Station News

The Connecticut Agricultural Experiment Station
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"Coastal region in Fairfield County, Connecticut with an established population of the Asian longhorned tick, an invasive pathogen vector and ectoparasite. Photo courtesy of G. Molaei, E. Little, S. Williams, and K. Stafford III, under publication by the *Journal of Medical Entomology*. The female Asian longhorned tick photographed by Katherine Dugas."

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 participated in the monthly Laboratory Preparedness Advisory Committee teleconference call with the CT Department of Public Health (May 3); participated in the annual FDA audit of the CT Department of Consumer Protection's Manufactured Food Regulatory Program Standards (MFRPS) project (May 4); met with Ms. Lauren Tarde, a masters candidate at The American University of Rome, to discuss her work on "Food Studies and Sustainable Production and Consumption Policies," with a specific focus on young CT farmers and the obstacles they encounter with regards to access to land (May 4); participated in the biweekly meeting of the CT Rapid Response Team (May 5, 18); participated in the weekly Center for Sustainable Nanotechnology (CSN) All-Hands call (May 5, 12, 26); participated in an organizational ZOOM call for planning the annual FDA Laboratory Flexible Funding Model (LFFM) meeting (May 5); participated in a ZOOM meeting with collaborators at Louisiana State University and the University of Auckland (New Zealand) to discuss our collaborative USDA project (May 6); was interviewed by Mr. Mario Jandrisevits who is a student of Vienna's University of Economics and Business and discussed new application fields in which nano-material silicon carbide could be used (May 7); participated in a Teams meeting with representatives from the CT Department of Agriculture to discuss updates for next year's sampling plan as part of the FDA LFFM Animal Food Project (May 7); participated in the 3rd International Conference on Plant Science and Research (Virtual) and gave an invited talk entitled "Nanotechnology and Agriculture: Tuning Agrochemical Chemistry at the Nanoscale to Maximize Crop Production" (May 10-11); participated in the monthly FDA LFFM WebEx calls for the Human & Animal Food and Food Defense cooperative agreement programs (May 10); met with Mr. Chris Sullivan and Ms. Melissa Mostowy of the Southwest Conservation District and gave a tour of CAES facilities and programs (May 11); had a ZOOM call with Professor Yu Yang of the University of Nevada Reno to discuss a collaborative USDA proposal (May 12, 20); participated in a ZOOM call with collaborators at the University of Birmingham (UK) and China Agricultural University to discuss collaborative research (May 13); as a member of her committee, participated in a ZOOM call with Ms. Jaya Borgatta of the University of Wisconsin about her PhD research (May 13); participated in an American Chemical Society webinar entitled "Nanosafety: Emerging Research Perspectives" (May 13); held a ZOOM call with collaborators at Johns Hopkins University to discuss collaborative research (May 14); participated by ZOOM call with collaborators at the Nanyang Technological University to plan upcoming collaborative experiments (May 17); participated in a ZOOM call with Professor Vasilis Vasilou of the Yale School of Public Health to discuss collaborative research (May 17); participated in a ZOOM with staff of the CSN to discuss diversity, equity, and inclusion issues (May 18); participated in a public meeting to present and discuss the upcoming quarantine of CT for the spotted lanternfly (May 18); participated in a ZOOM meeting with Professor Jorge Gardea-Torresdey of the University of Texas-El Paso to discuss a special issue of *Environmental Science & Technology* on Nanofertilizers that we are guest editing (May 21); participated in the annual face-to-face meeting (virtual) of the FDA Laboratory Flexible Funding Model Cooperative Agreement Program (May 24-27); hosted a ZOOM call with Professor Phil Demokritou of the Harvard T.H. Chan School of Public Health and discussed collaborative research and grant proposals (May 25); and participated in the undergraduate thesis defense of Ms. Meghan Cahill of the University of Minnesota Department of Chemistry (Meghan is starting as a CAES Research Technician I in late July).

ANALYTICAL CHEMISTRY

DR. CHRISTINA ROBB participated in Eastern Analytical Symposium (EAS) Executive Committee meetings (May 3, 10, 17, 24) and the EAS board meeting (May 14); attended an FDA LFFM Food Defense call (May 10); attended FDA LFFM meeting trainings (May 18); attended a progress meeting with the FDA Forensic Chemistry Center (FCC) (May 21); participated in LFFM CAP Grantee meetings (360 registered attendees) (May 24, 25, 26, 27), presented "ZipChip Technology" in the "Platforms, Technology and New Methods" panel, Chemistry: Methods and Technology (208 attendees) (May 25), and presented "Enhancing the Analysis of Abrin Protein Through ELISA to LC-MS Platform Transfer" in the LFFM Chemistry Track section, Chemistry Method Development (186 attendees) (May 26).

MS. KITTY PRAPAYOTIN-RIVEROS participated in LFFM CAP Grantee meetings (May 24, 25, 26, 27) (360 registered attendees), and presented "Communication with States - Connecticut Data Flow" in the session "Communication Efforts and Laboratory Data Flow" (220 attendees) (May 25).

DR. BRIAN EITZER participated in Connecticut Rapid Response Team bi-weekly phone calls (May 5, 18); participated in the Laboratory Flexible Funding Model monthly call (May 10); participated in the monthly conference call of the North American Chemical Residue Workshop (May 13); participated in LFFM CAP Grantee meetings (360 registered attendees) (May 24, 25, 26, 27), where he was a member of the "Chemistry: Methods and Technology" discussion panel (208 attendees) (May 25).

DR. WALTER KROL served as a judge for the Connecticut FFA State Virtual Agriscience Fair (May 21); and attended the LFFM CAP Grantee meetings (May 24-27) and was a co-author of the talk entitled "Enhancing the Analysis of Abrin Protein Through ELISA to LC-MS Platform Transfer," which was presented by **DR. CHRISTINA ROBB**.

ENTOMOLOGY

DR. KIRBY C. STAFFORD III was interviewed about tick activity in Connecticut by Jamie Ratliff, NBC-Universal (May 3); was interviewed about ticks on the Ray and Brian morning news talk show, WTIC 1080 (May 5); was interviewed about rodent Lyme disease vaccines by Nicole Davis, Times Union Hudson Valley (May 10); was interviewed about ticks in the state and personal protection measures by Loumarie I. Rodriguez, Voices News Southbury (May 12); presented talks on tick taxonomy and tick control for the NEVBD boot camp (35 attendees) (May 13-14); was interviewed about tick season by Stephanie Simoni, WTNH-TV (May 25); and was interviewed by broadcaster Brian Scott-Smith for a tick podcast (May 26).

MS. JAMIE CANTONI was interviewed by Debra Aleksinas, a contributing writer with The Lakeville Journal for the May 20th edition, featuring a section on Land Trusts in the Northwest corner (May 12). The interview pertained to the projected 2021 tick season, current tick sampling efforts and how this compares to previous results, and the arrival of novel tick species and their potential impact on CT residents, particularly those residents of the Northwest corner of CT and Dutchess County, NY.

MR. MARK H. CREIGHTON gave an online presentation about honey bees and the history of beekeeping in Connecticut to the Alumni Association of Albertus Magnus College (45 attendees) (May 5); conducted an online presentation and hive opening

demonstration at Massaro Farm in Woodbridge, where making a "Dolittle Split," Varroa mite evaluations, and late spring management of colonies was reviewed (98 member attendees) (May 8); and hosted a bee talk at Lockwood Farm in Hamden on varroa mite management to members of the Huneebee Project, which manages hives in the New Haven Area and works with young adults with disabilities (May 15).

DR. GALE E. RIDGE was interviewed about elevated tick activity in Connecticut by Harlan Levy from the Journal Inquirer (May 7).

DR. CLAIRE E. RUTLEDGE gave a talk about insects to a second grade class at Vinton Elementary School in Lafayette, IN (25 youths) (May 24).

DR. KIMBERLY A. STONER met with Dr. Theodora Pintou of Western Connecticut State University about graduate student projects on pollinator habitat and pollinator visitation at Tarrywile Park in Danbury (4 participants) (May 5); met with the Asylum Hill Neighborhood Association Green Team by ZOOM about the Pollinator Pathway and creating pollinator habitat in the urban environment of Hartford (13 participants) (May 10); and met with several members of the Asylum Neighborhood Association Green Team about creating a plan and planting pollinator habitat at Turning Point Park in Hartford (6 participants) (May 24).

ANAIS (ANNIE) BOLDUC, **BENJAMIN GLUCK**, **JAMES DURRELL,** and **SARA CARSON** return to work with us as seasonal research assistants this summer (see their pictures and profiles in the May 2020 Station News). Joining Entomology this year are **KENNETH GEISERT** and **ELIZABETH TRIANA**.

ENVIRONMENTAL SCIENCES

DR. JOSEPH PIGNATELLO met virtually with professors from Villanova University, Pacific Northwest National Laboratory, and Oregon Health and Science University on a SERDP grant project (May 4).

DR. PHILIP ARMSTRONG gave a virtual lecture entitled "Regional Vector-Borne Diseases and Emerging Threats" to participants of the Vector Boot Camp Course (25 attendees) (May 10); gave a virtual lecture entitled "Phylogenetic Relationships of EEE Virus Strains Circulating in the Northeastern US During the 2019 Outbreak" at the 12th Annual Northeastern Eastern Equine Encephalitis Conference (50 attendees) (May 17).

MS. ANGELA BRANSFIELD participated in the Federal Select Agent Program's RO webinar series "Plant Pathogen Biocontainment; Changes to the BMBL 6th edition and Impact on Inspections" (May 26).

MR. GREGORY BUGBEE was interviewed about grant funding awarded to CAES by the CT DEEP for aquatic invasive species research through the boat registration fee program by the Connecticut Examiner (May 6); with **MS. SUMMER STEBBINS**, gave a virtual talk entitled "2020 CAES IAPP Aquatic Plant Survey of Middle Bolton Lake" at a meeting of the Friends of Bolton Lake (approx. 30 attendees) (May 13); served as a panelist for the Northeast Aquatic Nuisance Species Panel (May 18-19); and gave a virtual talk entitled "Hydrilla Invades the Connecticut River" at a combined meeting of the Aquatic Plant Management Society and the National Aquatic Species Management Society as part of National Invasive Species Awareness Week (approx. 200 attendees) (May 20).

DR. GOUDARZ MOLAEI was interviewed on ticks and tick-borne diseases by: WCBS 880 Radio, https://www.msn.com/en-us/health/medical/connecticut-sees-increase-in-tick-populations/ar-BB1gjXio (May 3); News 12 Connecticut, https://connecticut.news12.com/hikers-beware-ticks-may-be-extra-active-this-year-ct-researchers-say (May 3); WTIC NewsTalk 1080 AM (May 3); Patch Media, https://patch.com/connecticut/wilton/ticks-are-overrunning-ct-what-can-be-done-it (May 4); Channel 3, https://www.wfsb.com/news/wet-warm-weather-causing-an-increase-in-the-tick-population-in-ct/article_dffa3742-ae9c-11eb-ae51-27a1ec33f675.html (May 5); Fox 5 New York, https://www.fox5ny.com/news/tick-poplations-on-the-rise-across-the-tri-state (May 5); the Washington Post, https://www.washingtonpost.com/lifestyle/wellness/ticks-protect-lyme-deer-dog-lonestar/2021/05/22/6c41bb40-ba54-11eb-a6b1-81296da0339b_story.html (May 18); WFSB Eyewitness News 3, https://www.wfsb.com/news/tick-season-proving-to-be-one-of-the-worst-yet/article_09533b10-b90c-11eb-8dd6-ebbfb992adee.amp.html (May 19); and NBC, https://www.yahoo.com/now/warning-surge-tick-activity-americans-231139833.html (May 25); participated in a Facebook Live webcast organized by the Newtown Bee and Newtown Health Department entitled "Tickborne Disease Awareness & Prevention," https://www.newtownbee.com/05122021/bee-webcast-focusing-on-tickborne-disease-prevention/ (May 21); and gave a virtual invited talk entitled "Public Health Importance of Ticks and Tick-associated Diseases" to the Avon Free Public Library, https://www.avonctlibrary.info/event/ticks-and-tick-associated-diseases/ (57 attendees) (May 25).

DR. SARA NASON presented a talk entitled "Drugs, Mental Health, and Disinfectants: Changes in Sewage Sludge Chemical Signatures During the COVID-19 Pandemic" at the virtual SETAC Europe meeting (May 3-6); attended virtual meetings of the Benchmarking and Publications for Non-Targeted Analysis Working Group (May 12, 13, and 20); visited the South Shore Water Pollution Abatement Facility in New Haven to plan a sampling campaign (May 13); met with Krystal Pollitt (Yale School of Public Health) regarding collaborative research (May 14); met with Lee Blaney (University of Maryland Baltimore County) and **DR. NUBIA ZUVERZA-MENA** to discuss a newly funded collaborative project (May 27); and met with Jordan Peccia (Yale Department of Chemical and Environmental Engineering) and Krystal Pollitt regarding a collaborative publication (May 31).

MR. JOHN SHEPARD gave three seminars for the 2021 Vector Biology Boot Camp (virtual meeting) offered by Northeast Regional Center for Excellence in Vector-Borne Diseases: "Mosquito Collection and Processing" (45 attendees) (May 11), "Taxonomic Identification of Adult Female Mosquitoes" (35 attendees) (May 13), and "Establishing and Maintaining Mosquito Colonies" (32 attendees) (May 19).

MS. SUMMER STEBBINS gave a virtual talk entitled "Using GIS to Map Invasive Aquatic Plants in Connecticut" at the annual spring conference for the Northeast Arc Users Group (approx. 55 attendees) (May 18).

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD spoke on current research at the Forest Management, Storm Resilient Roadside Forests & Climate Resilient Forests - Sustainable Litchfield Workshop at White Memorial Foundation in Litchfield (14 attendees) (May 15); participated in a meeting with DEEP officials, Yale, and UConn faculty to discuss research opportunities in forestry and climate (May 18); participated in a Forest Ecosystem Monitoring Cooperative State Coordinators meeting (May 20); and participated in the 2021 Forest Health Monitoring forest health metrics training (May 27).

FORESTRY AND HORTICULTURE

DR. SUSANNA KERIÖ hosted and mentored a student intern from Albertus Magnus (April 6-May 13); gave a webinar entitled "Drought and Urban Trees" to CT tree wardens (13 participants) (May 13); participated in a Connecticut Urban Forestry Council meeting (May 20); and attended a webinar entitled “Urban Forestry Today” (May 20).

DR. SCOTT C. WILLIAMS attended a ZOOM graduate committee meeting for Cornell Master's student Joseph Poggi (May 7); presented an invited ZOOM lecture on the link between public and forest health to members of the New Hartford Land Trust (32 attendees) (May 11); presented an invited in-person talk on ticks, forests, and public health for the Friends of Topsmead Park in Litchfield (29 attendees) (May 13); met with Guilford residents Susan and Bernardo Velez for a property/forest assessment of their property (May 25); and, as a sitting advisory member, participated in a biweekly meeting of the National Wildlife Tick-Borne Disease Program (May 27).

MR. JOSEPH P. BARSKY participated in the 2021 Forest Health Monitoring crown health training (May 27).

PLANT PATHOLOGY AND ECOLOGY

DR. WADE ELMER, as a member of the UConn search committee, participated in a final selection meeting for the PSLA Department Head via WebEx (May 4); gave a presentation entitled “Role of Nanoscale Cu in Suppressing Plant Diseases” at the 3rd International Meeting on Plant Science and Research (Virtual) (146 attendees) (May 10); with **DR. JASON WHITE,** had a ZOOM conference with Dr. Sara Thomas of Louisiana State University and discussed Nano fertilizers on soybeans (May 11); with **DRS. JASON WHITE**, **CHRISTIAN DIMKPA**, **YU SHEN**, and **CARLOS TAMEZ**, attended via ZOOM the CNS Plant Nano Group meeting (9 attendees) (May 11); with **DRS. JASON WHITE**, **CHRISTIAN DIMKPA**, and **ISHAQ ADISA**, participated in a NIFA grant project conference on Nano P via ZOOM with Ms. Jaya Borgata for Nano P research at CAES (May 14); attended via Teams the CT Management Advisory Council Meeting (112 attendees) (May 19); attended via ZOOM the monthly APS Foundation Committee meeting (May 19); with **DRS. JASON WHITE** and **YI WANG**, participated via ZOOM in the CAES-UMASS Nano S update (6 attendees) (May 21); and attended via ZOOM the NIFA plan of work conference webinar (146 attendees) (May 26).

DR. MOHAMED-AMINE HASSANI presented a seminar entitled “The Bacterial and Fungal Microbiota of Wheat” to students in Master of Science in Nutrition from School of Dietetics and Human Nutrition, Marseille, France (7 students) (May 18).

DR. YONGHAO LI presented “Backyard Small Fruits” at the Wethersfield Garden Club member’s meeting in Wethersfield (24 adults) (May 3); participated in the National Plant Diagnostic Network Online Communication and Web portal Committee Meeting via ZOOM (8 adults) (May 12); presented “Spring and Summer Gardening Tips” for the Rockville Public Library adult education program via ZOOM (6 adults) (May 19); and presented “Organic Disease Control” for Weston Community Garden members via ZOOM (30 adult attendees) (May 20).

DR. QUAN ZENG gave four presentations entitled “How do apple trees produce apples” to four groups (Daisy, Brownie, Junior, Senior) of Girl Scouts of Connecticut for the “Arbor Day” event in Stamford (85 children, 10 adults) (May 15).

VALLEY LABORATORY

DR. CAROLE CHEAH, in cooperative efforts with Tree-Savers, PA, through donations and purchases, arranged, coordinated, and implemented augmentative releases of >6,000 *Sasasjiscymnus tsugae* in April and May with CT DEEP foresters, managers of land trust properties, bird preserves, town conservation commission members, and volunteers to mitigate hemlock woolly adelgid damage in 14 hemlock forests in 11 towns: Barkhamsted, Canton, Killingly, Pomfret, Thompson, Colchester, Watertown, Plymouth, Coventry, Woodbury and Southbury, and assisted community releases in Mansfield and Ashford to manage resurgent hemlock woolly adelgid (HWA) in April and May 2021; was interviewed about biological control of HWA releases in the Town of Woodbury conservation area of Nonnewaug Falls by Hannah Snyder of the Republican-American and implemented the releases together with 15 members of the Woodbury Conservation Commission (May 12).

DR. RICHARD COWLES presented virtually "Scale Management: Say Nix to Neonics?" (40 attendees) (May 5) and "Soil Acidification for Phytophthora Root Rot Management," for the Massachusetts Christmas Tree Growers' Association (23 attendees) (May 13). Both presentations are archived on the CAES website.

DEPARTMENTAL RESEARCH UPDATES MAY 2021

ENVIRONMENTAL SCIENCES

1. Koelmel, J. P., P. Stelben, C. A. McDonough, D. A. Dukes, J. J. Aristizabal-Henao, **Sara Nason**, Y. Li, S. Sternberg, E. Lin, M. Beckmann, A. J. Williams, J. Draper, J. Finch, C. Deigl, E. E. Rennie, J. A. Bowden, and K. J. Godri Pollitt. 2021. FluoroMatch 2.0 – Making automated and comprehensive non-targeted PFAS annotation a reality. *Analytical and Bioanalytical Chemistry*; https://doi.org/10.1007/s00216-021-03392-7

Abstract: Because of the pervasiveness, persistence, and toxicity of per- and polyfluoroalkyl substances (PFAS), there is growing concern over PFAS contamination, exposures, and health effects. The diversity of potential PFAS is astounding, with nearly 10,000 PFAS catalogued in databases to date (and growing). The ability to detect the thousands of known PFAS, and discover previously uncatalogued PFAS, is necessary to understand the scope of PFAS contamination and to identify appropriate remediation and regulatory solutions. Current non-targeted methods for PFAS analysis require manual curation and are time-consuming, prone to error, and not comprehensive. FluoroMatch Flow 2.0 is the first software to cover all steps of data processing for PFAS discovery in liquid chromatography–high-resolution tandem mass spectrometry samples. These steps include feature detection, feature blank filtering, exact mass matching to catalogued PFAS, mass defect filtering, homologous series detection, retention time pattern analysis, class-based MS/MS screening, fragment screening, and predicted MS/MS from SMILES structures. In addition, a comprehensive confidence level criterion is implemented to help users understand annotation certainty and integrate various layers of evidence to reduce overreporting. Applying the software to aqueous film forming foam analysis, we discovered over one thousand likely PFAS including previously unreported species. Furthermore, we were able to filter out 96% of features which were likely not PFAS. FluoroMatch Flow 2 increased coverage of likely PFAS by over tenfold compared to the previous release. This software will enable researchers to better characterize PFAS in the environment and in biological systems.

2. Li, C., **Zhengyang Wang**, S. Bakshi, **Joseph J. Pignatello,** and S. J. Parikh. 2021. Evaluation of select biochars and clays as supports for phytase to increase the fertilizer potential of animal wastes. *Science of the Total Environment* 787, 147720; https://doi.org/10.1016/j.scitotenv.2021.147720

Abstract: Manures may contain considerable amounts of organophosphates (org-P) that must be enzymatically converted to inorganic phosphate to be plant available. Although adding enzymes into manures can facilitate mineralization of org-P to inorganic phosphate, enzymes that are not immobilized are easily lost through leaching, degradation, or denaturation. In this study, the immobilization of enzymes onto nine different biochar surfaces was explored. Phytase, which mineralizes a main class of org-P, was used as the model enzyme. Immobilization methods included covalent grafting accomplished by the carbodiimide cross-linker method and physical sorption. The results showed that physisorption was as effective as grafting for loading phytase to the biochars. Phytase loading after mixing 0.1 g biochar and 2 mg phytase correlated positively with biochar C:H ratio (an indicator of aromatic content) suggesting the importance of the hydrophobic effect. An increase in pH led to a decrease in phytase loading consistent with repulsion between negatively charged sites on phytase and the increasing negative charge on biochar. Less than 4% of the immobilized phytase leached after sequential extractions over seven days using manure dissolve organic matter solutions. However, the activity of immobilized phytase decreased markedly compared to the free state phytase. The specific activity of immobilized phytase was two orders of magnitude lower than that of free phytase at pH 5 and 7. Nevertheless, results showed that deactivation of phytase by biochars were reversible once the phytase was detached from the surfaces. Compared to the biochars, clay minerals (montmorillonite, kaolinite and hematite) tended to have greater loading rates and higher phytase activity. Composting manures with co-amendments of biochar and minerals may enhance both short- and long-term P mineralization potential.

3. Yang, Z., C. Shan, B. Pan, and **Joseph J. Pignatello.** 2021. The Fenton reaction in water assisted by picolinic acid: Accelerated iron cycling and co-generation of a selective Fe-based oxidant. *Environmental Science & Technology*, https://doi.org/10.1021/acs.est.1c00230

Abstract: The Fenton reaction is limited by a narrow acidic pH range, the slow reduction of Fe(III), and susceptibility of the nonselective hydroxyl radical (HO•) to scavenging by water constituents. Here, we employed the biodegradable chelating agent picolinic acid (PICA) to address these concerns. Compared to the classical Fenton reaction at pH 3.0, PICA greatly accelerated the degradation of atrazine, sulfamethazine, and various substituted phenols at pH 5.0 in a reaction with autocatalytic characteristics. Although HO• served as the principal oxidant, a high-spin, end-on hydroperoxo intermediate, tentatively identified as PICA–Fe^{III}–OOH, also exhibited reactivity toward several test compounds. Chloride release from the oxidation of 2,4,6-trichlorophenol and the positive slope of the Hammett correlation for a series of halogenated phenols were consistent with PICA–Fe^{III}–OOH reacting as a nucleophilic oxidant. Compared to HO•, PICA–Fe^{III}–OOH is less sensitive to potential scavengers in environmental water samples. Kinetic analysis reveals that PICA facilitates Fe(III)/Fe(II) transformation by accelerating Fe(III) reduction by H_2O_2. Autocatalysis is ascribed to the buildup of Fe(II) from the reduction of Fe(III) by H_2O_2 as well as PICA oxidation products. PICA assistance in the Fenton reaction may be beneficial to wastewater treatment because it favors iron cycling, extends the pH range, and balances oxidation universality with selectivity.

PLANT PATHOLOGY AND ECOLOGY

1. Schultes, Neil P., R. F. Castañeda-Ruiz, **Robert E. Marra**, N. Strzalkowski, and **De-Wei Li**. 2021. *Striatibotrys neoeucylindrosporus* sp. nov., a *Stachybotrys*-like fungus from North America. *International Journal of Systematic and Evolutionary Microbiology* 71:004778; DOI 10.1099/ijsem.0.004778.

Abstract: Two isolates from Canada and the USA (UAMH 7122 and UAMH 7211, respectively) previously identified as *Stachybotrys eucylindrosporus* were studied by morphology and six-locus phylogeny (*cmdA*, ITS, *LSU*, *rpb2*, *tef1*α and *tub2*). UAMH 7122 and UAMH7211 are morphologically related but phylogenetically distinct from *Striatibotrys eucylindrosporus* (*Stachybotrys eucylindrosporus*) and *Str. rhabdosporus*. Hence, UAMH 7122 and UAMH 7211 are described as a new species, *Striatibotrys neoeucylindrosporus* sp. nov. with UAMH 7211 as the holotype. The characters of this species include some phialides proliferating by holoblastic extension of phialides and conidia clavate, subcylindrical or cylindrical ellipsoid, or dumbbell-shaped, dark brown to olivaceous grey when mature, longitudinally striate, 10.3–12.3×3–3.8 µm. A key to the species of *Striatibotrys* is provided.

2. Kharadi, R. R., J. K. Schachterle, X. Yuan, L. F. Castiblanco, J. Peng, S. M. Slack, **Quan Zeng**, and G. W. Sundin. 2021. Genetic dissection of the *Erwinia amylovora* disease cycle. *Annual Review of Phytopathology* https://doi.org/10.1146/annurev-phyto-020620-095540

Abstract: Fire blight, caused by the bacterial phytopathogen Erwinia amylovora, is an economically important and mechanistically complex disease that affects apple and pear production in most geographic production hubs worldwide. We compile, assess, and present a genetic outlook on the progression of an *E. amylovora* infection in the host. We discuss the key aspects of type III secretion–mediated infection and systemic movement, biofilm formation in xylem, and pathogen dispersal via ooze droplets, a concentrated suspension of bacteria and exopolysaccharide components. We present an overall outlook on the genetic elements contributing to E. amylovora pathogenesis, including an exploration of the impact of floral microbiomes on *E. amylovora* colonization, and summarize the current knowledge of host responses to an incursion and how this response stimulates further infection and systemic spread. We hope to facilitate the identification of new, unexplored areas of research in this pathosystem that can help identify evolutionarily susceptible genetic targets to ultimately aid in the design of sustainable strategies for fire blight disease mitigation.

3. Ma, C., Li, Q., Jia, W., Shang, H., Zhao, J., Hao, Y., Li, C., Tomko, M., **Zuverza-Mena, N.**, **Elmer, Wade H,** and **White, Jason C.**, 2021. Role of Nanoscale Hydroxyapatite in Disease Suppression of Fusarium-Infected Tomato. *Environmental Science & Technology*.

Abstract: The present study investigated the mechanisms by which large- and small-sized nanoscale hydroxyapatite (nHA) suppressed Fusarium-induced wilt disease in tomato. Both nHA sizes at 9.3 mg/L (low) and 46.5 mg/L (high dose) phosphorus (P) were foliar-sprayed on Fusarium-infected tomato leaf surfaces three times. Diseased shoot mass was increased by 40% upon exposure to the low dose of large-sized nHA compared to disease controls. Exposure to both nHA sizes significantly elevated phenylalanine ammonialyase activity and total phenolic content in Fusarium-infected shoots by 30−80% and 40−68%, respectively. Shoot salicylic acid content was also increased by 10−45%, suggesting the potential relationship between antioxidant and phytohormone pathways in nHA-promoted defense against fungal infection. Exposure to the high dose of both nHA sizes increased the root P content by 27−46%. A constrained analysis of principal coordinates suggests that high dose of both nHA sizes significantly altered the fatty acid profile in diseased tomato. Particularly, the diseased root C18:3 content was increased by 28−31% in the large-sized nHA treatments, indicating that nHA remodeled the cell membrane as part of defense against Fusarium infection. Taken together, our findings demonstrate the important role of nHA in promoting disease suppression for the sustainable use of nHA in nanoenabled agriculture.

VALLEY LABORATORY

1. LaMondia, James A. 2021. Management of lesion and dagger nematodes with rotation crops. *Nematropica* 51:9-16.

Abstract: Annual rotation green manure crops of selected brassicas, buckwheat, forage pearl millet, forage radish, black-eyed Susan, sesame, sudangrass, and velvetbean were evaluated to determine impacts on lesion nematode *Pratylenchus penetrans* and dagger nematode *Xiphinema americanum* populations densities. Canadian forage pearl millet '101'and 'Tifgrain 102' millet effectively controlled *P. penetrans* but increased population densities of *X. americanum*. Black-eyed Susan (*Rudbeckia hirta*) and sudangrass 'Trudan 8' also reduced *P. penetrans* densities but not *X. americanum*. Rapeseed and other brassicas as a green manure reduced *X. americanum* densities but did not suppress *P. penetrans*. *Brassica juncea* 'Pacific Gold', *B. napus* 'Dwarf Essex', but not mustard 'Caliente' resulted in low densities of *X. americanum* in soil. Velvetbean and sesame increased both *P. penetrans* and *X. americanum* population densities. A moderately suitable host plant such as buckwheat was ineffective in managing both *P. penetrans* and *X. americanum* populations. These results emphasize that suppressive effects of any given cover crop are nematode-specific, and that within a group of cover crops, e.g., the Brassicaceae, species and varieties can vary substantially in their effectiveness. If the rotation crop chosen is a good host for the nematodes present, it may exacerbate the problem instead of controlling it.

2. Si, Y. Z., X. P. Guo, **De-Wei Li**, S. Wu, and L. H. Zhu. 2021. First report of *Diaporthe fusicola* causing leaf blotch of *Osmanthus fragrans* in China. *Plant Disease* 105(4):1193-1194. https://doi.org/10.1094/PDIS-07-20-1450-PDN

Abstract: *Osmanthus fragrans* Lour. is widely distributed in China, Japan, Thailand, and India (Zang et al. 2003) and one of the top 10 most well-known flowering plants in China. Since February 2017, a foliar disease, with a disease incidence of ~60%, occurred on *O. fragrans* in a community park in Luzhai, Guangxi, China. Symptoms began as round or irregular small yellow spots and became pale brown to gray-brown with time. Small leaf tissues (3 to 4 mm^2) cut from lesion margins were surface sterilized in 75% ethanol for 30 s and 1% NaClO for 90 s before they were rinsed in ddH_2O and dried on sterilized filter paper. After drying, the sterilized tissues were plated on potato dextrose agar (PDA) and incubated at 25°C in the dark for 5 days. Five single-spore isolates were obtained, and a representative isolate (GH3) was selected and deposited in the China Forestry Culture Collection Center. The colony on PDA was white with concentric zonation and white aerial mycelia, but the reverse was yellow. Black pycnidia developed on alfalfa extract + Czapek medium at 25°C with a 14-h/10-h light/dark cycle after 17 days. Conidiophores were hyaline, branched, septate, straight to sinuous, 12.4 to 24 × 1.9 to 2.5 µm (n = 20). The conidia were fusoid, hyaline, smooth, mostly two guttules, and measured 7.2 ± 0.7 × 2.3 ± 0.2 µm (n = 50). The morphological characters of pycnidia, conidiophores, and conidia of all five isolates matched those of *Diaporthe* spp. (Gomes et al. 2013). DNA of isolates GH3, GH7, and GH8 was extracted, and the internal transcribed spacer region (ITS) and partial sequences of elongation factor 1-alpha (*EF1-a*), calmodulin (*CAL*), beta-tubulin (*ß-tub*), and histone H3 (*HIS*) genes were amplified with primers ITS1/ITS4 (White et al. 1990), EF1-728F/EF1-986R, CAL228F/CAL737R (Carbone et al. 1999), ßt2a/ßt2b, and CYLH3F/H3-1b (Crous et al. 2004; Glass and Donaldson 1995), respectively. The sequences of GH3, GH7, and GH8 were deposited in GenBank (GH3: accession nos. MT499213 for ITS, MT506473 to MT506476 for *EF1-a*, *ß-tub*, *HIS*, and *CAL*; GH7: MT856374 and MT860397 to MT860400; GH8: MT856375 and MT860401 to MT860404). BLAST results showed that the ITS, *EF1-a*, *ß-tub*, *HIS*, and *CAL* sequences of GH3 were highly similar to sequences of *Phomopsis* sp. (LC168784 [ITS], identity = 506/506 [100%]), *Diaporthe fusicola* (MK654863 [*EF1-a*], identity = 274/275 [99%]), *D. amygdali* (MK570513 [*ß-tub*], identity = 461/461 [100%]), *D. fusicola* (MK726253 [*HIS*], identity = 403/403 [100%]), and *D. amygdali* (KC343263 [*CAL*], identity = 428/428 [100%]), respectively.

Maximum likelihood and Bayesian posterior probability analyses using IQ-Tree version 1.6.8 and Mr. Bayes version 3.2.6 with the concatenated sequences placed isolates GH3, GH7, and GH8 in the *D. fusicola* cluster and separated them from *D. eres* and *D. osmanthi*, which were previously reported from *Osmanthus* spp. (Gomes et al. 2013; Long et al. 2019). Based on the multigene phylogeny and morphology, all three isolates were identified as *D. fusicola*. The pathogenicity of GH3 was tested on 1-year-old seedlings of *O. fragrans*. Healthy leaves were wounded with a sterile needle and then inoculated with either 5-mm mycelial plugs cut from the edge of a 5-day-old culture of GH3 or 10 µl of conidial suspension (10^6 conidia/ml). Control leaves were treated with PDA plugs or ddH_2O. Three plants were used for each treatment. The plants were covered with a plastic bag after inoculation, and sterilized H_2O was sprayed into the bags twice per day to maintain humidity; they were kept in a greenhouse at day/night temperatures of 25 ± 2°C/16 ± 2°C. Lesions appeared 3 days later. No lesions were observed on control leaves. The same fungus was reisolated from lesions. This is the first report of *D. fusicola* causing leaf blotch on *O. fragrans*. These results form the basis for developing effective strategies for monitoring and managing this potential high-risk disease.

3. Jin, G. Q., G. Y. Mao, **De-Wei Li**, Y. Wan, and L. H. Zhu. 2021. First report of *Alternaria alternata* causing leaf spots of *Liriodendron chinense* × *tulipifera* in China. *Journal of Plant Pathology* 103:689–690. https://doi.org/10.1007/s42161-021-00775-8

Abstract: *Liriodendron chinense* (Hemsl.) Sarg. × *tulipifera* L. is an ornamental tree species in China (Xiang and Wang 2012). In September 2018, a leaf spot disease was observed on *L. chinense* × *tulipifera* in Nanjing and the incidence rate is about 60%. The lesions on the leaves were brown, round to irregular. Small pieces of symptomatic tissues were cut from the margin of the lesions, superficially disinfected and placed on potato dextrose agar (PDA) medium and incubated at 25°C. A representative isolate (M7) was used for the morphological and molecular identification. The colonies on PDA were gray to brown. The conidia of M7 were catenate, obclavate, with 1-2 longitudinal septa and 1-5 transverse septa, light brown to brown, smooth to punctulate, 9.4–14.1 × 24.0–55.1 µm in size. The morphological characteristics of M7 isolate matched those of *Alternaria* sp. and have straight or curved primary conidiophores with conidia obclavate, long ellipsoid, muriform (Woudenberg et al. 2013). For accurate identification, internal transcribed spacer (ITS), glyceraldehyde-3-phosphate dehydrogenase (GPD), small subunit (SSU), large subunit (LSU), *Alternaria* major allergen gene (Alt a 1) (Hong et al. 2005) and RNA polymerase second largest subunit (RPB2) (Sung et al. 2007) were amplified by using the following primer pairs ITS1/ITS4, GPD-1/GPD-2, NS1/NS4, LR0R/LR05, Alt-f/Alt-r and RPB2-5F2/fRPB2-7cR, respectively. The sequences were deposited in GenBank (Accession nos. MN136108, MN686254, MN686429, MN744264-MN744266). Phylogenetic analysis using Neighbor Joining and concatenated sequences placed M7 in the clade of *A. alternata*. Based on morphological characters and phylogenetic studies, M7 was identified as *A. alternata*. To verify the pathogenicity of M7, 10-wk-old detached and attached leaves from potted 1-year-old *L. chinense* × *tulipifera* were inoculated with 10 µl conidial suspension (10^6 conidia/ml). The leaves were wounded with a sterile needle, and the suspension was dropped on the wound. Control plants were treated with sterile double distilled water (ddH_2O). All detached leaves were placed on wet filter paper in glass dishes in an incubator at 25°C, and the attached leaves were covered with wet plastic bags on the trees for 24 h to maintain high humidity. Within 3 days, all the inoculated points showed lesions similar to those observed in the field. No lesions were observed on the control leaves. *A. alternata* was reisolated from symptomatic leaves. To our knowledge, this is the first report of *A. alternata* causing tulip tree leaf spots in China and worldwide (Farr and Rossman 2020).

JOURNAL ARTICLES APPROVED MAY 2021

Aulakh, Jatinder S. Stonecrops (*Sedum* spp.) tolerance to Gemini G (Isoxaben plus Prodiamine) and Basagran T&O (Bentazon) herbicides. *CAES Bulletin*

Bugbee, Gregory J., and **Summer E. Stebbins**. Connecticut River Gateway Conservation Zone - Invasive aquatic vegetation survey, aquatic plant management options 2019. *CAES Bulletin* (Web Only)

Bugbee, Gregory J., and **Summer E. Stebbins**. Pachaug Pond, Griswold, CT – Aquatic vegetation survey, water chemistry, aquatic plant management options 2020. *CAES Bulletin* (Web Only)

Chen, S., X. Yan, X. Tan, W. Zhang, Y. Huang, **Jason C. White**, and L. Zhao. Environmental implications of MoS_2 nanosheets on rice and associated soil microbial communities. *Environmental Science & Technology*

Elnour, M.-A.B., **Andrea Gloria-Soria**, R. S. Azrag, A. M. Alkhaiaibari, J. R. Powell, and B. Salim. Population genetic analysis of *Aedes aegypti* from Sudan revealed recent independent colonization events by the two subspecies. *PLOS Neglected Tropical Diseases*

He, J., **De-Wei Li**, Y. Zhang, Y. W. Ju, and L. Huang. *Fusarium rosicola* sp. nov. causing vascular wilt on *Rosa chinensis* in China. *Plant Pathology*

Li, De-Wei, C. Y. Tsai, and C. S. Yang. Chapter 16 Fungi. In *Bioaerosols: Assessment and Control, 2nd Edition*, Springston et al., eds.

Nason, Sara L., C. J. Stanley, C. E. PeterPaul, M. F. Blumenthal, **Nubia Zuverza-Mena**, and R. J. Silliboy. Hemp phytoremediation of PFAS: A community-based investigation at the former Loring Airforce Base. *iScience*

Place, B. J., E. M. Ulrich, J. K. Challis, A. Chao, B. Du, K. Favela, … **Sara L. Nason**, … A. J. Williams (25 authors). An introduction to the Benchmarking and Publications for Non-Targeted Analysis Working Group. *Analytical Chemistry*

Ridge, Gale E. Atlas of the Heteropteran (Hemiptera) Pterothorax endoskeleton. Monograph. *Thomas Say Monographs. Entomological Society of America*

Si, Y. Z., **De-Wei Li**, J. Zhong, L. Huang, and L. H. Zhu. Morphology and phylogeny revealing *Diaporthe sapindicola* sp. nov. a pathogen causing leaf spot of *Sapindus mukorossi* in China. *Plant Disease*

Stebbins, Summer E., and **Gregory J. Bugbee**. Lake Quonnipaug, Guilford, CT – 2020 Aquatic vegetation survey, state-listed species survey, water chemistry, aquatic plant management options. *CAES Bulletin* (Web Only)

Wong, J. W., J. Wang, J. S. Chang, W. Chow, R. Carlson, Ł. Rajski, … **Sara L. Nason**, **Michael Ammirata**, **Brian Eitzer**, … D. G. Hayward (59 authors). Multilaboratory collaborative study of a non-target Data Acquisition for Target Analysis (nDATA) workflow using liquid chromatography-high resolution accurate mass spectrometry for pesticide screening in fruits and vegetables. *Journal of Agriculture and Food Chemistry*

Zhang, M. Y., Y. Z. Si, Y. Ju, **De-Wei Li**, and L. H. Zhu. First report of leaf spot caused by *Colletotrichum siamense* on *Salix matsudana* in China. *Plant Disease*

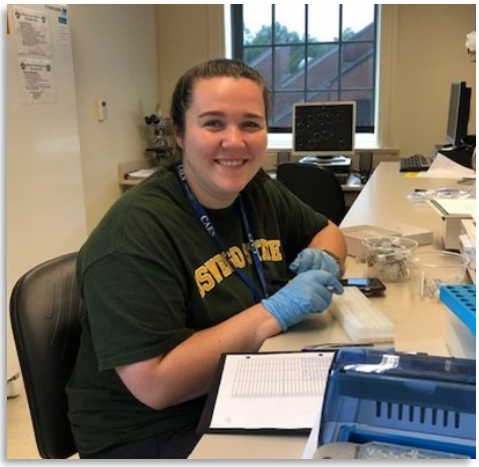
NEW STAFF, STUDENTS, AND VOLUNTEERS MAY 2021

MS. SHANTE HANNA joined the Station in May as an undergraduate research intern in the Department of Analytical Chemistry (DAC). She is currently pursuing a degree in Biomedical Sciences with a concentration in Pre-Medicine at the College of Saint Benedict, Saint Joseph, Minnesota. Ms. Hanna comes to DAC under the auspices of the Center for Sustainable Nanotechnology's Summer Undergraduate Research Experience (SURE) Program. She has an integrated background in youth outreach, health-care aide and team leadership with the ability to lead by example to implement a strong sense of community and purpose that aligns with organizational values. Ms. Hanna is a motivated and passionate student with an interest in human health, social justice, and ensuring equitable healthcare access for all.

Her mission is to advance the conditions in which people can be healthy through chemistry and public outreach. She is interested in the development of science-based policies and public health initiatives. In addition, she is a STEM diversity advocate and during the summers speak to elementary students of underrepresented areas to encourage pursing STEM education. Ms. Hanna aims to positively influence science culture by contributing voice and creativity in communicating science to the public. During the next 10 weeks, working on a project that focuses on the molecular biology/ transcriptomic aspects of nano-agriculture. Specifically, she will examine the ability of copper oxide nanoparticles to promote fungal disease tolerance in tomatoes and the effects of lithium cobalt oxide on soybean plant tissues with two mentors, Dr. Yu Chen and Dr. Carlos Tamez.

KENNETH GEISERT is an Entomology Major at the University of Delaware. He is also an aficionado of a capello singing and sings bass in the Golden Blues. Kenneth, from Easton, CT, is working with Dr. Claire Rutledge.

ELIZABETH TRIANA is a sophomore at SUNY-Oswego majoring in zoology with experience in bird banding with Connecticut Audubon and has interned at an animal rehabilitation center. She lives in Prospect, CT. She is working with Dr. Kirby Stafford and Heidi Stuber on the integrated tick management projects.

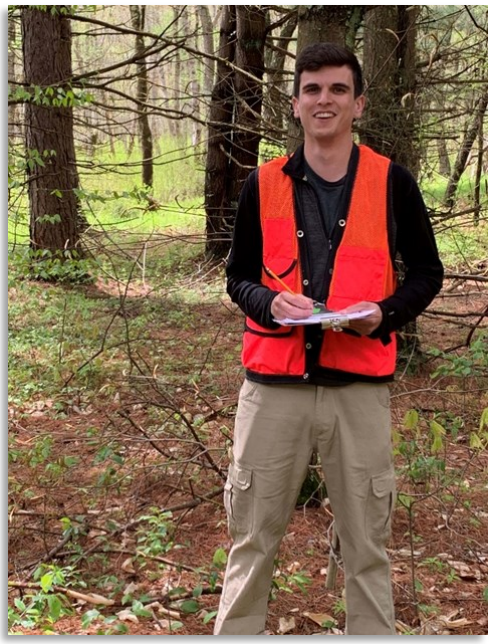


MR. AIDEN FLORIO is a seasonal assistant in the Department of Forestry and Horticulture working with Dr. Susanna Keriö. He works on a project that studies the impact of copper oxide nanoparticles on drought tolerance in hybrid chestnuts, and surveys stress levels in urban maples. Aiden is a recent graduate from the college of Natural Sciences, Forestry and Agriculture from the University of Maine, obtaining a degree in Ecology and Environmental Science. Previously, Aiden has worked at CAES with Dr. Jeffrey Ward in establishing a series of forest health plots as part of the Forest Ecosystem Monitoring Cooperative, and with the mosquito surveillance program with Dr. Philip Armstrong. Aiden's interest in natural resources peaked while working at White Memorial Conservation Center and their efforts with the invasive species, Emerald Ash Borer and the Asian Spotted Lanternfly.

MS. JACQUELINE LEMMON is a seasonal assistant in the Department of Forestry and Horticulture working with Dr. Susanna Keriö. She works on a project that studies the impact of copper oxide nanoparticles on drought tolerance in hybrid chestnuts, and surveys stress levels in urban maples. Jacqueline is an undergraduate student at Oregon State University in the Department of Botany and Plant Pathology, focusing on plant-microbe interaction ecology. She currently volunteers at the Native Plant Trust in Rhode Island to survey local rare plant populations, and is interested in how abiotic and biotic stress factors affect native plant communities. Jackie has several years of professional experience in the horticultural industry, which influenced her interest in studying plant sciences.

MS. ERIN REILLY is a seasonal assistant in the Department of Forestry and Horticulture working with Dr. Jeffery Ward collecting data on oak resiliency and forest ecosystem health monitoring as part of the Forest Ecosystem Monitoring Cooperative. She is a recent graduate of Paul Smith's College, where she studied Forest Biology. Erin realized her interest in forest health while studying beech bark disease and beech stump sprouting control in the Adirondacks, and is happy to return home to Connecticut this summer. She looks forward to increasing her familiarity with New England forests through her work at CAES.

MR. NICHOLAS TAIT is a seasonal assistant in the Department of Forestry and Horticulture. He recently moved to Connecticut from Washington, D.C., where he worked as a biological technician with the National Park Service conducting forest and vegetation monitoring throughout the region. Before that, he helped control invasive plants for the U.S. Fish and Wildlife Service, collected ticks for the U.S. Department of Agriculture, and received his B.A. in environmental studies from St. Mary's College of Maryland. This summer, he will be assisting Dr. Jeffrey Ward with forest ecosystem health monitoring and a study on white oak resiliency.



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