

Station News

The Connecticut Agricultural Experiment Station
Volume 11 Issue 9 September 2021



This Issue

The mission of The Connecticut Agricultural Experiment Station is to develop, advance, and disseminate scientific knowledge, improve agricultural productivity and environmental quality, protect plants, and enhance human health and well-being through research for the benefit of Connecticut residents and the nation. Seeking solutions across a variety of disciplines for the benefit of urban, suburban, and rural communities, Station scientists remain committed to "Putting Science to Work for Society", a motto as relevant today as it was at our founding in 1875.



CAES

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875

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GRANTS RECEIVED AUGUST 2021

1. Paulo Verardi (UConn), **Doug Brackney**, and Anthony Griffith (Boston University, National Emerging Infectious Diseases Laboratory). “Vaccines for Prevention of RG3 and RG4 Emerging Tickborne Viral Diseases.” CAES share \$352,302; 8/20/2021–7/31/2026.

Project Summary: Tickborne illnesses continue to be a significant public health concern in the US and worldwide, as environmental and climate changes have allowed the dramatic expansion of ticks, tick habitats, and their mammalian hosts. In the New England region alone, Lone Star ticks were first reported in 2017, followed by the establishment of exotic Asian longhorned ticks in 2018. A recent CDC report indicates that tickborne diseases in the US have more than doubled from 2004 to 2016, accounting for 77% of all reported vector-borne diseases. The report also indicates that the US is not fully prepared to prevent and control these threats. A number of tickborne viruses that cause encephalitis and hemorrhagic fever in humans are of particular concern in the US, such as the re-emerging Powassan virus (POWV), as well as the recently discovered Heartland virus (HRTV). Another emerging tickborne virus in Asia is severe fever with thrombocytopenia syndrome virus (SFTSV), closely related to HRTV, which is transmitted by the Asian longhorned tick that is spreading rapidly and is now present in 12 US states. A number of additional exotic tickborne viral agents are of concern to the US, including tickborne encephalitis virus (TBEV), Omsk hemorrhagic fever virus (OHFV), and Crimean-Congo hemorrhagic fever virus (CCHFV). To better prepare for these emerging threats, we assembled a team of experts in (1) vaccine development at the University of Connecticut, (2) tickborne viruses at the Connecticut Agricultural Experiment Station, and (3) animal models in maximum biocontainment at the National Emerging Infectious Diseases Laboratories and propose the development and testing of vaccines for four Risk Group 3 (RG3) and RG4 tickborne encephalitis and hemorrhagic fever viruses classified as NIAID Category A or C Priority Pathogens, and prioritized by the WHO under its most recent 2018 Blueprint list of priority diseases in need of accelerated research and development. We developed a rapid method to generate vaccinia virus (VACV) vectors that will allow us to quickly test a number of tickborne viral genes to ensure robust expression of protective antigens and secretion of virus-like particles (VLPs). This platform is based on a gold-standard viral vector (VACV) that induces high levels of humoral and cell-mediated immune responses. These VACV vectors are replication-defective when administered as a vaccine, yet easy to propagate in standard cell culture at high titers, unlike other replication-defective poxvirus vectors such as MVA. We will also generate DNA-based vaccines and purified VLPs (as a subunit vaccine), so that three different classes of vaccine candidates can be tested for immunogenicity, either alone or in prime-boost regimens. Finally, we will test the efficacy of the vaccines using tick-transmission animal models to recapitulate the enhancement of transmission and dissemination that has been documented by tick feeding.

2. **Scott Williams** and **Megan Linske**. “Evaluation of Fall and Spring Acaricide Applications to Suppress Host-Seeking *Ixodes scapularis* Ticks.” Competitive contract from the Centers for Disease Control and Prevention (\$220,000).

Project Summary: The work will compare fall to the more traditional spring application of a synthetic pyrethroid on the spring host-seeking nymphal *Ixodes scapularis* cohort. A late fall application would result in less incidental mortality to pollinators and other beneficial insects and hopefully will negatively impact spring tick populations as well.

DR. JASON C. WHITE hosted a Zoom meeting with collaborators at Johns Hopkins University to discuss joint experiments (August 3, 30); participated in the Center for Sustainable Nanotechnology (CSN) Zoom call for the Summer Undergraduate Research Experience (SURE) program conclusion (August 5); participated in the monthly FDA LFFM Zoom calls for Human and Animal Food and Food Defense (August 9); with **DR. CHRISTIAN DIMKPA**, hosted a Zoom call with Ms. Iqra Naseer, a PhD Scholar from Lahore College for Women University in Pakistan about a potential 6-month research visit to CAES (August 9); participated in the monthly NSF CSN Faculty Zoom call (August 10); gave a presentation entitled “Nano-enabled Agricultural Research at the CT Agricultural Experiment Station” at Nanotechnology Research and Innovation Bootcamp 2021 “Harnessing Nanotechnology for Sustainable Development in Energy, Water, Health, and Agriculture,” which was sponsored by the United Nations Economic Commission for Africa and the African Materials Research Society (August 11); participated in the weekly NSF CSN All-Hands calls (August 11, 18); participated in a Zoom call with Dr. Hongda Chen of the USDA National Institute of Food and Agriculture (NIFA) to discuss research topics in nano-enabled agriculture (August 12); hosted a Zoom call with Dr. Gul-i-Rayna Shahzad of the Free University of Bozen-Bolzano (Italy) to discuss potential collaborative research (August 13); hosted the NSF CSN monthly Nanochem-Plant working group Zoom call (August 17); with **DR. WADE ELMER**, participated in a Zoom call with collaborators at the University of Maryland to discuss the use of novel 2-dimensional materials for agrochemical delivery (August 19); participated by Zoom in a USDA NIFA Agriculture and Food Research Initiative (AFRI) grant review panel (August 23-27); with **DR. JAYA BORGATTA**, participated in a Zoom meeting with a Greenwich High School student to discuss a potential internship position (August 24); participated by Zoom in a Farmland Preservation Advisory Board (FPAB) meeting (August 26); participated in a Zoom meeting with collaborators at Rutgers University to discuss collaborative research and manuscript preparation (August 27); participated in a teleconference call with Dr. Lee Newman of SUNY ESF to discuss the *International Journal of Phytoremediation* (Dr. Newman is the Editor-in-Chief and I am the Managing Editor) (August 30); and with **DR. CHRISTIAN DIMKPA**, **DR. WADE ELMER**, **DR. ISHAQ ADISA**, and **DR. JAYA BORGATTA**, participated in a monthly research group call for a joint USDA-funded project on nanoscale phosphorus delivery (August 31).



United Nations
Economic Commission
for Africa

SPEAKERS



NANOTECHNOLOGY RESEARCH AND INNOVATION BOOTCAMP 2021
"Harnessing Nanotechnology for Sustainable Development in Energy, Water, Health and Agriculture"

10-13 AUGUST 2021

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ANALYTICAL CHEMISTRY

DR. BRIAN EITZER retired from the Station after 32 years of service. During this time, he rose to the position of full Agricultural Scientist, and assumed the acting Head of the Department of Analytical Chemistry (DAC) for a period of time in 2020. Over the years, Dr. Eitzer conducted research and public service on the detection and characterization of various types of toxins and other contaminants in food, water, and soil samples. In 2005, Brian became involved with the food emergency response network, where he quickly became a well-respected collaborator, traveling annually to national meetings as well as serving as the top analyst for the different samples involved in the program. While the analytical chemistry tools and methods have changed over the last 32 years, Brian's dedication, commitment to quality work, and willingness to perform any and all tasks relevant to his research and service remained steadfast. His ability to quickly familiarize with the changing landscape of analytical chemistry instrumentation in the last three decades indeed speaks to his great intelligence and adaptability. The entire DAC staff and management will miss Brian's dedication to duty. Thankfully, he was granted Emeritus status and will continue to professionally associate with the department. On the personal side, some of Brian's early colleagues in the department note that he enjoys fine dining, with lots of meat and beer samplers. The DAC is proud of the work that Brian conducted over the years and wishes him well in his well-deserved retirement.

DR. CHRISTINA ROBB participated in the Executive Committee meetings of the Eastern Analytical Symposium (EAS) (August 2, 9, 16, 23, 30); attended FDA LFFM Human and Animal Food and Food Defense calls (August 9); and joined the Royal Society of Chemistry (RSC) including the Analytical division and Separation Science group.

ENTOMOLOGY

DR. KIRBY C. STAFFORD III was appointed to the Health and Human Services Tick-Borne Disease Working Group, which was originally established by Congress in 2016, and participated in the first TBDWG meeting for this current two-year cycle (August 26).

MS. TIA M. BLEVINS participated in a webinar update from UMASS on trapping, research, and monitoring efforts for the invasive pest, spotted lanternfly (*Lycorma delicatula*) (August 31).

DR. MEGAN LINSKE participated in a Diversity, Equity, and Inclusivity Tactics discussion for The Wildlife Society (TWS) as both President of the Northeast Section of TWS and as a Leadership Institute alumni (August 31).

DR. GALE E. RIDGE participated in the Colin McEnroe WNPR radio show about flies, talking about experience in forensic entomology, maggot therapy, and rabbit bot fly infesting a Middlebury man (August 19).

DR. CLAIRE E. RUTLEDGE presented a talk via livestream entitled "They're Here, They're Coming and We Don't Want Them: Emerald Ash Borer, Spotted Lanternfly and Asian Longhorned Beetle" to the White Memorial Conservation Center (10 adults) (August 7); and supported her student Joselyn Clark in her talk entitled "Searching for Resistance to Emerald Ash Borer in Native Ash" to the Roxbury Land Trust via livestream (August 12).

DR. VICTORIA L. SMITH participated in a meeting of the Yale Biosafety Committee via Zoom (August 19); and was interviewed concerning spotted lanternfly by Caren Pinto of News 12 (August 26).

DR. KIMBERLY A. STONER participated in an online meeting of the Connecticut Native Plant Working Group (13 participants) (August 25).

ENVIRONMENTAL SCIENCES

DR. PHILIP ARMSTRONG was interviewed about West Nile virus activity in the state by the *Connecticut Post* (August 18); and was interviewed about the potential impacts of Tropical Storm Henri on mosquito populations and West Nile virus risk by NBC CT, News Channel 8, Fox CT, the *Connecticut Post*, and WTIC (August 24, 25).

MS. ANGELA BRANSFIELD participated in the Federal Select Agent Program's Responsible Official Webinar Series eFSAP "Did You Know?"; eFSAP System Updates (August 18).

MR. GREGORY BUGBEE gave a virtual "Brown Bag" seminar entitled "Hydrilla Invades the Connecticut River" to staff of the Connecticut Department of Environmental Protection (approx. 40 attendees) (August 3); gave a talk entitled "Aquatic Plant Survey and Management of Vegetation in Long and Bush Ponds" to the Lantern Hill Association in North Stonington (approx. 50 attendees) (August 21); participated as a panelist in the mid-term meeting of the Northeast Aquatic Nuisance Species Panel (August 25); and gave a talk entitled "Aquatic Plant Survey and Management of Variable Watermilfoil in Staffordville Reservoir" to the Staffordville Reservoir Association in Staffordville (approx. 50 attendees) (August 30).

DR. GOUDARZ MOLAEI was interviewed on the state of tick activity season by the *Hartford Courant*, <https://www.courant.com/news/connecticut/hc-news-ct-more-ticks-20210816-eafwrhehkbhspacc7r5qrw4m4m-story.html> (August 13); was interviewed on tick activity this year by WTIC-1080 AM, https://www.audacy.com/wtic/news/state/ct-is-experiencing-an-increase-in-the-tick-population?media_suffix=WTICAM (August 16); was interviewed on invasive tick species in Connecticut by NBC Connecticut (August 16); and was interviewed on the established population of the Asian longhorned tick in New Haven County by WTNH Channel 8 (August 31).

MR. JOHN SHEPARD provided updates from the CT Mosquito Trapping and Arbovirus Surveillance Program as part of Arbovirus Situational Awareness conference calls organized by the Northeast Regional Center for Excellence in Vector-Borne Diseases (25-37 participants) (August 2, 16, 30); provided an in-person overview of the CT Mosquito Trapping and Arbovirus Surveillance Program to Paul Kowalski and Kelly Tiernan of the West Haven Health Department (August 18); and participated in a virtual meeting of the Board of Directors for the Northeastern Mosquito Control Association (August 20).

DR. CHARLES VOSSBRINCK gave a lecture entitled "Growing Figs in Connecticut," a poster, and a demonstration of fig plantings at Lockwood Farm to students from the University of Connecticut's Master Gardener program (10 attendees) (August 31).

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD met with Aspetuck Land Trust members to discuss invasive species control (7 attendees) (August 17); met with Marc Trembley (RIFCO) to discuss effectiveness of slash walls in Foster, RI (August 24); met with Gabriel Horton and Pavel Pluhar (USAG West Point, NY) to discuss forest regeneration in areas with high deer density (August 25); and met with Will Hochholzer and CT DEEP Forestry staff to discuss forest regeneration (August 26).

DR. SUSANNA KERIÖ served as a reviewer on a USDA NIFA grant panel (August 17).

DR. SCOTT C. WILLIAMS participated in a conference call for the Editorial Advisory Board for The Wildlife Society's publication, *The Wildlife Professional* (August 10); and participated in a conference call advising staff at the Norcross Wildlife Sanctuary (Wales, MA) on deer management options (August 23).

PLANT PATHOLOGY AND ECOLOGY

DR. WADE H. ELMER attended the annual meeting of the American Phytopathological Society via Zoom (August 3-5); attended the NIFA plan of work conference webinar (51 attendees) (August 7); with **DRS. JASON WHITE, CHRISTIAN DIMKPA, JAYA BORGATTA,** and **YI WANG,** participated via Zoom in the CAES-UMASS Nano S update (6 attendees) (August 10); attended via Zoom the CNS Plant Nano Group meeting (26 attendees) (August 17); attended via Zoom the monthly APS Foundation committee meeting (9 attendees) (August 18); attended the CT Management Advisory Council Meeting (148 attendees) (August 18); and presented the Keynote lecture entitled "Nanotechnology and Plant Disease Management" at the 52nd Conference at the Brazilian Phytopathology meeting (493 participants) (August 25).

DR. YONGHAO LI presented "Backyard Composting 101" for the Avon Free Public Library Education Program via Zoom (38 adults) (August 18); presented a talk about "Abiotic Stress and Needle Cast Diseases" at the Connecticut Christmas Tree Growers Association Twilight Meeting in East Windsor (40 adults) (August 18); and presented "Principles of Organic Gardening" for the Conning Wellness Program via Zoom (51 adults) (August 19).

DR. ROBERT E. MARRA participated in a Beech Leaf Disease Working Group Zoom meeting with collaborators from Ohio, West Virginia, Ontario (CA), New York, USDA -ARS, and the US Forest Service (45 participants) (August 17).

DR. RAVIKUMAR PATEL presented "Populations of *Pseudomonas syringae* pv. *phaseolicola* Use Different Kinds of Persistence to Survive Biological and Chemical Control Treatments" as a Research on Demand presentation in the Plant Health 2021 virtual meeting (August 3).

DR. STEPHEN J. TAERUM organized and moderated the special session, "From the Top Down: How Microbial Predators Mediate Plant Disease" for the American Phytopathological Society Plant Health 2021 online meeting (186 adults) (August 2); moderated the technical session, "Plant-Associated Microbiome Composition and Activity" for the American Phytopathological Society Plant Health 2021 online meeting; and presented "A Dual Sequence and Culture-Based Survey of Maize Rhizosphere Protists Reveals Dominant, Plant-Enriched, and Culturable Community Members"

for the American Phytopathological Society Plant Health 2021 online meeting (132 adults) (August 4).

JUSTIN ALAMO (UConn '23, left) and **HANNAH COVER** (CCSU '22, right) recently completed summer internships in the lab of Dr. Lindsay Triplett. They assisted Drs. Stephen Taerum and Ravi Patel in experiments toward understanding the importance of protists in plant health. They presented their data in a lab meeting on August 17.



VALLEY LABORATORY

DR. RICHARD COWLES presented display posters of “Response of Bare-Root Christmas Tree Transplants to Fertilizer at Planting” and (for the children’s passport) “What Essential Minerals Do You Need?” for Plant Science Day in Hamden (August 4); presented “Soil Health” to the Massachusetts Christmas Tree Growers Association meeting in Hatfield, MA (45 participants) (August 14); hosted the Twilight Meeting for the Connecticut Christmas Tree Growers Association and discussed “After-Effects of Drought on Cone Production and Spruce Spider Mites” and “Phytophthora, Drainage and Soil Health” in Broad Brook (50 attendees) (August 18).

DR. JAMES LAMONDIA participated in the online American Phytopathological Society meeting (August 2-6); met virtually with SCRI colleagues to present research results in boxwood blight epidemiology (August 10); participated in the Beech Leaf Disease Update Zoom meeting (20 attendees) (August 17); and participated in a SCRI Boxwood Blight Grant project Zoom progress update meeting (15 attendees) (August 18).

DR. CAROLE CHEAH instructed two forestry interns from Great Mountain Forest, Norfolk, on hemlock pest identification and damage assessment (July 13); and assessed HWA infestations at Doolittle Lake, a private lake association in Norfolk, and gave a presentation on biological control of HWA (8 attendees) (August 26).

ADMINISTRATION:

1. Hou, J., C. Hu, J. C. White, K. Yang, L. Zhu, and D. Lin. 2021. Nano-zoo interfacial interaction as a design principle for hybrid soil remediation technology. *ACS Nano*. DOI: 10.1021/acsnano.1c05180.

Abstract: Using nanotechnology to remediate organochlorine-contaminated agricultural soil is promising but faces notable economic and technical challenges. Importantly, widely distributed soil invertebrates can potentially act as natural mobile facilitators for in situ nanoscale remediation of contaminated soil. Here, we have established a novel nanoscale-bioremediation technology using nanoscale zero-valent iron (nZVI) and nematodes for organochlorine-contaminated paddy soil. Approximately 80% soil pentachlorophenol (PCP, initially 50 mg/kg) was synergistically degraded by nZVI and nematodes within 3 days. Mechanistically, exposure to nZVI increased the generation of reductive biomolecules (including collagen, glutathione, and cysteine) which acted as a bioreductive barrier and significantly mitigated the toxicity of PCP. At the micro-interface, collagen distributed in the epidermis chelated nZVI; subsequently, L-cysteine and glutathione located below epidermis strongly accelerated nZVI-induced PCP dechlorination by facilitating the reductive dissolution of nZVI oxide shell and thus, electron transfer from the core Fe⁰ to PCP. Based on the micro-interfacial interaction, an optimized soil remediation approach composed of nZVI, nematodes, and L-cysteine was established, demonstrating further increased PCP dechlorination rates at lower rates of nZVI consumption. This work draws inspiration from unique nano-bio interaction mechanisms to provide a cost-effective approach for nano-enabled bioremediation that may be widely applicable to a range of environmental contamination scenarios.

2. Sigmon, L. R., I. Adisa, B. Liu, W. H. Elmer, J. C. White, C. O. Dimkpa, and D. H. Fairbrother. 2021. Biodegradable polymer nanocomposites provide effective delivery and reduced runoff of phosphorus during plant growth. *ACS Agric. Sci. Technol.* DOI: 10.1021/acscitech.1c00149.

Abstract: Although phosphorus (P) is an essential element, its availability to plants is often limited, and P-containing fertilizers must be supplemented to stimulate plant performance. However, the inefficiencies and/or negative environmental impacts associated with delivery strategies have motivated interest in nanotechnology-enabled agriculture. Here, we used solution blending to synthesize biodegradable polymer nanocomposites containing polyhydroxyalkanoates (PHA) with 5, 10, and 20 wt% calcium phosphate (CaP) nanoparticles and compared their efficacy as a vehicle for P-delivery to conventional P fertilizer (CaHPO₄), using tomato as a test plant. Plant performance was ascertained by biomass, yield, tissue elemental and chlorophyll content, and enzymatic biomarkers. A 155-day study assessed the impacts of PHA-CaP nanocomposites on fruit production and quality. Our results demonstrate that PHA-CaP nanocomposites support plant performance comparable to conventional P fertilizers, while reducing the magnitude of P in runoff by over 80%. Given the increasing global demand for nonrenewable mineral P-based fertilizers and the negative environmental consequences of eutrophication due to P in agricultural runoff, significant reduction in leached P has broader implications. Collectively, these findings demonstrate the significant potential of biopolymer nanocomposites as a powerful nano-enabled agricultural tool to simultaneously enhance crop productivity and reduce the negative impacts of agriculture on the environment.

3. Cao, X., X. Pan, S. Couvillion, T. Zhang, C. Tamez, L. M. Bramer, J. C. White, W.-J. Qian, B. D. Thrall, K. W. Ng, X. Hu, and P. Demokritou. 2021. Fate, cytotoxicity and cellular metabolomic impact of ingested carbon dots using simulated digestion and a triculture small intestinal epithelial model. *NanoImpact* 23:100349.

Abstract: Carbon dots (CDs) are a promising material currently being explored in many industrial applications in the biomedical and agri-food areas; however, studies supporting the environmental health risk assessment of CDs are needed. This study focuses on various CD forms including iron (FeCD) and copper (CuCD) doped CDs synthesized using hydrothermal method, their fate in gastrointestinal tract, and their cytotoxicity and potential changes to cellular metabolome in a triculture small intestinal epithelial model. Physicochemical characterization revealed that 75% of Fe in FeCD and 95% of Cu in CuCD were dissolved during digestion. No significant toxic effects were observed for pristine CDs and FeCDs. However, CuCD induced significant dose-dependent toxic effects including decreases in TEER and cell viability, increases in cytotoxicity and ROS production, and alterations in important metabolites, including D-glucose, L-cysteine, uridine, citric acid and multiple fatty acids. These results support the current understanding that pristine CDs are relatively non-toxic and the cytotoxicity is dependent on the doping molecules.

4. Zhu, J., J. Wang, Y. Shen, X. Zhan, A. Li, J. C. White, J. Gardea-Torresdey, and B. Xing. 2021. Role of charge and size in the translocation and distribution of zinc oxide particles in wheat cells *ACS Sustain. Chem. Eng.* 9(34):11556-11564.

Abstract: Nanoscale fertilizers offer the potential to sustainably enhance crop yield and quality. Foliar application of nano-fertilizers may improve utilization efficiency and significantly mitigate environmental risks compared to conventional chemical fertilizers applied through either soil or foliar routes. However, limited understandings of how the mechanisms controlling nanoparticle delivery and distribution are affected by nanoparticle properties impedes the efficacy and application of nano-fertilizers. Here, 2 mmol L⁻¹ zinc oxide particles with different characterizations (sizes, shapes and charges) were used to investigate delivery and distribution processes in wheat leaves and cells. Results suggested that the adsorption of ZnO particles onto leaf surface and cell wall was enhanced by both smaller sizes (main factor) and positive charge. Three-dimensional confocal laser scanning microscopy images indicated that positively charged nanoparticles distributed more uniformly inside the leaf than negatively charged ones. At the cellular level, only nanoscale particles could cross the cell wall and be transported into the cytoplasm. However, the translocation of both nanoscale and bulk particles was observed in unwalled cells, with uptake of the smaller particles being enhanced by positive charges. These findings provide valuable information for the optimized design of nano-fertilizers to improve their use and efficacy in agriculture.

ENVIRONMENTAL SCIENCES:

1. Brown, S. C., J. Cormier, J. Tuan, A. J. Lier, D. McGuone, P. M. Armstrong, F. Kaddouh, S. Parikh, M. L. Landry, and K. T. Gobeske. 2021. Four human cases of Eastern equine encephalitis in Connecticut, USA, during a larger regional outbreak, 2019. *Emerg. Infect. Dis.* 27(8):2042-2051.

Abstract: During three weeks in 2019, four human cases of Eastern equine encephalitis (EEE) were diagnosed at a single hospital in Connecticut, USA. The cases coincided with notable shifts in vector-host infection patterns in the northeastern United States.

ed States and signified a striking change in EEE incidence. All four cases were geographically clustered, rapidly progressive, and neurologically devastating. Diagnostic tests conducted by a national commercial reference laboratory revealed initial granulocytic cerebrospinal fluid pleocytosis and false-negative antibody results. EEE virus infection was diagnosed only after patient samples were retested by the arbovirus laboratory of the Centers for Disease Control and Prevention in Fort Collins, Colorado, USA. The crucial diagnostic challenges, clinical findings, and epidemiologic patterns revealed in this outbreak can inform future public health and clinical practice.

PLANT PATHOLOGY AND ECOLOGY:

1. Stravoravdis, Stefanos, Robert E. Marra, Nicholas R. LeBlanc, Jo A. Crouch, and Jonathan P. Hulvey. 2021. Evidence for the role of *CYP51A* and xenobiotic detoxification in differential sensitivity to azole fungicides in boxwood blight pathogens. *Int. J. Mol. Sci.* 22(17):9255, <https://doi.org/10.3390/ijms22179255>.

Abstract: Boxwood blight, a fungal disease of ornamental plants (*Buxus* spp.), is caused by two sister species, *Calonectria pseudonaviculata* (*Cps*) and *C. henricotiae* (*Che*). Compared to *Cps*, *Che* is documented to display reduced sensitivity to fungicides, including the azole class of antifungals, which block synthesis of a key fungal membrane component, ergosterol. A previous study reported an ergosterol biosynthesis gene in *Cps*, *CYP51A*, to be a pseudogene, and RNA-Seq data confirm that a functional *CYP51A* is expressed only in *Che*. The lack of additional ergosterol biosynthesis genes showing significant differential expression suggests that the functional *CYP51A* in *Che* could contribute to reduced azole sensitivity when compared to *Cps*. RNA-Seq and bioinformatic analyses found that following azole treatment, 55 genes in *Cps*, belonging to diverse pathways, displayed a significant decrease in expression. Putative xenobiotic detoxification genes overexpressed in tetraconazole-treated *Che* encoded predicted monooxygenase and oxidoreductase enzymes. In summary, expression of a functional *CYP51A* gene and overexpression of predicted xenobiotic detoxification genes appear likely to contribute to differential fungicide sensitivity in these two sister taxa.

Kapoor, P., R. K. Dhaka, P. Sihag, S. Mehla, V. Sawal, Y. Singh, S. Langaya, P. Bal-yan, K. P. Singh, B. Xing, **Jason C. White**, O. P. Dhankher, and U. Kumar. Nano-technology-enabled biofortification strategies for micronutrient enrichment of food crops: Current understanding and future scope. *Nanomaterials*.

Maynard, Abigail A., and Jeffrey S. Ward. Plasticulture increases okra yields in Connecticut: Evaluation of ten okra cultivars. *CAES Bulletin*.

Mendez, O., C. E. Astete, **Brian D. Eitzer**, F. Salina, **Carlos Tamez**, **Yi Wang**, **Jason C. White**, and C. M. Sabliov. Lignin nanoparticles as delivery systems to facilitate translocation of methoxyfenozide in soybean (*Glycine max*). *Journal of Agriculture and Food Research*.

Shen, Y., Jaya Borgatta, C. Ma, G. Singh, Carlos Tamez, Neil P. Schultes, Z. Zhang, O. Parkash Dhankher, Wade H. Elmer, L. He, R. J. Hamers, and Jason C. White. Role of foliar biointerface properties and nanomaterial chemistry in controlling Cu transfer into wild type and mutant *Arabidopsis thaliana* leaf tissue. *ACS Nano*.

Stafford, Kirby C., Goudarz Molaei, Scott C. Williams, and J. W. Mertins. Introduction of the geographically restricted South African tick species *Rhipicephalus capensis* (Acari: Ixodidae) into the United States with a human traveler. *Ticks and Tick-borne Diseases*.

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