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

This Issue

ADMINISTRATION

JASON C. WHITE, PH.D. along with **Nubia Zuverza-Mena, Ph.D.** and **Sara Nason, Ph.D.** participated in a Zoom meeting with collaborators at Yale University and the University of Minnesota for a joint NIEHS grant (September 3); met by Zoom with collaborators at the University of Minnesota and their Technology Transfer Office about intellectual property (September 3); met with staff scientists at the company Intrinsyx to discuss PFAS remediation (September 3); met by Zoom with collaborators at Johns Hopkins University and Auburn University about a USDA grant resubmission (September 4); gave a presentation at the CAE Seminar Series entitled "CAES, Nanotechnology, And Agriculture: How We Got Here And Where We Are Going" (September 4); met with collaborators at the University of Minnesota and Convergent Bioscience to discuss joint experiments (September 4, 20, 25); participated in the weekly NSF Center for Sustainable Nanotechnology (CSN) all hands call by Zoom (September 4; 11; 25); participated in a Teams call with a number of collaborators across the European Union about a joint food defense proposal (September 5); along with **Chaoyi Deng, Ph.D.** met by Zoom with Extension staff at the University of Minnesota to discuss soybean harvesting (September 5); along with **Yi Wang, Ph.D.** met by Zoom with collaborators at McGill University to discuss collaborative research (September 5); attended by Zoom the Virtual Town Hall: Quadrennial Review of the National Nanotechnology Initiative (2025) (September 5); met by Zoom with organizers of the upcoming Sustainable Nanotechnologies Organization (SNO) annual conference to discuss programming (September 6); met by Zoom with collaborators at the University of Minnesota and Merrimack College to discuss PFAS research (September 6); along with **Chaoyi Deng, Ph.D.** met by Zoom with collaborators at the New Jersey Institute of Technology to discuss collaborative research (September 6); along with **CHRISTIAN DIMKPA, PH.D.** hosted staff from Levo International for a tour and discussion of collaboration on urban agriculture (September 10); participated in the NERA Multistate Activities Committee meeting (September 11); along with **Chaoyi Deng, Ph.D.** met by Zoom with collaborators at the New Jersey Institute of Technology to discuss collaborative research (September 12); participated in a Zoom call with collaborators at Carnegie Mellon University, the University of California, Duke University, North Carolina A & T University, and Purdue University to discuss a joint NSF Center proposal (September 15); along with Dr. Blaire Steven and Dr. Jing Yuan travelled to the University of Delaware for a meeting with colleagues, including a team from NRC Italy, on a joint funded project (September 17-19); along with **CHRISTIAN DIMKPA, PH.D.** met by Zoom with collaborators at Johns Hopkins University and Stonybrook University (September 20); along with **Chaoyi Deng, Ph.D.** met by Zoom with collaborators at the University of Wisconsin Milwaukee to discuss collaborative research (September 20); hosted the quarterly CAES Safety Committee meeting (September 23); hosted a representative from Yanmar Industries and gave a tour and description of CAES programs (September 23); participated by Teams in a Board meeting of the International Phytotechnology Society (September 24); hosted the monthly CAES j-visa recipient meeting (September 25); along with **CHRISTIAN DIMKPA, PH.D.** and **Yi Wang, Ph.D.** met with collaborators at Mauritius to discuss joint research (September 26); along with **Sudhir Sharma, Ph.D.** met with collaborators at Columbia University to discuss progress on a joint project (September 26); and along with **Nubia Zuverza-Mena, Ph.D.** and **Mandeep Kaur, Ph.D.** met by Zoom with collaborators at Rutgers University and the New Jersey Institute of Technology to discuss progress on a joint project (September 30).

PUBLICATIONS:

1. **Muthuramalingam, R.**, **Da Silva, W. L.**, **Zuverza-Mena, N.**, **Dimkpa, C.**, **White, J. C.** (2024). Nano-sized metal oxide fertilizers for sustainable agriculture: Balancing benefits, risks, and risk management strategies. *Nanoscale*. DOI: 10.1039/D4NR01354A

Abstract: Metal oxide-based fertilizers at the nanoscale represent a recent breakthrough in agricultural technology, offering a sustainable strategy for improving plant growth and soil quality. These fertilizers, distinguished from their conventional counterparts, enhance nutrient uptake efficiency through controlled release mechanisms. Research indicates that nano-sized metal oxide fertilizers (NMOFs) positively impact crop yields by more effectively stimulating growth, enhancing photosynthesis, bolstering stress tolerance, and fortifying disease resistance. Moreover, the eco-friendly delivery of NMOFs reduces input amounts, minimizes chemical leaching and greenhouse gas emissions, thereby safeguarding environmental integrity. This review provides a comprehensive exploration of nano metal oxides in fertilization, encompassing essential nutrient oxies such as ZnO, CuO, Fe3O4, MgO, Mn2O3, CaO, and SiO2, as well as non-essential elements from compounds like NiO, TiO2, and CeO2. We emphasize the pivotal role of NMOFs in enhancing crop resilience under diverse stress conditions while critically evaluating associated benefits and challenges, including toxicity and environmental concerns. Given the pressing need for sustainable agricultural practices amidst resource constraints and a changing climate, this analysis underscores the importance of innovative solutions like nanometal oxide fertilizers, albeit considering their cost implications. Addressing key knowledge gaps, the review advocates for further research to optimize the efficacy and safety of NMOFs and suggests future research directions, highlighting the transformative potential of nano-enabled agriculture for global food safety and security.

2. Tao, R., Cui, M., Li, Y., Wang, J., He, W., Zhao, Y., Shen, Y., Feng, Y., **White, J. C.** (2024). Nanoscale biochar to optimize fertilizer quality during waste composting: Regulation of the microbial community *Bioresour. Technol.* DOI: 10.1016/j.biortech.2024.131571

Abstract: Conventional composting practices face a number of challenges, including nitrogen loss, unstable or immature products, and limited humic substance formation. Nanoscale biochars (nano-BCs) show significant promise in addressing these shortcomings due to their unique physicochemical properties and beneficial interactions with microbial communities. This study investigated the effects of nano-BCs on manure composting, with the hypothesis that nano-BC integration can simultaneously promote nitrogen retention and humification pathways via directed modulation of microbial communities. Nano-BCs, particularly nano-CSB, significantly improved compost maturity and reduced product phytotoxicity, achieving the highest germination index (146.20%) compared to regular BCs and control. Nano-BCs increased total nitrogen (55.09-63.64%) and total phosphorus (10.25-12.33%) in the final compost. Nano-BCs also reduced NH4+-N loss through adsorption and promoted nitrification, with nano-CSB showing the highest final NO3--N content (8.63 g/kg). Bacterial richness and diversity were enhanced in nano-BC treatments, with selective enrichment of beneficial species involved in N cycling (Truepera, Chelativorans), N fixation

(Desulfomicrobium, Chloropseudomonas), and organic matter decomposition (Streptomyces, A4b). The unique physicochemical properties of nano-BCs, such as high surface area and microporous structure, improved nutrient retention and mature compost production with reduced phytotoxicity. Nano-BCs optimized composting by regulating N transformations through adsorption, stimulating nitrification, and selectively modulating a beneficial microbial consortium involved in N cycling, organic matter decomposition, and nutrient mobilization. Nano-BCs offer a promising, sustainable solution for waste management and high-quality compost production in agriculture, providing molecular insights to engineer "nano-augmented composts" with global implications

3. Jia, W.-L., Goa, F.-Z., Bai, H., He, L.-Y., Ma, C., **White, J. C**., Ying, G.-G. (2024). Swine wastewater co-exposed with veterinary antibiotics enhanced the antibiotic resistance of endophytes in radish (*Raphanus sativus* L.). *Environ. Poll*. DOI: 10.1016/j.envpol.2024.125040

Abstract: The widespread utilization of antibiotics in livestock and poultry breeding has promoted the accumulation and diffusion of antibiotics in crop species and of antibiotic resistance in agricultural soils. The present study investigated the mechanisms of antibiotic uptake and accumulation in swine wastewater (SW)-treated radish and subsequent impacts on endophyte antibiotic resistance. Under SW treatments, exposure to 500 μg/L sulfamethazine (SMZ) and enrofloxacin (EFX) significantly impacted radish biomass, with SMZ causing 63.0% increases and EFZ causing 36.3% decreases relative to the untreated control. The root EFX content was 10.7- to 100.8-fold greater than SMZ, leaf EFX levels 4.9- to 22.6-fold greater than SMZ. Passive diffusion through anion channel proteins on cell membranes was an important route for SMZ uptake, while both passive diffusion and energy-dependent processes contributed to the accumulation and translcation of zwitterionic EFX. At the subcellular level, cell walls and soluble components play an important role in the antibiotic accumulation, accounting for more than 68.6% and 68.3% of the total SMZ and EFX, respectively.The abundance of antibiotic resistance genes (ARGs) in the roots was positively correlated with ARGs in Hoagland's solution (R=0.76). In antibiotic and SW co-treatments, significant correlations existed between ARGs and mobile genetic elements (MGEs) in both Hoagland's solution (R= 0.84) and roots (R= 0.83). More potential hosts were found in the roots than Hoagland's solution in antibiotic and SW co-treatments, but the opposite in antibiotic-alone treatments. Antibiotic co-exposure enhanced the dissemination of ARGs from swine wastewater into plant roots by increasing the diversity of host species diversity. These findings provide increased understanding of the fate and effects of antibiotics in crops and their subsequent impacts on antibiotic resistance of endophytic bacteria. This understanding is useful for predicting antibiotic/ARGs transfer in plants and for evaluating their risk of spread through the food chain.

4. Srivastava, R., Singh, Y., **White, J. C**., Dhankher, O. (2024). Strategies for limiting toxic elements in food: Addressing critical knowledge gaps to ensure a safe food supply. *Trend Food Sci.* DOI: 10.1016/j.tifs.2024.104725

Abstract: Background: Reducing exposure to harmful substances in food is highly desired, especially for infants, young children, and pregnant women. A workshop focused on understanding and reducing toxic metal contamination in food was conducted involving leading

scientists, educators, practitioners, and key stakeholders in conjunction with the USDA National Institute of Food and Agriculture.
Scope and Approach: The goal of this review and the workshop was to advance the current knowledge of major toxic metals concerning food safety, viz. arsenic (As), lead (Pb), cadmium (Cd), mercury (Hg), and chromium (Cr), preventive measures, identify critical knowledge gaps, and the need for research, extension, and education. Being a part of the "Closer to Zero (C2Z)" initiative of the USDA, FDA, and other federal agencies, the workshop adopted a "One Health" approach to mitigate dietary exposure and environmental pollution of hazardous elements.
Key Findings and Conclusions: The experts discussed the accumulation of toxic metals in food crops and drinking water in relation to soil biogeochemistry, plant uptake, and multidisciplinary factors such as food processing, detection, regulatory standards, etc. To forward food safety, this workshop critically examined toxic metals contamination, exposure and toxicity along the farm-to-fork-to-human continuum, research gaps, prevailing regulations, and sustainable remediation approaches, and offered significant recommendations. This review paper provides perspective on key findings of the workshop relative to addressing this important aspect of food safety, emphasizing interdisciplinary research that can effectively investigate and understand the complex and dynamic relationships between soil biogeochemistry, the microbiome, plant tolerance and accumulation strategies, uniform standards for acceptable and safe toxic element levels in food and water, and raising public awareness. This article also provides a foundation for decision-making regarding toxic metal fate and effects, including risk management strategies, in the face of modern industrialization and a changing climate.

5. Yan, X., **White, J. C**., He, E., Peijnenburg, W. J. G. M., Zhang, P., Qiu, H. (2024). Temporal dynamics of copper-based nanopesticide transfer and subsequent modulation of the interplay between hosts and microbiota across trophic levels. *ACS Nano 18*(37): 25552–25564. DOI: 10.1021/acsnano.4c06047

Abstract: During agricultural production, significant quantities of copper-based nanopesticides (CBNPs) may be released into terrestrial ecosystems through foliar spraying, thereby posing a potential risk of biological transmission via food chains. Consequently, we investigated the trophic transfer of two commonly available commercial CBNPs, Reap2000 (RP) and HolyCu (HC), in a plant-caterpillar terrestrial food chain and evaluated impacts on host microbiota. Upon foliar exposure, leaf Cu accumulation levels were 726 ± 180 and 571 ± 121 mg·kg-1 for RP and HC, respectively. HC exhibited less penetration through the cuticle compared to RP (RP: 55.5%, HC: 32.8%), possibly due to size exclusion limitations. While caterpillars accumulated higher amounts of RP, HC exhibited a higher trophic transfer factor (TTF, RP: 0.69, HC: 0.74) and was more likely to be transferred through the food chain. The application of RP promoted the dispersal of phyllosphere microbes and perturbed the original host intestinal microbiota, whereas the HC group was largely host-modulated (Control: 65%, RP: 94%, HC: 34%). Integrating multi-omics analyses and modeling approaches, we elucidated two pathways by which plants exert bottom-up control over caterpillar health. Beyond the direct transmission of phyllosphere microbes, the leaf microbiome recruited upon exposure to CBNPs further influenced the ingestion behavior and intestinal microbiota of caterpillars via altered leaf metabolites. Elevated Proteobacteria abundance benefited caterpillar growth with RP, while the reduction of Proteobacteria with HC increased the risk of lipid metabolism issues and gut disease. The recruited Bacteroidota in the RP phyllosphere proliferated more extensively into the caterpillar gut to enhance stress resistance. Overall, the gut microbes reshaped in RP caterpillars exerted a strong regulatory effect on host health. These findings expand our understanding of the dynamic transmission of host-microbiota interactions with foliar CBNPs exposure, and provide critical insight necessary to ensure the safety and sustainability of nano-enabled agricultural strategies.


"FROM COW TO

ANALYTICAL CHEMISTRY

JINGYI ZHOU, PH.D., MANDEEP KAUR, PH.D., and **JASMINE JONES** attended an USDA ARS workshop in Washington DC – Arlington. The workshop focused on identifying and prioritizing research and programmatic needs in the detection, mitigating, and remediating PFAS in agriculture and food systems (September 10–12).

PUBLICATIONS:

1. Sharma, S., Bindraban, P. S., **Dimkpa, C. O.,** Pandey, R. (2024). Phosphorus fertilizer: from commodity to specialty – from fertilizing the field to fertilizing the plant. *Current Opinion in Biotechnology.* DOI: 10.1016/j.copbio.2024.103198

Abstract: Phosphatic fertilizers are indispensable for sustainable agriculture, but phosphorus (P) scarcity has drawn global attention with respect to research and policy discussions. Soil conditions (pH, organic matter, metal oxides), P-fertilizer form and its application methods, and plant growth mechanisms influence plant P availability. Given the nonrenewable nature and low use efficiency of P, the development of speciality P-fertilizers and improved application methods are essential for reducing environmental P losses and increasing plant P uptake, thereby improving P use efficiency (PUE). This paper explores strategies for using innovative P-fertilizers targeting plant physiological processes instead of conventional bulk field applications to enhance PUE.

2. Sindhu, K., Goyal, V., Kumari, K., Avtar, R., **Dimkpa, C. O.,** Shweta Mehrotra, S. (2024). Physiological and biochemical underpinnings drive yield enhancement in Indian mustard (Brassica juncea) by silicon under field conditions. *Silicon.* DOI: 10.1007/s12633-

024-03130-5

Abstract: Mustard (*Brassica juncea*) is a major oilseed and medicinal crop and its consumption has considerably increased with growing human population, leading to greater demand than supply. Increasing production and productivity of oilseed brassica to meet out the projected demand of edible oils, crop management strategies need to be fabricated and implemented. The two varieties of mustard, RH 725 and RH 0749 display superior performance for yield and are recommended for farmers' fields in north India. The present study evaluated the efficacy of silicon applied in the form of orthosilicic acid (OSA) for improving the physiological and biochemical performances, growth, and yield of recommended mustard varieties under field conditions, as a function of variety, stage, dose, and application time. OSA was applied as a foliar spray at 20, 30, and 40 ppm during vegetative and flowering stages to analyse its influence on plant growth, physiology, enzymatic and non-enzymatic antioxidant enzymes, and yield attributes. Application of OSA at 30 ppm at vegetative stage and 20 ppm at flowering stage, increased activity of antioxidant enzymes, superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX), and peroxidase (POX) and metabolites, ascorbic acid and glutathione; and decreased the levels of hydrogen peroxide (H_2O_2), malondialdehyde (MDA), and relative stress injury (RSI), as compared to the respective untreated controls. The increase in antioxidant enzyme activity and ascorbic acid and glutathione content and protein content was greater in RH 0749 than RH 725. Photosynthetic rate, stomatal conductance, transpiration rate, and chlorophyll fluorescence and protein content improved with the application of 20 ppm OSA, where RH 0749 responded more at the vegetative stage whereas RH 725 showed better responses at flowering stage. The growth and yield related attributes also enhanced with the foliar application of 20 ppm and 30 ppm OSA in both the varieties. RH 725 displayed an increase of 15% and RH 0749 displayed an increase of 18% in seed yield with 20 ppm OSA. Single foliar application of OSA could yield pronounced effects on growth, physiological and biochemical responses and yield of Brassica varieties. The present study indicates the ability of OSA in low dosesto modulate crop physiological and biochemical responses under field conditions can contribute to bridging the productivity gap of brassica to meet consumer demand for establishing a sustainable cropping system.

ENTOMOLOGY

PHILIP ARMSTRONG, PH.D. interviewed by the N.Y. Times on the rise of infectious diseases this summer (September 10); gave a guest lecture on mosquito-borne viruses for a graduate course at CCSU (September 10); attended the annual meeting of the multistate project, NE2443: Biology, Ecology & Management of Emerging Disease Vectors (September 19); lectured on arboviruses for an undergraduate course on vector-borne diseases at SCSU (September 23); gave a guest lecture on surveillance of disease vectors for a graduate course at the Yale School of Public Health (September 24).

ANGELA BRANSFIELD participated via Zoom in Yale University's Biosafety Committee meeting (Sep 19); and participated in a CAES Health and Safety Committee meeting (Sep 23).

JAMIE CANTONI participated in staffing the Experiment Station exhibit at the Eastern States Exposition (the Big E) in West Springfield, MA (September 16) (67,034 attendees).

KELSEY E. FISHER, PH.D. presented at the Mariposas del Mundo (Butterflies of the World) garden in New Haven, CT, on research that occurred on monarch butterflies and bumblebees in the garden from May-October 2024 (Sep 15; 15 attendees); provided information about research for credit opportunities at CAES for Quinnipiac students (Sep 20; 50 attendees).

ANDREA GLORIA-SORIA, PH.D. gave the virtual lecture "Mosquito Biology, Ecology, and Behavior", as part of the Graduate Biology Seminar series in Vector Biology at Central Connecticut State University on September 3 (5 students, 2 faculty); attended State training "15 Minutes to Accessibility: What You Need to Know Now!. Online. September 10.

MEGAN LINSKE, PH.D. participated in a call with staff from the Centers for Disease Control and Prevention's Division of Vector-Borne Diseases on progress made on a funded integrated tick management and seasonal spray projects (Sept 4); interviewed by Shashika Himandi (University of Connecticut) to discuss recent advanced in landscape ecology and management of blacklegged ticks (Sept 6); participated in a meeting with Dr. Jason Richardson (Innovative Vector Control Consortium) to explore research on a personal prevention against ticks and tick-borne diseases (Sept 9); participated in meeting with Dr. Vanessa Ezenwa (Yale University) to discuss collaborative research on pathogen infection in rodents (Sept 11); co-hosted the Wildlife Society Leadership Institute Committee meeting as Co-Chairperson (Sept 12); gave a presentation titled "Optimization of Integrated Tick Management Strategies " for the Multistate Hatch meeting at the Society for Vector Ecology Conference, Fort Collins, CO (Sept 19, 40 attendees); interviewed by Alan Harrison (Wildlife Society Leadership Institute Class of 2024) on leadership in the field of Wildlife Biology (Sept 19); gave an invited lecture titled "Novel Application of Systemic Acaricides to Control Ticks on Key Host Species" at the University Glasgow, Glasgow, Scotland (Sept 26, 20 attendees).

GOUDARZ MOLAEI, PH.D. attended the monthly meeting of longhorned tick, *Haemaphysalis longicornis*, and discussed this tick activity in CT (September 9); guest lectured on vector-borne diseases for a graduate course, Emerging Infectious Diseases, at the SCSU (September 9); met with the NEWVEC officials and advised them on planning training programs on vector-borne diseases at the local universities and colleges (September 16); attended the Yale Monthly Biological Safety Committee Meeting (September 19); attended the annual meeting of the multistate project, NE2443: Biology, Ecology & Management of Emerging Disease Vectors (September 19); lectured a graduate course on parasitic mosquito-borne diseases at the CCSU (September 24); lectured an undergraduate/graduate course on parasitic

vector-borne diseases at the SCSU (September 30); and was interviewed by NBC Connecticut, New York Post, WFSB, The Middletown Press, Fox61, and Harford Courant about the recent discovery of *Rickettsia parkeri* rickettsiosis in Connecticut which was published by the CDC *Emerging Infectious Diseases* (September 30).

RAFFAELA NASTRI with **VICTORIA SMITH, PH.D.** hosted the Summer 2024 CT State CAPS Committee meeting (Sept 24, 7 attendees) to discuss updates on the CAPS, PPA, and PPQ surveys and outreach programs.

JOHN SHEPARD presented a virtual seminar, "Surveillance for Mosquito-borne Arboviruses in Connecticut" as part of the Department of Pathobiology Seminar Series at the University of Connecticut (September 5) (22 undergraduate students, 12 graduate students, 10 staff, and 13 faculty members); presented the lecture, "Mosquito Biology, Ecology, and Behavior", for the course, BIO 337 – Medically Important Arthropods, at Southern Connecticut State University (September 16)(20 students, 1 faculty); presented the lecture, "Mosquito Surveillance, Control and Prevention of Mosquito-Borne Disease", for the course, BIO 500 – Graduate Seminar in Vector Biology, at Central Connecticut State University (10 students, 2 faculty).

GALE E. RIDGE, PH.D. met with Donna Hill, Yale Microbiology Fellow to discuss with her human bed bug *Cimex lectularius* research and Delusional Infestation work (September 4); interviewed about the Southern yellowjacket *Vespula squamosa* by Sean Krofssik from the Hartford Courant (September 6); interviewed by Dylan Fearon, Channel 3 News and Abby Weiss, Hearst Media Connecticut about the Southern yellowjacket *Vespula squamosa* (September 10); received a significant donation of dragonflies, moths, and butterflies from the estate of Dr. Robert Muller a well-known taxonomist; interviewed by Kevin Gaiss NBC CT News about the spotted lanternfly and Neil Reily CBS, Boston about the Southern yellowjacket (September 13); participated in running the Experiment Stations exhibit at the Big-E (September 16); interviewed about yellowjacket media reporting and the Southern yellowjacket by Edward Ricciuti journalist for the CT Examiner (September 17); delivered a talk on bed bugs at the 2024 Tribal Pesticides Workshop hosted by the Mashpee Wampanoag Tribe in collaboration with the USEPA Region 1, North Falmouth, MA (online and in person meeting) (September 18); interviewed about the spotted lanternfly by Sydney Boyo NBC-CT news (September 23); Julia LeBlanc Fox 61 interview Dr. Ridge about the spotted lanternfly (September 24); and Calvin Hill Elementary School Kindergarten class visited the IIO for a lesson in Entomology (September 24).

PAULA WOLF presented at the Eastern Connecticut Beekeepers Association September Meeting on the importance of registering honey bee colonies (September 8) (47 attendees); interviewed by Bill Hesbach of the Connecticut Beekeeper's Association as part of their monthly Bee Talks meeting. This was an introduction of the new State Apiary Inspector to the beekeeping community of CBA (September 12th) (443 attendees); assisted with staffing the Experiment Station booth at the Big E, educating attendees about honey bees and other pollinators (September 16th) (67, 034 attendees), presented a brief talk to the Back Yard Beekeepers Association with a reminder about honey bee registration (September 24th)(56 attendees).

CAES
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STATION NEWS

Left: The Experiment Station exhibit and staff.
Above: Jake Ricker making an emergency phone call.

At the 98th annual meeting of the Eastern Plant Board, held at the Hilton Burlington Lake Champlain in Burlington, VT (April 1-4), **Victoria Smith, Ph.D.** was awarded the Distinguished Service Award by the Eastern Chapter of the Horticulture Inspection Society (April 4). The plaque was delivered on October 3.

ENVIRONMENTAL SCIENCE & FORESTRY

SCOTT WILLIAMS, PH.D. 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 (September 3); as the Northeast Section Representative, participated in a Zoom call for members of the Professional Certification Review Board of The Wildlife Society (September 9); met with Dr. Vanessa Ezenwa, Yale University Department of Ecology and Evolutionary Biology, and her Ph. D. student Isaac Osew about possible collaborative research on tick-borne pathogen ecology (September 11); presented research poster titled "Oral Delivery of a Modern -Day Systemic Acaricide Formulation for Pathogen Vector Management on White-Tailed Deer in Connecticut, USA" at the Society for Vector Ecology meeting and met with CDC Division of Vector-Borne Disease staff in Ft. Collins, CO (September 16-20); gave invited talk about ticks and tick-borne pathogens at Chatfield Hollow State Park for the Friends of Chatfield Hollow (10 attendees) (September 28); participated in a Zoom call with staff from the CDC Division of Vector-Borne Diseases on refocusing and establishing a revised work plan for a funded integrated tick management project (September 30).

JOSEPH P. BARSKY was interviewed by John Silva of the Hartford radio station WTIC-1080 about the results of the 2024 Connecticut Oak Mast Surveillance Program (September 9); an article was published in the Hartford Courant on the results of the 2024 Connecticut Oak Mast Surveillance Program (September 10); presented a research poster and participated in House of Society Delegates meeting at the Society of American Foresters National Convention in Loveland, CO (September 16-20); participated in the Tour des Trees panel discussion at the Connecticut Forest and Park Association Headquarters in Rockfall (September 23).

JESSICA BROWN, PH.D. met with lecturers from Penn State and the University of Kentucky to assist in developing an undergraduate course in important diseases throughout history (September 10); participated in a meeting to advise students at Penn State on grant writing (September 10); met with colleagues at the University of Kentucky, the USDA Agricultural Research Service, and the University of Georgia to collaborate on a publication about community science in entomology (September 30).

GREGORY BUGBEE was interviewed by Debera Aleksinas of the Lakeville Journal on hydrilla in Connecticut (September 9); spoke on the history of the Connecticut Agricultural Experiment Station as part of welcoming remarks to the United States Army Corps of Engineers Aquatic Plant Workshop hosted in the Jones Auditorium (30 attendees) (September 10); participated in a virtual meeting of the Terramation Task Force convened by State Representative Christine Palm (September 12); judged posters prepared by Future Farmers of America students at the Big E in West Springfield, MA (September 13); provided guidance at the "Hydrilla Rake the Lake Day" at Lake Pocotopaug in East Hampton (September 22); presented an invited talk entitled "The March of Hydrilla in Connecticut" at the 2024 Virtual CT Lake Symposia hosted by Western Connecticut State University (100 attendees) (September 23); toured the northernmost Connecticut River hydrilla infestation in Agawam, MA with officials from the United States Army Corps of Engineers and the Massachusetts Department of Conservation and Recreation (September 23).

RILEY DOHERTY attended the Connecticut River Conservancy Meet and Greet event at the Essex Yacht Club (September 9); participated in the Connecticut Federation of Lakes Board of Directors meeting (September 18); received an Early Career Achievement Award from Estuary Magazine and its parent organization, The Watershed Fund, and spoke on her journey and current work at the Station at the Lyme Public Library (September 26).

SUSANNA KERIö, D.SC. administered the arborist exam in Lockwood (September 4); gave an invited talk titled "Basic Tree biology and Function" in Tree Warden School (20 attendees)

(September 5); attended the NE2333 Multistate Chestnut Research Project meeting in Syracuse NY (September 12-15) and presented on "Chestnut Research in CAES" (40 attendees); met with Dr. Anna Conrad (USFS) and Dr. Elena Karlsen-Ayala (USFS) to discuss collaboration on butternut canker resistance testing (September 18); attended the Connecticut Urban Forest Council meeting as executive board member (September 26).

SARA NASON, PH.D. participated in meetings for the Best Practices for Non-Targeted Analysis working group (September 3, 9, 17, and 19, virtual); participated in a meeting on "Identifying and Prioritizing Research and Programmatic Needs in the Detection, Mitigating, and Remediating PFAS in Agriculture and Food Systems" organized by the USDA-ARS - Center of Excellence for Environmental Monitoring and Mitigation and the University of Maine (September 10-12, Arlington, VA and virtual); met with colleagues from the CT Department of Energy and Environmental Protection and the CT Department of Public Health regarding designing a program to analyze PFAS in agricultural soils (September 26, virtual).

ITAMAR SHABTAI, PH.D. with **ALICE ZHOU, PH.D.** met with collaborators from Yale University to discuss collaborative research projects (September 17); met with colleagues from UConn to discuss extension opportunities (September 18); met with collaborators from Cornell University and DoE EMSL to discuss an ongoing study supported by EMSL's Exploratory Project Program and with **BLAIRE STEVEN, PH.D.,** met with collaborators from University of Maryland and NASA to discuss a grant proposal to the NASA Exobiology program (September 30).

BLAIRE STEVEN PH.D. met with the executive board of the Connecticut Valley American Society for Microbiology to plan the annual business meeting (September 13).

ELISABETH WARD, PH.D. participated in the CT Council on Soil and Water Conservation Soil Health Committee meeting (September 4); met with Cameron McIntire, Ph.D. (USDA Forest Service) and VT forest health practitioners to discuss collaborative beech leaf disease (BLD) management grant (September 4); gave a lecture and tree identification workshop for the Tree Wardens School (20 attendees) (September 5); met with Cameron McIntire, Ph.D. (USDA Forest Service) and NY forest health practitioners to discuss collaborative BLD management grant (September 5); met with CT DEEP Forestry Division and ME forest health practitioners staff to discuss collaborative BLD management grant (September 9); met with Marlyse Duguid, Ph.D. (The Forest School, Yale), Colleen Murphy-Dunning (Urban Resources Initiative/Yale), and Annie Mixswell (Tree Warden, City of New Haven) to discuss grant for BLD management in New Haven parks (September 10); met with Mike Zarfos, Ph.D. (Director, Great Mountain Forest) to discuss collaborative BLD management grant (September 10, 24); participated in the monthly Forest Ecosystem Monitoring Cooperative state coordinators meeting (September 12); met with Josh Halsey (Peconic Land Trust) to discuss BLD management grant on Long Island (September 12); met with staff from New England Forestry Foundation to discuss BLD management grant (September 12); led joint CAES-CT DEEP Forest Health meeting with Senior Staff from the Forestry Division (September 16); met with RI forestry staff from the Department of Environmental Management to discuss collaborative BLD management grant (September 16); met with Helen Poulos, Ph.D. (Wesleyan University), Craig Brodersen, Ph.D. (Yale University), Jonathan Gewirtzman (Yale University) and **SUSANNA KERIO, PH.D.** to discuss grant opportunities for analyzing non-structural carbohydrate depletion from BLD (September 18); participated as the CT representative in the Northeast-Midwest State Foresters Alliance Forest Health Committee meeting (September 19); led a field tour and workshop on forest ecology and stand dynamics for the Master Woodland Manager Program at the North Madison slash wall and experimental silviculture plots (25 attendees) (September 21); met with Robert Fahey, Ph.D. (UConn) to discuss research overlaps and future collaborations (September 30).

SUMMER WEIDMAN participated in the Twin Lakes End of Season Scientific Coalition

Meeting and led a boat tour of East Twin Lake *Hydrilla* sites (September 9); assisted with the United States Army Corps of Engineers aquatic plant training event and led a boat tour of *Hydrilla* treatment sites on the Connecticut River (September 10, 11); participated in the Northeast Aquatic Plant Management Society board meeting (September 12).

LEIGH WHITTINGHILL, PH.D. participated in the Connecticut Department of Agriculture's Climate Smart Agriculture & Forestry Working Group meeting at which there was some discussion about how CAES could benefit from available funding opportunities (September 1); attended the CT Council on Soil and Water Conservation quarterly meeting and gave a report of CAES activities (September 22).

YINGUE (CHARLIE) YU, PH.D. attended the "Engineering Research Initiation Webinar" from NSF (September 6); attended the HYDRUS short course (September 9–10); attended the online workshop from EMSL "MONet XCT" (September 19).

GRANTS RECEIVED:

YINGUE (CHARLIE) YU, PH.D. received 2024-2025 CAES Board of Control Research Award to study "Effects of Micro- and Nanoplastics on Transport of Heavy Metals in Unsaturated Porous Media," **$38,101**.

JEREMIAH FOLEY, IV, PH.D. was awarded a cooperative agreement with the U.S. Army Corps of Engineers to study the "Biology, Ecology, and Management of *Hydrilla verticillata* subsp. *lithuanica*" **$585,633.**

LEIGH WHITTINGHILL, PH.D. was awarded a USDA Specialty Crop Block Grant to study The Effects of Management Practices on the Nutritional Quality of Cut-and-Come-Again Greens from Urban Farms in Connecticut. **$58,495**. CAES will analyze the mineral nutrient content of successive harvests of greens grown using cut-and-come-again harvesting practices in a controlled experiment and on urban farms to identify the effect of different management practices on crop quality and develop cut-and-come-again production guidance. Greens are a high-value crop with high nutrient content and relatively quick growing times. This makes them a valuable crop in urban agriculture where space is limited, and food security is a motivational factor. Information gained from the analysis of leaf samples from farms using cut-and-come-again harvesting will enable us to identify management practices that promote high quality greens, especially from later harvests, and start to develop management guidance.

PUBLICATIONS:

1. Wang, Z., Nagat, M., Murano, H. and **Pignatello, J. J.** (2024). Participation of strong charge-assisted hydrogen bonds in interactions of dissolved organic matter represented by Suwannee River humic acid. *Water Research* 265: 122274 DOI: 10.1016/j.watres.2024.122274

Abstract: Terrestrial dissolved organic matter (DOM) plays critical roles in many biotic and abiotic environmental reactions as well as in water treatment. Its structure is therefore of great interest. We examined dissolved Suwannee River Humic Acid (HA) to probe the potential participation of exceptionally strong, negative charge-assisted hydrogen bonds, (−)CAHB, in DOM cohesion and interaction with small weak acids using high performance size exclusion chromatography (HPSEC), transmission electron microscopy, zeta-pH curves, and pH drift experiments. The results support a previously proposed two-tier state of aggregation, in which tightly-knit primary particles (≤ ~10kDa) form larger secondary aggregates (up to micrometer in size). Evidence for (−)CAHB is gained through zeta potential changes and pH drift experiments. The primary particles interact with (−)CAHB-capable solutes (simple carboxylic acids and phosphate) but not (−)CAHB-incapable solutes. We identified disruption of intra-

segmental and inter-molecular (−)CAHB leading to swelling and disaggregation, as well as formation of nouveau (−)CAHB with free groups on HA. The effects were solute-concentration dependent and greater at pH 5 than pH 6, consistent with CAHB theory. Phosphate induced the greatest shifts in the HPSEC molecular size distribution curves. The shifts were unaffected by prior stripping of innate polyvalent metals. We conclude that the (−) CAHB contributes to the cohesion of DOM, affecting its size and charge, and provides a means by which weak acid pollutants, nutrients, and natural compounds can interact with DOM. Such interactions have implications for the behavior of DOM in the environment, the fate and transport of anthropogenic pollutants, and the roles DOM play in water treatment technologies.

2. Rhim, J. H., Kopf, S., McFarlin, J., Maloney, A. E., Batther, H., Harris, C. M., **Zhou, A.**, Feng, X., Weber, Y., Hoeft-McCann, S., Pearson, A., Leavitt, W. D. (2024). Metabolic imprints in the hydrogen isotopes of *Archaeoglobus fulgidus* tetraether lipids. *Geochimica et Cosmochimica Acta*. DOI: 10.1016/j.gca.2024.09.032 .

Abstract: The stable hydrogen isotope composition of archaeal lipids is emerging as a potential paleoenvironmental proxy, adding to the well-established application of plant leaf wax-derived *n*-alkanes in paleohydrological reconstruction. A handful of studies reported relatively invariant and depleted hydrogen isotope compositions for archaeal lipids despite the range of different organisms and growth conditions explored. However, how modes of metabolism and physiological state (growth phase) affect the hydrogen isotope signatures of archaeal lipids remains poorly understood, limiting our ability to interpret archaeal lipid biomarker records from the environment. Here we conducted water isotope label experiments with a metabolically flexible and well-studied model archaeon *Archaeoglobus fulgidus* and quantified the hydrogen isotope fractionation between lipids and water in response to different carbon substrates and electron donor–acceptor pairs at different growth phases. The $^{2}H/^{1}H$ fractionation between lipids and water ($\varepsilon_{L/W}$) was overall negative. Both carbon metabolism and growth phase affected the magnitude of isotope fractionation in *A. fulgidus*; however, the changes in $\varepsilon_{L/W}$ values were relatively subtle where they ranged from –283 to –229 ‰ across all tested conditions, overlapping with the ranges observed for other archaea in previous studies. Isotope flux-balance model results suggest that ≥ 80 % and ≥ 50 % of lipid-bound H in *A. fulgidus* cultures directly reflect water isotope compositions (i.e., not via organic substrate or H_2) during autotrophy and heterotrophy, respectively. The model results also suggest two main mechanisms of consistent ^{2}H depletion observed in *A. fulgidus* tetraethers as well as other archaeal lipids reported in previous studies: 1) isotopic re-equilibration via upstream isomerization reactions involving C_5 units and 2) downstream double bond reduction catalyzed by a flavoenzyme geranylgeranyl reductase. These results are consistent with previous isotope flux-balance model results for a different archaeon. Finally, we synthesized available data to compare $\varepsilon_{L/W}$ patterns across all three domains of life: Eukarya, Archaea and Bacteria. Because they vary fundamentally in lipid biosynthesis pathways, we present comparative discussions in pairs, focusing on the shared biochemical mechanisms among isoprenoid lipids and potential signals of metabolic adaptations across prokaryotic lipids. Emerging patterns between diverse archaeal and eukaryotic isoprenoid lipids are consistent with the two proposed mechanisms for ^{2}H depletion identified (isomerization and final saturation). The patterns between archaeal isoprenoids and bacterial fatty acids suggest that the general state of energy limitation may also contribute to large, negative values of $\varepsilon_{L/W}$ observed in prokaryotic lipids. Altogether, these findings lend further support for the potential of archaeal lipid $\varepsilon_{L/W}$ as a paleohydrological proxy and provide a broader insight into the $^{2}H/^{1}H$ fractionation mechanisms potentially shared among prokaryotic and eukaryotic lipid biomarkers.

3. Ward, E. B., Ashton, M. S., Wikle, J. L., Duguid, M., Bradford, M. A. (2024). Local controls modify the effects of timber harvesting on surface soil carbon and nitrogen in a temperate hardwood forest. *Forest Ecology and Management* 572: 122268. DOI: 10.1016/j.foreco.2024.122268

Abstract: Managing for structural complexity to enhance forest health and resiliency is increasingly incorporated in silvicultural treatments. High spatial variability in stands managed for structural complexity could obscure forest management effects on surface soils. Yet few studies have assessed how within-stand variation in forest structure and other local controls influence the effects of timber harvesting on surface soil organic matter dynamics over time. We used a stratified random sampling design to capture variation in stand age, legacy structure, soil type, and topography in a second-growth, oak-hardwood forest in the northeastern U.S. We compared surface soil carbon and nitrogen content and availability in 15 harvested stands managed to promote tree regeneration (n = 144 plots) and five unharvested controls (n = 48 plots). We also examined changes over time since harvest in just the harvested stands using a 25-year chronosequence. Timber harvesting strongly influenced surface soil carbon and nitrogen dynamics. The harvested stands had lower soil carbon and nitrogen, microbial biomass, and carbon mineralization but higher nitrogen mineralization. These differences were more pronounced in the drier soil type with higher organic matter content than in the more moist soil type. Across the 25-year chronosequence, elevation, soil type, and downed woody material density dictated the direction of changes in surface soil carbon and nitrogen over time. Soil carbon and nitrogen accrued over time at drier, higher elevation (□300 m) sites and was positively associated with higher densities of fine woody material but declined at lower elevations (□180 m). Proximity to legacy trees was associated with higher soil carbon and nitrogen concentrations and availability. Our findings underscore the importance of silvicultural practices that retain structural legacies in shaping surface soil carbon and nitrogen dynamics over time. Our results also highlight how accounting for spatial variation in local controls on soil carbon and nitrogen, such as topography, can improve detection of changes from forest management practices that increase spatial heterogeneity within stands, such as irregular shelterwood and seed tree regeneration methods.

OTHER DEPARTMETAL NEWS:

On September 26, **RILEY DOHERTY** was honored with an Early Career Achievement Award from Estuary Magazine for her current and past work within the Connecticut River watershed. Head of the Office of Aquatic Invasive Species **GREG BUGBEE** (left) and Environmental Science and Forestry Department Head **SCOTT C. WILLIAMS, PH.D.** (right) were also in attendance.

On Sunday, September 1, 2024, **JOSEPH P. BARSKY** and Karin Fox were married at Lockwood Farm in Hamden.

PLANT PATHOLOGY AND ECOLOGY

FELICIA MILLETT traveled to Portland, Maine to participate in the National Meeting of the National Plant Diagnostic Network (NPDN) where she hosted the NPDN Proficiency Committee meeting (10 adults) (September 9) and presented a Lightning Round talk during the poster session (September 10); visited the Connecticut Flower Collective to meet with cut flower farm growers (Meriden, CT) (September 20); and presented "Selection and Care of Broadleaf Evergreens" to the Daytime Gardeners of North Haven (12 adults) (September 24).

YONGHAO LI, PH.D. attended the National Plant Diagnostic Network Conference in Portland, ME (September 9-11); presented a poster, Bacterial Leaf Scorch, in the CT Tree Wardens Association Fall Workshop (adults 55) (September 13); presented Selection and Care of Houseplants to the Vernon Senior Center members (23 adults) (September 17); presented Tree Diseases for the CT Tree Wardens School (22 adults) (September 19).

QUAN ZENG, PH.D. hosted Dr. Srdjan Acimovic from Virginia Tech University who gave a seminar at CAES (60 adults) (September 18).

GRANTS RECEIVED:

QUAN ZENG, PH.D. and Mr. Rich Cecarelli received a new grant from USDA-ORG program "Improving Fruit Safety of Blossom Protect for Organic Fire Blight Management in the East". In this project, they will study fruit russeting caused by yeast like fungi, and come up with solutions to mitigate russeting and integrate these biological control microorganisms into the pest management program. Drs. Kari Peter (Penn State University), Ken Johnson (Oregon State University), and Evan Lentz (University of Connecticut) are also co-investigating this project (Total funding $982,921, CAES budget: $740K). https://portal.nifa.usda.gov/enterprise-search/ss/1992

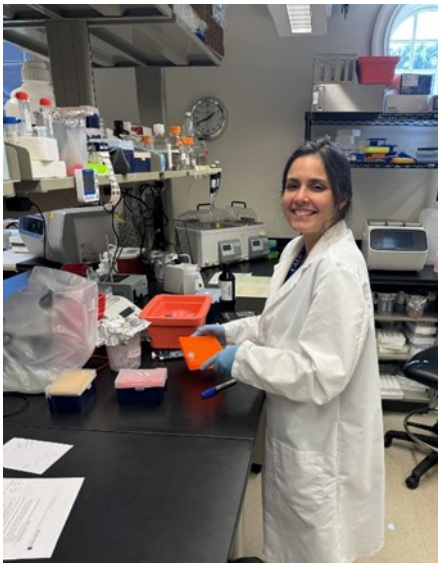
Drs. LINDSAY TRIPLETT and STEPHEN TAERUM are co-project directors on a $3.5M USDA Organic Agriculture Research and Extension Initiative grant titled "Hunting for healthy soils: Organic management of soil micro-predators for pathogen control". Conducted on 14 organic farms nationally, the project will study how organic carbon and nutrient amendments shape the composition and function of predatory nematodes, viruses, bacteria, and protists in the soil, and investigate grower perceptions of microbiome research. The project brings together scientists from the University of Florida, Penn State, University of California-Davis, and USDA-ARS; CAES will support protist research and conduct a citizen science study. (CAES budget: $598K).

OTHER DEPARTMETAL NEWS:

Over 30 CAES staff joined a Sete de Septembro potluck feast of Latin American foods to celebrate Brazil National Day on September 6th. Pictured are Brazilian members of the PPE department: **Joedson Lima, Raquel Ro-**

cha, Talison da Costa, Monique Rodriguez, Jarlan Silva, Paola Gonzales, and **Washington da Silva**. The feast also celebrated the arrival of new student Paola and bid farewell to Talison, both from the da Silva lab.

On September 27th, the PPE Department celebrated the birthday of **Ravi Patel, Ph.D.**



The Rocha Lab is pleased to welcome **Neuzivette Abecassis**, who will be volunteering at CAES for a year. As a Chemical Engineering graduate, Neuzi's project will center on the exciting task of identifying and cloning root-knot nematode virulence genes to unravel their pivotal role in parasitism.

VALLEY LABORATORY

JATINDER S AULAKH, PH.D. conducted a field survey with Bill Syme, Manager Nutrien Ag Solutions, on herbicide resistant common waterhemp infestation in Soybean and field corn in Connecticut (September 4); reviewed a manuscript entitled "Nonsynthetic Herbicides for Turfgrass: Assessing Frequency of Consumer Information and Regional Performance for Annual Bluegrass (Poa annua L.) Control" for International Turfgrass Society Research Journal (September 18); had a phone interview with Abby Weiss from the Hearst Connecticut Media Group on Japanese knotweed, LINKED HERE (September 19).

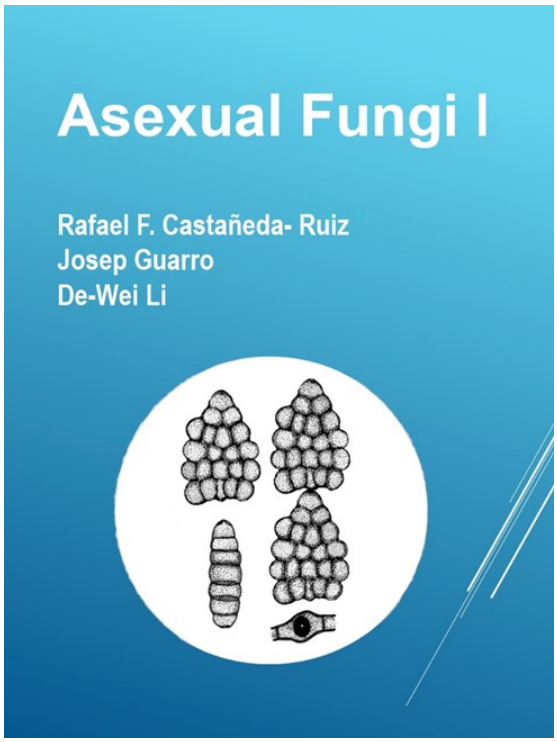
RICHARD COWLES, PH.D. presented "Deer repellents," for a webinar sponsored by the Real Christmas Tree Board, (100 attendees) (September 10); discussed "Needle retention" and "Basal bark sprays and root dips," to a joint meeting of the New Hampshire/Vermont and Maine Christmas Tree Growers' Associations (100 and 50 attendees, respectively) (September 21 and 22, respectively).

NATE WESTRICK, PH.D. presented an invited seminar at the University of Connecticut Department of Plant Science and Landscape Architecture entitled "Exploring and exploiting the genetics of *Sclerotinia sclerotiorum*: a Cosmopolitan Pathogen" (30 attendees) (September 13).

PUBLICATIONS:

1. Castañeda-Ruiz R. F., Guarro, J., **Li, D. W.** (2024). Asexual Fungi I: A compilation of tretic hyphomycetes published after Ellis 1976. Graficas Selvi, Valencia, Spain. 397+vii pp.

Abstract: This book is the production of a multi-year collaboration among mycologists from different continents and a compilation of the more than 500 taxa of enterogenous dematiaceous hyphomycetes. With publications of more new taxa coming out every year, it sometimes seemed that our manuscript would become a never-ending task. Finally, a cut-off date (2022) was set, to allow the manuscript to see the light at the end of the tunnel. As the subtitle indicates, this book covers dematiaceous tretic hyphomycetes. The book is not only a monograph for mycological studies, but also a manual for other professionals who work with fungi, to identify the fungi covered in this book, based on morphological characteristics.



JOURNAL ARTICLES APPROVED SEPTEMBER 2024

Chen, L., Huang, F., Yang, R., Hu, Q., Li, T., **White, J. C.**, Zeng, Y., Qiu, T., Fang, L. Nano-enabled strategies to enhance crop growth and water use efficiency under drought: Evidence from a hierarchical meta-analysis. *Global Change Biology*.

Cowles R. S. and **Westrick N.** Roundup of new pests and diseases. *The Real Tree Line.*
Fang, L., Banerjee, B., Yuan, X., **Zeng, Q.**, Liang, C., Chen, X., YangLiwei Fang, C.–H. Genetic and Environmental Investigation of a Novel Phenylamino Acetamide Inhibitor of the Pseudomonas aeruginosa Type III Secretion System. *Applied and Environmental Microbiology.*

Huang, J., Huyen, T. N. B. V., Liu, X., Mitra, S., Yu, M., **Zeng, Q.**, Sundin, G. W., Cox, K. D., Förster, H., Adaskaveg, J. E., Kuo, C.–H., Yuan, X., and Yang, C.–H. RejuAgro A: A novel antimicrobial for fire blight control of pome fruits and beyond. *Nature Biotechnology*.

Irewale, A. T., Elemike, E., **Aikpokpodion, P.**, **Muthuramalingam, R.**, **Dimkpa, C.**, Oguzie, E. Morphological and Chemical Profiling of Biochar Derived from Water Hyacinth (Eichhornia crassipes) Towards Bio-nanofertilizer Development. *ACS Applied Materials & Interfaces*.

Millett, F., **Standish, J.**, Scanley, J., Cui, Z., Miller, K., Inguagiato, J., **Zuverza-Mena, N.**, Abril, M., Robinson, V., Sundin, G. W., and **Zeng, Q.** The fire blight pathogen Erwinia amylovora enters apple leaves through naturally occurred wounds during abscission of trichomes. *The Plant Journal*.

Norris, K. E.*, **Pignatello, J. J.**, Vialykh, E., McNeill, K., Sander, M., Rosario-Ortiz, F. L.* Recent Developments on the Three-Dimensional Structure of Dissolved Organic Matter: Towards a Unified Description. *Environmental Science and Technology*.

Srivastava, R., Singh, Y., **White, J. C.**, Dhankher, O. Strategies for limiting toxic elements in food: Addressing critical knowledge gaps to ensure a safe food supply. *Trends in Food Science*.

Tao, X., Lin, X., Lin, M., **White, J. C.**, Li, Z., Wu, X., Hou, J., Liu, Y., Qin, Z., Xu, J., Yang, K., Lin, D. A controlled P-delivery nanoplatform for enhancing maize growth in acid and alkaline P-deficient soils. *ACS Nano*.

Wang, N., Sundin, G. W., De La Fuente, L., Cubero, J., Tatineni, S., Brewer, M. T., **Zeng, Q.**, Bock, C. H., Cunniffe, N. J., Wang, C., Candresse, T., Chappell, T., Coleman, J. J., and Munkvold, G. Key Challenges in Plant Pathology in the Next Decade. *Phytopathology*.
Xu, S., Ding, Z., Cui, J., **White, J. C.**, Wang, W., Li, Y. Selenium nanoparticles modulate transcriptome and metabolite profiles to alleviate PFOA stress in Brassica chinensis L. *Nature Communications*.

Xu, Y., Chen, Y., Coa, Y., **White, J. C.**, Yue, H., Ma, C., Yan, W., Xing, B. Combined stress of lead exposure and flooding on soil bacterial assembly and function in a rhizosphere ecosystem. *Soil Biology and Biochemistry*.

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