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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ADMINISTRATION

JASON C. WHITE, PH.D. met by Teams with representatives of the agrichemical company Mosaic to discuss funding and research (November 1); participated by Zoom in the weekly all hands call for the NSF Center for Sustainable Nanotechnology (CSN) (November 1, 15, & 29), along with **CHRISTIAN DIMKPA, PH.D.** and **SHITAL VAIDYA, PH.D.,** hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA nanoscale phosphorus project (November 1 & 21); met by Teams with collaborators at the University of Minnesota and Katana Agriscience Corporation to discuss collaborative research (November 2 & 16); hosted the monthly CAES J-visa recipient meeting (November 3); participated in the bi-monthly CSN Faculty Zoom call (November 3 & 17); traveled to Athens, Greece and gave a presentation titled "Sustainable Agriculture: Nano-enabled strategies for food security in a changing climate" at the University of Athens as part of a Sustainability Masterclass (November 5-9); traveled to Marina del Rey, California to present a lecture titled "Nanobiotechnology-based strategies for enhanced crop stress resilience" at the 12th Annual Sustainable Nanotechnology Organization Conference (November 10-12); met by Zoom with CSN Faculty to discuss the future of the Center's nanochemistry-plant work (November 13); along with **PH.D.s PHILIP ARMSTRONG, DOUG BRACKNEY, ANDREA GLORIA-SORIA, MEGAN LINSKE**, **GOUDARZ MOLAEI** and **SCOTT WILLIAMS,** participated in a Zoom call with colleagues at the University of Parma in Parma, Italy, and discussed ways to collaborate on vector borne disease research (November 14); hosted the monthly CSN nanochem-plant Zoom call (November 14); along with **SARA NASON, PH.D.,** participated in the monthly PFAS Laboratory Working Group call (November 14); participated in the annual meeting of the CAES Experiment Station Associates and gave a Director's Report (November 15); participated in the monthly Farmland Preservation Advisory Committee meeting (November 16); along with CT DCP staff participated in an audit of the Adult Use Cannabis Program sampling and analysis for mold (November 17); along with staff in the Department of Analytical Chemistry, welcomed Lauro Pilotto from the University of Udine as a visiting graduate student; Laura will be at CAES until May 2024 (November 17); met by Zoom with collaborators at the University of California (Irvine, Santa Barbara) to discuss work on a new collaborative USDA grant (November 21); along with **PH.D.s TRUNG BUI, CHRISTIAN DIMKPA, SHITAL VAIDYA** and **YINGXUE (CHARLIE) YU**, visited the laboratories of 12-15 Molecular Diagnostics (November 22); along with **LEIGH WHITTINGHILL, PH.D.**, hosted Prof. Amy Harder (Associate Dean for Extension) and Stacey Stearns of the UConn CAHNR to discuss collaborative programs (November 27); met by Zoom with a student and teacher at Edison High School in Alexandria, VA to discuss a science fair project using nanoclay (November 27); traveled to the University of Rhode Island and gave a lecture titled "Nano-enabled agriculture: A path to global food security in a changing climate" to a Bionanotechnology class (November 28); met by Zoom with a collaborator at Johns Hopkins University to discuss joint experiments (November 29); and along with **YI WANG, PH.D.,** met by Zoom with collaborators at Louisiana State University and the University of Auckland in New Zealand to discuss a new USDA collaborative project (November 30).

PUBLICATIONS:

1. Xu, X., Guo, Y., Hao, Y., Cai, Z., Cao, Y., Fang, W., Zhao, B., Haynes, C. L., **White, J. C.**, and Ma, C. (2023). Nano-silicon fertilizer increases the yield and quality of cherry radish *(Raphanus sativus* L.). *Modern Agriculture.* In press.

Abstract: Although silicon-based nanomaterials (Si-based NMs) can promote crop yield and alleviate biotic and abiotic stress, the underlying performance mechanisms are unknown and must be investigated to optimize impact in sustainable nano-enabled agriculture. In the present study, the effect of the root application of Si-based NMs on the physiological responses of cherry radish (*Raphanus sativus* L.) was evaluated in a life cycle experiment for 35 days. Root exposure to 0.1% (w/w) Si-based NMs significantly increased total fresh weight, total chlorophyll, and carotenoids by 36.0, 14.2 and 18.7%, respectively, relative to untreated controls. The nutritional content of the edible tissue was significantly enhanced, with an increase of 23.7% in reducing sugar, 24.8% in total sugar, and 232.7% in proteins; in addition, a number of nutritional elements (Cu, Mn, Fe, Zn, K, Ca, and P) were increased. Si-based NM exposure positively altered the phytohormone network and decreased abscisic acid (ABA) content, both of which promoted radish fresh weight. LC-MS based metabolomic analysis shows that Si-based NMs increased the contents of most carbohydrates (e.g., α-D-glucose, acetylgalactosamine, lactose, fructose, etc.) and amino acids (e.g., asparagine, glutamic acid, glutamine, valine, arginine, etc.), subsequently improving overall nutritional values. Overall, nanoscale Si-based agrochemicals have significant potential as a novel strategy for the biofortification of vegetable crops in sustainable nano-enabled agriculture.

2. Chen, S., Liu, H., Yangzong, Z., Gardea-Torresdey, J., **White, J. C.**, and Zhao, L. (2023). Nano-enabled seed training strategy to enhance maize abiotic stress tolerance. *Environ. Sci. Technol*. In press.

Abstract: Climate change induced extreme weather events (heat, cold, drought and flooding) will severely affect crop production. Increasing crop resilience to fluctuating environmental conditions is critically important. Here, we report that nanomaterials (NMs) with reactive oxygen species (ROS)-generating properties can be used as seed-priming agents to simultaneously enhance the tolerance of maize seeds/seedlings to diverse, even multiple stresses. Maize seeds primed with 40 mg/L of silver nanoparticles (AgNPs) exhibited accelerated seed germination speed, as well as increased germination rate, seedling vigor, and seedling growth under drought (10% and 20% PEG), saline (50 mM and 100 mM NaCl), and cold (15 ºC) stress conditions, indicating the enhanced resilience to diverse stresses. Importantly, maize resistance to simultaneous multiple stresses (drought+cold, drought+salt, salt+cold) was markedly enhanced. Under drought conditions, seed priming significantly boosted root hair density and length (17.3%~82.7%), which enabled greater tolerance to water deficiency. RNA-seq analysis reveals that AgNPs seed priming induced transcriptomic shift in maize seeds. Plant hormone signal transduction and MAPK signaling pathways were activated upon seed priming. Importantly, low-cost and environmentally-friendly ROS-generating Fe-based NMs (Fe_2O_3 and Fe_3O_4 NPs) were also demonstrated to enhance seeds and seedlings' resistance to drought, salt, and cold stresses. These findings demonstrate that a simple seed priming strategy can be used to significantly enhance the climate-resilience of crops through modulated ROS homeostasis and that this approach

could be a powerful nano-enabled tool to address worsening food insecurity.

3. Sun, K., **White, J. C.**, He, E., Van Gestel, C.A.M., Zhang, P., Peijnenburg, W.J.G.M. (2023). Earthworm coelomocyte internalization of MoS_2 nanosheets: multiplexed imaging, molecular profiling, and computational modeling. *Environ. Sci. Technol. 57*(51), 21637–21649, https://doi.org/10.1021/acs.est.3c06665

Abstract: Fully understanding the cellular uptake and intracellular localization of MoS_2 nanosheets ($NSMoS_2$) is a prerequisite for their safe application. Here, we characterized the uptake profile of $NSMoS_2$ by functional coelomocytes of the earthworm Eisenia fetida. Considering that vacancy engineering is widely applied to enhance $NSMoS_2$ performance, we assessed the potential role of such atom vacancies in regulating cellular uptake processes. Coelomocyte internalization and lysosomal accumulation of $NSMoS_2$ was tracked using a fluorescent labeling technique specific to nanomorphology. Cellular uptake inhibitors, proteomics, and transcriptomics helped to distinguish vacancy-mediated endocytosis pathways and associated molecular mechanisms. Specifically, Mo ions activated transmembrane transporter and ion-binding pathways, entering the coelomocyte through assisted diffusion. Compared to Mo ions, pristine $NSMoS_2$ (P-$NSMoS_2$) induced protein polymerization and upregulated gene expression related to actin filament binding, which phenotypically initiated actin-mediated endocytosis. Conversely, vacancy-rich $NSMoS_2$ (V-$NSMoS_2$) were internalized by coelomocytes through a vesicle-mediated and energy-dependent pathway. Mechanistically, atom vacancies inhibited mitochondrial transport gene expression and likely induced membrane stress, significantly enhancing endocytosis (20.3 %, $p < 0.001$). Molecular dynamics modeling revealed structural and conformational damage of cytoskeletal proteins caused by P-$NSMoS_2$ exposure, as well as the rapid response of intracellular signaling proteins to V-$NSMoS_2$. These findings demonstrate that earthworm functional coelomocytes can accumulate $NSMoS_2$ and directly mediate cytotoxicity, and that atomic vacancies can alter the endocytic pathway and enhance cellular uptake by reprogramming protein response and gene expression patterns. This study provides important mechanistic understanding of the ecological risks of $NSMoS_2$.

CAES staff at the 12th Sustainable Nanotechnology Organization (SNO) Conference, Marina del Rey, CA.

ANALYTICAL CHEMISTRY

PH.D.s PAUL AIKPOKPODION, CHRISTIAN DIMKPA, JASON WHITE, JINGYI ZHOU, and **NUBIA ZUVERZA-MENA** attended the 12th Sustainable Nanotechnology Organization's annual meeting which held in Marina Del Rey, California. **PAUL AIKPOKPODION, PH.D.** and **NUBIA ZUVERZA-MENA, PH.D.** gave oral presentations. **JINGYI ZHOU, PH.D.** gave a poster presentation. **CHRISTIAN DIMKPA, PH.D.** and **JASON WHITE, PH.D.** chaired different sessions during the meeting (November 9-12).

PUBLICATIONS:

1. Sigmon, L. R., **Vaidya, S.,** Thrasher, C., Mahad, S., **Dimkpa, C., Elmer, W., White, J. C.**, and Fairbrother, D.H. (2023). Role of phosphorous type and biodegradable polymer on the phosphorus fate in a plant-soil system to optimize treatment efficacy and sustainability. *J. Agric. Food Chem*. DOI: 10.1021/acs.jafc.3c04735

Abstract: Phosphorus (P) is critical for crop production but has a high nutrient use inefficiency. Tomato was grown in soil amended with five P-sources, used as-is, or embedded within a biodegradable polymer, polyhydroxyalkanoate (PHA). Correlation analysis identified treatments that maintain plant growth, improve bioavailable soil P, and reduce P loss. Three performance classes were identified: (i) micro- and nanohydroxyapatite, which did not increase bioavailable P, plant P-uptake, or change P in runoff/leaching compared to controls; (ii) monocalcium phosphate (MCP), dicalcium phosphate (DCP), calcium pyrophosphate nanoparticles (CAP), and PHA-MCP that increased P-uptake and/or bioavailable P but also increased P loss in runoff/leaching; and (iii) PHA-DCP and PHA-CAP, where increased bioavailable P and plant P-uptake were achieved with minimal P loss in runoff/leaching. In addition to identifying treatments that maintain plant growth, increase bioavailable P, and minimize nutrient loss, correlation plots also revealed that (i) bioavailable P was a good indicator of plant P-uptake; (ii) leached P could be predicted from water solubility; and (iii) P loss through runoff versus leaching showed similar trends. This study highlights that biopolymers can promote plant P-uptake and improve bioavailable soil P, with implications for mitigating the negative environmental impacts of P loss from agricultural systems.

2. Christudoss, A. C., **Dimkpa, C. O.**, and Mukherjee, A. (2023). Eco-corona formation diminishes the cytogenotoxicity of graphene oxide on *Allium cepa*: Role of soil extracted-EPS in combating oxidative stress. *Plant Physiology & Biochemistry*, *204*, 108123. DOI: 10.1016/j.plaphy.2023.108123

Abstract: Graphene oxide (GO) is widely acknowledged for its exceptional biological and industrial applications. However, its discharge into the environment negatively impacts the ecosystem. This study aimed to investigate the toxicity of GO in Allium cepa root tip cells and the role of extracellular polymeric substances (EPS) in modulating its toxic effects. To evaluate toxicity, various endpoints like cell viability using Evans blue dye, cytotoxicity (mitotic index), genotoxicity (chromosomal aberrations), and oxidative stress assessments (total ROS, superoxide, hydroxyl radical production, and lipid peroxidation) were considered. The results suggest that pristine GO caused a dose-dependent increase in various toxicity parameters, especially the genotoxic effects. Oxidative stress generation by GO is proposed to be the principal mode of action. The EPS-corona formed on GO could potentially counteract the toxic effects, substantially reducing the oxidative stress within the cells.

3.Sarita, Mehrotra S., **Dimkpa, C. O.**, and Goyal V. (2023). Survival mechanisms of chickpea (*Cicer arietinum*) under saline condition. *Plant Physiology & Biochemistry*, *205*, 108168. DOI: 10.1016/j.plaphy.2023.108168

Abstract: Salinity is a significant abiotic stress that is steadily increasing in intensity globally. Salinity is caused by various factors such as use of poor-quality water for irrigation, poor drainage systems, and increasing spate of drought that concentrates salt solutions in the soil; salinity is responsible for substantial agricultural losses worldwide. Chickpea (Cicer arietinum) is one of the crops most sensitive to salinity stress. Salinity restricts chickpea growth and production by interfering with various physiological and metabolic processes, downregulating genes linked to growth, and upregulating genes encoding intermediates of the tolerance and avoidance mechanisms. Salinity, which also leads to osmotic stress, disturbs the ionic equilibrium of plants. Survival under salinity stress is a primary concern for the plant. Therefore, plants adopt tolerance strategies such as the SOS pathway, antioxidative defense mechanisms, and several other biochemical mechanisms. Simultaneously, affected plants exhibit mechanisms like ion compartmentalization and salt exclusion. In this review, we highlight the impact of salinity in chickpea, strategies employed by the plant to tolerate and avoid salinity, and agricultural strategies for dealing with salinity. With the increasing spate of salinity spurred by natural events and anthropogenic agricultural activities, it is pertinent to explore and exploit the underpinning mechanisms for salinity tolerance to develop mitigation and adaptation strategies in globally important food crops such as chickpea.

NEW STUDENTS, STAFF, AND VOLUNTEERS:

Rym Boukhalfa from Algeria joined the Department of Analytical chemistry on November 15, 2023, as a visiting researcher. She is pursuing her PhD at the University of Bari "Aldo Moro," in Italy. Her Research interests include the phytotoxic effect of allelochemicals and active molecules that may be used as new sources of active ingredients in bio-herbicide formulations for a sustainable weed control. **Rym Boukhalfa** will be at CAES for 6 months where the focus of her study will be on assays of development of a nano-based herbicide.

Jasmine Jones was hired as a Research Technician I in the Department of Analytical Chemistry on November 17, 2023. She previously served as a Seasonal Research Assistant, working under **SARA NASON, PH.D**., **NUBIA ZUVERZA-MENA, PH.D.** and **SARA THOMAS, PH.D.** in their PFAS phytoremediation and wastewater irrigation projects. In her new role, she will be contributing to a new program testing agricultural soils in CT for PFAS. She graduated with a bachelor's degree in biology and mathematics from Albertus Magnus College in May of 2023.

Laura Pilotto from Italy has joined the Department of Analytical Chemistry on November 20, 2023, as a visiting researcher. She is currently pursuing a Ph.D. in Environmental Life Sciences at the Universities of Trieste and Udine. Her research focuses on the application of nanomaterials in agriculture to enhance Nutrient Use Efficiency, as well as the recovery of phosphorus from waste. Laura will be at CAES for 5 months, during which she will investigate the application of nanohydroxyapatite synthesized from chicken bones in plant-soil systems.

ENTOMOLOGY

GOUDARZ MOLAEI, PH.D. attended the annual meeting of the Entomological Society of America at National Harbor, MD, and presented an invited talk, "Pleading for a Cross-Disciplinary Conversation: Range Expansion of Native and Invasive Ticks and Ensuing Public and Veterinary Health Challenges" to the symposium, "Rising to the Grand Challenge: Building Collaborations for Innovative Cattle Fever Tick Research" (November 7-8); along with **PHILIP ARMSTRONG, PH.D.** met with Daniel Carrión, Ph.D. and Jennifer Wang, Ph.D. of the Yale school of Public Health to discuss collaborative projects to engage graduate students on the intersection of climate change and health as well as hosting Yale graduate students as summer interns at the Connecticut Agricultural and Experimental Station (CAES) through the Yale Center on Climate Change and Health's Climate Change and Health Summer Practice Experience Program (November 15); met with representatives from Yale University School of Public Health and the University of Connecticut School of Medicine to discuss collaborative epidemiological studies on the outcomes of patients who had their ticks tested by the CAES Tick Testing Laboratory (November 17); was interviewed by WCBS (November 15), WTNH (November 17), and CT Insider (November 20) on the incursion and range expansion of the longhorned tick, *Haemaphysalis longicornis*, in Connecticut and the Northeast; as a member of the stakeholders advisory council, attended the quarterly meeting of the New England Center of Excellence in Vector-Borne Diseases (NEWVEC) and discussed the projects' updates and progress (November 20); and attended the annual meeting (virtual) of the Multistate NE1943, "Biology, Ecology, and Management of Emerging Disease Vectors" (November 27).

PHILIP ARMSTRONG, PH.D with **PH.D.s GOUDARZ MOLAEI, SCOTT WILLIAMS, DOUGLAS BRACKNEY, ANDREA GLORIA-SORIA,** and **MEGAN LINSKE** met with Laura Kramer, Ph.D. of Cornell University and collaborators at the University of Parma in Italy to discuss student exchanges and research collaborations in vector-borne and zoonotic diseases (November 15).

ANGELA BRANSFIELD participated in the "FBI Weapons of Mass Destruction & Bioeconomy Webinar" hosted by the Association for Biosafety and Biosecurity (November 9 & 16); participated in a CAES DEI Disability and Accessibility subcommittee meeting (November 28).

HANY DWECK, PH.D. gave a talk on "Taste: from function to the emergence of a pest fly" at the Department of Neurobiology at the University of Connecticut (October 11); attended the annual meeting of the Entomological Society of America, organized a symposium on "New Advances in Insect Chemorecepion", and gave a talk on "The emergence of a pest fly: mechanisms of ecological niche adaptations" (November 7).

KELSEY FISHER, PH.D. presented "Monarch Butterfly Biology, Ecology, and Conservation Needs" at the UConn Native Plants and Pollinator Conference (November 2); attended the attended the annual meeting of the Entomological Society of America at national Harbor, MD, and presented oral presentation "My path to conducting research as a state employee" in the "Exploring alternative careers as an ECP so you are more prepared and less scared" symposium, organized and moderated a symposium titled "Policies that worked: How policy shapes entomology and impacts people" and a corresponding workshop titled "Priorities into policy: Driving change on the next generation of policies that work", and presented a poster

"Insect movement ecology informs management strategies" (November 5-8); and presented "Monarch Butterfly Biology, Ecology, and Conservation Needs" at the 580th monthly meeting of Connecticut Entomological Society (November 17).

ANDREA GLORIA-SORIA, PH.D. attended the annual meeting of the Entomological Society of America, National Harbor, MD, and gave the invited talk "Evolutionary history and population genetics of the Aegypti group in the South West Indian Ocean" as part of the symposium "Beyond the Bite: Natural History, Systematics, and Ecology Enhance Knowledge of Our Most Deadly Foe" and also presented the poster "Population dynamics at an invasive front – *Aedes aegypti* in the American Southwest" co-authored with Joseph McMillan, Ph.D. as part of the MUVE: Vectors and Vector Control session, and co-authored a presentation with Balcazar, Ph.D., "Evidence that the ancestral lineage leading to *Aedes aegypti* colonization of America is present in Argentina" in the Systematic, Evolution, and Biodiversity section, and an on-demand poster "Using population genetics and directed evolution to better understand insecticide resistance in *Culex pipiens*" with **DAVID GIESBRECHT, PH.D.** (November 5-8).

MEGAN LINSKE, PH.D. participated in a collaborative meeting with Alison Snow to discuss recent advances in the field of integrated tick management (November 1); participated in a meeting with Banfield Bio, Inc. and North Carolina State University to discuss updates in field and laboratory trials (November 1, 15 & 29); hosted the Diversity, Equity, and Inclusivity (DEI) discussion section of the 2023 Leadership Institute training program at the National Wildlife Society (TWS) meeting in Louisville, (November 7); co-hosted in the Northeast Section of TWS Annual Fall Member's Meeting (November 8); participated in the master's committee meeting for Ms. Sandra M. Zapata-Ramirez from Western Connecticut State University (November 13); and co-hosted the FFA Forestry CDE at Lockwood Farms with 12 high schools in attendance (60 participants) (November 17).

JACOB RICKER completed his Connecticut Accredited Nursery Program course through the Connecticut Nursery and Landscape Association (November 28); completed the USDA-APHIS Accredited Certification Official training; and passed his examination (November 30).

GALE RIDGE, PH.D. spoke about managing bed bugs at two senior residences under Berlin senior housing. She spoke first at Marjorie Moore, then Percival Heights senior residences (November 8); delivered a lecture about delusional infestation to the UMass Extension Pesticide Education group, the talk was then sent to the Colorado State University Extension Services (November 15); attended a live webcast sponsored by the New England Journal of Medicine on fossil fuel pollution, climate change, and the downstream effects of air quality and vector-borne diseases; presented a talk on jumping worms to the Hardy Plant Society (November 29).

CLAIRE RUTLEDGE, PH.D. attended the annual meeting of the Entomological Society of America in National Landing, MD, and presented the poster "Impact of Emerald Ash Borer invasion stage and post-release time on the persistence and impact of introduced Emerald Ash Borer larval parasitoids" (November 5-8).

VICTORIA SMITH, PH.D. participated in the annual meeting of the US Forest Service Cooperators, held at the Asian Longhorned Beetle Eradication Headquarters in Worcester, MA, with a presentation on CT Forest Conditions Update (November 8-9); and participated in the annual meeting of the CT Pomological Society, held at the Middletown Elks Club in Middletown, CT, with a Spotted Lanternfly Update (November 28).

TRACY ZARRILLO presented an invited talk titled "The Connecticut wild bee monitoring program" at the annual meeting of the Entomological Society of America at National Harbor, MD (November 7); was invited to become a member of the Connecticut Wildlife Action Plan Invertebrate Taxa Team and participated in a virtual meeting to discuss invertebrate species of greatest conservation need in Connecticut (November 13); visited the Hymenoptera collection at the Museum of Comparative Zoology at Harvard to confirm identification of bee species relevant to Connecticut (November 17).

PUBLICATIONS:

1. Soghigian, J., Sither, C., **Gloria-Soria, A.**, et al. (2023). Phylogenomics reveals the history of host use in mosquitoes. *Nat. Commun.*, *14,* 6252. DOI: 10.1038/s41467-023-41764-y

Abstract: Mosquitoes have profoundly affected human history and continue to threaten human health through the transmission of a diverse array of pathogens. The phylogeny of mosquitoes has remained poorly characterized due to difficulty in taxonomic sampling and limited availability of genomic data beyond the most important vector species. Here, we used phylogenomic analysis of 709 single copy ortholog groups from 256 mosquito species to produce a strongly supported phylogeny that resolves the position of the major disease vector species and the major mosquito lineages. Our analyses support an origin of mosquitoes in the early Triassic (217 MYA [highest posterior density region: 188–250 MYA]), considerably older than previous estimates. Moreover, we utilize an extensive database of host associations for mosquitoes to show that mosquitoes have shifted to feeding upon the blood of mammals numerous times, and that mosquito diversification and host-use patterns within major lineages appear to coincide in earth history both with major continental drift events and with the diversification of vertebrate classes.

2. Johnson, R. M., **Cozens, D. W.**, Ferdous, Z., **Armstrong, P. M.**, and **Brackney, D. E.** (2023). Increased blood meal size and feeding frequency compromise *Aedes aegypti* midgut integrity and enhance dengue virus dissemination. *PLoS Negl. Trop. Dis. 17*, (11). DOI: 10.1371/journal.pntd.0011703

Abstract: *Aedes aegypti* is a highly efficient vector for numerous pathogenic arboviruses including dengue virus (DENV), Zika virus, and yellow fever virus. This efficiency can in part be attributed to their frequent feeding behavior. We previously found that acquisition of a second, full, non-infectious blood meal could accelerate virus dissemination within the mosquito by temporarily compromising midgut basal lamina integrity; however, in the wild, mosquitoes are often interrupted during feeding and only acquire partial or minimal blood meals. To explore the impact of this feeding behavior further, we examined the effects of partial blood feeding on DENV dissemination rates and midgut basal lamina damage in *Ae. aegypti*. DENV -infected mosquitoes given a secondary partial blood meal had intermediate rates of dissemination and midgut basal lamina damage compared to single-fed and fully double-fed counterparts. Subsequently, we evaluated if basal lamina damage accumulated across feeding episodes. Interestingly, within 24 hours of feeding, damage was proportional to the number of blood meals imbibed; however, this additive effect returned to baseline levels by 96 hours. These data reveal that midgut basal lamina damage and rates of dissemination are proportional to feeding frequency and size, and further demonstrate the impact that mosquito feeding behavior has on vector competence and arbovirus epidemiology. This work has strong implications for our understanding of virus transmission in the field and will be useful when design-

ing laboratory experiments and creating more accurate models of virus spread and maintenance.

3. Dweck, H. K. M. and Carlson, J. R. (2023). Diverse mechanisms of taste coding in Drosophila. *Science Advances*, *9*(46). DOI: 10.1126/sciadv.adj7032

Abstract: Taste systems encode chemical cues that drive vital behaviors. We have elucidated noncanonical features of taste coding using an unconventional kind of electrophysiological analysis. We find that taste neurons of Drosophila are much more sensitive than previously thought. They have a low spontaneous firing frequency that depends on taste receptors. Taste neurons have a dual function as olfactory neurons: They are activated by most tested odorants, including N,N-diethyl-meta-toluamide (DEET), at a distance. DEET can also inhibit certain taste neurons, revealing that there are two modes of taste response: activation and inhibition. We characterize electrophysiological OFF responses and find that the tastants that elicit them are related in structure. OFF responses link tastant identity to behavior: the magnitude of the OFF response elicited by a tastant correlated with the egg laying behavior it elicited. In summary, the sensitivity and coding capacity of the taste system are much greater than previously known.

ENVIRONMENTAL SCIENCE & FORESTRY

SCOTT WILLIAMS, PH.D. hosted Allison Snow, Ph.D. (Adjunct Professor, University of Massachusetts) and discussed host-targeted strategies for tick management (November 1); participated in a collaborative Zoom call with members of the Banfield Biologic NIH SBIR-funded tick repellent fabric team (November 1); participated in a Zoom call with staff from CDC Division of Vector-Borne Diseases, University of Massachusetts, University of Rhode Island, Penn State University, State of Massachusetts, MaineHealth, Michigan State University, Texas A&M University, and Genesis Laboratories about tick management strategies involving white-tailed deer (November 1); attended the National Conference of The Wildlife Society in Louisville, KY (November 5-9) and as Executive Treasurer, participated in the biannual meeting of the Northeast Section of The Wildlife Society (November 7); as the representative of the Northeast Section, accepted a position with the Professional Wildlife Biologist Certification Review Board (CRB) of The Wildlife Society and participated in the CRB meetings (November 8-9); participated in a Zoom call with CAES vector biologists and professors from the University of Parma, Italy about future collaborative research opportunities (November 14); participated in a collaborative Zoom call with members of the Banfield Biologic NIH SBIR-funded tick repellent fabric team (November 15); participated in a Zoom meeting of The Wildlife Society's Professional Certification Review Board (November 28); participated in a collaborative Zoom call with members of the Banfield Biologic NIH SBIR-funded tick repellent fabric team (November 29).

JOSEPH P. BARSKY was interviewed by Joy VanderLek (RJ Media Group) regarding the results of the 2023 Connecticut Acorn Mast Survey (November 1); led a guided hike titled "Biodiversity in Connecticut Forests" for the Sleeping Giant Park Association in Hamden (November 4); gave virtual presentation titled "The Clean Dozen - Our Silent Heroes the Native Shrubs" as part of the Land Trust Hot Topics Seminar Series, hosted by Flanders Nature Center (17 attendees) (November 14); elected to the New England Society of American Foresters Board of Directors to begin serving a three-year term as incoming Chair (November 16); gave presentation titled "Tree Identification, Biodiversity and Urban Forestry Challenges" to 12th grade environmental science students at W. F. Kaynor Technical High School in Waterbury (21 students, 1 teacher) (November 21); gave three presentations on "Forest Biodiversity" to 8th grade students at Ledyard Middle School (71 students, 1 teacher, 1 teacher aide) (November 27).

GREGORY BUGBEE gave a virtual presentation sponsored by the Last Green Valley Advisory Committee on "Connecticut River Hydrilla" (25 attendees) (November 21); gave a talk titled "CAES Aquatic Plant Surveys of Pinewood Lake" to the Pinewood Lake Association in Trumbull (35 attendees) (November 28).

JEREMIAH FOLEY, IV, PH.D. participated in the Connecticut Agricultural Expo "Cultivating Connections" as an exhibitor representing CAES (November 8); featured in a New York Times article "Will Dyeing the Connecticut River Help Keep It Alive?" (November 28); was interviewed by WCBS 880 News on the threat *Hydrilla* poses to the Connecticut River (November 29).

SUSANNA KERIÖ, PH.D. met with Dr. Ali Nikbakht (Isfahan University of Technology, Iran) to discuss collaboration on urban tree research (November 7); participated in NSF grant

application discussions led by Dr. Tara Trammell (University of Delaware) with Dr. Max Piana, Dr. Richard Hallett, Vince D'Amico, Ph.D., Nancy Sonti, Ph.D., Andrew Reinman, Ph.D., Meghan Avolio, Ph.D., Dr. Susannah Lerman, and Myla Aronson, Ph.D. (November 7, 24, & 28); attended a DEEP working group meeting on the environmental impacts of road salt (November 8); attended the annual meeting of the Connecticut Chapter of The American Chestnut Foundation (November 10); hosted a student from Wesleyan University for a visit to CAES (November 15); participated in a planning meeting for Connecticut Urban Forest Council conference (November 17); organized a call to plan a proposal submission to the USDA NIFA Specialty Crop Research Initiative (November 17); participated in a call to plan the annual meeting of The American Chestnut Foundation in 2024 (November 21); attended the Connecticut Urban Forest Council meeting (November 30).

LINGJUN MENG, PH.D. attended the Department of Defense's Energy and Environment Innovation Symposium in Arlington, VA and presented research poster titled “Optimizing carbon amendments that can simultaneously adsorb and transform legacy and insensitive high explosives” (November 28-30).

SARA NASON, PH.D. participated in meetings for the Best Practices for Non-Targeted Analysis working group (November 8, 9, & 28); attended the Society for Environmental Toxicology and Chemistry North America meeting in Louisville, KY (November 13-16) and presented a research poster titled “Characterizing Variability in Wastewater Effluent and its Effects on Wastewater Reuse for Irrigation” (November 13) and gave a presentation titled “Investigation of PFAS in Domestic Water Supplies in an Oil and Gas Producing Region of Northern West Virginia” (100 attendees) (November 16).

ITAMAR SHABTAI, PH.D. in collaboration with colleagues from Cornell University, has been granted user access to the Department of Energy's Environmental Molecular Sciences Laboratory (EMSL) under the Exploratory Research Grants Programs. He will use spatially resolved metabolomic and isotopic techniques to pursue his project "Characterizing rhizosphere size and composition under distinct plant water use strategies" (November 30).

SUMMER STEBBINS presented virtual talk titled “Using GIS to Map Invasive Aquatic Plants in Connecticut” to the CT DEEP Bureau of Water Protection & Land Reuse GIS Workgroup (20 people) (November 1).

BLAIRE STEVEN, PH.D. was elected Councilor of the Connecticut Valley Branch of the American Society of Microbiology (ASM) and will represent the Branch at national meetings of the ASM (November 1).

ELISABETH WARD, PH.D. met with Casey Cordes (Forester, Regional Water Authority) to select sites for ash mortality project at Lake Gaillard (November 1); met with Dr. Elena Karlsen-Ayala (forest pathologist, US Forest Service) and Nate Piche (Forester, CT DEEP) at Meshomasic State Forest to discuss collaborative Beech Leaf Disease monitoring project along with **JEFFREY WARD, PH.D.** and **JOSEPH P. BARSKY** (November 6); participated in the Master Woodland Managers partners meeting (November 7); presented a guest lecture titled “Plant mycorrhizal associations and their effects on carbon and nitrogen dynamics in forests” in Dr. Helen Poulos’s Forest Ecosystem Ecology class at Wesleyan University (20 participants) (November 8); participated in the monthly Forest Ecosystem Monitoring Cooperative State Coordinators meeting (November 9); presented a guest lecture titled “Using plant mycorrhizal associations to link forest composition to carbon and nitrogen dynamics” in Dr.

Marlyse Duguid's Forest Dynamics class at Yale University (30 participants) (November 16).

JEFFREY WARD, PH.D. (Emeritus) spoke on assessing post-defoliation tree health and management recommendations at "Oak defoliation wood tour" in Cornwall (17 attendees) (November 3).

LEIGH WHITTINGHILL, PH.D. represented the CAES at the CT Ag Expo and spoke with stakeholders about her research and CAES services (November 8); gave a talk titled "Nutrient Management on Urban Farms: Research Collaborations with Common Ground" at the Common Ground annual Farm and Garden Conference in New Haven, CT (35 attendees) (November 11); participated in the CAES DEI committee meeting (November 14); participated in the CAES Disability and Accessibility subcommittee meeting (November 28).

CHARLIE YU, PH.D. participated in the Molecular Observation Network's Community Science Meeting (November 7–8).

PUBLICATIONS:

1. LaReau, J., Hyde, J., **Brackney, D. E.**, and **Steven, B.** (2023). Introducing an environmental microbiome to axenic *Aedes aegypti* mosquitoes documents bacterial responses to a blood meal. *Appl. Environ. Microbiol*. DOI: 10.1128/aem.00959-23

Abstract: Axenic *Aedes aegypti* mosquitoes were colonized with bacteria from an environmental water source to compare the midgut microbiota acquired from the wild to the microbiome of insectary-reared mosquitoes, specifically over the course of blood meal digestion. 16S rRNA gene sequencing revealed that diversity, composition, and community turnover of the midgut microbiomes were distinct between the insectary and environmental groups, with the environmental microbiomes having a greater diversity and larger temporal shifts over the course of the blood meal. Metagenomic prediction from the 16S rRNA gene sequence data pointed to metabolic processes such as vitamin biosynthesis, fatty acid recycling, and fermentation pathways differentiating the functional potential of the two different microbiomes. To further test if we could identify functional traits that distinguished the two microbiomes, we performed a culture-based assay. Culturable bacteria were more abundant in the insectary microbiomes and there was very little overlap in the taxonomy of bacteria recovered from the insectary or environmental groups. The ability of the isolates to lyse blood cells was determined on blood agar plates, and only isolates from the environmental microbiome harbored the ability to perform hemolysis in culture. These data support that the differences in taxonomy observed between the two different microbiomes also result in differences in the functional potential of the community. Thus, this study demonstrates the power of the axenic mosquito model to shed light on the community ecology of the mosquito microbiome, and the potential to better represent the microbiomes of wild mosquitoes in a laboratory setting.

2. Yang, Z., Cui, Y., Pan, B., and **Pignatello, J. J.** (2023). Peroxymonosulfate activation by Fe(III)−Picolinate complexes for efficient water treatment at circumneutral pH: Fe(III)/Fe(IV) cycle and generation of oxyl radicals. *Environ. Sci. Technol. 57,* 18918–18928. DOI: 10.1021/acs.est.3c00777

Abstract: Improving the reactivity of Fe(III) for activating peroxymonosulfate (PMS) at circumneutral pH is critical to propel the iron-activated PMS processes toward practical wastewater treatment but is yet challenging. Here we employed the complexes of Fe(III) with the biodegradable picolinic acid (PICA) to activate PMS for degradation of selected chlorinat-

ed phenols, antibiotics, pharmaceuticals, herbicides, and industrial compounds at pH 4.0–6.0. The Fe^{III}–PICA complexes greatly outperformed the ligand-free Fe(III) and other Fe(III) complexes of common aminopolycarboxylate ligands. In the main activation pathway, the key intermediate is a peroxymonosulfate complex, tentatively identified as PICA–Fe^{III}–$OOSO_3^-$, which undergoes O–O homolysis or reacts with Fe^{III}–PICA and PMS to yield Fe^{IV}=O and $SO_4^{\bullet-}$ without the involvement of commonly invoked Fe(II). PICA–Fe^{III}–$OOSO_3^-$ can also react directly with certain compounds (chlorophenols and sulfamethoxazole). The relative contributions of PICA–Fe^{III}–$OOSO_3^-$, Fe^{IV}=O, and $SO_4^{\bullet-}$ depend on the structure of target compounds. This work sets an eligible example to enhance the reactivity of Fe(III) toward PMS activation by ligands and sheds light on the previously unrecognized role of the metal–PMS complexes in directing the catalytic cycle and decontamination as well.

3. Li., Z., Jorn, R., Samonte, P. R. V., Mao, J., Sivey, J. D., **Pignatello, J. J.**, and Xu, W. (2022) Surface-catalyzed hydrolysis by pyrogenic carbonaceous matter and model polymers: An experimental and computational study on functional group and pore characteristics. *Applied Catalysis B: Environmental*, *319.* DOI: 10.1016/j.apcatb.2022.121877

Abstract: We employed a polymer network to understand what properties of pyrogenic carbonaceous matter (PCM; *e.g.*, activated carbon) confer its reactivity, which we hereinafter referred to as PCM-like polymers (PLP). This approach allows us to delineate the role of functional groups and micropore characteristics using 2,4,6-trinitrotoluene (TNT) as a model contaminant. Six PLP were synthesized via cross-coupling chemistry with specific functionality (-OH, $-NH_2$, $-N(CH_3)_2$, or $-N(CH_3)^{3+}$) and pore characteristics (mesopore, micropore). Results suggest that PCM functionality catalyzed the reaction by: (1) serving as a weak base (-OH, $-NH_2$) to attack TNT, or (2) accumulating OH- near PCM surfaces ($-N(CH_3)^{3+}$). Additionally, TNT hydrolysis rates, pH and co-ion effects, and products were monitored. Microporous PLP accelerated TNT decay compared to its mesoporous counterpart, as further supported by molecular dynamics modeling results. We also demonstrated that quaternary ammonium-modified activated carbon enhanced TNT hydrolysis. These findings have broad implications for pollutant abatement and catalyst design.

4. Bylaska, E. J., Tratnyek, P. G., Torralba-Sanchez, T. L., Edwards, K. C., Dixon, D. A., **Pignatello, J. J.**, and Xu, W. (2022). Computational predictions of the hydrolysis of 2,4,6-Trinitrotoluene (TNT) and 2,4-Dinitroanisole (DNAN). *J. Phys. Chem. A. 126,* 9059−9075. DOI: 10.1021/acs.jpca.2c06014

Abstract: Hydrolysis is a common transformation reaction that can affect the environmental fate of many organic compounds. In this study, three proposed mechanisms of alkaline hydrolysis of 2,4,6-trinitrotoluene (TNT) and 2,4- dinitroaniline (DNAN) were investigated with plane-wave density functional theory (DFT) combined with ab initio and classical molecular dynamics (AIMD/MM) free energy simulations, Gaussian basis set DFT calculations, and correlated molecular orbital theory calculations. Most of the computations in this study were carried out using the Arrows web-based tools. For each mechanism, Meisenheimer complex formation, nucleophilic aromatic substitution, and proton abstraction reaction energies and activation barriers were calculated for the reaction at each relevant site. For TNT, it was found that the most kinetically favorable first hydrolysis steps involve Meisenheimer complex formation by attachment of OH− at the C1 and C3 arene carbons and proton abstraction from the methyl group. The nucleophilic aromatic substitution reactions at the C2 and C4 arene carbons

were found to be thermodynamically favorable. However, the calculated activation barriers were slightly lower than in previous studies, but still found to be $\Delta G‡ \approx 18$ kcal/mol using PBE0 AIMD/MM free energy simulations, suggesting that the reactions are not kinetically significant. For DNAN, the barriers of nucleophilic aromatic substitution were even greater ($\Delta G‡ > 29$ kcal/mol PBE0 AIMD/MM). The most favorable hydrolysis reaction for DNAN was found to be a two-step process in which the hydroxyl first attacks the C1 carbon to form a Meisenheimer complex at the C1 arene carbon C1−(OCH3)OH−, and subsequently, the methoxy anion (−OCH3) at the C1 arene carbon dissociates and the proton shuttles from the C1−OH to the dissociated methoxy group, resulting in methanol and an aryloxy anion.

5. Waller, A., Swanson, T. J., **Wang, Z.**, **Pignatello, J. J.**, **Elmer, W.**, **Wang, Y.**, **Musante, C.**, and Parikh, S. (2023). Modified biochars reduce leaching while maintaining bioavailability of phosphate to dragoon lettuce (*Lactuca sativa*) in potting tests. *ACS Agric. Sci. Technol. 3,* 1103–1112. DOI: 10.1021/acsagscitech.3c00459

Abstract: The traditional use of soluble phosphate fertilizers in agriculture depletes finite global supplies and accounts for a major nonpoint source of phosphorus pollution. In potting experiments, we tested whether two modified softwood biochars that strongly bind phosphate could fertilize romaine "Dragoon" lettuce while retarding P leaching. Modifications included doping with MgO (MgO-BC), or binding, postpyrolysis, of a cationic polymer, poly (diallyldimethylammonium) chloride (pDADMAC-BC). The former sorbs phosphate via coordination with MgO nanoparticles or coatings and the latter through enhanced anion exchange. The presterilized potting soil (SS) was a mixture of fine sand and peat moss. The test sets contained modified biochars (3 or 2% g-C/g-SS) either preadsorbed with phosphate or added along with the same amount of soluble phosphate, all at the rate of 180 or 120 mg-P/pot. We also tested sets containing the P-rich mineral dolomite. Control sets included SS and SS amended with unmodified biochar, with or without soluble phosphate, and SS amended with MgO-BC but without soluble phosphate. All pots were fertilized weekly with a phosphate-free Hoagland nutrient solution. Sets amended with the modified biochars, either preadsorbed with phosphate or added along with soluble phosphate, gave dramatically higher plant yields than the control or dolomite sets. Sets amended with modified biochars preadsorbed with phosphate leached a small fraction (0.1–23%) of P relative to the controls fertilized with soluble phosphate. Plant uptake of Mg was high in sets amended with MgO-doped biochars and induced a toxic response when those biochars were incorporated uniformly in a fine powdered form. Arbuscular mycorrhizal fungi added to some sets decreased the root:shoot ratio but otherwise had little impact. The results indicate that the tested modified biochars can appreciably reduce P leaching while providing a bioavailable source of P for crop growth.

OTHER DEPARTMENTAL NEWS:

On November 17, the Departments of Entomology and Environmental Sciences & Forestry hosted the Connecticut-FFA Forestry Career Development Event at the Lockwood Farm Pavilion. The event evaluates student's general forestry knowledge, forest mensuration, and identification of cut wood, trees, forestry related equipment, and tree disorders (disease and insect damage). Forty-six students from 10 State FFA Chapters participated in this year's event, with the four-student team from the E. O. Smith High School Agricultural Education Program taking first place. These students will represent the State of Connecticut at the 2024 National FFA Convention in Indianapolis, IN.

We would like to thank Eric Hansen of Ferrucci and Walicki, LLC, Frank Cervo and Emily Picard (former CAES seasonal employee) of the Connecticut Department of Energy and Environmental Protection and George Lyman of USDA-APHIS for their assistance with individual components of the exam.

MEGAN LINSKE, PH.D., of the Department of Entomology and **JOSEPH P. BARSKY** of the Department of Environmental Science and Forestry organized and coordinated the event.

PLANT PATHOLOGY AND ECOLOGY

LINDSAY TRIPLETT, PH.D. hosted a visit from seminar speaker Charles Yarish, Ph.D. of GreenWave (November 7), presented three class lectures titled, "Non-self recognition and response in plants", "Recognition suppression and the plant-pathogen arms race", and "The plant as a holobiont" for the class Advances in Plant Molecular Biology at Yale, and led literature discussion of four journal papers (13 adult students) (November 10 & 17), and represented CAES at the Annual Meeting of the Working Lands Association in Hartford (48 attendees) (November 15).

WASHINGTON DA SILVA, PH.D. delivered an invited seminar titled "Using Nanocarriers for Targeted RNAi Therapy in Controlling Plant Pathogens" at the Sustainable Nanotechnology Organization (SNO) annual meeting in Los Angeles LA (20 adults) (November 11), had a Zoom meeting with Prof. Cleverson Freitas from the Universidade Federal do Ceara and Prof. Vivian Irish group from Yale University to discuss future research collaborations.

YONGHAO LI, PH.D. presented "Backyard Composting" to Morris Cove Garden Club members in New Haven (13 adults) (November 8), participated in the National Plant Diagnostic Network Online Communication & Web Portal Committee meeting via Zoom (7 adults) (November 8), attended the Plant Diagnostic Network Northeast Reginal monthly meeting via Zoom (November 9), interviewed by Vincent Gabrielle at Hearst Media about the latest USDA Hardiness Zone Map update and its implications for Connecticut (November 17).

ROBERT MARRA, PH.D. was interviewed about beech leaf disease by Leslie Virostek of the MIT Graduate Program in Science Journalism (November 13), and by Sophie Noelle Hartley of the Quinnipiac University program in science journalism (November 14); was appointed as Lecturer by the Yale School of the Environment Ladder Faculty, for co-teaching the course ENV 674, *Forest Ecosystem Health and Stability in a Changing Climate* with Talbot Trotter, meeting with students, and collaborating with YSE faculty (November 16);

FELICIA MILLETT presented "Pruning Woody Plants in the Landscape" for the Town & Country Garden Club of Newtown, CT (50 adults); participated in the Northeast Plant Diagnostic Network monthly meeting (15 adults) (November 9); participated in the NPDN Accreditation Help Session (7 adults) (November 14); provided support for the CTPA Workshop on Beech Leaf Disease in Jones Auditorium (November 27); and participated in the NPDN National Meeting Workshops and Fieldtrips Sub-Committee Meeting (5 adults) (November 30).

RAQUEL ROCHA, PH.D. represented the Plant Pathology and Ecology Department at the Connecticut Agricultural Expo 2023 at Aquaturf in Southington (50 adults) (November 8); presented a seminar at UConn about her research projects on plant pathogenic fungi, root-knot -nematodes, and beach leaf disease nematodes (30 adults) (November 17); presented a seminar about the molecular mechanisms driving plant diseases at the Federal University of Ceará-Brazil (20 adults) (November 22).

NEIL SCHULTES, PH.D. gave the first of a three lecture series on "Genetically Modified Plants in Agriculture" in the Yale University course Sci030 (13 students) (November 17); attended the Connecticut Pomological Society annual meeting in Middletown, CT (50 attendees) (November 28).

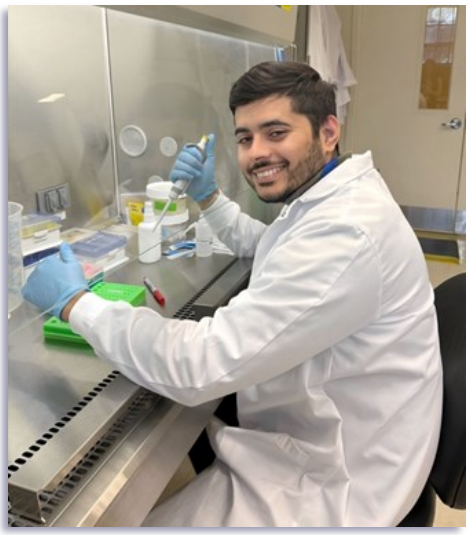
QUAN ZENG, PH.D. taught a guest lecture and a lab "Bacterial Plant Pathogens and Bacterial Plant Diseases" to the General Plant Pathology taught by John Inguagiato, Ph.D., at University of Connecticut (22 students) (November 8), delivered a webinar presentation "Using Blossom Protect to Control Fire Blight in the Northeast" at Annual IPM toolbox series organized by the Northeastern IPM center (51 adults) (November 16), served as a panelist for a USDA-AFRI competitive grant program (November 28-December 1).

GRANTS AWARDED:

1. QUAN ZENG, PH.D., and a team of 14 scientists were awarded a USDA-SCRI grant "An all-stage fire blight control: remote sensing, DNA, enzyme and plant activator technologies for cankers, blossom blight and shoot blight" ($679,710 to CAES, $5.7 million total).

In this grant, Quan will characterize the molecular pathogenicity of *Erwinia amylovora* particularly related to canker formation, and develop novel management strategies.

NEW STUDENTS, STAFF, AND VOLUNTEERS:



Joedson Lima, a Ph.D. student from the Universidade Federal do Ceara in Brazil, will spend one year at the **da Silva Lab** to work on a project involving the control of *Fusarium* spp. using target peptides. Joedson received a prestigious scholarship from the Brazilian Federal Agency for Research and Education (CAPES) to fully cover his stay at CAES.

VALLEY LABORATORY

DEWEI LI, PH.D., CAROLE CHEAH, PH.D., RICHARD COWLES, PH.D., ROSE HISKES, MICHELLE SALVAS, DIANE RIDDLE, and **NATE WESTRICK, PH.D.** hosted a visit by Bloomfield Agriscience Freshman (21 attendees) (November 1). Each aforementioned Valley Laboratory staff member made an oral presentation about their research/work and Valley Laboratory to the students and their teachers.

CAROLE CHEAH, PH.D. presented her research and implementation of HWA biological control to 9th grade students from D.F. Harris Sr. AgriScience Center at Bloomfield High School during their tour of the Valley Laboratory (21 attendees) (November 1); assessed New Hartford Land Trust properties for HWA and inclusion for biological control implementation in 2024 with the President of NHLT (November 15).

RICHARD COWLES, PH.D. presented "Beech Leaf Disease" to arborists, Woodbury (80 participants) (November 18), interviewed by Debra Aleksinas, writer for the Lakeville Journal, about Christmas trees. This resulted in an article published on November 23; sponsored by the Connecticut Tree Protective Association, New Haven (85 participants) (November 27).

ROSE HISKES with other Valley Laboratory staff, presented the Diagnostic Office work to Bloomfield Agriscience Freshman (21 attendees) (November 1); mentored Wilton High School sophomore, Shriya Natajaran, with her science project developing an artificial intelligence app that would analyze photos of invasive plants over time and space via Zoom (November 28-29).

MICHELLE SALVAS explained ongoing research testing cultivar resistance to Boxwood Blight to Bloomfield Agriscience Freshman (21 attendees) (November 1).

PUBLICATIONS:

1. Wan, Y., Zhu L.-H., and **Li, D.-W.** (2023). First report of *Diaporthe acuta* causing leaf blight of *Acer palmatum* in China. *Plant Disease*, *107*(10), 3316. DOI: 10.1094/PDIS-10-22-2425-PDN

Abstract: A foliar disease of ~95% incidence was observed on *A. palmatum* in three community parks in Shaoxing, Xuzhou, and Wuhan cities of China. The symptoms appeared as brown necrotic lesions at the tip, margin, and surface of leaves. Thirty leaves with symptoms from three trees were collected from the three parks. Gray pycnidia developed on the sterile alfalfa stems at 25°C with a 14/10-h light/dark cycle in 30 days. Conidiophores were hyaline, cylindrical, septate, branched, smooth, and 14.3 to 37.2 × 1.5 to 3.7 µm (n = 30). Conidiogenous cells were cylindrical and 5.6 to 21.6 × 1.3 to 2.1 µm (n = 30). Alpha conidia were aseptate, fusiform to oval, 6.5 ± 0.6 × 2.2 ± 0.2 µm (n = 50), and bi- or multiguttulate. Beta conidia were aseptate, hyaline, curved, and 31.0 ± 3.5 × 1.0 ± 0.1 µm (n = 30). Gamma conidia were aseptate, infrequent, botuliform, and 12.4 ± 1.2 × 1.4 ± 0.1 µm (n = 10)....Maximum likelihood and Bayesian posterior probability analyses with the concatenated sequences placed WH52, SX13, and XZ96 in the clade of *D. acuta*. Based on the phylogeny and morphology, the three isolates were identified as *D. acuta*. The pathogenicity was tested on 3-year-old potted seedlings of *A. palmatum*. Five days after inoculation, the inoculated leaves developed lesions similar to those in the field. The controls remained healthy. This is the first report of *D. acuta* causing leaf blight of *A. palmatum*. This finding will provide an effective basis for developing control strategies for the disease.

JOURNAL ARTICLES APPROVED NOVEMBER 2023

Armstrong, P. M., **Anderson, J. F.**, Sharma, R., **Misencik, M. J.**, **Bransfield, A.**, **Vossbrinck, C. R.**, and **Brackney, D. E.** Field isolation and vector competence evaluation of Brazoran virus (Peribunyaviridae, Orthobunyavirus) from Florida. *American Journal of Tropical Medicine and Hygiene*.

Azeem, I, Adeel, M., Shakoor, N., Zain, M., Bibi, H., Azeem, K., Li, Y., Zhang, P., **White, J. C.**, and Rui, Y. Tire wear particles co-exposure of with nickel inhibits mung bean yield by reducing nutrient uptake. *Environmental Science and Technology*.

Chen, L., Fang, L., Yang, X., Luo, X., Qiu, T., Zeng, Y., Huang, F., Dong, F., **White, J. C.**, Bolan, N., and Rinklebe, J. Sources and human health risks associated with potentially toxic elements (PTEs) in urban dust: A global perspective. *Nature Communications*.

Chen, X., Jiang, Y., Wang, C., Yue, L., Liu, Y., **White, J. C.**, Cao, X., Wang, Z., and Xing, B. Selenium nanomaterials enhance sheath blight resistance and nutritional quality of rice: Mechanisms of action and human health benefit. *PNAS*.

Foley, J. R. IV, **Stebbins, S. E.**, **Doherty, R.**, Tippery, N. P., and **Bugbee, G. J.** *Hydrilla verticillata* subsp. *lithuanica*: Discovery and establishment outside of the Connecticut River. *Invasive Plant Science and Management*.

Hyde, K. D...**Li, D.-W.**, et al. Global consortium for the classification of fungi and fungus-like taxa. *Mycosphere*.

Johnson, R. M., Stopard, I. J., Byrne, H. M., **Armstrong, P. M.**, **Brackney, D. E.**, and Lambert, B. Investigating the dose-dependency of midgut escape using a mechanistic model of within-mosquito dengue virus population dynamics. *PloS Pathogens*.

Karim, A., Yadav, A., Sweety, U. H., Kumar, J., Delgado, S., Hernandez, J. A., **White, J. C.**, Vukovic, L., and Narayan, M. Interfacial interactions between nanoplastics and biological systems: Towards an atomic and molecular understanding of plastics-driven cellular dyshomeostasis. *ACS Nano*.

Nason, S. L., **Thomas, S.**, Stanley, C., Silliboy, R., Blumenthal, M., Zhang, W., Liang, Y., **Jones, J. P.**, **Zuverza-Mena, N.**, **White, J. C.**, Haynes, C. L., Vasiliou, V., Timko, M. P., and Berger, B. W. A comprehensive trial on PFAS remediation: Hemp phytoextraction and PFAS degradation in harvested plants. *Environmental Science: Advances*.

Williams, S. C. and **Linske, M. A.** Late fall synthetic acaricide application is effective at reducing host-seeking adult and nymphal *Ixodes scapularis* (Ixodida: Ixodidae) abundances the following spring. *Environmental Entomology*.

Yu, Y., Velandia, M., Hayes, D. G., et al. Biodegradable plastics as alternatives for polyethylene mulch films. *Advances in Agronomy*.

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