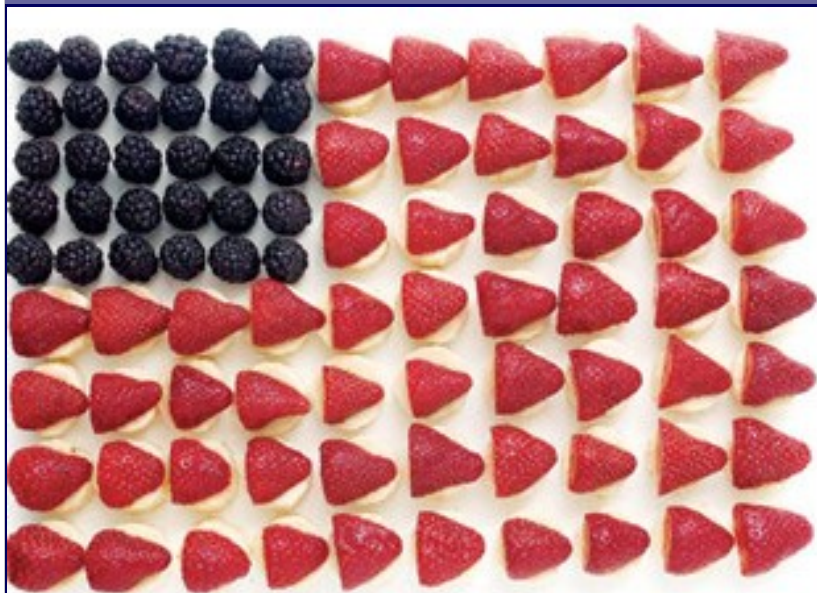


Station News

The Connecticut Agricultural Experiment Station
Volume 9 Issue 7 July 2019



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

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ADMINISTRATION

DR. THEODORE ANDREADIS participated in a joint summer meeting of the Northeastern Regional Association of State Agricultural Experiment Station and Extension Directors held in conjunction with CARET/AHS held in Washington, DC (June 2-5); presented an update on CAES activities at a Board Meeting of the Experiment Station Associates held at the Station (June 19); presented welcoming remarks and an overview of the Experiment Station and its various research, regulatory, and public service programs to a group of students from Central Connecticut State University (15 attendees) (June 20).

ANALYTICAL CHEMISTRY

DR. JASON C. WHITE participated in the weekly all-hands ZOOM call for the Center for Sustainable Nanotechnology (June 5, 12, 19, 26); was interviewed in a ZOOM call by three graduate students from University of Arkansas-Fayetteville as part of the National Science Foundation I-Corp; the students asked questions about sustainable agriculture and food production (June 10); participated in a ZOOM call with collaborators at the University of Wisconsin (serving on a graduate student's PhD committee) to discuss ongoing and future work related to the chemistry of pathogen suppression in nano-enabled agriculture (June 11); hosted a ZOOM call for the "Nanochem-plant" working group of the Center for Sustainable Nanotechnology (June 11); along with **DR. BRIAN EITZER, DR. WALTER KROL, MS. TERRI ARSENAULT, MR. CRAIG MUSANTE, DR. CHRISTINA ROBB, MR. JOHN RANCIATO, AND MS. KITTY PRAPAYOTIN-RIVEROS**, participated in the monthly FDA FERN cCAP WebEx call (June 13); presented an invited lecture entitled "Engineered nanomaterials for the suppression of fungal and viral crop disease in agriculture" at the 2019 TechConnect World Innovation Conference and Expo held in Boston, MA (35 attendees) (June 17-19); participated in a bi-monthly FDA FERN-wide WebEx call (June 20); participated in a Center for Sustainable Nanotechnology ZOOM call to discuss collaborative experiments related to foliar uptake of nanoparticles (June 20); presented an invited lecture entitled "Engineered nanomaterials for the suppression of fungal and viral crop disease in agriculture" at the 3rd Annual Symposium of the Nanyang Technological University-Harvard University TH Chan School of Public Health Initiative for Sustainable Nanotechnology (NTU-Harvard SusNano), which was held in conjunction with the 10th International Conference on Materials for Advanced Technologies (ICMAT 2019) in Singapore (35 attendees) (June 24-26); and hosted Ms. Becky Curtis of the University of Wisconsin-Milwaukee as part of a lab exchange within the Center for Sustainable Nanotechnology (I am on her Ph.D. Committee) (June 24-28).

DR. BRIAN EITZER was a participant in the North American Chemical Residue Workshop's Organizing Committee conference call (June 13); and presented two talks entitled "An Inter-Lab Study of a Non-Target Data Acquisition - Target Data Analysis Method for Pesticides in Foods Using Liquid Chromatography -High Resolution Mass Spectrometry: The Connecticut Participation Experience" and "FERN CHE.0008 - LC/MS Poison Screen: Extension to Q Exactive" at the Food Emergency Response Network Cooperative Agreement Program technical meeting held in Baltimore, MD (50 attendees) (June 18-19).

DR. NUBIA ZUVERZA-MENA toured and presented our work at the Analytical Chemistry Dept. to a group of students and faculty from Quinnipiac University (~10 visitors) (June 12); presented "Cerium oxide nanoparticle ($n\text{CeO}_2$) interactions with the short chain perfluoroalkyl substance PFBS on radish plants" at the Nanotech 2019 Conference and Expo held in Boston, MA (~20 attendees) (June 17-19).



Dr. Jason C. White presented participated in the 3rd Annual Symposium of the Nanyang Technological University-Harvard University TH Chan School of Public Health Initiative for Sustainable Nanotechnology (NTU-Harvard SusNano) which was held in conjunction with the 10th International Conference on Materials for Advanced Technologies (ICMAT 2019) in Singapore.

ENTOMOLOGY

DR. KIRBY C. STAFFORD III spoke on ticks and tick management at the Rogers Corporation in Rogers (40 attendees) (June 5); spoke on ticks and tick management at the Lyme Public Library (38 attendees) (June 6); with **DR. GALE E. RIDGE**, presented a talk on forensic entomology to the States Attorneys and staff held in Hartford (20 attendees) (June 12); with a panel organized by the Westport Weston Health District, taped a presentation on ticks and tick-borne diseases in Westport (June 13); participated in a meeting of the Cooperative Agricultural Pest Survey (CAPS) committee in the Slate Board Room (10 participants) (June 17); participated and presented on tick management in a conference call organized by the Midwest Center for Excellence in Vector-Borne Diseases (June 18); presented a talk on ticks and tick management at the Willow Tree Community Center in Waterbury (16 attendees) (June 25).

MS. KATHERINE DUGAS attended and ran the state Cooperative Agricultural Pest Survey (CAPS) committee meeting in the Slate Board Room (10 participants) (June 17); and attended the CT Grape Growers Twilight Meeting held at Paradise Hills Winery in Wallingford (June 19).

MR. MARK H. CREIGHTON attended the CT Beekeepers Association meeting at Lockwood Farm in Hamden with guest speaker Keith Delaplane from the University of Georgia and conducted hive inspections with the 75 members in attendance (June 1).

DR. MEGAN LINSKE gave an invited lecture entitled “Blacklegged tick reservoir host diversity and abundance impacts on dilution of *Borrelia burgdorferi* in residential and woodland habitats in Connecticut” at the International Urban Wildlife Conference in Portland, OR (30 attendees) (June 4); was interviewed about professional development and leadership in vector-borne and zoonotic disease research by Justin Shew for the Wildlife Society’s Leadership Institute (June 14); participated

in a conference call with the Northeast Section of the Wildlife Society's Executive Committee as the Executive Secretary to discuss budget planning (June 21).

DR. GALE E. RIDGE attended a Cross Cultural Communication symposium, sponsored by the Department of Consumer Protection, in Hartford (June 6), where speakers delivered a series of talks and workshops on the media and its function in cultural communication; with **DR. KIRBY STAFFORD**, presented a joint talk about Forensic Entomology to staff at the Connecticut Chief States Attorney's Office in Hartford (20 attendees) (June 12); hosted students from Central Connecticut State University visiting the Insect Information Office as part of a Station tour (17 attendees) (June 20); and noted an outbreak of the Oak shothole leafminer, *Japanagromyza viridula* synonym *Agromyza viridula*, which is an agromyxid fly that pierces swelling oak leaf buds in the early spring, which causes a bilateral hole pattern as the leaves develop (see photo). The leafminer laps up weeping fluids from the wounds it caused prior to oviposition. Massachusetts reported widespread damage by this fly. In lower Fairfield County, a Fall webworm, *Hyphantria cunea*, outbreak was also noted in the Insect Information Office.



DR. CLAIRE E. RUTLEDGE participated in "Parent University" at North Haven Middle School and told students about becoming an entomologist and what I do in my job (95 youths) (June 7).

DR. VICTORIA L. SMITH participated in the spring meeting of the Cooperative Agricultural Pest Survey committee held in the Slate Board Room (10 participants) (June 17) and participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) (June 20).

DR. KIMBERLY A. STONER met with conservation groups about creating guidelines for management of utility rights-of-way in order to protect habitat for a wide range of organisms (birds, reptiles, amphibians, New England cottontails, and rare plants as well as pollinators) at the Connecticut Forest and Park Association in Middlefield (12 attendees) (June 10).

ENVIRONMENTAL SCIENCES

DR. PHILIP ARMSTRONG held a press event in the Johnson-Horsfall atrium with Connecticut Senator Richard Blumenthal on the public health threat and response to mosquito-borne diseases in Connecticut (June 3); gave a talk entitled "Mosquito Biology, Disease Risk, and Personal Protection" at the 16th Annual Conference of the International Society of Travel Medicine in Washington, D.C. (150 attendees) (June 6).

DR. DOUG BRACKNEY gave a poster entitled "Broadly cross neutralizing antibodies and peptide inhibitors can effectively block the ability of dengue virus to infect mosquito cells and mosquitoes" at the Positive Strand RNA viruses Keystone Symposium in Killarney, Ireland (June 9-13); and gave a poster entitled "Generation of axenic *Aedes aegypti* mosquitoes to study vector-microbiome-pathogen interactions" at the Jacques Monod Integrated Insect Immunology Conference held in Roscoff, France (June 24-28).

MR. GREGORY BUGBEE spoke on "Hydrilla in the Connecticut River" at a meeting of the Northeast Aquatic Nuisance Species Panel held in Springfield, MA (approx. 35 attendees) (June 3); participated in Hydrilla surveillance training in conjunction with the US Army Corp of Engineers on the Connecticut River held in Agawam, MA (approx. 20 attendees) (June 4); participated as a panelist on the Northeast Aquatic Nuisance Species Panel and updated the Panel on CT's invasive aquatic plant issues (approx. 25 attendees) (June 5); spoke on "Hydrilla in the Connecticut River and 2019 CAES IAPP Surveillance" at an outing sponsored by the Gateway Commission on a river boat cruise in the

Connecticut River (approx. 50 attendees) (June 12); spoke on “Connecticut’s Invasive Aquatic Plant Problem” at a workshop sponsored by the Sustainable Essex Committee at the Essex Town Hall (approx. 25 attendees) (June 18); spoke on “Hydrilla in the Connecticut River” at a meeting of the Capital Region Council of Governments held in Hartford (approx. 25 attendees) (June 19); was interviewed by the Republican-American on invasive aquatic plants in Lake Quassapaug in Middlebury (June 25).

DR. ANDREA GLORIA-SORIA attended the 13th Annual Science Symposium at Amity Regional High School to support her high school senior mentee Jack Tajmajer (April 17).

DR. JOSEPHINE HYDE gave a poster at the Animal-Microbe Symbioses Gordon Research Seminar (approx. 50 total attendees; approx. 30 students) and Animal-Microbe Symbioses Gordon Research Conference (approx. 130 attendees; approx. 50 students) (June 15-21).

DR. GOUDARZ MOLAEI hosted a group of faculty and students from Central Connecticut State University at the Tick Testing Laboratory and spoke on ticks (17 attendees) (June 17); was interviewed by Christy Colasurdo, a freelance journalist, on the underreporting of Lyme disease cases in Connecticut and the impact of temperature on tick populations (June 20).

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD administered practical and oral examination to arborist candidates for the Connecticut Tree Protection Examining Board (June 12); was an invited participant in the Forest Action Plan 2020 Roundtable held in Waterbury (June 13); was interviewed about the impact of sycamore anthracnose on tree growth and survival by Bob Miller, Danbury News-Times (June 18); was interviewed about the extent of barberry in Connecticut by Ted Goerner, Hartford Courant (June 18); participated in a quarterly meeting of the Connecticut Invasive Plant Council held in Windsor (June 25); participated in an NESAF 2020 planning committee conference call (June 25); gave an invited lecture entitled “Tending oak stands for stocking, growth and quality” at the University of New Hampshire’s Red Oak...the Book and Beyond: The Ecology and Management of Northern Red Oak (68 attendees) (June 28).

DR. ABIGAIL A. MAYNARD discussed the new crops program with five growers at the Litchfield farmers market (June 15); discussed the new crops program with three growers at the Middletown farmers market (June 21); discussed the new crops program with two growers at the Madison farmers market (June 28).

DR. SCOTT C. WILLIAMS presented an invited lecture entitled “Discovery of an established population of lone star ticks in southwestern Connecticut” at the International Urban Wildlife Conference held in Portland, OR (76 attendees) (June 2-5); gave an invited lecture entitled ““Ticked Off! Invasive Plants, Ticks, Deer and Lyme Disease—A Surprising Connection” in New Canaan at a lecture series jointly run by the Town Conservation Commission and New Canaan Land Trust (110 attendees) (June 12); participated in a conference call of the Executive Committee of the Northeast Section of the Wildlife Society (June 21).

MR. JOSEPH P. BARSKY participated in the accreditation review of The Sound School in New Haven (15 students, 5 teachers) (June 5); participated in the Forest Action Plan 2020 Roundtable held at Naugatuck Valley Community College in Waterbury (June 13); participated in an NESAF 2020 planning committee conference call (June 25).

PLANT PATHOLOGY AND ECOLOGY

DR. LINDSAY TRIPLETT The 2019 CAES-SCSU Plant Health Fellows program welcomed 10 students on June 10 with 9 students working in research groups at CAES and 1 student at SCSU. In addition

to performing a mentored research project over 9 weeks, the students will perform a group field plot experiment, participate in communication and career-building workshops, take a field trip to Indigo Agriculture in Boston, and present their research at Plant Science Day and at their final research symposium on August 8th. Dr. Lindsay Triplett with Plant Health Fellows Ethan Tippett (da Silva lab), Olivia Rianhard (Marra lab), Carlos Calderon (Triplett lab), Harvey Ng (Zuverza lab), Kylee Brown (Zeng lab), Esther Kim (Rutledge lab), Kawai Navares (Silady lab at SCSU), Alenka Mora (Ward lab), Amanda DeLucia (Elmer lab), and Kate Manning (Steven Lab).

DR. WASHINGTON DA SILVA along with PH.D student **DARLAN BORGES**, and interns **STEPHANIE PREISING**, and **ETHAN TIPPETT** attended the 2019 CT Farm Wine Twilight Meeting held at Paradise Hills Vineyard & Winery in Wallingford, and **DR. DA SILVA** presented “Grapevine Viruses Identification” (65 attendees) (June 19).

DR. WADE ELMER attended the Gordon conference on Environmental Nanotechnology and presented a poster entitled “Metallic nanoparticles for plant disease suppression” and served on a career discussion panel for graduate students (42 attendees) (June 1-2); participated in a conference call for the American Phytopathological Society Ornamental Disease Committee (June 5); was visited by Mr. Andrew Bramante (Science teacher), and his students, Alexander Patti, and Edgar Sosa from Greenwich High School to begin setting up experiments using nanoparticles to suppress diseases on coffee and basil (June 18); co-sponsored the 2019 Greenhouse Biological Control Conference in Jones Auditorium (70 attendees) (June 19); and organized a zoom conference for coeditors and co-authors of a new Handbook on Vegetable and Herb Diseases.

DR. ZHOUQI CUI attended the 2nd International Symposium on Fire Blight of Rosaceous Plants and gave an oral presentation entitled “Role of type III secretion system during the infection of apple flowers by *Erwinia amylovora*” in Traverse City, MI (70 participants) (June 20).

DR. YONGHAO LI was interviewed by Robert Miller at the News Times in Danbury about epidemics of anthracnose on sycamore and oak trees this spring (June 17); talked about the Plant Disease Information Office to CCSU students and faculty during a tour of the Station (18 adults) (June 20); presented “Backyard Small Fruit 101” for a Cheshire Public Library event in Cheshire (16 adults) (June 24); presented “Gardening with Native Plants” for a Rockville Public Library event in Vernon (10 adults) (June 25); presented “Disease Management in Christmas Tree Farms” at the CCTGA Twilight Meeting held in Broad Brook (60 adults) (June 26); and gave a 4-day on-site training of disease diagnostics and document management to Ms. Abby Beissinger, a new plant diagnostician at UConn.

DR. ROBERT MARRA presented a talk entitled “On the Lookout for Oak Wilt” at the annual meeting of the Tree Wardens Association of Connecticut held at Stony Creek Brewery (75 adults) (June 6); participated in an oak wilt sampling workshop at Cornell, via webinar (June 12); and performed a demonstration of tree tomography at Lockwood Farm for a journalist from the science publication *Undark* (June 16).

DR. NEIL SCHULTES participated in the 2nd International Symposium on Fire Blight of Rosaceous Plants in Traverse City, MI (June 17-21); and presented a poster entitled “Nucleobase transport in fire blight pathogen and host” (65 adults) (June 18).

DR. QUAN ZENG gave a presentation entitled “Management of bacterial plant diseases, using fire blight as an example” to a group of visiting undergraduate students from Quinnipiac University (10 adults) (June 12); participated in the 2nd International Symposium on Fire Blight of Rosaceous Plants in Traverse City, MI (June 17-21) and gave an invited presentation entitled “New insights from *Erwinia amylovora* genomics and how that influences disease management” (65 adults) (June 18); and an oral presentation entitled “Microbiome associated with apple flowers and its impact on fire blight infection” (65 adults) (June 20).



Dr. da Silva presenting at the 2019 CT Farm Wine Twilight Meeting.



From left to right: Ph.D. Student Darlan Borges, Dr. Washington da Silva, and undergraduate interns Stephanie Preising and Ethan Tippett.

VALLEY LABORATORY

DR. CAROLE CHEAH met with the First Selectwoman of Old Lyme, Bonnie Reemsynder, to release weevils for biological control of mile-a-minute weed (June 19); met with the Director of the Conservation Commission of Fairfield, Brian Carey, to release weevils in Fairfield (June 21); and with Kris Vagos, wildlife biologist with the US Fish and Wildlife Service, released weevils on Calf Island, Greenwich (June 28).

DR. RICHARD COWLES was awarded a \$1,000 grant from the CT Christmas Tree Growers Association to study pheromones to attract the western pine moth/Zimmerman pine moth. Presented “Update on Hartford EAB study” to the Hartford Tree Advisory Commission, Hartford (June 5, 12 attendees); discussed management of armored scales and phytophthora root rot at the Christmas Tree Farmers’ Association of New York twilight meeting, New Grangeville, NY (40 attendees) (June 20); presented “Turf, shrub, and tree insect pests” for the Municipal Turf Academy, University of Connecticut, Storrs (60 attendees) (June 25); and hosted at his farm and presented research efforts and practical tips for growing Christmas trees for the CCTGA twilight meeting, Broad Brook (67 attendees) (June 27).

26).

MS. ROSE HISKES gave a talk entitled “What’s Bugging Your Plants” to the Branford Garden Club at the Public Library in Branford (19 attendees) (June 4); participated in a CIPWG Executive Committee meeting at the Valley Laboratory (June 11); and gave a talk entitled “What’s Bugging Your Plants” at the Strong Family Farm in Vernon (8 attendees) (June 30).

DR. JAMES LAMONDIA 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 (June 12); and spoke about the Experiment Station and Valley Laboratory research and outreach and the Valley Laboratory Garden as a part of the 2019 Windsor Garden Club senior citizen garden tour (15 attendees) (June 27).

DEPARTMENTAL RESEARCH UPDATES JUNE 2019

Agrimonti, C.; White, J.C.; Tonetti, S.; Marmiroli, N. 2018. Antimicrobial activity of cellulosic pads treated with emulsions derived from essential oils of oregano and thyme against bacteria of minced beef meat. *Int. J. Food Micro.* DOI.org/10.1016/j.ijfoodmicro.2019.108246.

Abstract- Cellulosic pads, amended with emulsions containing essential oils of thyme and oregano, exhibited antimicrobial activity against the psychrophilic microbiota of minced beef. In addition, the pads were active against specific meat bacterial species (*Pseudomonas putida*, *Pseudomonas fragi*, *Pseudomonas fluorescens*, *Enterococcus faecalis* and *Lactococcus lactis*) and some common foodborne pathogens (*Salmonella enterica*, *Campylobacter jejuni* and *Staphylococcus aureus*). Three emulsions, IT131017, Mediterranean and Ethnic, containing different percentages of carvacrol, thymol, linalool, and α and β -pinene significantly reduced the growth of *S. enterica* and *P. putida*. Pads derived from emulsions Mediterranean and Ethnic induced slight (0.3-0.8 Log₁₀ CFU/g) but reproducible reduction of the psychrophilic microbiota in minced meat and hamburger stored for 12 and 15 days at 4 °C.

Bohne, M. J., Rutledge, C. E., Hanson, T., Carrier, N. C., Teerling, C., Weimer, J., ... & Dodds, K. J. (2019). Utilizing prey captures by *Cerceris fumipennis* Say (Hymenoptera: Crabronidae) for a survey of Buprestidae (Coleoptera) in New England, USA. *The Coleopterists Bulletin*, 73(2), 369-379.

Abstract- The solitary predatory wasp *Cerceris fumipennis* Say provisions its nests with beetles from the family Buprestidae. State and federal officials in New England, USA collected Buprestidae prey from *C. fumipennis* starting in 2009. At least 220 colonies of *C. fumipennis* were monitored as part of the cooperative survey. A total of 6,044 individual Buprestidae from 12 genera and 69 species were collected during surveys conducted during 2009-2011. In total, 56 new state records for 40 species are documented in New England through July 2018. Rarefaction analysis of data pooled by state suggested that more species potentially collected by *C. fumipennis* exist but were not sampled.

Cao, X.; Ma, C.; Zhao, J.; Musante, C.; White, J.C.; Wang, Z.; Xing, B. 2019. Interaction of graphene oxide with co-existing arsenite and arsenate: adsorption, transformation and combined toxicity. *Environ. Int.* doi.org/10.1016/j.envint.2019.104992.

Abstract- Interactions between arsenite [As (III)] / arsenate [As (V)] and graphene oxide (GO) and their combined toxicity to *Chlorella pyrenoidosa* were investigated. Under abiotic conditions, the maximum adsorption capacity of GO for As (III) and As (V) was 25.1 ± 0.5 mg/g and 17.2 ± 0.7 mg/g, respectively. Approximately 42% of the adsorbed As (III) was oxidized by GO under lighted conditions, which was induced by electron-hole pairs on the surface of GO. Co-exposure to GO greatly enhanced the toxicity of As (III, V) to alga. When adding 10 mg/L GO, the 72 h EC₅₀ of As (III) and As (V) to *C. pyrenoidosa* decreased to 12.7 and 9.4 mg/L from 30.1 and 16.3 mg/L in the As alone treatment, respectively. One possible mechanisms by which GO enhanced As toxicity could be that GO decreased the phosphate concentration in the algal medium as the As (V) increased. In addition, transmission electron microscope (TEM) images demonstrated that GO acted as a carrier for As (III) and As (V) transport into the algal cells. In addition, GO induced severe oxidative stress, which could have subsequently compromised important detoxification pathways

(e.g., arsenic complexation with glutathione, arsenic methylation, and intracellular arsenic efflux) in the algal cells. Our findings provide important information on potential of GO for increasing the arsenic toxicity to algal species, and highlight the significant impact of GO on the fate and transport of arsenic in the aquatic environment.

da Silva, W.L., Yang, K., Pettis, G., Soares, N.R., Giorno, R. and Clark, C. **Flooding-associated soft rot of sweetpotato storage roots caused by distinct *Clostridium* isolates.** *Plant Disease* <https://doi.org/10.1094/PDIS-03-19-0548-RE>

Abstract- Flooding of sweetpotatoes in the field leads to development of soft rot on the storage roots while they remain submerged or upon subsequent harvest and storage. Incidences of flooding following periods of intense rainy weather are on the rise in the southeastern United States, which is home to the majority of sweetpotato production in the nation. In an effort to characterize the causative agent(s) of this devastating disease, here we describe two distinct bacterial strains isolated from soft-rotted sweetpotato storage roots retrieved from an intentionally flooded field. Both of these anaerobic spore-forming isolates were identified as members of the genus *Clostridium* based on sequence similarity of multiple housekeeping genes, and both were confirmed to cause soft rot disease on sweetpotato and other vegetable crops. Despite these common features, the isolates were distinguishable by several phenotypic and biochemical properties and phylogenetic analysis placed them in separate well-supported clades within the genus. Overall, our results demonstrate that multiple plant-pathogenic *Clostridium* species can cause soft rot disease on sweetpotato and suggest that a variety of other plant hosts may also be susceptible.

Dimkpa, C.O.; Singh, U.; Bindraban, P.S.; Elmer, W.H.; Gardea-Torresdey, J.L.; White, J.C. 2019. Zinc oxide nanoparticles alleviate drought-induced alterations in sorghum performance, nutrient acquisition, and grain fortification. *Sci. Tot. Environ.* 688:926-934.

Abstract- Drought is a major climatic event affecting both the productivity and the nutritional quality of crops. In this study, sorghum was evaluated to understand the effects of drought on performance and nutrient acquisition and distribution, and how ZnO nanoparticles might alleviate such effects. Soil was amended with zinc oxide nanoparticles (ZnO-NPs) at 1, 3, and 5 mg Zn/kg soil; and drought was administered 4 weeks after germination by maintain the soil at 40% of the field moisture capacity. Sorghum development (flag leaf and grain head emergence) was delayed by drought but was improved by ZnO-NPs exposure. Vegetative growth (tiller, panicle and shoot biomass) and reproductive (grain) yield were significantly ($p < 0.05$) lowered by drought; notably, shoot biomass was reduced by 39%, and grain yield by 76%. However, ZnO-NPs amendment under drought stress improved biomass production on average by 19%, while grain yield was improved by 22-183%. Grain nitrogen (N) translocation and total (root, shoot and grain) acquisition were inhibited by drought by 57% and 22%, respectively; however, ZnO-NPs (5 mg/kg) improved (84%) grain N and restored total plant N levels to the non-drought condition. Shoot uptake of phosphorus (P) was promoted (39%) by drought, while grain P translocation was inhibited (63%); however, ZnO-NPs lowered total P acquisition under drought by 11-23%. Drought impeded potassium (K) shoot uptake, grain translocation and total acquisition by 45%, 71%, and 41%, respectively. Amendment of ZnO-NPs (5 mg/kg) under drought improved grain K by 123%, and total acquisition by 16-30%. Drought negatively affected shoot Zn uptake (74-88%) and grain translocation (34-82%), regardless of ZnO-NP rate. Notably, drought-induced inhibition of total Zn acquisition was negated at high Zn amendment rate (5 mg/kg). Similarly, drought lowered grain Zn concentration by an average of 32%; however, ZnO-NP amendments improved grain Zn concentration under drought by 94%, on average. Taken together, these findings demonstrate profound effects of drought on sorghum agronomic performance and nutrient use, and the mitigating effect of ZnO-NP amendment on these parameters. The ability of ZnO-NPs to promote crop yield, improve nutrient acquisition, and fortify edible grains with critically essential nutrients such as Zn under drought stress has strong implications for sustaining food/feed and nutrition security, and for improving nutrient losses and environmental pollution associated with N-fertilizer use in agriculture.

Hou, J.; Lin, D.; White, J.C.; Gardea-Torresdey, J.; Xing, B. 2019. Joint nanotoxicology assessment provides a new strategy for developing nano-enabled bioremediation technologies. *Environ. Sci. Technol.* doi.org/10.1021/acs.est.9b03593.

Abstract- Nanomaterials (NMs) are utilized in various sectors of everyday life and releases into ground/surface water, soils, and sediments are likely significant. Concerns over the combined risks of NMs and co-existing pollutants have led to investigations into co-contamination

scenarios; in fact, annual research on joint contaminant exposures have increased more than 10 times over the last 10 years¹. Synergistic, additive, antagonistic, and independent effects are all possible toxic interactions resulting from NMs and co-contaminant exposure. Interestingly, NMs may antagonize the toxicity of co-existing contaminants by adsorption/reductive-oxidation reactions, or may decrease toxicity through altered biological processes such as antioxidation, detoxification or biodegradation¹. These types of interactions clearly suggest the potential use of NMs to facilitate the bioremediation of contaminated sites. Although a robust literature has developed on the biological response to NMs exposure for a wide range of biota, most toxicity assessments aim at evaluating environmental risks without significant exploration of potential applications. Here, we recommend extracting valuable information from joint nano-toxicity studies as an indicator for the development of nano-enabled bioremediation technologies.

Keyel, A.C., Elison Timm, O., Backenson, P.B., Prussing, C., Quinones, S., McDonough, K.A., Vuille, M., Conn, J.E., **Armstrong, P.M., Andreadis, T.G.**, Kramer, L.D. Seasonal temperatures and hydrological conditions improve the prediction of West Nile virus infection rates in Culex mosquitoes and human case counts in New York and Connecticut. *PLoS One*. 2019 Jun 3;14(6):e0217854.

Abstract- West Nile virus (WNV; Flaviviridae: Flavivirus) is a widely distributed arthropod-borne virus that has negatively affected human health and animal populations. WNV infection rates of mosquitoes and human cases have been shown to be correlated with climate. However, previous studies have been conducted at a variety of spatial and temporal scales, and the scale-dependence of these relationships has been understudied. We tested the hypothesis that climate variables are important to understand these relationships at all spatial scales. We analyzed the influence of climate on WNV infection rate of mosquitoes and number of human cases in New York and Connecticut using Random Forests, a machine learning technique. During model development, 66 climate-related variables based on temperature, precipitation and soil moisture were tested for predictive skill. We also included 20-21 non-climatic variables to account for known environmental effects (e.g., land cover and human population), surveillance related information (e.g., relative mosquito abundance), and to assess the potential explanatory power of other relevant factors (e.g., presence of wastewater treatment plants). Random forest models were used to identify the most important climate variables for explaining spatial-temporal variation in mosquito infection rates (abbreviated as MLE). The results of the cross-validation support our hypothesis that climate variables improve the predictive skill for MLE at county- and trap-scales and for human cases at the county-scale. Of the climate-related variables selected, mean minimum temperature from July-September was selected in all analyses, and soil moisture was selected for the mosquito county-scale analysis. Models demonstrated predictive skill, but still over- and underestimated WNV MLE and numbers of human cases. Models at fine spatial scales had lower absolute errors but had greater errors relative to the mean infection rates.

Su, Y.; Ashworth, V.; Kim, C.; Adeleye, A.S.; Rolshausen, P.; Roper, C.; White, J.C.; Jassby, D. 2019. Delivery, uptake, fate, and transport of engineered nanoparticles in plants: A critical review and data analysis. *Environ. Sci.: Nano*. DOI: 10.1039/C9EN00461K

Abstract- The increasing demand for food coupled to various environmental pressures, is increasing the importance of sustainable agricultural practices. Based on results published across a wide range of disciplines, it is becoming evident that nanotechnology can play a crucial role in increasing the sustainability of agriculture, particularly in the area of fertilizer delivery and pest control. In this paper, we reviewed the critical plant morphological and physiological indices (pore size in xylem and phloem, xylem/phloem sap composition, xylem/phloem sap flow rate and flow conducting area) for nanoparticle (NP) translocation, examined the efficacy of various delivery methods for NPs (foliar application, root application, and feeding/injecting directly into plant tissue) with an emphasis on NP translocation efficiency in the whole plant. While only a few studies have explored the feeding/injection of NPs, these application pathways are the most efficient in terms of translocation, indicating their practical potential (e.g., for agrochemical delivery). In contrast, when applied via soil drenching or foliar spraying, the majority of the applied NPs are not taken up by the plants. However, those NPs that do penetrate the plant exhibit efficient translocation from leaf to root, and vice versa. Of these two application methods, foliar application appears to be more effective in both NPs delivery and translocation than soil drenching. To further explain the data reported in the literature and to study the translocation process of NPs throughout the plant, we applied the Derjaguin-Landau-Verwey-Overbeek model to study the interactions of NPs with the surfaces of the plant vascular system

(xylem and phloem), via which these NPs are transported throughout the plant structure. We found that the interaction energy between negatively charged NPs and plant tissue is negative, indicating that these NPs can effectively translocate. We discussed future research needs regarding NP translocation, which will enable effective utilization of NPs for different agricultural applications.

JOURNAL ARTICLES APPROVED JUNE 2019

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Bravo, Joan L. Wine Making Basics - The Next Step for the Home Grower. *CAES Fact Sheet*

Cao, X., G. M. DeLoid, D. Bitounisa, Roberto De La Torre-Roche, Jason C. White, Z. Zhang, H. C. Guan, K. W. Nga, W. Zhong, Brian D. Eitzer, and P. Demokritou. Co-Exposure of Food Additives SiO₂ (E551) and TiO₂ (E171) with Pesticide Boscalid and Effects on Cytotoxicity and Bioavailability of Boscalid Using a Tri-Culture Small Intestinal Epithelium Cell Model: Potential Health Implications. *Environmental Science: Nano*

Cheah, Carole. Hemlock Woolly Adelgid Web Page. At <https://portal.ct.gov/caes>

Hou, J., D. Lin, Jason C. White, J. Gardea-Torresdey, and B. Xing. Joint Nanotoxicology Assessment Provides a New Strategy for Developing Nano-Enabled Bioremediation Technologies. *Environmental Science & Technology*

Hyde, Josephine, C. Gorham, Doug E. Brackney, and Blaire Steven. Antibiotic Resistant Bacteria and Commensal Fungi Are Common and Conserved in the Mosquito Microbiome. *PLOS ONE*

Ma, Chuanxin, H. Liu, G. Chen, Q. Zhao, H. Guo, R. Minocha, S. Long, Y. Tang, E. M. Saad, Roberto De La Torre Roche, Jason C. White, O. Parkash Dhankher, and B. Xing. Dual Role of Glutathione in Silver Nanoparticle Detoxification and Enhancement of Nitrogen Assimilation in Soybean (*Glycine max* L.). *ACS Nano*

Ma, Chuanxin, S. Zhang, X. Cao, W. Ma, H. Guo, Y. Tang, R. Huang, Z. Wang, O. Parkash Dhankher, X. Zhang, Q. Zhao, Jason C. White, and B. Xing. Black Phosphorus: A Biological Evaluation of Its Potential as a Novel P-Based Fertilizer. *Nature Nanotechnology*

Molaei, Goudarz, Eliza A. H. Little, and Kirby C. Stafford III. A Seven-Legged Tick: Report of a Morphological Anomaly in *Ixodes scapularis* (Ixodidae: Acari) Biting a Human Host from the Northeastern United States. *Ticks and Tick-borne Diseases*

Paesano, L., M. Marmioli, M. G. Bianchi, Jason C. White, O. Bussolati, A. Zappettini, M. Villani, and N. Marmioli. Effect of CdS Quantum Dots on Human Cells: Nanoscale-Specific Toxicity on Mitochondrial Function and Tumor Suppression Ability as Measured by miRNA Profiling. *Nature Nanotechnology*

Rochlin, I., A. Faraji, K. Healy, and Theodore G. Andreadis. West Nile Virus Mosquito Vectors in North America. *Journal of Medical Entomology*

Soghigian, J., Andrea Gloria-Soria, V. Robert, G. Le Goff, A. B. Failloux, and J. R. Powell. Genetic Diversity of *Aedes aegypti* and Close Relatives: Evidence for the Origin of the Aegypti Group in the Southwestern Indian Ocean. *Proceedings of the National Academy of Sciences*

Sponsler, D. B., C. Grozinger, R. Richardson, A. Nurse, D. Brough, H. M. Patch, and Kimberly A. Stoner. A Minority of Ornamental Plants Make a Major Contribution to the Pollen Provisioning of a Generalist Pollinator (*Apis mellifera* L.). *Arthropod-Plant Interactions*

Su, Y., P. Rolshausen, C. Roper, Jason C. White, and D. Jassby. Application, Uptake, Fate, and Transport of Engineered Nanoparticles in Plants: A Critical Review and Data Analysis. *Environmental Science: Nano*

NEW STAFF, STUDENTS, AND VOLUNTEERS JUNE 2019



VICTORIA KAMILAR is a senior at Texas A&M where she is a double major in Entomology and Animal Science with a certificate in Public Health. She has worked at an aviary with a range of avian species, including macaws and other parrot breeds, some of whom were diseased or aggressive, assisted in small mammal trapping (mice, opossum, raccoons...) for arthropod hosts, and mist netting song birds for ectoparasites. She loves the outdoors and is an avid rock climber, hiker, backpacker, and photographer of wildlife. She is working on the Cooperative Agricultural Pest Survey (CAPS) program to widen her experience.



Stephanie Preising and **Ethan Tippet** joined the da Silva Lab for an internship. Stephanie is a third-year student from Southern Connecticut State University, she will be working on characterizing strains of *Grapevine leafroll-associated virus 3* by using bioinformatic analyses. Ethan is a third-year student from Ferris State University in Michigan, he is participating in the 2019 Undergraduate Fellowship Health and Protection Program, which is sponsored by NIFA-ELI REEU. Ethan will be working on the detection of viruses from grapevine samples collected from Connecticut vineyards.

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STATION NEWS



DR. LINDSAY TRIPLETT and 2019 CAES-SCSU Plant Health Fellows program students



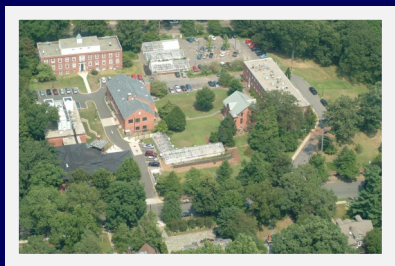
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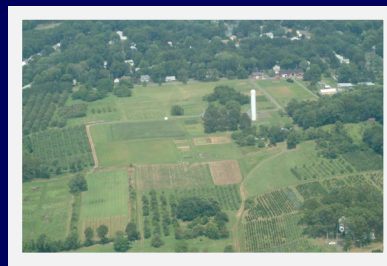
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