# Station News

The Connecticut Agricultural Experiment Station
Volume 12 Issue 12| December 2022

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

**DR. JASON C. WHITE** along with **DR. SARA NASON, DR. NUBIA ZUVERZA-MENA AND DR. SARA THOMAS** participated in a Zoom call with collaborators at Yale University and the University of Minnesota to discuss progress on a joint NIEHS grant (November 2), attended the monthly Laboratory Preparedness meeting at the CT Department of Public Health (November 7), met by Zoom with collaborators at Purdue University to discuss a collaborative grant submission (November 7), hosted the monthly Center for Sustainable Nanotechnology (CSN) Nanochemistry-Plant Working Group Zoom call (November 8), hosted the monthly CAES J-Visa recipient meeting (November 8, 22), along with **DR. SHITAL VAIDYA, DR. CHRISTIAN DIMKPA** and **DR. WADE ELMER** hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA research project (November 8), spoke by phone with Prof. Lee Newman of SUNY ESF to discuss a phytoremediation grant proposal (November 9), participated in the weekly CSN All Hands Zoom call (November 9, 23, 30), held a Zoom call with collaborators at the University of Minnesota to discuss a joint manuscript preparation for *Trends in Chemistry* (November 10, 22), participated in the CT DEEP EEJ & Climate Smart Agriculture & Forestry Zoom call (November 10), along with **DR. YI WANG** met by Zoom with Prof. Korin Wheeler of Santa Clara University to discuss collaborative research (November 11), participated in the CSN Plant-Biosurfaces monthly call (November 14), met with CAES Research Affiliate Dr. Rania Eltanbouly to discuss her research project (November 14), attended the SETAC for North America 43rd Annual Meeting, Pittsburgh PA, and gave a presentation titled "Nanoscale sulfur uniquely suppresses fungal disease and increases biomass and yield of crop plants" (November 13-17), participated on the monthly CSN Faculty Call (November 17), along with **DR. YI WANG** and **DR. WADE ELMER** hosted a Zoom call with collaborators at the University of Massachusetts to discuss progress on a USDA nanosulfur grant (November 18), along with Department of Analytical Chemistry staff held a Teams call with Department of Consumer Protection Division of Drug Control staff to discuss Adult Use Cannabis Program sample analysis (November 22), held a Zoom call with Dr. Samuel Chigome of the Botswana Institute of Technology Research and Innovation (BITRI) to discuss his visit to CAES early next year (November 23), along with **DR. CHRISTIAN DIMKPA** hosted a Zoom call with two students from SKUAST-Kashmir, India for intern positions funded by OCP (November 28, 30), visited Johns Hopkins University in Baltimore Maryland and gave a presentation for the Wolman Seminar Series titled "Nanotechnology-enabled agriculture: A path to global food security?" (November 30).

## PUBLICATIONS

**1.** Pagano, L., Rossi, R., **White, J. C.**, Marmiroli, N., and Marmiroli, M. (2022). Nanomaterials biotransformation: In planta mechanisms of action. *Environ. Poll. In press.*

**Abstract:** Research on engineered nanomaterials (ENMs) exposure has continued to expand rapidly, with focus to uncover the underlying mechanisms. EU largely limits the number and the type of organisms that can be used for experimental testing through the 3R normative. There are different routes through which ENMs can enter the soil-plant system:

this includes the agricultural application of sewage sludges, and the distribution of nano-enabled agrochemicals. However, a thorough understanding of the physiological and molecular implications of ENMs dispersion and chronic low-dose exposure remains elusive, thus requiring new evidence and a more mechanistic overview of pathways and major effectors involved in plants. Plants can offer a reliable alternative to conventional model systems to elucidate the concept of ENM biotransformation within tissues and organs, as a crucial step in understanding the mechanisms of ENM-organism interaction. To facilitate the understanding of the physico-chemical forms involved in plant response, synchrotron-based techniques have added new potential perspectives in studying the interactions between ENMs and biota. These techniques are providing new insights on the interactions between ENMs and biomolecules. In the present review are discussed the principal outcomes related to the ENMs after the intake by the plant including possible routes of biotransformation which make their final faith less uncertain, but still needing further investigation.

**2.** Noman, M., Ahmed, T., Ijaz, U., Shahid, M., Nazir, M. M., Aizullaha, **White, J. C.**, Li, D., and Song, F. (2022). Bio-functionalized manganese nanoparticles suppress Fusarium wilt in watermelon (*Citrullus lanatus* L.) by infection disruption, host defense response potentiation and soil microbial community modulation. *Small*. DOI: 10.1002/smll.202205687

**Abstract:** Chemically synthesized micronutrient-based nanoparticles (NPs) have been shown to improve plant nutrition and growth, as well as reduce disease, however, the potential of biogenic nanoscale micronutrients in disease control is largely unknown. (bio-MnNPs). Here, we report on the performance and mechanisms of biogenic manganese NPs (bio-MnNPs) suppression of watermelon Fusarium wilt, caused by *Fusarium oxysporum* f. sp. *niveum* (Fon). For particle synthesis, a bA Mn-resistant bacterial strain (NOM14) was isolated from the watermelon rhizosphere soil and identified as *Bacillus megaterium*. Bio-MnNPs were synthesized by cell-free cultural filtrate of B. megaterium NOM14 and had spherical morphology with a size range of 27.0-65.7 nm. In greenhouse experiments, application of bio-MnNPs as a soil drench increased the Mn content in watermelon plants and improved the growth performance by enhancing multiple important physiological processes, including antioxidative defense pathways. Importantly, bio-MnNPs suppressed Fusarium wilt through inhibiting in planta colonization and invasive growth of Fon in the roots and stems of watermelon plants. Specifically, Bio-MnNPs significantly reduced Fon vegetative growth, conidiation, conidial morphology and germination, and cellular integrity in an in vitro assay. Transcriptomic and metagenomics analyses of plant tissues demonstrated that bio-MnNPs potentiated systemic acquired resistance by triggering the salicylic acid (SA) signaling pathway upon Fon infection, and also improved the soil microbial community by increasing the diversity of the fungal community. These findings indicate that bio-MnNPs suppress Fusarium wilt in watermelon by multiple ex planta and in planta mechanisms, and demonstrate that this approach may be an important nano-enabled approach for the sustainable management of crop diseases.

**Dr. Jason C. White** with colleagues from Johns Hopkins University and the NSF Center for Sustainable Nanotechnology.

CAES J-Visa recipients celebrating Thanksgiving at the Director's house.

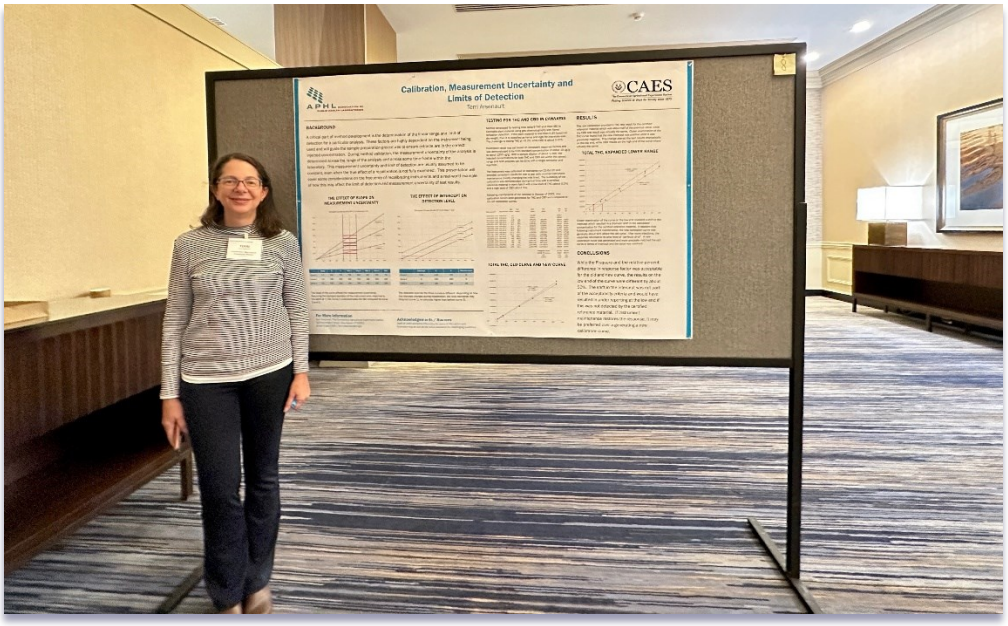
# ANALYTICAL CHEMISTRY

**MRS. KITTY PRAPAYOTIN-RIVEROS**, **MRS. TERRI ARSENAULT**, **MS. MEGHAN CAHILL**, **DR. CARLOS TAMEZ**, and **DR. CHRIS DIMKPA** attended the Laboratory Flexible Funding Model (LFFM) CAP Grantee Meeting in St. Louis, MO (November 15–17). **MRS. KITTY PRAPAYOTIN-RIVEROS** presented State Experiences with ORA DX and provided the feedback the FDA to improve the data exchange system, along with participating in the Town Hall Q&A for ORA DX. **DR. CHRIS DIMKPA** presented Food Safety Analysis at CAES: Focus on Toxic Elements in Infant Foods; **MRS. TERRI ARSENAULT** presented the poster on "Calibration, Measurement Uncertainty and Limits of Detection," and **DR. CARLOS TAMEZ** presented the poster on "Analysis of Pesticides in the State of Connecticut."

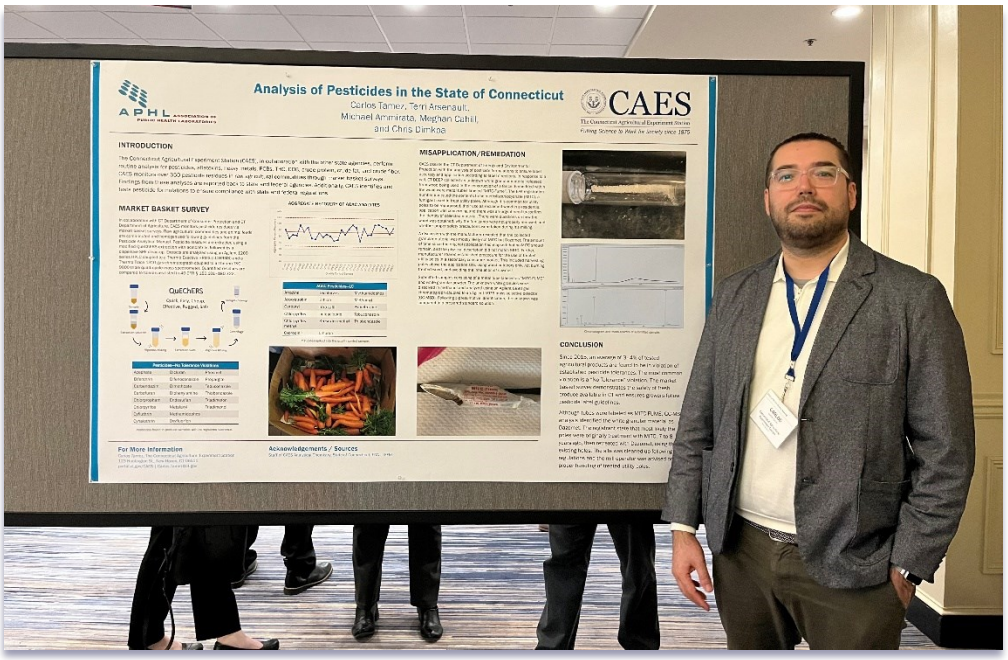

Pictured from left to right: **Mrs. Kitty Prapayotin-Riveros**, **Mrs. Terri Arsenault**, **Dr. Carlos Tamez**, **Dr. Christian Dimkpa**, and **Ms. Meghan Cahill** at the LFFM CAP Grantee Meeting in St. Louis, Missouri, November 15-17, 2022.


**Dr. Chris Dimkpa** presenting "Food Safety Analysis at CAES: Focus on Toxic Elements in Infant Foods"


**Mrs. Kitty Prapayotin-Riveros** presenting "ORA Data Exchange (DX) - Data Sharing from the Program Standpoint and Data Flow (Connecticut)"




**Mrs. Terri Arsenault** presenting her poster "Calibration, Measurement Uncertainty and Limits of Detection."




**Dr. Carlos Tamez** presenting his poster "Analysis of Pesticides in the State of Connecticut."

**DR. SHITAL VAIDYA** gave a talk at the Sussex Symposium at The Connecticut Agricultural Experiment Station. The title of the talk was, ''Phosphorus type and particle size control release from biodegradable polymer nanocomposites, leachability from the soil, and availability to tomato" (November 4).


**Dr. Shital Vaidya** presenting a lecture during the Sussex Symposium at The CAES on November 4, 2022.

**DR. NUBIA ZUVERZA-MENA**, along with **DR. SUSANNA KERIÖ**, **DR. LEIGH WHITTINGHILL**, and **DR. FAISAL QASEEM** went on a field excursion in the New Haven area to test the sample collection of maple urban trees (November 1) and rate trees' health (November 9). **DR. ZUVERZA-MENA** presented "Biodegradable polymer nanocomposites for controlled release and targeted delivery of phosphorus during crop growth" during the Sustainable Phosphorous Summit in Raleigh, NC (November 2-4); participated in a podcast interview with **DR. SARA NASON** and **DR. SARA THOMAS** on various research projects at The CAES that involve per- and polyfluoroalkyl substances (PFAS) (November 10); and with **DR. WASHINGTON DA SILVA** and **DR. ITAMAR SHABTAI**, staffed a CAES booth showcasing various lines of research at the CT Agricultural Expo in Southington (November 18).

**DR. YI WANG** presented an invited talk at the University of Connecticut, Department of Nutritional Sciences (30 attendees) (October 21); with **DR. CHAOYI DENG** visited the CT Department of Public Health to discuss collaborative research with Dr. Joanne Lenoce (October 26); attended the 2022 ASA, CSSA, SSSA International Annual Meeting in Baltimore, MD and gave a poster presentation "Integrated Metabolomics for Disease Suppression Responses in Plants" (~200 attendees) (November 6-9); was invited by Dr. Laura McConnell (Deputy Editor) to join the Editorial Advisory Board of ACS Agricultural Science and Technology (November 10); attended the 11$^{th}$ SNO Conference in Austin, TX and gave an oral presentation titled "Unique bio-assimilation of sulfur nanomaterials in plants for fungal disease suppression and crop yield augmentation" (~30 attendees) (November 10-13).

# ENTOMOLOGY

**DR. GOUDARZ MOLAEI** was interviewed by UConn students on the impact of climate change on tick activity and recent changes in the dynamics of tick activity in the Northeast. The interview will be available online as a podcast, and as a member of the advisory committee, attended the monthly meeting of the New England Regional Center for Excellence in Vector-borne Diseases (November 29).

**DR. PHILIP ARMSTRONG** gave a poster presentation titled "Genetic characterization and vector competence of a regional variant of Brazoran virus from Florida" at the Annual Meeting of the American Society of Tropical Medicine and Hygiene in Seattle, WA (October 30–November 3).

**DR. DOUGLAS BRACKNEY** presented a Biology Departmental Seminar via Zoom at the University of Bridgeport titled, "Navigating Anatomical Barriers to Transmission: An Arbovirus Tale" (October 17).

**MS. ANGELA BRANSFIELD** participated via Zoom in Yale's Biosafety Committee meeting (November 17).

**MR. DUNCAN COZENS** presented a poster titled "Longitudinal study of *Ixodes scapularis* abundance and pathogen burden in Connecticut, USA" at the 71st annual meeting of the American Society of Tropical Medicine and Hygiene in Seattle, Washington (October 30–November 3).

**DR. ANDREA GLORIA-SORIA** presented a talk, "Tracking down invasions of the yellow fever mosquito, *Aedes aegypti*, using molecular markers," as a keynote speaker to the II Latin American Society for Vector Ecology Congress (LA SOVE 2022) in La Plata, Argentina (November 1); was a coauthor of an oral presentation "Assembling de novo *Aedes* genomes from single specimens" and poster presentation "Draft genome for *Aedes triseriatus*, the vector of La Crosse virus" at the annual meeting of the Entomological Society of America, Vancouver, Canada (November 13–16).

**DR. REBECCA JOHNSON** participated in the Young Investigator Award competition and won Honorable Mention for her short talk about the influence of successive blood feeding on dengue virus dissemination in *Wolbachia* transinfected *Aedes aegypti* at the Annual Meeting of the American Society of Tropical Medicine and Hygiene in Seattle, Washington (October 30–November 4), and later gave a longer talk presenting this work as part of a scientific session.

**DR. GALE E. RIDGE** was interviewed by the NewsTimes about insect activity during the winter months (November 22).

**DR. CLAIRE RUTLEDGE** presented a talk titled "Emerald ash borer biological control in Connecticut" at the Environmental Research Symposium sponsored by Flanders Nature Center and Land Trust, and the Taft School in Watertown, CT (November 3); presented a talk titled "Spotted lanternfly and maple syrup" at the Annual Meeting of the Connecticut Maple Syrup Producers Association in Avon, CT (November 5); gave an invited talk titled "Tracking outbreaks of native buprestids using a native wasp" in the symposium "From

culture to chemistry: Managing flatheaded borers in specialty crops" at the Entomological Society of America Annual Meeting in Vancouver, British Columbia, Canada (November 13-16), and served as a committee member for Niklas Lowe, a master of science student at CCSU, and participated at his successful thesis defense (November 22).

**MS. TRACY ZARRILLO** hosted a bumble bee identification workshop in her lab, given by Joan Milam of the University of Massachusetts, on how to identify cryptic species of bumble bees (*Bombus* spp.) (November 4).

**DR. KIRBY C. STAFFORD III** (Emeritus Scientist) participated as a member in a meeting of the national Tick-Borne Disease Working Group (November 21) as the group approved its 2022 Report to Congress and attended the annual meeting of the Entomological Society of America in Vancouver, British Columbia, Canada and presented a talk with co-author **DR. GOUDARZ MOLAEI** titled "Changes in the frequency and dynamics of ticks and tick-borne pathogens as a serious public health threat in the northeastern USA" (November 13–16).

**DR. KIMBERLY STONER** (Emeritus Scientist) presented a talk on "Native pollinators" to the CT Beekeepers Association via Zoom (November 15).

## PUBLICATIONS

**1. Bransfield, A. B.**, **Misencik, M. J.**, **Brackney, D. E.**, and **Armstrong, P. M.** (2022). Limited capacity for *Aedes aegypti* to mechanically transmit chikungunya virus and dengue virus. *Am J. Trop. Med. Hyg*. DOI: 10.4269/ajtmh.22-0323

**Abstract:** Mechanical transmission is an understudied mode of arbovirus transmission that occurs when a biting insect transmits virus among hosts by the direct transfer of virus particles contaminating its mouthparts. Multiple arboviruses have been shown to be capable of utilizing this transmission route, but most studies were conducted 40 to 70 years ago using dated methodologies. To gain a better understanding of this phenomenon, we used molecular techniques to evaluate the efficiency of mechanical transmission by *Aedes aegypti* mosquitoes for two evolutionarily divergent arboviruses, chikungunya virus (CHIKV) and dengue virus (DENV). Viral RNA and/or infectious DENV could be detected on 13.8% of mosquito proboscises sampled immediately after an infectious bloodmeal, but positivity rates declined within hours. CHIKV RNA and/or infectious virus was detected on 38.8% of proboscises immediately after feeding but positivity rates dropped to 2.5% within 4 hours. RNA copy numbers were low for both viruses, and we were unable to demonstrate mechanical transmission of CHIKV using an established animal model, suggesting that this mode of transmission is unlikely under natural conditions.

**2.** Field, E. N., **Shepard, J. J.**, Clifton, M. E., Price, K. J., Witmier, B. J., Johnson, K., Boze, B., Abadam, C., Ebel, G. D., **Armstrong, P. M.**, Barker, C. M., and Smith, R. C. (2022). Semi-field and surveillance data define the natural diapause timeline for *Culex pipiens* across the United States. *Commun. Biol. 5*(1). DOI: 10.1038/s42003-022-04276-x

**Abstract:** Reproductive diapause serves as biological mechanism for many insects, including the mosquito *Culex pipiens*, to overwinter in temperate climates. While *Cx. pipiens* diapause has been well-studied in the laboratory, the timing and environmental signals that promote diapause under natural conditions are less understood. In this study, we examine laboratory, semi-field, and mosquito surveillance data to define the approximate timeline and seasonal conditions that contribute to *Cx. pipiens* diapause across the United States. While confirming integral roles of temperature and photoperiod in diapause induction, we also demonstrate the influence of latitude, elevation, and mosquito population genetics in shaping *Cx. pipiens* diapause incidence across the country. Coinciding with the cessation of WNV activity, these data can have important implications for mosquito control, where targeted efforts prior to diapause induction can decrease mosquito populations and WNV overwintering to reduce mosquito-borne disease incidence the following season.

**3. Gloria-Soria, A.**, Shragai, T., Ciota, A. T., Duval, T. B., Alto, B. W., Martins, A. J., Westby, K. M., Medley, K. A., Unl, I., Campbell, S. R., and Kawalkowski, M. (2022). Population genetics of an invasive mosquito vector, *Aedes albopictus* in the Northeastern USA. *NeoBiota*, *78*(4), 99-127. DOI: 10.3897/neobiota.78.84986

**Abstract:** The Asian tiger mosquito (*Aedes albopictus*) arrived in the USA in the 1980's and rapidly spread throughout eastern USA within a decade. The predicted northern edge of its overwintering distribution on the East Coast of the USA roughly falls across New York, Connecticut, and Massachusetts, where the species has been recorded as early as 2000. It is unclear whether *Ae. albopictus* populations have become established and survive the cold winters in these areas or are recolonized every year. We genotyped and analyzed populations of *Ae. albopictus* from the northeast USA using 15 microsatellite markers and compared them with other populations across the country and to representatives of the major global genetic clades to investigate their connectivity and stability. Founder effects or bottlenecks were rare at the northern range of the *Ae. Albopictus* distribution in the northeastern USA, with populations displaying high levels of genetic diversity and connectivity along the East Coast. There is no evidence of population turnover in Connecticut during the course of three consecutive years, with consistent genetic structure throughout this period. Overall, these results support the presence of established populations of *Ae. albopictus* in New York, Connecticut, and Massachusetts, successfully overwintering and migrating in large numbers. Given the stability and interconnectedness of these populations, *Ae. albopictus* has the potential to continue to proliferate and expand its range northward under mean warming conditions of climate change. Efforts to control *Ae. albopictus* in these areas should thus focus on vector suppression rather than eradication strategies, as local populations have become firmly established and are expected to reemerge every summer.

## GRANTS AWARDED

1. **DR. SUSANNA KEIRÖ** was awarded a grant through The American Chestnut Foundation's External Grants Program to study "Variation in blight severity and inhibitory properties of bark against *Cryphonectria parasitica* in 20-year-old full-sib progeny of *Castanea mollissima* ('Mahogany' x 'Nanking')." **$10,000**.

**Abstract:** The project will phenotype a 20-year-old full-sib population of 150 Chinese chestnut crosses (Mahogany x Nanking) for variation in blight severity from natural infection. Additionally, the project will test the potential of in vitro bark extract plate assays as a phenotyping method to screen the bark from a subset of the phenotyped trees for variation in inhibitory properties against *Cryphonectria parasitica*. This project will aid in identifying the genetic variation underlying bark chemistry and blight resistance in Chinese chestnut, and in developing phenotyping tools to identify trees with high blight resistance.

## PUBLICATIONS

**1.** Jespersen, N., Ehrenbolger, K., Winiger, R. R., Svedberg, D., **Vossbrinck, C. R.**, and Barandun, J. (2022). Structure of the reduced microsporidian proteasome bound by PI31-like peptides in dormant spores. *Nature Communications*, *13*, 1-14. DOI: 10.1038/s41467-022-34691-x

**Abstract**: Proteasomes play an essential role in the life cycle of intracellular pathogens with extracellular stages by ensuring proteostasis in environments with limited resources. In microsporidia, divergent parasites with extraordinarily streamlined genomes, the proteasome complexity and structure are unknown, which limits our understanding of how these unique pathogens adapt and compact essential eukaryotic complexes. We present cryo-electron microscopy structures of the microsporidian 20S and 26S proteasome isolated from dormant or germinated *Vairimorpha necatrix* spores. The discovery of PI31-like peptides, known to inhibit proteasome activity, bound simultaneously to all six active sites within the central cavity of the dormant spore proteasome, suggests reduced activity in the environmental stage. In contrast, the absence of the PI31-like peptides and the existence of 26S particles post-germination in the presence of ATP indicates that proteasomes are reactivated in nutrient-rich conditions. Structural and phylogenetic analyses reveal that microsporidian proteasomes have undergone extensive reductive evolution, lost at least two regulatory proteins, and compacted nearly every subunit. The highly derived structure of the microsporidian proteasome, and the minimized version of PI31 presented here, reinforce the feasibility of the development of specific inhibitors and provide insight into the unique evolution and biology of these medically and economically important pathogens.

**2.** Sarwer, Q., Amjad, M. S., Mehmood, A., Binish, Z., Mustafa, G., Farooq, A., **Qaseem**, **M. F.**, Abasi, F., and Pérez de la Lastra, J. M. (2022). Green synthesis and characterization of silver nanoparticles using *Myrsine africana* leaf extract for their antibacterial, antioxidant and phytotoxic activities. *Molecules*, *27*, 7612. DOI: 10.3390/molecules27217612

**Abstract:** Nanotechnology is the study and control of materials at length scales between 1 and 100 nanometers (nm), where incredible phenomena enable new applications. It affects all aspects of human life and is the most active research topic in modern materials science. Among the various metallic nanoparticles used in biomedical applications, silver nanoparticles (AgNPs) are among the most important and interesting nanomaterials. The aim of this study was to synthesize AgNPs from the leaf extract of *Myrsine africana* to investigate their antibacterial, antioxidant, and phytotoxic activities. When the leaf extract was treated with AgNO3, the color of the reaction solution changed from light brown to dark brown, indicating the formation of AgNPs. The UV-visible spectrum showed an absorption peak at 438 nm, confirming the synthesis of AgNPs. Scanning electron microscopy (SEM) showed that the AgNPs were spherical and oval with an average size of 28.32 nm. Fourier transform infrared spectroscopy confirms the presence of bio-compound functional groups on the surface of the AgNPs. The crystalline nature of the AgNPs was confirmed by XRD pattern. These biosynthesized AgNPs showed pronounced antibacterial activity against Gram-positive and Gram-negative bacteria, with higher inhibitory activity against *Escherichia coli*. At 40 µg/mL AgNPs, the highest antioxidant activity was obtained, which was 57.7% and an IC50 value of 77.56 µg/mL. A significant positive effect was observed on all morphological parameters when AgNPs were applied to wheat seedlings under constant external conditions at the different concentrations. The present study provides a cost-effective and environmentally friendly method for the synthesis of AgNPs, which can be effectively used in the field of therapeutics, as antimicrobial and diagnostic agents, and as plant growth promoters.

## DEPARTMENTAL RESEARCH UPDATES

**DR. SCOTT WILLIAMS** was interviewed by Jennifer Ahrens of Connecticut Public Radio on the impact of a poor acorn crop to wildlife and public health in Connecticut (https://www.ctpublic.org/news/2022-11-13/connecticuts-depleted-acorn-crop-will-have-wide-reaching-impact) (November 9); gave an invited talk on the use of repellents in averting deer and rabbit damage to gardens to the Gardeners of Simsbury (27 attendees) (November 15); held a Zoom call with collaborators and scientists from the CDC on progress on an awarded grant project (November 28).

**MR. JOSEPH P. BARSKY** was interviewed by Jennifer Ahrens of Connecticut Public Radio about the importance of oak acorns for forest ecology in an article titled "Connecticut's depleted acorn crop will have wide-reaching impact" (November 8), Participated in the Yankee Division of the Society of American Foresters Fall Field Meeting on Old Growth Forest Dynamics (November 16).

**MR. GREGORY BUGBEE** presented the invited lecture titled "Hydrilla invades the Connecticut river" at the virtual Connecticut Invasive Pant Working Group Symposium (200 attendees) (November 3), with **MS. SUMMER STEBBINS** presented a seminar on "Invasive aquatic plants" as part of watershed inspector training at CTDPH headquarters in Hartford (80 attendees) (November 8); also with **MS. SUMMER STEBBINS** presented a lecture titled "A novel strain of Hydrilla invades the northeast" at the North American Lake Management Society Conference in Minneapolis, Minnesota (50 attendees) (November

16); gave a virtual update on invasive aquatic plants in Connecticut to the annual meeting of the Northeast Aquatic Nuisance Species Panel (30 attendees) (November 30); and gave an invited lecture titled "Invasive aquatic plants – Our lakes in peril" at the Guilford Public Library (50 attendees) (November 30).

**DR. ZHIHAO CHEN** attended the Methyl Bromide Alternatives Outreach Fumigation and Alternatives for Production, Storage and Trade Conference in Orlando, FL (November 2–4) and presented a research lecture titled "Potentiometric Method for the Sulfuryl Fluoride Hydrolyzate, $FSO_3$-" (50 attendees) (November 4).

**DR. SUSANNA KEIRÖ** met virtually with Dr. Monique Sakalidis from Michigan State University to discuss collaboration related to chestnut blight research (November 3); was awarded a grant to study the antimicrobial properties of Chinese chestnut bark against the chestnut blight pathogen (November 11); served on the Yale Biosafety Committee meeting (November 17); served on the CT Urban Forest Council meeting (November 17); and coordinated a Zoom meeting to recruit new examiners for the CT Tree Protection Examining Board (November 29).

**DR. SARA NASON** attending virtual meetings with the Benchmarking and Publications for Non-Targeted Analysis working group (November 9–10), gave a talk titled "Collaborative PFAS research using high resolution mass spectrometry: Challenges and progress" at the Eastern Analytical Symposium Plainsboro, NJ (23 attendees) (November 16); met with Dr. Satish Myneni, Professor of Geosciences in the Molecular Environmental Geochemistry Group at Princeton University and discussed potential collaboration (November 16); and met with stakeholders interested in expanding the use of non-targeted analysis in the fields of medical device regulation and emergency response (November 17).

**DR. FAISAL QASEEM** presented a research poster titled "Association of soil conditions, tree growth metrics and sugar levels (NSC) with urban maple decline" at the Connecticut Forest Forum's symposium, "Growing Grassroots in Connecticut's Forests" (October 26).

**DR. ITAMAR SHABTAI** presented a seminar for the Department of Natural Resources and Environment at the University of Connecticut (40 attendees) (November 4); met with a collaborator from Purdue University to discuss a project on microbial attachment to minerals using synchrotron radiation spectromicroscopy (November 17); and attended the Connecticut Agricultural Expo 2022 (November 18).

**MS. SUMMER STEBBINS** with **DR. MEGAN LINSKE**, **DR. SARAH THOMAS**, Dr. Ileana Reyes, **DR. AMINE HASSANI**, and **DR. QUAN ZENG** presented to a group of young women at Wilbur Cross High School to promote Women in STEM and a mentorship program between Wilbur Cross and CAES (10 attendees) (November 3).

**DR. CHARLES VOSSBRINCK** began teaching a laboratory class in Introductory Biology at Gateway Community College in New Haven (November 1).

**DR. JEFFREY WARD** participated in a (FEMC) Forest Ecosystem Monitoring Cooperative State Coordinators virtual meeting (November 10); and participated in a Connecticut Forest and Park Association (CFPA) Board of Directors meeting (November 16).

**DR. LEIGH WHITTINGHILL** gave the lecture "Preliminary findings on the effect of different fertilizer applications on cut-and-come-again kale production" at the Yale University's Sussex Plant Biology Symposium (November 4); and met with Nancy Grabowski from New Opportunities Inc., and Bill Davenport of UConn Extension to discuss CAES contributions/collaboration on an urban agriculture education grant (November 16).

## EVENTS

### 2022 Connecticut FFA Forestry Career Development Event

On November 10, the Department of Environmental Science and Forestry hosted the Connecticut FFA-Forestry Career Development Event at Lockwood Farm Pavilion. The event included several components and evaluated students' individual knowledge in the following areas: tree identification, mensuration, equipment, a compass practicum, and a general knowledge exam. In addition, a team event included a timber stand improvement scenario.

Forty-eight students from 12 high school agriscience programs in Connecticut participated in the event this year. The winning team this year attend the E. O. Smith High School in Storrs and will represent Connecticut at the National FFA Convention in 2023. The E. O. Smith team placed 10th nationally at the 2022 National FFA Convention.

The CAES would also like to thank and recognize Mr. Frank Cervo of CT-DEEP, Mr. Eric Hansen of Ferrucci and Walicki, LLC, and Mr. George Lyman for their participation and assistance with the event. **DR. SCOTT WILLIAMS** and **MR. JOSEPH P. BARSKY** of the Department of Environmental Science and Forestry and **DR. MEGAN LINSKE** of the Department of Entomology helped organize and oversee the event.

# PLANT PATHOLOGY AND ECOLOGY

**DR. YONGHAO LI** presented "Pruning 101" to the Windsor Garden Club members in Windsor (30 adults) (November 14); participated in the National Plant Diagnostic Network Online Communication and Web Portal Committee meeting via Zoom (7 adults) (November 18); attended the Plant Diagnostic Network Northeast Reginal meeting via Zoom (November 18).

**DR. ROBERT MARRA** met with Matt Gallagher of Great Mountain Forest to discuss research collaborations, and to collect beech leaf disease samples (November 2).

**DR. NEIL SCHULTES** gave an oral presentation titled "Probing metabolite requirements for *Erwinia amylovora* disease establishment" at the 84th Annual Meeting of New England Tree Fruit IPM Working Group, Fairlee, VT (50 attendees) (October 25-26).

**DR. WASHINGTON DA SILVA** delivered a seminar titled "Nano-enabled technologies: prospective weapons to tackle destructive plant viruses" at the Department of Plant Pathology and Crop Physiology at Louisiana State University in Baton Rouge, LA (50 attendees) (October 5). Attended the 2022 Working Lands Alliance Annual Meeting at Thomas Hooker Live Center, Hartford (30 attendees) (November 16). **DRS. NUBIA ZUVERZA-MENA, ITAMAR SHABTAI,** and **WASHINGTON DA SILVA** attended the 2022 CT Ag Expo at the Aquaturf Center in Southington (~70 attendees) (November 18).

**DR. RAVIKUMAR PATEL** presented his poster "Functional microbiomes of protist predators" at the 6th Sussex Symposium held at The CAES (November 4).

## PUBLICATIONS

**1.** Dumas, M., Borges, D., Preising, S., Tippett, E., Ambrosio, M. M. Q., and **da Silva, W. L.** (2022). Gathered from the vine: a survey of seven grapevine viruses within New England vineyards. *Plant Disease*. DOI: 10.1094/PDIS-03-22-0668-SR

**Abstract:** Vineyards in the Southeastern New England American Viticultural Area were surveyed for the incidence of seven major viruses: grapevine leafroll-associated viruses (GLRaV-1, GLRaV-2, GLRaV-3, and GLRaV-4), grapevine fanleaf virus (GFLV), tomato ringspot virus (ToRSV), and tobacco ringspot virus (TRSV). Viruses were detected by ELISA and confirmed by RT-PCR and Sanger sequencing. Multiple viruses were present in 19 out of the 25 vineyards surveyed between 2018 to 2020. GLRaV-3 (27.59%) was the most prevalent virus followed by GLRaV-4 (14.90%), GLRaV-1 (13.52%), GLRaV-2 (11.03%), ToRSV (6.34%), GFLV (5.24%), and TRSV (2.62%). Furthermore, phylogenetic analyses of the viral partial genome sequences acquired in this study revealed that the grapevine viruses present in this area are diverse, indicating that they may have been introduced from different sources. Our findings stress the need for improving the sanitary status of planting materials to avoid the introduction and dissemination of viruses to vineyards in this important wine-producing region of New England.

**2.** Borges, D. F., Nogueira, G. A., Cruz, G. A., Silva, S. G. A., **da Silva, W. L.**, Ambrósio, M. M. Q. (2022). Changes on soil microbiota induced by the use of commercial products and the incorporation of plant materials. *Revista Caatinga*.

**Abstract:** Growers have long adopted monoculture to maintain the high melon (*Cucumis melo* L.) production demand in the Northeastern region of Brazil. This cultivating strategy

culminates in up to three crop cycles per year being used. The main objective of this study was to evaluate if the incorporation of plant material used with polyethylene mulch and or in association with commercial soil amendment products can help to condition an environment that is beneficial to soil microbial communities. Two identical greenhouse experiments were conducted using a completely randomized design with seven treatments and seven replications. The treatments were: (C) – Control, (M) - polyethylene mulch, (C+M) - incorporation of *Crotalaria juncea* L. + polyethylene mulch, (P+M) - incorporation of Pennisetum glaucum L. + polyethylene mulch, (M+CS) - polyethylene mulch + (Compost-Aid® + Soil-Set®, trade names of products produced by Alltech Crop Science), (C+M+CS) - incorporation of *C. juncea* L. + polyethylene mulch + (Compost-Aid® + Soil-Set®), and (P+M+CS) - incorporation of *P. glaucum* L. + polyethylene mulch + (Compost-Aid® + Soil-Set®). To quantify the target soil microbiota (fungi, bacteria, sporulating bacteria, and actinomycetes), isolations were attempted on selective culture media specific for each group of microorganisms. Collectively, the incorporation of *P. glaucum* together with the use of polyethylene mulch and commercial products (Compost-Aid® and Soil-Set®), (P+M+CS), increased the total fungi population by 183%, total bacteria by 55%, sporulating bacteria by 21%, and actinomycetes 146% in relation to the control treatment.

**Dr. da Silva** with LSU students during his visit to the University.

# VALLEY LABORATORY

**DR. CAROLE CHEAH** gave a zoom presentation on 10 years of biological control of mile-a-minute weed at the virtual Connecticut Invasive Plant Working Group (CIPWG) Symposium "Strategies for Managing Invasive Plants" (49 attendees) (November 3); and gave an evening presentation on collaborations in biological control of hemlock woolly adelgid at the Environmental Research Symposium hosted by Flanders Land Trust and the Taft School, at Taft School in Watertown (152 attendees) (November 3).

**DR. RICHARD COWLES** presented "Climate change science and its impacts on rose culture" for the Connecticut Rose Society, (20 participants) (November 6). He discussed "Facts and fallacies of organic agriculture" at the Waterbury Senior Center (25 participants) (November 7). He discussed "Pesticide resistance: theory and practice" to the Connecticut Environmental Council in Woodbridge (120 participants) (November 29).

**MS. ROSE HISKES** hosted Master Conservationist Cassandra Schelhas for a jumping worm identification session (November 1); organized, moderated, and participated in the Connecticut Invasive Plant Working Group (CIPWG) Virtual Symposium (419 attendees) (November 3); participated in a CIPWG Symposium wrap up session (10 attendees) (November 17).

**DR. JAMES LAMONDIA** presented "Using biological and epidemiological knowledge to improve boxwood blight management" at the Quarterly Project Director and Associate Meeting (20 attendees) (November 16); and spoke about reduced tillage in Connecticut broadleaf tobacco for a webinar hosted by the American Farmland Trust, the recording of which is posted online (12 participants) (November 17).

## PUBLICATIONS

**1.** Zhou, M., Liu, Z.-B., Lim, Y. W., Cho, Y., Yang, R.-H., Bao, D.-P., Zhao, C.-L., **Li, D.-W.**, Vlasák, J., and Dai, Y.-C. (2022). Two new species of *Fistulina* (Agaricales, Basidiomycota) from the Northern Hemisphere. *Front. Microbiol*. *13*. DOI: 10.3389/fmicb.2022.1063038

**Abstract:** Phylogenetic and morphological analyses on samples of *Fistulina* from East Asia and North America were carried out, and two new species were described, namely, *Fistulina americana* and *Fistulina orientalis*, both previously known as *Fistulina hepatica*. The former is characterized by lateral stipitate basidiocarps, relatively small pores (7–8 per mm), a monomitic hyphal system with both clamp connections and simple septa, and ellipsoid basidiospores of 4–4.8 × 3–3.3 mm, and the species has been found on Quercus in North-East USA. *F. orientalis* is characterized by lateral stipitate basidiocarps, very small pores (11–12 per mm) with pruinose dissepiments, a monomitic hyphal system with both clamp connections and simple septa, and ovoid to subglobose basidiospores of 3–4 × 2.7–3 mm, and the species has been found on *Castanopsis* in East Asia. Phylogenetically, samples of *F. americana* and *F. orientalis* form two new lineages nested in the *Fistulina* clade.

# JOURNAL ARTICLES APPROVED NOVEMBER 2022

**Wang, Z.**, Alinezhad, A., **Nason, S.**, Xiao, F., and **Pignatello, J. J.** Enhancement of per - and polyfluoroalkyl substances removal from water by pyrogenic carbons: Tailoring carbon surface chemistry and pore properties. *Water Research*.

**Wang, Z.**, Alinezhad, A., Sun, R., Xiao, F., and **Pignatello, J. J.** Pre- and post-application thermal treatment strategies for sorption enhancement and reactivation of biochars for removal of perfluoroalkyl substances from water. *ACS ES&T Engineering*.

Price, K. J., Khalil, N., Witmier, B. J., Coder, B. L., Boyer, C. N., Foster, E., Eisen, R. J., and Molaei, G.* Evidence of *Babesia microti* and *Borrelia burgdorferi* sensu lato Infection and Co-infection and Partial Blood Feeding in the Invasive Tick, *Haemaphysalis longicornis* in Pennsylvania, USA. *Ticks and Tick-borne Diseases*.

Li, M., Zhang, P., Guo, Z., Cao, W., Gao, L., **Li, Y.**, **White, J. C.**, Rui, Y., and Lynch, I. Multifunctional molybdenum disulfide nanofertilizer enhances biological nitrogen fixation and yield of soybean. *Nature*.

**Aulakh, J. S.** Weed Efficacy and Ornamental Plant Tolerance to Dimethenamid–p + Pendimethalin Herbicide. *Journal of Environmental Horticulture*.

Wang, L., Xu, M., Song, C., **White, J. C.**, Gan, Y., Zhang, X., Liang, J., Wu, X., Wang, Y., and Yang, W. Biosynthesis of nanoscale Ag composite by metabolite extracts from soybean pods and tea residues: Enhanced antioxidant and antibacterial applications. *Science of the Total Environment*.

Leite, A. A., Melo, L. C. A., Hurtarte, L. C. C., Zuin, L., Piccolla, C. D., Werder, D., **Shabtai, I.**, and Lehmann, J. Magnesium-enriched poultry manure enhances phosphorus bioavailability in biochars. *Chemosphere*.

Karmous, I., **Vaidya, S.**, **Dimkpa, C.**, **da Silva, W.**, Alves Barroso, K., Milagres, J., **Zuverza-Mena, N.**, **Bharadwaj, A.**, Abdelraheem, W., **White, J. C.**, and **Elmer, W. H.** Biologically synthesized zinc and copper oxide nanoparticles using *Cannabis sativa* L. enhance soybean (*Glycine max*) defense against *Fusarium virguliforme*. *Plant Biotechnology Journal*.

Curtis, B. J., Niemuth, N. J., Bennett, E., Schmoldt, A., Mueller, O., Mohaimani, A. A., Laudadio, E. D., Henke, A., Shen, Y., **White, J. C.**, Hamers, R. J., and Klaper, R. D. Time dependent transcriptomic trends in three model freshwater organisms after exposure to lithium cobalt oxide nanomaterial. *Environmental Science and Technology*.

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