

Station News

The Connecticut Agricultural Experiment Station
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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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DR. JASON C. WHITE met with two PhD students to discuss research on nano-enabled agriculture (June 1); along with **DR. CHRISTIAN DIMKPA** and **DR. NUBIA ZUVERZA-MENA** hosted Prof. Vinka Craver of the University of Rhode Island and Prof. Carlina Luisa Astudillo Castro of Pontificia Catholic University of Valparaiso to discuss potential collaborative research on nanotechnology and agriculture (June 2); participated in an NSF I-Corps interview with PhD students from Stonybrook University (June 2); along with **DR. SARA THOMAS**, **DR. SARA NASON**, and **DR. NUBIA ZUVERZA-MENA** participated in a Zoom meeting with collaborators at Yale University and the University of Minnesota to discuss our joint NIEHS grant on PFAS phytoremediation (June 6); along with **DR. NUBIA ZUVERZA-MENA** and **DR. LEIGH WHITTINGHILL** participated in a Zoom seminar with colleagues from the University of Arkansas, University of California Irvine, Texas A & M University, and Houston Christian University about a joint USDA grant proposal (June 6, 13, 20, and 27); along with **DR. CHAOYI DENG** participated in the weekly NSF Center for Sustainable Nanotechnology (NSF) weekly all-hands call (June 7, 14, 21, and 28); participated in a Zoom call with collaborators at the University of Delaware and the National Research Council of Italy to discuss a new USDA grant (June 9); along with **DR. SARA THOMAS**, **DR. SARA NASON**, and **DR. NUBIA ZUVERZA-MENA** participated in the monthly CT PFAS Laboratory Testing workgroup call (June 13); hosted the monthly NSF CSN Nanochem-Plant working group Zoom call (June 13); participated by Zoom in the Farmland Preservation Advisory Board meeting (June 15); hosted a tour for the New Haven International Festival of Arts and Ideas (June 16); participated in a Zoom call with staff from Taylor and Francis to discuss the *International Journal of Phytoremediation* where I am Managing Editor (June 20); along with **DR. CHRISTIAN DIMKPA** and **DR. SHITAL VAIDYA**, hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA nanoscale phosphorus project (June 20); along with **DR. CHAOYI DENG** participated in a Zoom call with members of the International Network For Researching, Advancing, and Assessing Materials for Environmental Sustainability (INFRAMES) to discuss collaborative experiments (June 21); along with Michael Last participated in a Teams call with Construction Services to discuss the Valley Laboratory construction and renovation project (June 21); along with **DR. SARA THOMAS**, **DR. SARA NASON**, and **DR. NUBIA ZUVERZA-MENA** participated in a Zoom call with officials at the NIEHS to discuss our current research (June 22); participated in the monthly CSN Faculty call (June 22); traveled to the University of Minnesota to meet with Prof. Christy Haynes and representatives of a company interested in nano-enabled agriculture (June 23); along with **DR. NUBIA ZUVERZA-MENA** and **DR. TRUNG BUI** met with collaborators at Rutgers University and the New Jersey Institute of Technology to discuss a joint USDA project on micro-nanoplastics (June 26); along with **DR. CHRISTIAN DIMKPA** and **MEGHAN CAHILL** spoke by Zoom with officials from the FDA as part of their annual audit of the Department of Consumer Protection Foods Division and CAES CT Manufactured Foods Regulatory Program Standards (June 28); hosted the quarterly CAES Safety Committee meeting (June 30); and along with **DR. WADE ELMER** and **DR. CHRISTIAN DIMKPA** hosted Professor Swadesh Santra of the University of Central Florida to discuss collaborative research (June 30).

PUBLICATIONS

1. Sun, K., **White, J. C.**, Qiu, H., van Gestel, C. A. M., Peijnenburg, W., and He, E. (2023). Coupled lipidomics and digital pathology as an effective strategy to identify novel adverse outcome pathways in *Eisenia fetida* exposed to MoS₂ nanosheets and ionic Mo. *Environ. Sci. Technol.* DOI: [10.1021/acs.est.3c02518](https://doi.org/10.1021/acs.est.3c02518)

Abstract: Molybdenum disulfide (MoS₂) nanosheets are increasingly applied in several fields, but effective and accurate strategies to fully characterize potential risks to soil ecosystems are lacking. We introduce a coelomocyte-based in vivo exposure strategy to identify novel adverse outcome pathways (AOPs) and molecular endpoints from pristine and environmentally transformed MoS₂ nanosheets (10 and 100 mg Mo/L) on the earthworm *Eisenia fetida* using non-targeted lipidomics integrated with transcriptomics. Machine learning-based digital pathology analysis coupled with phenotypic monitoring was further used to establish the correlation between lipid profiling and whole organism effects. As an ionic control, Na₂MoO₄ exposure significantly reduced (36.2%~79.5%) the cellular contents of membrane-associated lipids (glycerophospholipids) in earthworm coelomocytes. Down-regulation of the unsaturated fatty acid synthesis pathway and leakage of lactate dehydrogenase verified the Na₂MoO₄-induced membrane stress. Compared to conventional molybdate, pristine MoS₂ nanosheets (PMoS₂) inhibited genes related to transmembrane transport and caused differential upregulation of phospholipid content. Unlike PMoS₂, UV-aged MoS₂ nanosheets (AMoS₂) specifically upregulated the glycerolipid metabolism (10.4%~180%) and lipid peroxidation degree (50.4%~69.2%). Consequently, lipolytic pathways were activated to compensate for the potential energy deprivation. With pathology image quantification, we report that AMoS₂ caused more severe epithelial damage and intestinal steatosis than PMoS₂, which is attributed to the edge effect and higher Mo release upon UV aging. Our results reveal differential AOPs involving soil sentry exposure to different Mo forms, demonstrating the potential of liposome analysis to identify novel AOPs and further more accurate soil risk assessment strategies for emerging contaminants.

2. Ahmad, M. A., Adeel, M., Ishfaq, M., Peng, Y., Shakoor, N., Zain, M., Azeem, I., Ali, I., Usman, M., Wu, Z., Gohari, G., Ming, X., **White, J. C.**, and Deng, X. (2023). Modifying engineered nanomaterials to produce next generation agents for environmental remediation. *Sci. Tot. Environ.* 894. DOI: [10.1016/j.scitotenv.2023.164861](https://doi.org/10.1016/j.scitotenv.2023.164861)

Abstract: Application of pristine nanomaterials (PNMs) for environment remediation remains challenging due to inherently high potential for aggregation, low stability, sub-optimum efficiency, and non-uniformity in size and toxicity. Contrary, modified nanomaterials (MNMs) approaches have shown significant potential to enhance the technical and economic efficiency of conventional nanoscale remediation strategies by decreasing aggregation of nanomaterials by imparting electrostatic, electrosteric or steric repulsion between particles. Furthermore, the solubility enhancing agents in MNMs have been shown to increase metal bioavailability and accelerate the breakdown of pollutants. As such, it is imperative to modify nanomaterials for unlocking their full potential and expanding their range of applications. However, there is no comprehensive review study in the literature that evaluates the efficacy and environmental impact of MNMs against PNMs in the environment. This critical review identifies major barriers preventing the widescale application

of nano-enabled remediation and discusses strategies to increase the stability and activity of nanomaterials at reaction sites. The higher reactivity and versatility of MNMs, along with novel properties and functionalities, enable effective removal of a range of chemical pollutants from complex environmental matrices. Additionally, MNMs show significant improvement in mobility, reactivity, and controlled and targeted release of active ingredients for in situ remediation. However, the uncertainties associated with the adverse effects of some modification agents of MNMs are not well-understood, requiring further in-depth investigations. Overall, our findings show that MNMs are potentially more efficient, cost-effective, and resilient for remediation of soil and sediment, water, and air pollution than PNMs. The possible action mechanisms of MNMs have been demonstrated for different environmental compartments. Conclusively, this work provides a path forward for developing effective nano-enabled remediation technologies with MNMs, which are widely applicable to a range of environmental contamination scenarios.

3. Ye, Y., Reyes, A., Li, C., **White, J. C.**, and Gardea-Torresdey, J. L. (2023). Mechanistic insight into the internalization, distribution, and autophagy process of manganese nanoparticles in *Capsicum annuum* L.: Evidence from orthogonal microscopic analysis. *Environ. Sci. Technol.* DOI: [10.1021/acs.est.3c01783](https://doi.org/10.1021/acs.est.3c01783)

Abstract: Orthogonal techniques were used to track manganese nanoparticles (MnNPs) in *Capsicum annuum* L. leaf tissue and cell compartments, and subsequently, to explain the mechanism of uptake, translocation, and cellular interaction. *C. annuum* L. was cultivated and foliarly exposed to MnNPs (100 mg/L, 50 mL/per leaf) before analysis by using scanning electron microscopy coupled with energy dispersive X-ray spectroscopy (SEM-EDS), as well as dark-field hyperspectral and two-photon microscopy. We visualized the internalization of MnNPs aggregates from the leaf surface and observed particle accumulation in the leaf cuticle and epidermis, as well as spongy mesophyll and guard cells. These techniques enabled a description of how MnNPs cross different plant tissues, as well as selectively accumulate and translocate in specific cells. We also imaged abundant fluorescent vesicles and vacuoles containing MnNPs, indicating likely induction of autophagy processes in *C. annuum* L., which is the bio-response upon storing or transforming the particles. These findings highlight the importance of utilizing orthogonal techniques to characterize nanoscale material fate and distribution with complex biological matrices and demonstrate that such an approach offers a significant mechanistic understanding that can inform both risk assessment and efforts aimed at applying nanotechnology to agriculture.

4. Ahmed, T., Noman, M., Gardea-Torresdey, J. L., **White, J. C.**, and Li, B. (2023). Dynamic interplay between nano-enabled agrochemicals and the plant-associated-microbiome. *Trends Plant Sci.* DOI: [10.1016/j.tplants.2023.06.001](https://doi.org/10.1016/j.tplants.2023.06.001)

Abstract: The plant-associated microbiome is known to be a critical component for crop growth, nutrient acquisition, resistance to pathogens and abiotic stress tolerance. Conventional approaches have been attempted to manipulate the plant-soil-microbiome to improve plant performance; however, several issues have arisen, such as collateral negative impacts to microbiota composition. A lack of reliability and robustness of these conventional techniques warrants effort to develop novel alternative strategies. Nano-

enabled approaches have emerged as promising platforms for enhancing agricultural sustainability and global food security. Specifically, the use of engineered nanomaterials (ENMs) as nanoscale agrochemicals has great potential to modulate the plant-associated microbiome. This review focuses on the dynamic interplay between nano-agrochemicals and the plant-associated microbiome for the safe development and use of nano-enabled microbiome engineering.

ANALYTICAL CHEMISTRY

DR. NASSIFATOU TITTIKPIN met with 5th graders of the Shepherd Glen Elementary School in Hamden to share her experience and life as a scientist with the students (June 7). The meeting was set up with Powell Suzanne and Carolyn Nielsen from the Shepherd Glen Elementary School and **DR. LINDSAY TRIPLETT** from The CAES; gave an online lecture on the “Isolation of bioactive natural compounds” as one of the invited guest lecturers of the project "Science in the time of War-Digital Ukraine" (100 attendees) (June 30). The project is an online lecture project organized by the Institute of Bioorganic Chemistry of the Saarland University (UdS) in Germany, and the Faculty of Chemistry, Ecology and Pharmacy, Lesya Ukrainka Volyn National University (VNU) in Ukraine. The project will provide Ukrainian pharmacy students from VNU in Lutsk and other Ukrainian Universities with the opportunity to attend weekly online lectures with a wide variety of scientific topics such as chemistry, biology, biochemistry, nanotechnology, biotechnology, public health, and philosophy of science from lecturers from all over the world. The project is funded by the University of Saarland and the German Academic Exchange Service (DAAD).

NEW STUDENTS, STAFF, AND VOLUNTEERS:



James LeVier joined the Station on June 12, 2023, as a summer intern on the project “Unravelling the impact of wildfires on plants metabolism through exposure to black and brown particles from wildfires.” He is a recent graduate from the University of Connecticut, where he obtained a bachelor’s degree in environmental science and an Ecology and Evolutionary Biology minor. He also has plans to attend the University of Connecticut’s Energy and Environmental Management graduate program in the Fall. Within the project of the “Unravelling the impact of wildfires on plants metabolism through exposure to black and brown particles from wildfires,” James helps set up the experiment

by helping with plant seedlings, treatment applications, and helping cultivate the plants. In addition, he is helping prepare samples for analysis.

Ms. Adrionna Taylor joined the NSF Center for Sustainable Nanotechnology (CSN) Program on June 12, 2023, as a Summer Undergraduate Research Intern student seconded to CAES. She is currently going into her 4th year at Tuskegee University in the field of Animal and Poultry Science. Her goal for the internship at CAES is to learn research skills; attend professional development in-person activities, webinars, and lab- and center-related meetings. During her 2 months at CAES she will focus on conducting research in collaboration with one or more principal investigators or affiliate faculty of the CSN to understand nanoparticle interactions with plants under various conditions, including disease and abiotic factors.



Natnael Mulugeta Yaregal, a rising junior at Bates College Maine, joined the Department of Analytical Chemistry at CAES on June 12, 2023, as a summer undergraduate research intern through the NSF Center for Sustainable Nanotechnology program. During his two-month tenure, Natnael's work focuses on collaborating with a postdoctoral researcher, who is an affiliate faculty of the CSN, assisting with cutting-edge research projects, and actively participating in professional development activities.

PUBLICATIONS

1. Karmous, I., Vaidya, S., Dimkpa, C., Zuverza-Mena, N., da Silva, W., Barroso, K. A., Milagres, J., Bharadwaj, A., Abdelraheem, W., White, J. C., and Elmer, W. H. (2023). Biologically synthesized zinc and copper oxide nanoparticles using *Cannabis sativa* L. enhance soybean (*Glycine max*) defense against *Fusarium virguliforme*. *Pesticide Biochemistry and Physiology*, 194. DOI: [10.1016/j.pestbp.2023.105486](https://doi.org/10.1016/j.pestbp.2023.105486)

Abstract: In this study, zinc and copper oxide nanoparticles (NPs) were synthesized using hemp (*Cannabis sativa* L.) leaves (ZnONP-HL and CuONP-HL), and their antifungal potential was assessed against *Fusarium virguliforme* in soybean (*Glycine max* L.). Hemp was selected because it is known to contain large quantities of secondary metabolites that can potentially enhance the reactivity of NPs through surface property modification. Synthesizing NPs with biologically derived materials allows to avoid the use of harsh and expensive synthetic reducing and capping agents.

DR. GOUDARZ MOLAEI was interviewed by NBC Connecticut (June 7), Hearst CT Media Group and NBC News 4 New York (June 13), Channel 3 (June 14), Fox Weather (June 22), New Jersey Advanced Media (June 28), and Connecticut Post (June 30) about native and invasive tick and tick-borne pathogen activities; attended cross CDC Centers of Excellence in Vector-borne Diseases Tick Bite Prevention Working Group (June 19); presented an invited talk, “Range Expansion of Native and Invasive Ticks: A Looming Public Health Threat” to the weekly meeting of the Connecticut Department of Public Health (June 22); presented a short talk to the tick working group of the USGS on tick surveillance and research activity at the CAES; co-presented a talk, “Evidence of Protozoan and Bacterial Infection and Co-Infection and Partial Blood Feeding in The Invasive Tick *Haemaphysalis Longicornis*” to the National Asian Longhorned Tick Stakeholder Call (June 26); hosted two groups of International Festival of Arts and Ideas visitors at the Tick Testing Laboratory and presented short talks on tick and tick-borne pathogen activity and surveillance (June 16 and 23); and hosted Dr. Bruce Rottmann, a medical microbiology fellow at Yale New Haven Hospital, and along with **DR. KIRBY STAFFORD III, DR. DOUGLAS BRACKNEY, DR. PHILIP ARMSTRONG, DR. GALE RIDGE, DR. ANDREA GLORIA-SORIA, DR. SCOTT WILLIAMS, DR. MEGAN LINSKE,** and **JOHN SHEPARD** provided him with training on medically important vectors and vector-borne diseases (June 20-21).

DR. PHILIP ARMSTRONG spoke to visitors about the mosquito trapping and testing program as a part of the New Haven Festival of Arts and Ideas (June 16 and 23).

MS. ANGELA BRANSFIELD participated in a CAES DEI Parental Rights subcommittee meeting (June 13); participated in the Federal Select Agent Program’s Responsible Official webinar “SARS-CoV/SARS-CoV-2 Chimeric Viruses Guidance Overview; APHIS/CDC Forms 3 and 4” (June 29); participated in a CAES Health and Safety Committee meeting (June 30); and met with members of Yale EHS to discuss CAES’s Select Agent program and to provide a tour of the BSL3 laboratory (June 30).

DR. KELSEY FISHER met with colleagues from Colorado State University (June 1) and the University of Oklahoma (June 1), the Insect Resistance Management working group (June 13), USDA (June 13 and 28), Iowa State University (June 14 and 30), and Albertus Magnus College (June 16) to discuss various research projects; presented about wild bee diversity prior to the Science on Screen showing of Honeyland at Real Art Ways in Hartford, CT (June 14); presented “Implications of movement ecology in conservation planning for monarchs” to Monarch Joint Venture’s 2023 Monarch Conservation Webinar Series (June 27); met with Joshua Sullivan, Gail Cameron, and **TRACY ZARRILLO** about community engagement and pollinator habitat establishment (June 28).

MS. TANYA PETRUFF presented a talk titled, “Connecticut Mosquito Surveillance Program for West Nile Virus and Eastern Equine Encephalitis” to community members of the Middletown Senior Center (June 5).

DR. GALE RIDGE presented a talk on bed bug behavior and management during a sym-

posium sponsored by the City of Bridgeport Department of Health and Social Services (June 1); trained new hires and summer assistants during the annual summer safety training program on self-protection while working in the field (June 5); and participated in a YouTube video about Hemlock Woolly Adelgid produced by Summer Rayne of Flock Finger Lakes productions (June 6).

DR. VICTORIA SMITH was featured in the National Plant Board Quarterly Newsletter “SPRO Spotlight” (June 6); and was a guest on the “Keeping It Green” podcast, discussing the importance of regulatory work for protecting the nursery plant industry and other agriculture, plus spotted lanternfly (June 9).

DR. KIRBY C. STAFFORD III (Emeritus) participated in the visit and training of Yale Medical Microbiology Fellow Dr. Bruce Rottmann (June 20).

DR. KIMBERLY STONER (Emeritus) spoke at a press conference at the CT State Capitol about the importance to farmers, farmworkers, and farming communities of bills being considered in the state legislature creating a climate decarbonization roadmap and strengthening environmental justice (June 5); joined the steering committee of the Working Lands Alliance (June 13); and was interviewed along with Maya van Rossum, Delaware Riverkeeper, about Green Amendments to state constitutions and the Connecticut Environmental Rights Amendment by Melinda Tuhus for her program, “The Forest and the Trees” on WPKN radio (June 27).

PUBLICATIONS:

- Hill, V., Koch, R. T., Bialosuknia, S. M., Ngo, K., Zink, S. D., Koetzner, C. A., Maffei, J. G., Dupuis, A. P., Backenson, P. B., Oliver, J., **Bransfield, A. B., Misencik, M. J., Petruff, T. A., Shepard, J. J.**, Warren, J. L., Gill, M. S., Baele, G., Vogels, C. B. F., Gallagher, G., Burns, P., Hentoff, A., Smole, S., Brown, C., Osborne, M., Kramer L. D., **Armstrong, P. M.**, Ciota, A. T., and Grubaugh, N. D. (2023). Dynamics of eastern equine encephalitis virus during the 2019 outbreak in the Northeast United States. *Curr Biol.* 33(12), 2515-2527.

Abstract: Eastern equine encephalitis virus (EEEV) causes a rare but severe disease in horses and humans and is maintained in an enzootic transmission cycle between songbirds and *Culiseta melanura* mosquitoes. In 2019, the largest EEEV outbreak in the United States for more than 50 years occurred, centered in the Northeast. To explore the dynamics of the outbreak, we sequenced 80 isolates of EEEV and combined them with existing genomic data. We found that, similar to previous years, cases were driven by multiple independent but short-lived virus introductions into the Northeast from Florida. Once in the Northeast, we found that Massachusetts was important for regional spread. We found no evidence of any changes in viral, human, or bird factors which would explain the increase in cases in 2019, although the ecology of EEEV is complex and further data is required to explore these in more detail. By using detailed mosquito surveillance data collected by Massachusetts and Connecticut, however, we found that the abundance of *Cs. melanura* was exceptionally high in 2019, as was the EEEV infection rate. We employed these

mosquito data to build a negative binomial regression model and applied it to estimate early season risks of human or horse cases. We found that the month of first detection of EEEV in mosquito surveillance data and vector index (abundance multiplied by infection rate) were predictive of cases later in the season. We therefore highlight the importance of mosquito surveillance programs as an integral part of public health and disease control.

2. Anderson, J. F., Main, A. J., Armstrong, P. M., and Andreadis, T. G. (2023). Seasonality of mosquitoes in North Dakota, 2003-2006, with four new state records. *J. Am. Mosq. Control Assoc.* 39(2), 68-74.

Abstract: Thirty-seven species and subspecies of mosquitoes were identified from 3,580,610 specimens collected in eastern (Cass, Nelson, and Richland counties) and western (Williams County) North Dakota in 2003-2006. Four species were new state records (*Aedes schizopinax*, *Psorophora ciliata*, *Ps. ferox*, and *Ps. horrida*). *Aedes vexans* was dominant (82.9%). Other relatively abundant species were *Ae. trivittatus* (7.7%), *Ae. melanimon* (2.7%), *Culex tarsalis* (2.6%), *Ae. dorsalis* (1.6%), *Ae. sticticus* (1.0), and *Culiseta inornata* (0.9%). The seasonality of the species is presented.

3. Hester, K. P., Stoner, K. A., Eitzer, B. D., Koethe, R. W., and Lehmann, D. M. (2023). Pesticide residues in honey bee (*Apis mellifera*) pollen collected in two ornamental plant nurseries in Connecticut: Implications for bee health and risk assessment. *Environmental Pollution*. DOI: [10.1016/j.envpol.2023.122037](https://doi.org/10.1016/j.envpol.2023.122037)

Abstract: : Honey bees (*Apis mellifera* L.) are one of the most important managed pollinators of agricultural crops. While potential effects of agricultural pesticides on honey bee health have been investigated in some settings, risks to honey bees associated with exposures occurring in the plant nursery setting have received little attention. We sought to identify and quantify pesticide levels present in honey bee-collected pollen harvested in two ornamental plant nurseries (*i.e.*, Nursery A and Nursery B) in Connecticut. From June to September 2018, pollen was collected weekly from 8 colonies using bottom-mounted pollen traps. Fifty-five unique pesticides (including related metabolites) were detected: 24 insecticides, 20 fungicides, and 11 herbicides. Some of the pesticide contaminants detected in the pollen had not been applied by the nurseries, indicating that the honey bee colonies did not exclusively forage on pollen at their respective nursery. The average number of pesticides per sample was similar at both nurseries (*i.e.*, 12.9 at Nursery A and 14.2 at Nursery B). To estimate the potential risk posed to honey bees from these samples, we utilized the EPA's BeeREX tool to calculate risk quotients (RQs) for each pesticide within each sample. The median aggregate RQ for nurse bees, was 0.003 at both nurseries, well below the acute risk level of concern (LOC) of ≥ 0.4 . We also calculated RQs for larvae due to their increased sensitivity to certain pesticides. In total, 6 samples had larval RQs above the LOC (0.45–2.51), resulting from the organophosphate insecticide diazinon. Since 2015, the frequency and amount of diazinon detected in pollen increased at one of our study locations, potentially due to pressure to reduce the use of neonicotinoid insecticides. Overall, these data highlight the importance of considering all life stages when estimating potential risk to honey bee colonies from pesticide exposure.

NEW STUDENTS, STAFF, AND VOLUNTEERS:



DR. DAVID GIESBRECHT joined the **Gloria-Soria lab** at CAES to study the insecticide resistance in mosquitoes. He completed a PhD from the University of Manitoba where he focused on mosquito reproductive biology and development of RNAi delivery methods, and spent three years at Brown University supporting the construction of genomics laboratories in Rwanda and Tanzania. Prior to his PhD research he studied insecticidal wall liners for malaria control in Liberia and tick-borne diseases in Tanzania. He holds a BSc in zoology from the University of Manitoba and an MSc from the Liverpool School of Tropical Medicine.

ENVIRONMENTAL SCIENCE AND FORESTRY

DR. SCOTT WILLIAMS was asked to write up a popular summary of a recently published paper titled “[Feeding Deer Corn With Tick-Control Drug Shows Promise in New Study](#)” for the Entomological Society of America’s *Entomology Today* (June 5); participated in Zoom call with recent UConn Ph.D. graduate about collaborative research regarding invasive plant control and impacts to ecosystem and public health for a National Science Foundation Small Business Innovation Research Program, Phase II grant submission (June 7); participated in a Zoom call with staff from CDC Division of Vector-Borne Diseases, Cornell University, USDA Agricultural Research Center, Maine Health, University of Massachusetts, University of Rhode Island, Penn State University, State of Massachusetts, Texas A&M, Tufts University, and Michigan State University about tick management strategies involving white-tailed deer and gave invited presentation on recently published paper involving the systemic acaricidal treatment of deer against ticks (19 attendees) (June 7); participated in a Zoom call with staff from the CDC Division of Vector-Borne Diseases on progress made on a funded integrated tick management project (June 8); participated in a collaborative Zoom call with members of the Banfield Biologic NIH SBIR-funded tick repellent fabric team (June 13); participated in an interview with Yale University Medical School Microbiology Fellow Dr. Bruce Rottmann (June 20); participated in a Zoom call with staff from the CDC Division of Vector-Borne Diseases on progress made on a funded integrated tick management project (June 21); participated in a collaborative Zoom call with members of the Banfield Biologic NIH SBIR-funded tick repellent fabric team (June 27); was appointed to the Professional Wildlife Biologist Certification Review Board for The Wildlife Society (June 27).

JOSEPH P. BARSKY attended the Forest Ecosystem Monitoring Cooperative (FEMC) Forest Health Monitoring workshop at University of Vermont (June 5-6); participated in the New England Society of American Foresters Quarterly Board of Directors Meeting via Zoom (June 14).

GREGORY BUGBEE spoke on “*Hydrilla* in the Connecticut River” at a virtual meeting of the Connecticut River Conservancy (20 attendees) (June 20); gave a talk entitled “Aquatic Plant Management Options for Great Hill Pond, Portland CT” at a stakeholders meeting at the Portland Public Library (75 attendees) (June 20); along with the United States Army Corp of Engineers presented a talk entitled “Connecticut River *Hydrilla* Research and Demonstration Project” at the Middletown Town Hall (30 attendees) (June 29).

DR. JEREMIAH FOLEY, IV participated in weekly collaborative meetings with the U.S. Army Engineer Research and Development Center (ERDC) to develop standard operating procedures and gather preliminary data for 2024 herbicide trials for Connecticut River *Hydrilla* infestations (June 7 and 21); served as a virtual panelist for the ERDC public stakeholder meeting on *Hydrilla* herbicide trials in the Connecticut River hosted by Middletown, CT (June 29); provided technical guidance and support for Northeastern University undergraduates working on their capstone research project focusing on the fusion of mechanical and electrical engineering principles to develop a method for identifying Connecticut River *Hydrilla* (June 29).

DR. SUSANNA KERIÖ administered the arborist exams at Lockwood Farm (June 14); co-organized a meet and greet with Albertus Magnus College students and teachers with **DR. ANDREA GLORIA-SORIA** and **DR. NEIL SCHULTES** (June 16); attended the Yale University Biosafety Committee meeting (June 22).

DR. SARA NASON participated in virtual meetings for the Best Practices for Non-Targeted Analysis working group (June 1, 8, and 16); participated in the CT PFAS testing Laboratory Capacity and Capability discussion group (June 13); met virtually with Heather Henry from the National Institutes of Health (NIH) regarding revising and expanding our NIH funding on PFAS (June 22); co-hosted a virtual meeting for epidemiologists from various universities and the EPA for the purpose of discussing the usefulness of and improvements needed in using non-targeted analysis in epidemiology studies (June 23).

DR. ITAMAR SHABTAI presented his work at the annual meeting of the Multi-State Hatch Project NC1178 “Land use and management practice impacts on soil carbon and associated agroecosystems services” held at Florence, SC (10 attendees) (June 13-14); met with collaborators from Virginia Tech to discuss upcoming work at the Canadian Light Source synchrotron (June 16); met with collaborators from Cornell University to discuss grant proposal development for user access to DoE EMSL (June 23).

SUMMER STEBBINS with **RILEY DOHERTY** attended the US Army Corps of Engineers Connecticut River *Hydrilla* Research and Demonstration Project Public Stakeholder Meeting in Middletown, CT (June 29).

DR. ELISABETH WARD met with Dr. Helen Poulos (Professor, Wesleyan University) and **DR. CLAIRE RUTLEDGE** to discuss research on ash tree regeneration and invasive plant management in sites affected by Emerald Ash Borer (June 2 and 30); attended the Forest Ecosystem Monitoring Cooperative (FEMC) Forest Health Monitoring workshop at University of Vermont (June 5-6); participated in the monthly FEMC State Coordinators meeting (June 8); met with Colleen-Murphy Dunning (Director, Urban Resources Initiative, Yale School of the Environment), Dr. Danica Doroski (State Urban Forestry Coordinator, CT DEEP), and Dawn Henning (Assistant Engineer, City of New Haven) to plan panel on urban forest ecology at the Yale School of the Environment (June 8); met with Dr. Fiona Jevon (Postdoctoral Associate, Yale School of the Environment) to discuss project on forest management and carbon storage and sequestration (June 8); met with Drs. Peter Raymond and Mark Bradford (Professors, Yale School of the Environment) and Brad Erkila (Director, Yale Analytical and Stable Isotope Center) to discuss project assessing forest soil carbon persistence using radiocarbon data (June 8); met with Chris Martin (Connecticut State Forester, CT DEEP) and Andrea Urbano (Program Supervisor of Private and Municipal Lands, CT DEEP) to discuss grant looking at the effects of forest management practices on carbon storage and sequestration; met with Dr. Sara Kuebbing (Director, Yale Applied Science and Synthesis Program) and Dr. Weier Liu (Postdoctoral Associate, Yale School of the Environment) to discuss project on invasive pests and pathogens and forest carbon dynamics (June 14); met with Lilian Ruiz (Executive Director, CT Council on Soil and Water Conservation) to write the Forest Soil chapter of the CT Soil Health Action Plan (June 16); met with Dr. Danica Doroski to discuss collaborative research on urban forest dynamics (June 23); was interviewed by Chris Donnelly (Former DEEP Urban Forester) for the Connecticut Tree Protective Association newsletter (June 27).

DR. JEFFREY WARD participated in a meeting of the Great Mountain Forest Trustees in Norfolk (June 3); spoke on "Forest Carbon and Multi-Use Forest Management" at a Great Mountain Forest lecture in Norfolk (27 attendees) (June 3); led a Spanish language nature walk for Torrington Middle School English as a Second Language (ESL) students (37 students, 3 teachers) (June 13); participated in a Connecticut Forest and Park Association Governance Committee meeting (June 15); was named as a Fellow of the Society of American Foresters (June 16); spoke on "A Short History of the Connecticut Forest" for the Stonington Land Trust (24 attendees) (June 20); spoke on assessing post-defoliation tree health and management recommendations at "Oak Defoliation Wood Tour" in Sharon (19 attendees) (June 22); interviewed about forest management by Brigitte Ruthman of the Waterbury Republican (June 22); participated in a meeting of the Connecticut Forest Practices Advisory Board (June 28); along with **DR. ELISABETH WARD**, spoke on efficacy and construction on a field tour of slash walls in Seymour and North Madison for Don Donnelly (NJ NRCS State Forester), four of his staff, and Eric Dunnack and Todd Bobowick (CT NRCS Foresters) (7 attendees) (June 29).

DR. LEIGH WHITTINGHILL gave a talk titled "The Effect of Annual Compost Additions to Green Roof Media on Cut-and-Come-Again Lettuce Production" at the Institute of Food Technologists Research and Technology Advances in Urban Agriculture Live Webinar with the Fruit & Vegetable Products Division (June 2); participated in a stakeholder interview for an NSF I-CORPS interview with Dr. Rasel Das and Dr. Anna Hsiao, re-

searchers from Stony Brook University (June 8); met with Dr. Rosemary Whelan and Professor Rebecca Brogan and students from the Albertus Magnus Biology Department and other CAES scientists to discuss CAES research and potential internships (June 16); gave a talk to Common Ground High School summer interns titled “Urban Agriculture Research Collaborations” about the research that she is conducting at Lockwood Farm (June 28).

NEW STUDENTS, STAFF, AND VOLUNTEERS:



Zachary Bates is a seasonal assistant and recent graduate from the University of Connecticut School of Agriculture with a degree in Natural Resources, Sustainable Forestry. He has worked with the UConn Forest Crew and UConn Forest Ecology Laboratory as a Forestry Technician/Research Technician on various efforts, including the International Adaptive Silviculture for Climate Change project and The White Oak Initiative. He is an aspiring forester, passionate about conservation of public lands and forest resources. **Zach** is assisting **DR. ELI WARD** this summer.

Liberty Bednarz (left) is a seasonal assistant who just graduated from Central Connecticut State University in December 2022 with a degree in Biology and a concentration in Environmental Science. She is currently working as a seasonal assistant with **DR. SUSANNA KERIÖ**. Liberty is interested in learning more about all aspects of plant science as well as ecology. **Eveleen Jiang** (right) is a summer intern in the Department of Environmental Science and Forestry in **DR. SUSANNA KERIÖ**'s lab. **Eveleen** is a sophomore at UConn with her major in Landscape Architecture. She hopes the internship will expose her to more areas of environmental study that may help her choose a career path in the future. In the middle is **Ana DiMauro**, Plant Health Fellow.

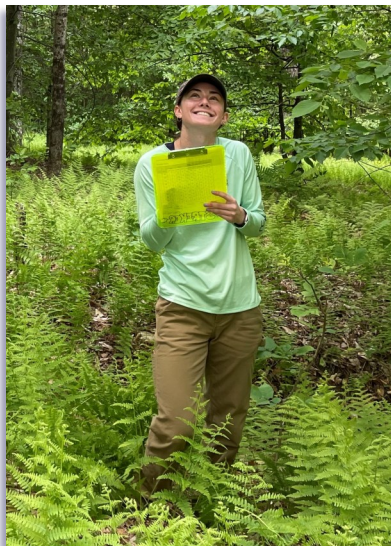




Madison Grieger (left) and **Matilda Kutschinski** (right) are seasonal assistants working with **DRS. SCOTT WILLIAMS** and **MEGAN LINSKE**. **Madison** is a junior at Colby-Sawyer College. She is a Biology Pre-Med major with a minor in Chemistry. She is involved in several organizations in college including peer mentoring, peer tutoring, Presidential Blue Key Society, and softball. In her free time, she likes to spend time with animals and doing arts and crafts. **Matilda** is a sophomore at Southern

Connecticut State University General Biology major with an honors minor in Transdisciplinary Studies. She is interested in wildlife biology, ecology, and evolutionary biology. Her hobbies include roller derby, hiking, and listening to music.

Madison Manke is a seasonal assistant who joined the Department of Environmental Science and Forestry working on soil testing and aquatic plant surveys in Connecticut. **Madison** is pursuing a bachelor's degree in marine biology at the University of New Haven.

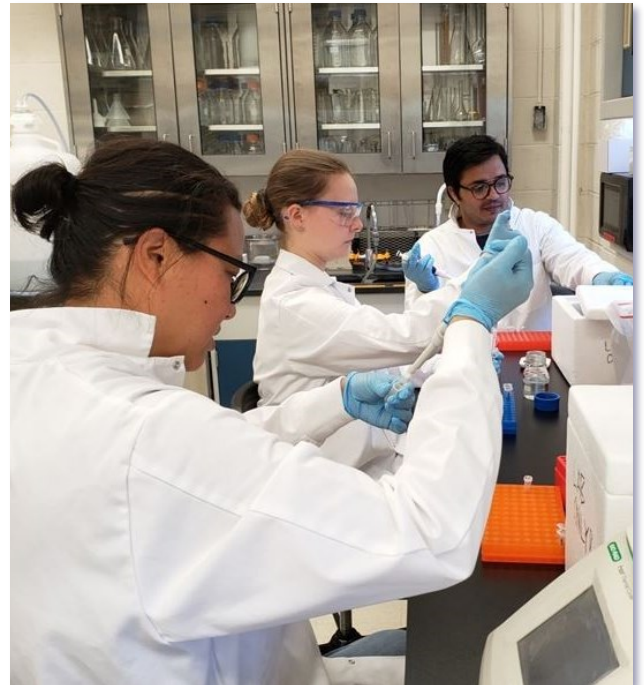


Nicole Gotthardt is a seasonal assistant and currently an undergraduate student at Yale College pursuing a B.S. in Environmental Studies and a Certificate in Energy Studies. **Nicole** began her forestry career by planting trees with TreePeople for a fire restoration project in her hometown of Los Angeles. **Nicole** is excited to learn more about New England forest ecosystem dynamics through her work with CAES and hopes her work will inspire her thesis project that she will begin in the Spring. **Nicole** is assisting **DR. ELI WARD** this summer.



Sofia Shubin is a seasonal assistant and current student in the Southern Connecticut State University Honors college pursuing a B.S./M.S. in Biology. She is a recent alumnus of the Plant Health Fellows program, returning this summer as a seasonal employee with **DR. LEIGH WHITTINGHILL** and is very happy to be back!

Susan Yang (left) has joined the Department of Environmental Science and Forestry as a summer intern in **DR. SUSANNA KERIÖ**'s lab. She is a student at Naugatuck Valley Community College. She will be at CAES for 14 weeks to assist with research related to urban tree health and forestry. She hopes her summer experience will help to understand current day research in these areas. In the middle is seasonal employee **Liberty Bednarz** and on the right is Magnarelli Postdoctoral Scientist **Dr. Faisal Qaseem**.





DR. ELISABETH WARD (4th from left) and **JOSEPH P. BARSKY** (6th from left) along with seasonal employees **Zach Bates** (3rd from left) and **Nicole Gotthardt** (4th from left) traveled to Northfield, VT along with foresters from Vermont Forests, Parks, and Recreation to attend the Forest Health Monitoring workshop (June 5-6).



DR. JEFFREY WARD led Spanish language nature walk for Torrington Middle School English as a Second Language students (June 13).

PUBLICATIONS:

1. Hillen, A. P., **Foley, J. R.**, Salcedo, M. K., Socha, J. J., and Salom, S. M. (2023). 3D X-ray analysis of the subterranean burrowing depth and pupal chamber size of *Laricobius* (Coleoptera: Derodontidae), a specialist predator of *Adelges tsugae* (Hemiptera: Adelgidae). Journal of Insect Science. DOI: [10.1093/jisesa/iead044](https://doi.org/10.1093/jisesa/iead044)

Abstract: The non-native hemlock woolly adelgid (HWA), *Adelges tsugae* Annand (Hemiptera: Adelgidae) has caused significant decline of eastern hemlock, *Tsuga canadensis* L. (Pinales: Pinaceae), and Carolina hemlock, *Tsuga caroliniana* Engelmann (Pinales: Pinaceae) in eastern North America. Biological control of HWA has focused on the use of two *Laricobius* spp. (Coleoptera: Derodontidae), natural predators of HWA, which require arboreal and subterranean life phases to complete their development. In its subterranean phase, *Laricobius* spp. are subject to abiotic factors including soil compaction or soil-applied insecticides used to protect hemlock from HWA. This study used 3D computed microtomography (microCT) to identify the depth at which *Laricobius* spp. burrows during its subterranean lifecycle, characterize pupal chamber volume, and determine if soil compaction had a significant effect on these variables. The mean burrowing depth in soil of individuals was $27.0 \text{ mm} \pm 14.8$ (SD) and $13.7 \text{ mm} \pm 13.3$ (SD) at compaction levels of 0.36 and 0.54 g/cm^3 , respectively. The mean pupal chamber volume was $9.61 \text{ mm}^3 \pm 3.1$ (SD) and $7.26 \text{ mm}^3 \pm 4.7$ (SD) in soil compacted at 0.36 and 0.54 g/cm^3 , respectively. These data show that soil compaction influences burrowing depth and pupal chamber size for *Laricobius* spp. This information will help us better identify the effect of soil-applied insecticide residues on aestivating *Laricobius* spp. and soil-applied insecticide residues in the field. Additionally, these results demonstrate the utility of 3D microCT in assessing subterranean insect activity in future studies.

2. **Whittinghill, L.** (2023). Irrigating Your Home Vegetable Garden. CAES Fact Sheet. https://portal.ct.gov/-/media/CAES/DOCUMENTS/Publications/Fact_Sheets/Environmental-Science-and-Forestry/Irrigating-Your-Home-Vegetable-Garden.pdf



DR. WASHINGTON DA SILVA had a Zoom meeting with Professor Marcia Ambrosio and her group from the Universidade Federal Rural do Semi-Arido (UFERSA) to discuss ongoing projects in using RNAi to control fungal plant diseases and to discuss the writing of grant proposals on the two groups collaborative research to be submitted to the Brazilian Science Foundation (10 adults) (June 7). **DR. DA SILVA** participated in a Zoom meeting to discuss the Women in STEM program recently started at CAES (6 adults) (June 12); had a Zoom meeting with Professors Lindomar Silveira and Glauber Nunes from UFERSA regarding their interest in coming to the **da Silva Lab** for a one-year sabbatical potentially starting in June 2024 (3 adults) (June 12). **DR. DA SILVA** had a Zoom meeting with Professors Maria Raquel Alcântara de Miranda and Pedro Filho Noronha de Souza from the Universidade Federal do Ceara (UFC) to discuss potential collaborations and to initiate a program for Ph.D. students from UFC to come to the **da Silva Lab** at CAES to get trained on molecular virology and nanotechnology (June 14); visited the lab of Professor Jose Antonio Daros at the Universidad Politécnica de Valencia (UPV) and gave a lecture titled “Tunable release of dsRNA molecules into plants from sustainable nanocarriers” (15 adults) (June 28), during the meeting it was discussed options for future collaborations between the two labs in using nanocarriers of dsRNA to fight plant virus infections.

DR. YONGHAO LI participated in the National Plant Diagnostic Network Online Communication & Web Portal Committee meeting via Zoom (7 adults) (June 14); gave a talk about the Plant Disease Information Office and disease diagnosis to two Station tour groups from the International Festival of Arts and Ideas in New Haven (24 adults per tour) (June 16 and 23); participated in the Northeast Plant Diagnostic Network monthly meeting via Zoom (20 adults) (June 22); instructed “Diagnosis Hands-on” in the Diagnosis and Management of Plant Diseases in Ornamental Greenhouses Workshop in New Haven (55 adults) (June 29).

DR. ROBERT MARRA. Participated as a Board member and examiner for the TPX oral exams (June 14). Presented “Climate Extremes: Impact of Tropical Storms on Tree Diseases” to the PierceCare Senior Living Center, Brooklyn, CT (20 adults) (June 21).

FELICIA MILLETT led a tree ID walk for the Hebron Pollinator Pathways at Raymond Brook Preserve (3 adults) (June 15); participated in the NPDN Proficiency Meeting (6 adults) (June 20); participated in the NEPDN Monthly Meeting) (20 adults) (June 22); and presented “Collecting High Quality Samples” at the UConn Extension Diagnosis and Management of Plant Diseases in Ornamental Greenhouses Workshop (55 adults) (June 29).

DR. LINDSAY TRIPLETT Led a half-day orientation session for the Plant Health Fellows program (12 adults) (June 5); organized lab, field, and farm safety training for new staff, seasonal employees, and volunteers (39 adults) (June 5); led a field trip to Enko Chem in Mystic (12 adults) (June 9); met with the Microbial Predators working group (7 adults) (June 15); gave a talk titled “CAES: Then and Now” on two days for the Arts and Ideas Festival Tour (30 adults per tour) (June 16 and 23); organized and co-presented State-mandated diversity training for staff, with **DEBRA FREUND** (94 adults) (June 16); and held a Q&A panel with graduate students in plant health (12 adults) (June 26).

DR. QUAN ZENG attended the Microbiology Spectrum Editors Meeting 2023 via Zoom (June 6), met students from Albertus Magnus College and introduced research at his lab (23 adults) (June 16), met Dr. Swadesh Santra from University of Central Florida and discussed about future research collaboration (June 27).



Ravi and Avni Patel welcomed a baby son, Riyaan, on June 29, 2023 (6 lbs, 10 oz, and 20 inches long). Congratulations, Ravi and Avni!

PUBLICATIONS:

1. Yuan, X., Sundin, G. W., **Zeng, Q.**, Johnson, K. B., Cox, K. D., Yu, M., Huang, J., and Yang, C. H. (2023). The *Erwinia amylovora* type III secretion system inhibitors reduce fire blight infection under field conditions. *Phytopathology*. DOI: [10.1094/PHYTO-04-23-0111-SA](https://doi.org/10.1094/PHYTO-04-23-0111-SA)

Abstract: Fire blight, caused by *Erwinia amylovora*, is an economically important disease in apples and pears worldwide. This pathogen relies on the type III secretion system (T3SS) to cause disease. Compounds that inhibit the function of the T3SS (T3SS inhibitors) have emerged as alternative strategies for bacterial plant disease management, as they block bacterial virulence without affecting growth, unlike traditional antibiotics. In this study, we investigated the mode of action of a T3SS inhibitor named TS108, a plant phenolic acid derivative, in *E. amylovora*. We showed that adding TS108 to an in vitro culture of *E. amylovora* repressed the expression of several T3SS regulon genes, including the master regulator gene *hrpL*. Further studies demonstrated that TS108 negatively regulates *CsrB*, a global regulatory small RNA, at the post-transcriptional level, resulting in a repression of *hrpS*, which encodes a key activator of *hrpL*. Additionally, TS108 has no impact on the expression of T3SS in *Dickeya dadantii* or *Pseudomonas aeruginosa*, suggesting that

its inhibition of the *E. amylovora* T3SS is likely species specific. To better evaluate the performance of T3SS inhibitors in fire blight management, we conducted five independent field experiments in four states (Michigan, New York, Oregon, and Connecticut) from 2015 to 2022 and observed reductions in blossom blight incidence as high as 96.7% compared to untreated trees. In summary, the T3SS inhibitors exhibited good efficacy against fire blight.

2. **Muthuramalingam, R.**, Barroso, K. A., Milagres, J., Tedardi, V., de Oliveira, F. F., Takeshita, V., Karmous, I., Eltanbouly, R., and **da Silva, W.** (2023). Tiny but Mighty: Nanoscale Materials in Plant Disease Management. *Plant Disease*. DOI: [10.1094/PDIS-05-23-0970-FE](https://doi.org/10.1094/PDIS-05-23-0970-FE)

Abstract: Nanoscale materials are promising tools for managing plant diseases and are becoming important components in the current agritech revolution. However, adopting modern methodologies requires a broad understanding of their effectiveness in solving target problems and their effects on the environment and food chain. Furthermore, it is paramount that such technologies are mechanistically and economically feasible for growers to adopt in order to be sustainable. This Feature Article summarizes the latest findings on the role of nanoscale materials in managing agricultural plant pathogens. Herein, we discussed the benefits and limitations of using nanoscale materials in plant disease management and their potential impacts on the environment and global food security.

3. **Schultes, N. P.**, Sinn, J. P., and McNellis, T. W. (2023). Glyceraldehyde-3-phosphate dehydrogenase is required for fire blight disease establishment in apple fruitlets. *Physiol. Mol. Plant Path.* 126. DOI: [10.1016/j.pmpp.2023.102044](https://doi.org/10.1016/j.pmpp.2023.102044)

Abstract: Host sugar resource utilization is an essential aspect of parasitism by *Erwinia amylovora*, the bacterium that causes fire blight disease of pome fruits. We assessed the virulence of *E. amylovora glyceraldehyde-3-phosphate dehydrogenase (gapA)* mutants, which are predicted to be defective in sugar utilization through both glycolysis and the phosphogluconate pathway. A plasmid insertion mutant and an allelic exchange mutant of *gapA* were generated and found to be avirulent in apple fruitlets. The *gapA* insertion mutant was unstable, with insertion element excision resulting in restoration of pathogenicity. The results indicate that *gapA* is essential for *E. amylovora* virulence on apple fruitlets.

4. **Elmer, W.**, Hines, D., and **Schultes, N. P.** (2023). First report of *Fusarium liberatis*, a member of the *Fusarium oxysporum* species complex, causing vascular disease of jade plant (*Crassula ovata*) in Connecticut, USA. *J. Plant. Path.* DOI: [10.1007/s42161-023-01410-4](https://doi.org/10.1007/s42161-023-01410-4)

Abstract: During 2021, approximately 10% of 50 jade plants [*Crassula ovata* (Miller) Druce] from a green house in central Connecticut, USA, dropped basal leaflets and showed extensive vascular discoloration in longitudinally cut basal stems. Isolates, designated JP 1 to JP 5, were grown from surface-disinfested vascular tissue from five plants placed on peptone *pentachloronitrobenzene* agar. Single conidium sub-culturing were carried out from the resulting colonies onto carnation leaf agar and potato dextrose agar with incubation for 10 days at 25° C under cool white fluorescent lights and for 12 h photoperiod. Iso-

lates came from independent plants. Cultures were examined under the microscope with 400x magnification. Macroconidia were produced on monophialides in orange sporodochia, 2 or 3-septate, and averaged 15 to 25 μm in length. Microconidia were abundant, 1- or 2-celled and were born on mono- and polyphialides in the aerial mycelium. ClustalW alignment of sequences for *translation elongation factor-1a* (*tef1*: primers EF-1/EF-2; Gb acc. no. OP150936), *calmodulin* (*CmdA*: primers CAL228F/CAL2Rd; OP150935), *RNA polymerase subunit 2* (*RPB2*: primers fRPB2-5f2/-7cr; OP150938) and *b-tubulin 2* (*b-tub*: primers T1/Bt2b; OP150937) from isolate JP 5 displayed 100% (615/615bp); 100% (602/602bp); 100%(877/877) and 99.8% (573/574bp) sequence identity with sequences from *Fusarium libertatis* strain CPC28465, respectively (Lombard et al. 2019). Phylogenetic analysis using concatenated *RPB2* and *tef1* sequences from representative species across the *Fusarium* genus and JP5 employing Maximum Likelihood or Neighbor Joining analysis placed JP 5 in the FoSC clade (Table S1; Fig. S1). A more detailed phylogenetic analysis using using *tef1*, *CmdA*, *RPB2* and *b-tub* concatenated sequences from FoSC species and JP5 employing Maximum Likelihood or Bayesian inference analysis placed JP 5 in a clade with three *F. libertatis* accessions (Table S1; Fig. S2). Pathogenicity tests were performed on jade with five isolates each with four replications (ten replicates for JP 5) under greenhouse conditions. Ground colonized millet inoculum was added to potting soil at 1 g inoculum/liter potting soil and non-infested potting mix served as controls. All inoculated plants developed dull green coloration after two weeks, dropped basal leaves, and had vascular discoloration. Controls remained green and healthy. Fungal isolates from the discolored tissue in the Koch's postulate tests for JP 1 through JP5 were isolated and upon microscopic analysis were similar to the original JP 5 isolate. The DNA sequence of *tef1* amplified from the JP 5 Koch's postulate fungal isolate matched that of the original JP 5 *tef1*. This is the first report of *F. libertatis* causing disease on jade plants.

DR. JATINDER S. AULAKH gave a research plot demonstration on Frequency (topramezone) and Tenacity (mesotrione) herbicides crop safety and weed efficacy at the twilight meeting of the Connecticut Christmas Tree Growers Association (June 14).

DR. CAROLE CHEAH as part of 2023 federal funding for HWA biological control along the Lower Farmington by the Lower Farmington River Salmon Brook Wild and Scenic Committee, implemented additional *S. tsugae* releases for HWA biological control Town of Windsor's Northwest Park (June 2); released *S. tsugae* to control HWA at state lands in Avon for water access and at the State Fish Hatchery on Bradley Brook, Burlington, (June 5); with state foresters, released along the west Branch of Salmon Brook, Tunxis State Forest, in Hartland, (June 7); gave an overview of the HWA biocontrol program in CT to forestry interns at McLean Game Refuge, Simsbury and guided releases there (5 attendees) (June 8); released *S. tsugae* along the Farmington River at Nepaug State Forest in New Hartford, Stratton Brook State Park, Simsbury and at the Town of Bloomfield's Farmington River Park (June 9).

As part of the grant from the Farmington River Coordinating Committee (FRCC) which provided funding for the 2023 HWA biological control program of the Upper Farmington River, gave an overview of the CT HWA biological control program and collaborations to protect hemlocks along the Wild and Scenic Farmington River watershed to Canton Conservation Land Trust members and the Farmington River Stewards and guided the biocontrol releases of *S. tsugae* at Pratt Preserve (CCLT), at the AGM event (50 attendees) (June 4); released *S. tsugae* at Riverview Park, New Hartford Land Trust and at the Helen Butler Scenic Riverfront Trail, Town of New Hartford, (June 4); gave an overview of the program to FRCC board members and volunteers of the Friends of the American Legion and Peoples State Forests (9 attendees) and guided *S. tsugae* releases at the two above state forests, then released *S. tsugae* with Hartland Land Trust members at Mill District Preserve, (2 attendees) (June 6); met with Metropolitan District Commission (MDC) foresters about the HWA biological control program along the Upper Farmington River (May 12) and released *S. tsugae* on MDC Farmington River watershed property (June 7); showed Norfolk property owners and Great Mountain Forest forestry interns how to identify viable HWA (8 attendees) and then guided releases at Great Mountain Forest, Norfolk (4 attendees) (June 12); scouted and released *S. tsugae* with state foresters at the Sandy Brook Natural Preserve Area, Algonquin State Forest, in Colebrook (June 13 and 16); and at Tunxis State Forest West Block, in Hartland (June 16); met with the Director of the Roaring Brook Nature Center, Children's Museum of West Hartford, Canton, and released *S. tsugae* for HWA biological control at the location (2 attendees) (June 15).

DR. RICHARD COWLES presented "CAES research projects in Christmas trees" for the Connecticut Christmas Tree Growers' Association Twilight Meeting, Hamden (43 participants) (June 13). He submitted "The science of frost/freeze damage and frost protection," to the Real Tree Line.

ROSE HISKES conducted a free Invasive Plant Walk and Talk at the Alfred Sabolcik Preserve with Dr. Todd Mervosh in New Hartford (16 attendees) (June 10).

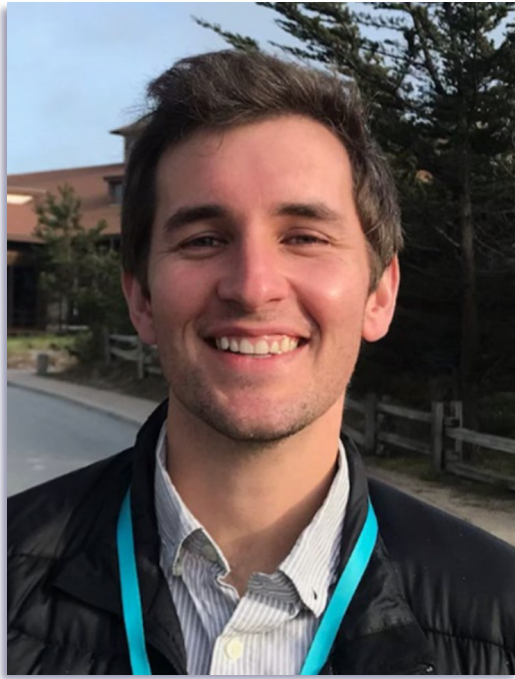
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STATION NEWS

NEW STUDENTS, STAFF, AND VOLUNTEERS:



DR. NATHANIEL WESTRICK, Plant Pathologist will join the Valley Laboratory as an Assistant Agricultural Scientist II on September 22, 2023.

Five Seasonal Research Assistants joined the Valley Laboratory this spring: Jason Flynn, Levi Lacoss, Ben Radcliffe, Rebecca Syme, and David Yih.

Anderson, J., Molaei, G., Fish, D., Armstrong, P. M., Khalil, N., Misencik, M., Bransfield, A., Olson, M., and Andreadis, T. Host Interactions of Mosquito Species, *Aedes*, *Anopheles*, *Culex*, *Mansonia*, *Psorophora*, and *Uranotaenia* in Southwest Florida. *Vector-borne and Zoonotic Diseases*.

Cowles, R. S. The science of frost/freezing damage and frost protection. *The Real Tree Line*.

Deng, C., Protter, C. R., Wang, Y., Borgatta, J., Zhou, J., Wang, P., Goyal, V., Brown, H., Rodriguez-Otero, K., Dimkpa, C. O., Hernandez, R., Hamers, R. J., White, J. C., and Elmer, W. H. Surface charge and morphology of copper oxide nanomaterials controls suppression of Fusarium disease and nutrient biofortification in field-grown tomato and watermelon. *Journal of Experimental Botany*.

Kah, M., Sabliov, C., Wang, Y., White, J. C. Sustainable nanotechnology for global food security. *One Earth*.

Meselhy, A. G., Mosa, K., Kumar, K., Musante, C., White, J. C., and Dhankher, O. P. Rice plasma membrane intrinsic protein OsPIP2;6 is involved in root-to-shoot arsenic translocation in rice. *New Phytologist*.

Muthuramalingam, R., Muruganathan, N., Dimkpa, C., and da Silva, W. L. Nanometal Oxide Fertilizers for Sustainable Agriculture: Balancing Benefits and Risk. *ACS Agricultural Science and Technology*.

Pignatello, J. J.*, Uchimiya, M., and Abiven, S. Aging of Biochar in Soils and its Implications. In J. Lehmann and S. Joseph (Eds.), *Biochar for Environmental Management: Science, Technology and Implementation* (3rd ed.). Routledge Taylor & Francis.

Polussa, A., Ward, E. B., Bradford, M. A., and Oliverio, A. M. Ericoid shrubs modulate the function and structure of soil fungal communities across arbuscular to ectomycorrhizal tree dominance gradients. *New Phytologist*.

Stebbins, S. E. and Bugbee, G. J. Lake Waubeeka, Danbury, CT | Aquatic Vegetation Survey, Water Chemistry, Aquatic Plant Management Options 2022. *CAES Bulletin (Web Only)*.

Stebbins, S. E. and Bugbee, G. J. Monitoring Report Invasive Aquatic Plants Lake Housatonic 2022. *CAES Bulletin (Web Only)*.

Stebbins, S. E. and Bugbee, G. J. Tauton Lake, Newtown, CT | Aquatic Vegetation Survey, Water Chemistry, Aquatic Plant Management Options 2022. *CAES Bulletin (Web Only)*.

Stebbins, S. E. and Bugbee, G. J. West Lake, Guilford, CT | Aquatic Vegetation Survey, Water Chemistry, Aquatic Plant Management Options 2022. *CAES Bulletin (Web Only)*.

Stebbins, S. E., Doherty, R. S., and Bugbee, G. J. Amos Lake, Preston, CT | Aquatic Vegetation Survey, Water Chemistry, Aquatic Plant Management Options 2022. *CAES Bulletin (Web Only)*.

Stebbins, S. E., Doherty, R. S., and Bugbee, G. J. Bashan Lake, East Haddam, CT | Aquatic Vegetation Survey, Water Chemistry, Aquatic Plant Management Options 2022. *CAES Bulletin (Web Only)*.

Stebbins, S. E., Doherty, R. S., and Bugbee, G. J. Laurel Lake, New Hartford, CT | Aquatic Vegetation Survey, Water Chemistry, Aquatic Plant Management Options 2022. *CAES Bulletin (Web Only)*.

Stebbins, S. E., Doherty, R. S., and Bugbee, G. J. Pachaug Pond, Griswold, CT | Aquatic Vegetation Survey, Water Chemistry, Aquatic Plant Management Options 2022. *CAES Bulletin (Web Only)*.

Stebbins, S. E., Doherty, R. S., and Bugbee, G. J. West Hill Pond, New Hartford, CT | Aquatic Vegetation Survey, Water Chemistry, Aquatic Plant Management Options 2022. *CAES Bulletin (Web Only)*.

Welker, L., **Ward, E. B.**, Bradford, M. A., and Ferraro, K. M. Mycorrhizal functional type shapes nitrogen availability in a regenerating forest. *Plant and Soil*.

Whittinghill, L. Irrigating Your Home Vegetable Garden. *CAES Fact Sheet*.

Xu, X., Guo, Y., Hao, Y., Cai, Z., Cao, Y., Fang, W., Zhao, B., **White, J. C.**, and Ma, C. Nano-silicon fertilizer increases the yield and quality of cherry radish (*Raphanus sativus* L.). *Modern Agriculture*.



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Main Laboratories, New Haven



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Phone: 860-376-0365



Griswold Research Center, Griswold



Valley Laboratory, Windsor

Valley Laboratory
153 Cook Hill Road
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