisburg PA (March 6-7); and staffed a table covering CAES services and Forest Pest information including spotted lanternfly at the Master Gardener Association Annual Symposium held at Connecticut College in New London (March 16).

DR. MEGAN LINSKE presented current research titled "Determining effects of winter weather conditions on nymphal *Ixodes scapularis* and adult *Amblyomma americanum* survival in Connecticut and Maine, USA" for Northeast Regional Center for Excellence in Vector-Borne Diseases Trainee Seminar Series (10 attendees) (March 11); spoke to Lyman Hall High School students about career paths and research opportunities at CAES (16 students) (March 11); and discussed careers in wildlife biology and management with Girls Scouts for the STEM guest speaker series held at West Side Middle School in Waterbury (15 students) (March 21).

DR. CHRIS T. MAIER spoke about "Two Alien Beetles Expand Their Distributional Range in Connecticut" at the Forest Health Monitoring Workshop held in Jones Auditorium (March 5).

DR. GALE E. RIDGE presented a talk about bed bugs to nursing students and health department staff members as part of recertification training at Southern Connecticut State University (44 attendees) (March 27).

DR. CLAIRE E. RUTLEDGE presented a talk entitled "Ash and Oak, and Southern Pine Beetles, Oh My!" at the Forest Health Monitoring Workshop held in Jones Auditorium (65 attendees) (March 5); participated in the CTPA monthly board meeting for the Connecticut Tree Protective Association held in the Director's Board Room (March 12); administered the oral portion of the State Arborist Licensing Exam (March 13); and organized, moderated, and presented a talk entitled "How did we get here? Emerald Ash Borer in Connecticut" at the workshop "Oak-calypse and Ash-mageddon: Connecticut Trees in Trouble," held in Jones Auditorium (100 attendees) (March 25).

DR. VICTORIA L. SMITH organized and participated in the annual Forest Health Monitoring Workshop held in Jones Auditorium (65 participants) (March 5). Presentations may be viewed at https://portal.ct.gov/CAES/Publications/Publications/Forest-Health-Monitoring-Workshop-2019

DR. KIMBERLY A. STONER presented a Keynote speech entitled "Pollinator Pathways: What Science Can Tell Us?" at the All-Town Meeting for Pollinator Pathways held at Grace Farms in New Canaan (85 attendees) (March 5); was featured as a guest on the Organic Farmstead radio program, WPKN, 89.5 FM (March 7); spoke to a meeting of 350 CT on "Bee Health and the Threats They Face" at the Agora in New Haven (12 attendees) (March 10); organized, led, and gave a talk entitled "Pollinator Habitat: What Can Science Tell Us?" at the 4th Annual Pollinator Habitat Conference held in Jones Auditorium (90 attendees) (March 14); met by conference call with the group Connecticut Native Plants for Pollinators and Wildlife (9 participants) (March 19); with Mary Ellen Lemay, presented a workshop entitled "Planting for the Bees' Needs: Providing Habitat for Honey Bees and Wild Bees" at the 2019 Connecticut Land Conservation Conference held at Wesleyan University in Middletown (65 attendees) (March 23); presented a talk entitled "Keep Your Garden Buzzing" at the Greenwich Botanical Center (18 attendees) (March 26); presented a talk entitled "The Pollinator Pathway: 'Bee' On It" to the Elm City Parks Conservancy at Edge of the Woods in New Haven (9 attendees) (March 27); and presented a keynote lecture entitled "How Integrated Pest Management Helps Pollinators in Agriculture" to the annual Envirothon at Sessions Woods Environmental Center in Burlington (130 attendees, of whom about 100 were high school students) (March 30).

ENVIRONMENTAL SCIENCES

DR. DOUG BRACKNEY gave a talk entitled "Navigating anatomical barriers to transmission: an arbovirus tale" at Southern Connecticut State University (approx. 20 students, 30 attendees total) (March 8).

MS. ANGELA BRANSFIELD, along with **MR. MICHAEL MISENCIK**, met with Terry Jones, Vice President of the CAES Board of Control, and guests to discuss the Biosafety Level 3 laboratory and mosquito surveillance program (March 18); and participated in The American Biological Safety Association's (ABSA) Select Agent Community Webinar Training Curriculum Development: Select Agent Entity Experiences (March 21).

MR. GREGORY BUGBEE was interviewed about Hydrilla in Coventry Lake by The Chronical (March 5); with **MS. SUMMER STEBBINS**, spoke on "Hydrilla in the Connecticut River" at a meeting of the Friends of Silvio O. Conte Wildlife Refuge (approx. 25 attendees) (March 15); with **MS. SUMMER STEBBINS**, spoke on "Hydrilla in the Connecticut River" at a meet-

ing of the Connecticut River Gateway Commission (approx. 25 attendees) (March 28).

DR. GOUDARZ MOLAEI was interviewed by News 8 WTNH on ticks (https://www.wtnh.com/news/health/will-connecticut-residents-see-less-ticks-this-summer-/1846415878) (March 13); was interviewed by the Wilton Bulletin on the consequences of warming temperatures on rodent and tick abundance and tick-borne diseases in Connecticut (March 13); and was interviewed by WFSB Channel 3 on the outlook for tick activity in the upcoming spring and summer (https://www.wfsb.com/news/doctors-warn-of-tick-dangers-as-population-rises/article_734a9b26-496a-11e9-beaf-e713248c8226.html) (March 18).

DR. SARA NASON met with Dr. Benoit Van Aken from George Mason University during his visit to CAES and discussed potential research ideas (March 15).

DR. ANDREA GLORIA-SORIA gave an invited seminar entitled "Transmission of arboviruses by mosquito vectors to live vertebrate hosts is underestimated by *in vitro* assays" to the Powell-Caccone research group at the Ecology and Evolutionary Biology Department at Yale University (15 attendees) (March 5); her high school mentee Jack Tajmajer was awarded runner-up at the Connecticut Entomological Society annual student talk competition, non-college division with a talk entitled "Inter-specific Competition Between Two Invasive Mosquito Species, *Aedes aegypti* and *Aedes albopictus*, over Multiple Generations" at the University of Connecticut, Storrs (30 attendees) (March 8); participated in a discussion panel titled "Being a minority in STEM," a conversation about the experience of minority identities in the STEM fields with students, alumni, and faculty. The event took place at Silliman College, Yale University (25 attendees) (March 26).

DR. CHARLES VOSSBRINCK held a fig workshop at Lockwood Farm demonstrating rooting and pruning techniques (25 attendees) (March 9).

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD spoke on the relationship between deer density and oak regeneration at the Forest Health Monitoring Workshop held in Jones Auditorium (43 attendees) (March 5); met with Will Hochholzer, Nathan Piché, and Judy Wilson (CT DEEP) in Marlborough to discuss forest regeneration (March 11); administered practical and oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board (March 13); gave a keynote talk entitled "Gypsy moths and oak forests - past, present, and future" at the Looking Forward-Recovering from Oak Loss on Rhode Island's Private Woodlands workshop held in Coventry, RI (150 attendees) (March 16); spoke on "Invasive species and urban forests" at the Invasive Plant Species workshop hosted by the Bristol Public Works Department and the Environmental Learning Centers of CT (March 20); presented an invited lecture entitled "Want oak? Clearcut and Hunt" at the New England Society of American Foresters annual meeting held in Burlington, VT (87 attendees) (March 27-29).

DR. ABIGAIL A. MAYNARD spoke on "Composting and Utilization of Compost" to the Branford Garden Club (41 adults) (March 5); participated in the New England Vegetable and Fruit Conference steering committee conference call (March 14); visited Offinger's

Farm in Wilton to discuss the New Crops Program collaboration (March 5); visited Viaiuso Farms in Brandford to discuss the New Crops Program collaboration (March 6, 17); worked with staff and students to prepare the Hamden Hall Country Day School Learning Garden (36 students, 3 teachers) (March 8, 22, 28).

DR. SCOTT C. WILLIAMS gave a talk at the Connecticut Forest Health Monitoring Workshop entitled "Putting Science to Work for Society: Linking Forest and Public Health" (March 5); participated in Connecticut Public Radio's "The Whole Story" program on "Managing the Deer Population" http://www.wshu.org/post/managing-deer-population#stream/0 (March 5); hosted Lyman Hall High School students and discussed professional opportunities in the sciences (16 students, 1 teacher) (March 11); participated in a conference call of the Executive Committee of the Northeast Section of the Wildlife Society (March 12).

MR. JOSEPH P. BARSKY presented a research poster entitled "Mature oak crop tree growth" at the New England Society of American Foresters 99th Annual Winter Meeting held in Burlington, VT (450 attendees) (March 27-29).

PLANT PATHOLOGY AND ECOLOGY

DR. WADE ELMER attended the Forest Health Monitoring Workshop in Jones Auditorium (March 5); organized the Mini-symposium “Nanoparticles in the environment: The Good News” and presented a talk entitled “Nanoparticles for the suppression of root diseases” at the Connecticut Conference on Natural Resources held at UConn in Storrs (32 attendees) (March 11).

DR. YONGHAO LI presented “Disease Management Updates” at the CCTGA Annual Meeting held in Middletown (60 attendees) (March 2); presented “What’s Causing Oak Decline?” at the Forest Health Monitoring Workshop held in Jones Auditorium (60 attendees) (March 5); presented “Pruning 101” to members of the Haddam Garden Club in Haddam (68 attendees) (March 7); presented “All About Fungi and Fungicides - What Every Gardener Needs to Know” in the UConn Advanced Master Gardener Class in Fairfield (25 attendees) (March 12); presented “Boxwood Blight and Common Diseases in Landscapes” for the Boxwood Blight Lunch & Learn Program at SiteOne Landscape Supply in East Haven (35 attendees) (March 27).

DR. ROBERT MARRA. presented “On the Lookout for Wilt” for the Forest Health Monitoring Workshop in Jones Auditorium (70 adults) (March 5); administered oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board at CAES (3 adults) (March 12,); presented “The Effects on Climate Change on Agriculture” as part of a panel discussion sponsored by the Massaro Community Farm at the Woodbridge Town Library (40 adults) (March 13); attended the annual Connecticut Conference on Natural Resources at the University of Connecticut, as a member of the Conference’s Steering Committee (350 adults) (March 18); presented “Fungi of the Forest” for the Cheshire Land Trust, at the Cheshire Town Hall (60 adults) (March 28).

DR. LINDSAY TRIPLETT administered written comprehensive exams for Jingyu Peng, Ph.D. candidate, as a member of his thesis committee at Michigan State University (March 6); along with **DRS. STEVEN, DA SILVA,** and **MS. HYDE** met with Dr. Britt Koskella of the University of California at Berkeley who is a phyllosphere phage ecologist and

guest speaker at the Ecology and Evolutionary Biology seminar series at Yale (March 6).

DR. QUAN ZENG met with Dr. Britt Koskella from University of California (March 6) and Dr. Benoit Aken from George Mason University to discussed mutual research interests

VALLEY LABORATORY

DR. ELISHA ALLAN-PERKINS presented "Scientific Presentations Don't Have to Be Boring" as an American Phytopathological Society Webinar https://www.apsnet.org/edcenter/resources/Webinars/Pages/Scientific-Presentations-Don%27t-Have-to-be-Boring.aspx.

DR. JATINDER S AULAKH attended the CAES Tobacco research meeting and talked on weed management updates (110 attendees) (February 26); attended the annual meeting of the Connecticut Christmas Tree Growers Association and presented a talk on post-emergence weed management options (55 attendees) (March 2); and was interviewed by Henry Graber, staff writer from Slate, on Japanese knotweed management (March 18).

DR. CAROLE CHEAH gave a presentation on predictions of winter mortality of hemlock woolly adelgid at the 2019 Forest Health Monitoring Workshop held in Jones Auditorium (50 attendees) (March 5); and presented a hemlock tour and talk to members of the West Hill Beach Club in New Hartford (12 participants) (March 29).

DR. RICHARD COWLES presented "Zimmerman pine moth" for the CT Christmas Tree Growers' Association in Middletown (55 attendees) (March 2); and spoke on "Not dead yet – preserving stressed ash and oaks" for the CT Tree Protective Association, in New Haven (100 attendees) (March 25).

ROSE HISKES gave a talk on Butterfly Gardening to the Wild Ones group at Connecticut College in New London (38 attendees) (March 9).

DR. JAMES LAMONDIA was interviewed about Agriculture Day at the Capitol and the Outstanding Young Farmer Award program conducted by the Connecticut Agricultural Information Council by Mark Hood for the Dept. of Agriculture Weekly Agricultural Report (March 6); taught a class on identification, biology, and management of tree diseases to students in the Connecticut Tree Protective Association's Arboriculture 101 class in Wallingford (40 attendees) (March 6); conducted oral exams for candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven (March 13); participated in the Connecticut Vegetable and Small Fruit Conference Steering Committee meeting at the Tolland County Extension Office (March 18); participated in Agriculture Day at the Capitol, speaking about the 2018 Century Farm Award recognizing Zentek Farms (100 attendees) (March 20); participated in a Master's Degree thesis defense for Ayse Adams, graduate student at Central Connecticut State University (March 26); and with **DR. RICHARD COWLES**, met with Suffield High School Intern Brooke Tillotson and Teacher Ms. Kate McCluskey to review progress of the internship program at the Valley Lab (March 27).

DEPARTMENTAL RESEARCH UPDATES MARCH 2019

Eitzer, B. D., K. A. Stoner, R. S. Cowles, and A. Nurse. 2019. Tracking pesticide residues to a plant genus using palynology in pollen trapped from honey bees (Hymenoptera: Apidae) at ornamental plant nurseries. Environ. Entomol. 48: 351-362.

Abstract- Worldwide studies have used the technique of pollen trapping, collecting pollen loads from returning honey bee (*Apis mellifera* L.) (Hymenoptera: Apidae) foragers, to evaluate the exposure of honey bees to pesticides through pollen and as a biomonitoring tool. Typically, these surveys have found frequent contamination of pollen with multiple pesticides, with most of the estimated risk of acute oral toxicity to honey bees coming from insecticides. In our survey of pesticides in trapped pollen from three commercial ornamental plant nurseries in Connecticut, we found most samples within the range of acute toxicity in a previous state pollen survey, but a few samples at one nursery with unusually high acute oral toxicity. Using visual sorting by color of the pollen pellets collected in two samples from this nursery, followed by pesticide analysis of the sorted pollen and palynology to identify the plant sources of the pollen with the greatest acute toxicity of pesticide residues, we were able to associate pollen from the plant genus *Spiraea* L. (Rosales: Rosaceae) with extraordinarily high concentrations of thiamethoxam and clothianidin, and also with high concentrations of acephate and its metabolite methamidophos. This study is the first to trace highly toxic pollen collected by honey bees to a single plant genus. This method of tracking high toxicity pollen samples back to potential source plants could identify additional high-risk combinations of pesticide application methods and timing, movement into pollen, and attractiveness to bees that would be difficult to identify through modeling each of the contributing factors.

Guo, H.; Ma, C.; Thistle, L.; Huynh, M.; Yu, C.; Clasby, D.; Chefetz, B.; Polubesovaǁ, T.; White, J.C.; He, L.; Xing, B. 2019. Transformation of Ag ions to Ag nanoparticles -loaded AgCl microcubes in the plant root zone. *Environ. Sci.: Nano* DOI.10.1039/C9EN00088G

Abstract- The formation of metal nanoparticles induced by mineralization is an important pathway that will modify the fate, behavior, and biological availability of heavy metal ions in the environment. Most work has focused on the ability of natural organic molecules (*e.g.*, natural organic matter and extracellular polymeric substances (EPS)) to convert metal ions to nanoparticles. However, plant roots, which are ubiquitous in soil and aquatic environments, may have a significant role in the formation of naturally occurring metal nanoparticles. This work demonstrates the importance of plant roots and associated exudates in mediating the transformation of soluble Ag^+ in the presence of sunlight. Using Ag^+ as the starting material, the transformation took place in three steps: 1) formation of AgCl microcubes (μAgCl) through complexation of Ag^+ by plant-released chloride ions in root exudates; 2) stabilization of μAgCl by biomolecules in root exudates; and 3) partial photoreduction of μAgCl to Ag(0) nanoparticles (nAg) facilitated by exudate biomolecules. The quantification of Ag^+, μAgCl and nAg fractions over time demonstrates that the transformation kinetics fit (R^2=0.99) a second-order reaction (k=1.11 $mM^{-1}.h^{-1}$). Morphological changes were observed by SEM-EDS on the particles from 0-24 h: Cubic AgCl microcrystals were converted to cauliflower-shaped core-shell structures with nAg clusters as the shell and μAgCl as the core. The discovery of plant root exudate-mediated phototransformation of Ag^+ adds important knowledge to our understanding of Ag transformation in soil and will guide the assess-

ment of both exposure and risk in the environment.

Majumdar, S.; Ma, C.; Villani, M.; Pagano, L.; Zuverza-Mena, N.; Huang, Y.; Zappettini, A.; Keller, A.; Marmiroli, N.; Parkash, O.; White, J.C. 2019. Surface coating determines the response of soybean plants to cadmium sulfide quantum dots. NanoImpact doi.org/10.1016/j.impact.2019.100151.

Abstract- Understanding the influence of surface coating on bioavailability and biological response of functional nanomaterials will be important to their successful implementation for different ag-ricultural applications. In the current study, soybean seedlings were exposed to 50-200 mg/L cadmium sulfide quantum dots (CdS-QDs) capped with different ligands that vary in surface charge, size, and polarity; these include trioctylphosphine oxide (TOPO), polyvinylpyrrolidone (PVP), mercaptoacetic acid (MAA), and glycine (GLY). In aqueous suspension for a duration of 14d, QD-MAA were most stable, maintaining size at 332±8 nm with least Cd dissolution (9.3%), whereas QD-TOPO agglomerated to 3861 ± 416 nm with maximum dissolution (26.8%); howev-er, in presence of roots, the QD sizes in suspension ranged between 386-495 nm, with high negative zeta potential (-23 mV). After 14 d of CdS-QD exposure in vermiculite, at 100 and 200 mg/L, all plants accumulated statistically similar Cd content in roots, ranging from 568 ± 97 (QD-MAA) to 1010.2 (QD-PVP) µg/g tissue dry weight; also equivalent to bulk CdS treatment (639.2 µg/g). In the roots, Cd from ionic, bulk CdS, QD-MAA and QD-GLY accumulated primarily in the cell wall (~40-55%) followed by organelles (28~40%), suggesting apoplastic pathway; whereas in QD-TOPO, due to high dissolution, dissolved Cd ions accumulated in the cell mem-brane. The exception was QD-PVP, which mainly sequestered in the organelles (49%), potential-ly via symplastic pathway and was more significantly translocated to and accumulated in the shoots, also resulting in reduction in leaf biomass; but this did not alter the metabolite levels or antioxidant activities in these tissues. Results suggested that peroxidases play the dominant role in quenching the oxidative stress due to QDs. At the highest QD treatment level (200 mg/L), root lignification allowed the plants to restrict aerial translocation of Cd, except in QD-PVP, where the lignification was reduced by 21% leading to higher content in shoots. Increased amino acid content in the leaves were noted as a stress tolerance mechanism by the soybean plants exposed to high QD treatment levels, with QD-Bare treatment showing the greatest effect, increasing Phe, Leu, Ile, Met, Val, Pro, Ala, Thr, Asn. Glu, Asp by 209,146, 204, 139, 556, 503, 134, 271, 68, 105, and 147% compared to control. This study highlights the significant influence that sur-face coating exerts on QDs fate and effects in a planted system.

Nason, S.L., Miller, E.L., Karthikeyan, K.G., Pedersen, J.A., 2019. Effects of Binary Mixtures and Transpiration on Accumulation of Pharmaceuticals by Spinach. *Environ. Sci. Technol.* DOI: 10.1021/acs.est.8b05515.

Abstract- Many pharmaceuticals are present in reclaimed wastewater and effluent-dominated water bodies used to irrigate edible crops. Previous research has shown that plants irrigated with reclaimed wastewater can accumulate pharmaceuticals. However, plant-driven processes that contribute to differences in accumulation among compounds are not well understood. Here, we tested the effects of exposure to mixtures on spinach accumulation and metabolism of four psychoactive pharmaceuticals found in

reclaimed wastewater: carbamazepine, fluoxetine, amitriptyline, and lamotrigine. Coexposure of plants to carbamazepine and fluoxetine or amitriptyline decreased accumulation of the toxic carbamazepine metabolite 10,11-epoxycarbamazepine. Furthermore, we tested a simple transpiration-based accumulation model and found that transpiration is a strong predictor for accumulation of the studied compounds. Amitriptyline accumulated to a larger extent than predicted from transpiration alone, and we suggest the possibility that a transporter protein may be involved in its uptake. Our findings highlight the need to consider plant physiology and mixture effects in studying accumulation of polar and ionizable organic contaminants and their metabolites.

Ridge, G. E., Elmer, W., Gaines, S., Li, X., Schlatzer, D., McClure-Brinton, K., and Sheele, J. M. 2019. Xenointoxication of a Rabbit for the Control of the Common Bed Bug *Cimex lectularius* L. Using Ivermectin. Scientifica Vol. 2019 Article ID 4793569. https://doi.org/10.1155/2019/4793569

Abstract- Human bed bug infestations have undergone a recent global resurgence. ,e human antiparasitic drug ivermectin has been proposed as a strategy to help control bed bug infestations, but *in vivo* data are lacking. We allowed separate populations of the common bed bug, *Cimex lectularius* L., to feed once on a rabbit before and after it was injected subcutaneously with 0.3 mg/kg of ivermectin, and bed bug morbidity and mortality were recorded. Ivermectin levels in the rabbit were measured using highperformance liquid chromatography and mass spectroscopy. Ivermectin blood levels of ~2 ng/mL caused reductions in bed bug fecundity, and levels of >8 ng/mL caused bed bug death and long-term morbidity including reductions in refeeding, mobility, reproduction, and molting. Gut bacterial cultures from the fed bed bugs showed that ivermectin altered the bed bug gut microbiome.

JOURNAL ARTICLES APPROVED MARCH 2019

Barandun, J., M. Hunziker, **Charles R. Vossbrinck**, and S. Klinge. Evolutionary Compaction and Adaptation Visualized by the Structure of the Dormant Microsporidian Ribosome. *Nature Microbiology*

Bugbee, Gregory J. Task Force Finds Alarming Population of Hydrilla in the Connecticut River. *National Water Monitoring Council Newsletter*

Cheah, Carole. Climate Impacts on Eastern Hemlock Sustainability. *The Habitat*

Cui, Zhouqi, C. H. Yang, R. R. Kharadi, X. Yuan, G. W. Sundin, **Lindsay R. Triplett**, J. Wang, and **Quan Zeng**. Cell-Length Heterogeneity: A Population-Level Solution to Growth/Virulence Trade-Offs in the Plant Pathogen *Dickeya dadantii*. *PLOS Pathogens*

Duan, J. J., R. G. Van Driesche, R. S. Crandall, J. M. Schmude, **Claire E. Rutledge**, B. H. Slager, J. R. Gould, and J. S. Elkinton. Establishment and Early Impact of *Spathius galinae* (Hymenoptera: Braconidae) on Emerald Ash Borer (Coleoptera: Buprestidae) in the Northeastern U.S. *Journal of Economic Entomology*

Dugas, Katherine. Information Update on the Spotted Lanternfly. *Connecticut Weekly Agricultural Report*

Geitner, N. K., C. O. Hendren, G. Cornelis, et al., **Jason C. White**. Harmonizing Across Environmental Nanomaterial Testing Media for Increased Comparability of Nanomaterial Datasets. *Environmental Science: Nano*

Gent, Martin P.N. Modeling Translocation and Metabolism in Lettuce. *Acta Horticulturae*

Gloria-Soria, Andrea, J. Soghigian, D. Kellner, and J. R. Powell. Genetic Diversity of Laboratory Strains and Implications for Research: The Case of *Aedes aegypti*. *Current Biology*

Hiskes, Rose. Pesticide Guide Toward Integrated Insect Management for Connecticut Arborists. *CAES Bulletin*

Hiskes, Rose. Pesticide Guide Toward Integrated Insect Management for Connecticut Landscapers. *CAES Bulletin*

Hiskes, Rose. Pesticide Guide Toward Integrated Insect Management for Connecticut Nurseries. *CAES Bulletin*

LaMondia, James A. Curative Fungicide Activity Against *Calonectria pseudonaviculata*, the Boxwood Blight Pathogen. *Journal of Environmental Horticulture*

LaMondia, James A. Fungicides for Boxwood Blight Management in Connecticut. *CAES Fact Sheet*

LaMondia, James A. Susceptibility of Boxwood Species, Cultivars, Hybrids and Accessions to Boxwood Blight. *CAES Fact Sheet*

LaMondia, James A. Susceptibility of Pachysandra Species and Cultivars to Boxwood Blight. *CAES Fact Sheet*

LaMondia, James A., **Yonghao Li**, and Sharon Douglas. Best Management Practices for Boxwood Blight for Connecticut - Commercial, Public and Residential Landscapes. *CAES Fact Sheet*

LaMondia, James A., **Yonghao Li**, and Sharon Douglas. Best Management Practices for Boxwood Blight for Connecticut – Production and Retail Nurseries. *CAES Fact Sheet*

Maier, Chris T. Larval Hosts of Lamiine Cerambycidae (Coleoptera) in Connecticut and Nearby States. *The Coleopterists Bulletin*

Molaei, Goudarz, S. E. Karpathy, J. L. Schlater, and **Theodore G. Andreadis**. Enduring Challenge of Exotic Vectors: First Report of the Introduction of *Amblyomma coelebs* (Acari: Ixodidae) on a Human into the USA. *Emerging Infectious Diseases*

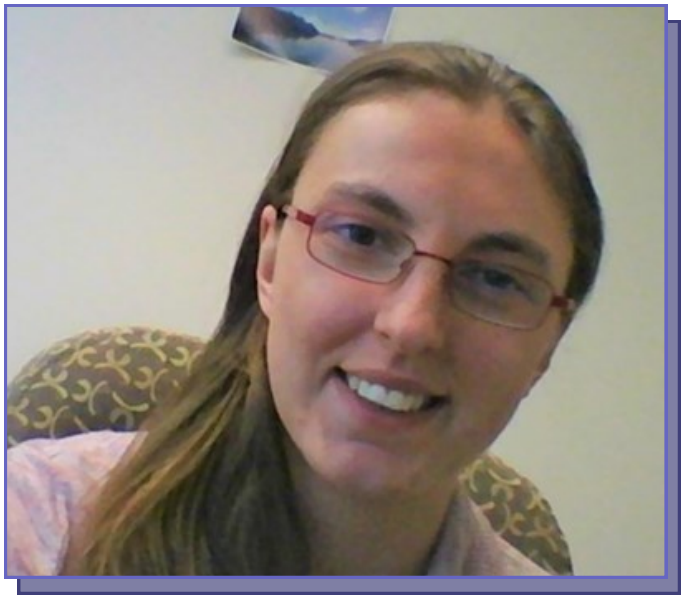
Ruiz, M., **Yi Yang**, C. A. Lochbaum, **Joseph J. Pignatello**, and J. A. Pedersen. Peroxymonosulfate Oxidizes Amino Acids in Water Without Activation. *Environmental Science & Technology*

ARTICLES OF INTEREST MARCH 2019

Agriculture Day at the Capitol, Wednesday, March 20, 2019

Dr. Theodore Andreadis speaking with Lt. Governor Susan Bysiewicz. Also shown, are Board of Control Member, Mr. Paul Larson, and then acting Commissioner of Agriculture, Melody Currey.

NEW STAFF, STUDENTS, AND VOLUNTEERS MARCH 2019



Dr. Sara L. Nason is a new Assistant Scientist II in the departments of Environmental Science and Analytical Chemistry. She began on February 28, 2019. Previously, Sara completed a postdoctoral fellowship in the Johns Hopkins Bloomberg School of Public Health, received her Ph.D. in Environmental Chemistry and Technology from the University of Wisconsin – Madison, and completed a Bachelor's degree in Geosciences at Princeton University. Sara's research at the Connecticut Agricultural Experiment Station will focus on using high resolution mass spectrometry to detect contaminants in the environment such as pesticides, pharmaceuticals, and perfluorinated compounds, as well as on plant interactions with environmental contaminants. Her office is 111 Johnson-Horsfall Laboratory.

Brooke Tillotson, student at Suffield High School in the AgriScience Program, is working as an intern in Dr. Richard Cowles' lab at the Valley Laboratory learning about *Phytophthora* species in Christmas trees

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