

Station News

The Connecticut Agricultural Experiment Station

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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.



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GRANTS RECEIVED JUNE 2020

Spencer S. Walse, Joseph J. Pignatello, William A. Mitch, and Thomas Jones, "Preserving sulfuryl fluoride for dried fruit exports to the European Union" USDA FAS/TASC (California Dried Plum Board); July 17, 2020 to July 16, 2023; CAES award, \$418,000. (June 28)

Abstract - US industry wishes to pro-actively address the voids in residue data associated with the use of sulfuryl fluoride (SF) for treating US dried fruit and tree nuts as an alternative to methyl bromide in quarantine and pre-shipment fumigation. While the proposal is focused on retaining dried fruit and tree nuts exports to the EU, valued at > \$4 billion annually, the research ultimately supports the continued and optimal use of SF in export markets around the world. The Project's technical Objectives are as follows. 1) Establish proper tolerances/maximum residue limits for SF on dried fruit. 2) Evaluate residues associated with contemporary SF use patterns on dried fruit and tree nuts. 3) Quantify fluoride residues from SF vacuum fumigation of dried fruit and tree nuts. 4) Limit SF emissions following postharvest fumigation, as SF is a powerful greenhouse gas. The co-PI Pignatello has a lead role in Objective 4.

Dr. James LaMondia was one of 14 scientists at 10 institutions in 7 states funded by the NIFA SCRI to conduct research on "Boxwood blight mitigation: A new model for sustainable specialty crop production in the 21st century." This grant will provide nearly \$4 million dollars nationwide to manage the most important disease affecting the #1 nursery crop in the USA. The Experiment Station will receive \$181,352.

Dr. Jason C. White (CAES Director) and Dr. Wade Elmer (CAES Vice Director and Chief Scientist of the Department of Plant Pathology and Ecology) along with 10 Universities and one National Laboratory, has been funded as part of The Center for Sustainability Nanotechnology (CSN) New Haven, CT for 5 years with a \$20 million grant. CAES will investigate the safe use of novel Center-produced nanoscale nutrients to improve agricultural productivity and advance efforts to combat global food insecurity.

ADMINISTRATION

DR. JASON C. WHITE participated in the monthly CT Laboratory Preparedness teleconference call with the Department of Public Health and other state/federal agencies (June 1); participated in a Zoom call with collaborators in the Center for Sustainable Nanotechnology (CSN) regarding collaborative experiments related to nano-enabled phosphorus fertilization (June 2); participated in the weekly CSN center-wide Zoom call (June 3, 10, 17, 24); participated in a Teams call with staff at the CT Department of Agriculture regarding collaborative FDA-funded work (June 3); hosted a Zoom call with Jason Longenberger, a Research Experience for Veterans (REV) student working in CAES labs as part of the CSN (June 5); hosted the monthly CSN Nanochem-plant Zoom call (June 9); participated in the annual meeting of the Northeastern Regional Association of State Agricultural Experiment Station Directors (NERA) by Zoom (June 10); participated in the monthly FDA FERN cCAP Zoom call (June 11); hosted the CAES J-1 Visa recipients monthly Zoom call (June 12); participated in a Zoom call with collaborators at Harvard University and the University of Texas El Paso regarding a grant proposal for an NSF Engineering Research Center on advanced materials and the food supply (June 16); as a committee member, participated in a WebEx meeting with Ms. Jaya Borgatta and the rest of her PhD committee as part of the year 4 update on her program (June 18); met with staff of Levo International Inc. at Lockwood Farm during installation of their hydroponic plant growth system (June 19); along with DR. SARA NASON, participated on a Zoom call with Ms. Akram Bagheripour of Lorestan University in Iran regarding a potential funded visit at CAES (June 22); partici-

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pated by Zoom in the annual FDA AFRPS face-to-face conference and program review (June 23-24); participated in a CSN panel discussion on maintaining a healthy work-life balance (June 29); and participated in a Teams meeting with CSN faculty and Dr. Amarjit Basra of OCP North America to discuss nanofertilizers (June 30).

ANALYTICAL CHEMISTRY

DR. BRIAN EITZER attended sessions of the Food Labs/Cannabis Labs virtual conference (June 6); attended a Zoom meeting of the North American Chemical Residue Workshop's organizing committee (June 11); presented a webinar entitled "Use of LC-HRMS in the Analysis of Pesticides in Foods" at the HPLC in Practice: A Virtual Symposium sponsored by LCGC magazine (250 attendees) (June 24); and was a participant in the APHL Cannabis Community of Practice Zoom meeting (June 26).

DR. CHRISTINA ROBB accepted the position of Associate Editor (review) with the Journal of Liquid Chromatography; presented a poster at the American Society of Mass Spectrometry (June 1-4); and participated in meetings for the Eastern Analytical Symposium, short courses (June 1, 30) and long range planning (June 2).

MS. KITTY PRAPAYOTIN-RIVEROS participated in a Sample Analysis Data Exchange - IT Implementation Phase Meeting on WebEx to discuss the NFSDX (National Food Safety Data Exchange) phase II Sample Data Elements Mapping File (June 2, 16); participated in the CT Weekly Office Hours for Teams with Microsoft Customer Success Manager (June 1, 8, 15, 22, 29); and participated in the 2020 Animal Feed Regulatory Program Standards Annual Face-to-Face Virtual Meeting (June 23, 24).

MS. TERRI ARSENAULT attended the 2020 Animal Feed Regulatory Program Annual Face-to-Face Virtual Meeting (June 23, 24).

ENTOMOLOGY

DR. KIRBY C. STAFFORD III presented a webinar on ticks and tick management for the Town of Bloomfield and the Bloomfield Land Trust (40 attendees) (June 3); presented a webinar on "Strategies and Barriers to the Prevention of Tick-Borne Disease" for the Northeastern IPM Center (40 participants) (June 10); participated as a panelist on the "Tick Management and Control" webinar, which was recorded in May for the Tick Talk webinars with Dr. Stephen Rich at the University of Massachusetts (450 attendees) (June 10); participated in a conference call of the Tick IPM Working Group (June 10); participated in the annual Spring Cooperative Agricultural Pest Survey (CAPS) meeting via Zoom (15 participants) (June 23); and was interviewed live about the lone star tick on WVIT NBC-CT (June 30).

MS. KATHERINE DUGAS, with **DR. KIRBY STAFFORD**, **DR. VICTORIA SMITH**, and **MS. GERDA MAGANA**, participated in the annual Spring Cooperative Agricultural Pest Survey (CAPS) meeting via Zoom (15 participants) (June 23).

MR. MARK H. CREIGHTON was interviewed on honey bee behavior by Harlan Levy of the Journal Inquirer (June 23).

DR. MEGAN LINSKE participated in a conference call with collaborators for a Department of Defense project entitled "Novel Evaluation of Control and Prevention Strategies for Ticks and Tick-borne Diseases" (June 17); and participated in the Executive Committee meeting of the Northeast Section of the Wildlife Society as President Elect and Workshop

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Committee Chairperson (June 22).

MS. GERDA MAGANA, as the State Survey Coordinator, organized and ran the annual Spring Cooperative Agricultural Pest Survey (CAPS) meeting via Zoom (15 participants) (June 23).

DR. GALE E. RIDGE was interviewed about bees in Connecticut by Harlan Levy of the Journal Inquirer (June 22); was interviewed about fireflies and environmental degradation by Kathleen Connelly of The Day (June 23); and, with **DR. WASHINGTON DA SILVA**, published a fact sheet on Grape Timid Galls (June 25).

DR. VICTORIA L. SMITH participated in a meeting of the Yale Biosafety committee via Zoom (20 participants) (June 18); and participated in the annual Spring Cooperative Agricultural Pest Survey (CAPS) meeting via Zoom (15 participants) (June 23).

DR. KIMBERLY A. STONER participated in a meeting of the Agriculture and Soils Working Group of the Governor's Council on Climate Change via Zoom (25 participants) (June 25).

MS. MARY CONSOLI joined Dr. Claire Rutledge's emerald ash borer wasp watchers and biocontrol project. A graduate of New Mexico Highlands University in Conservation Management with a minor in Anthropology, Ms. Consoli has experience working with primates and in archaeological studies. She is currently working toward a graduate certificate in museum studies.



ENVIRONMENTAL SCIENCES

DR. JOSEPH PIGNATELLO participated in a virtual meeting of collaborators from Brandeis University on an NSF grant project (June 25); and virtually attended the annual dinner and business meeting of the Connecticut Academy of Science and Engineering (June 30).

DR. PHILIP ARMSTRONG was interviewed about the start and expansion of the mosquito surveillance program by WTIC (June 1); was interviewed about the start and expansion of the mosquito surveillance program by NBC CT (June 5); was interviewed about the current mosquito season by News Channel 8 (June 12); was interviewed about EEE virus by Yale Medicine Magazine (June 16); and was interviewed about State plans to respond to EEE this year by the Valley Courier (June 23).

MS. ANGELA BRANSFIELD participated in the Federal Select Agent Program webinar Operations Section (June 24).

DR. DOUG BRACKNEY was interviewed about coronavirus in sewage sludge by the Chester-

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ton Tribune (his hometown local newspaper) (June 16).

MR. GREGORY BUGBEE presented the results of the 2018-2019 CAES IAPP Invasive Aquatic Plant Monitoring of Candlewood Lake and Squantz Pond to the Candlewood Lake Authority via conference call (approx. 15 attendees) (June 13); with **MS. SUMMER STEBBINS**, presented the results of the 2019 CAES IAPP Invasive Aquatic Plant Monitoring of the southern section of the Connecticut River at a Zoom meeting of the CT Resource Conservation and Development Area, Inc. (approx. 25 attendees) (June 25).

DR. GOUDARZ MOLAEI was interviewed about range expansion of the lone star tick in Connecticut and throughout the Northeast by WTIC-AM/FM (June 23); Channel 3 Eyewitness News (June 23); Brian Scott-Smith, a Media Consultant (June 24); News 8 WTNH (June 25); Rich Kirby, an editor patch media (June 25); WSHU-NPR (June 24); and News 12 (June 29).

DR. SARA NASON participated in two conference calls for the Benchmarks and Publications for Non-targeted Analysis working group (June 15, 25).

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD met with Chris Caparso to examine declining and dead maples in Prospect (June 3); administered practical and oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board (June 10); met with Massachusetts DCR-Division of Water Supply Protection staff in Oakham, MA to discuss forest regeneration and collaborative research (6 foresters) (June 11); participated in a Connecticut Invasive Plant Council conference call (June 23); and participated in a Yankee SAF, Forest Management and Carbon Task Force conference call (June 30).

DR. SUSANNA KERIÖ collaborated with Dr. Florian Carle, CT Chapter of the American Chestnut Foundation, in collecting tissue samples (June 2); participated in a Zoom meeting to plan chestnut-related research with the Connecticut Chapter members of the American Chestnut Foundation (June 5); participated in Connecticut Tree Protection Examining Board oral examinations of arborist candidates (June 10); and participated in a Beech Leaf Disease research update Zoom meeting coordinated by the Ohio State University (June 17).

DR. ABIGAIL A. MAYNARD visited the Offinger's Farm in Wilton (June 6); reported on Station activities at a quarterly Zoom meeting of the Council on Soil and Water Conservation (15 adults) (June 17); visited Hindinger Farm in Hamden and inspected their heirloom tomatoes (June 21); and participated in the G3 Governor's Council on Climate Change, Agriculture/Soils Working Group Zoom meetings (June 25, 29).

DR. SCOTT C. WILLIAMS was interviewed about vaccinating wildlife against zoonotic diseases by Madeline Bodin for Discover Magazine: <https://www.discovermagazine.com/health/deadly-animal-diseases-can-jump-to-humans-is-vaccinating-wildlife-the-answer> (June 1); participated in a conference call for the Editorial Advisory Board for The Wildlife Society's publication, The Wildlife Professional (June 4); and participated in a Zoom meeting of the Executive Board of the Northeast Section of The Wildlife Society (June 22).

MR. JOSEPH P. BARSKY participated in a conference call for the New England Society of American Foresters Executive Committee (June 10); participated in a conference call for the Connecticut State Consulting Committee for Agricultural Science and Technology Education and was elected as Vice-Chair (June 16); and participated in the Annual Meeting for the Sleeping Giant Park Association and was elected as Park Naturalist (June 23).

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PLANT PATHOLOGY AND ECOLOGY

DR. WADE ELMER participated in an APS Committee chair conference call (June 10); and participated in bi-weekly USDA NIFA Zoom conferences (June 11, 24, 29).

DR. ROBERT E. MARRA was interviewed about Oak Wilt and Beech Leaf Disease by Hearst News reporter Robert Miller (June 2); administered oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board at Lockwood Farm (June 10); 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 (40 participants) (June 17); presented a webinar entitled “Updates on Beech Leaf Disease and Oak Wilt” to the UConn “Hot Topics” series via Zoom (160 adults) (June 18); gave a presentation on Beech Leaf Disease via Zoom to the CAPS meeting (40 participants) (June 23).

The Plant Health Fellows started a shortened, distanced internship program on June 29. “Group” photo (L-R): Louis Orifice (mentored by Dr. Neil Schultes), Eboni Traverso (Dr. Lindsay Triplett), Jose Ayala (Dr. Claire Rutledge), Joshua Lovett-Graff (Dr. Susanna Keriö), Justin Alamo (Dr. Jeff Ward), Dylan Alderrucci (Dr. Nubia Zuverza), Lauren Bower (Dr. Blaire Steven), and Hector Diaz (Dr. Washington da Silva). Not pictured: Kaitlin Miller, mentored by Dr. Quan Zeng. The students will present their research projects in a virtual seminar scheduled for August 18.



VALLEY LABORATORY

DR. CAROLE CHEAH, in cooperative efforts with Tree-Savers, PA, through donations and purchases, arranged, coordinated, and implemented augmentative releases of > 6,500 *Sasajiscymnus tsugae* with land trust preserve, state, and municipal forest managers to manage resurgent hemlock woolly adelgid (HWA) in spring and summer 2020: released 1,100 *S. tsugae* on HWA-infested hemlocks at the Hidden Valley and Steep Rock Preserves, Washington, with Rory Larson, conservation and program leader and Brian Hagenbuch, executive director of Steep Rock Association (May 28, 30); released 700 *S. tsugae* on infested hemlocks with Andy Hubbard, MDC forester, on MDC watershed lands for the Barkhamsted Reservoir in Colebrook and Hartland (June 4); released > 2,000 *S. tsugae* at the Pachaug State Forest in Voluntown with Dan Evans, DEEP state forester, and DEEP seasonal, Ruby Hayes (June 16, 19, July 2); released 500 *S. tsugae* with Will Hochholzer, CT State Lands Management Program Supervisor, at Devil’s Hopyard State Park, East Haddam (June 18); released 300 *S. tsugae* with Stephany Dumond, park manager, and seasonal staff at Burr Pond State Park, Torrington (June 23); released 300 *S. tsugae* at Bigelow Hollow State Park and 224 *S. tsugae* at Natchaug State Forest with DEEP seasonal Ruby Hayes (June 30); implemented other spring releases of 1375 *S. tsugae*, donated by Tree-Savers, at Mashamoquet Brook State Park (April 6, 20), Great Mountain Forest (April 28), People’s State Forest (June 25); participated in the surveying of hemlock stands at the MDC Barkhamsted Reservoir watershed lands with forester Andy Hubbard and Philip Royer, MDC Natural Resources Director (May 14, June 9); was interviewed about the 2020 *S. tsugae* biological control releases by Robert Miller of the News Times (June 23); and presented an overview of the mile-a-minute biological control program in 2019 at the annual Spring Cooperative Agricultural Pest Survey (CAPS) meeting via Zoom (15 participants)

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(June 23).

MS. ROSE HISKES participated in virtual Connecticut Invasive Plant Working Group symposium planning committee meetings (June 16, 30).

DR. JAMES LAMONDIA conducted oral exams for candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in Hamden (June 10); participated in an SCRI Grant project initiation Zoom meeting (22 participants) (June 29); and was interviewed about the Valley Laboratory by Ken Dixon of the Connecticut Post (June 30).

DEPARTMENTAL RESEARCH UPDATES JUNE 2020

Aulakh, Jatinder S. 2020. Role of nitrogen and herbicides in integrated management of mugwort (*Artemisia vulgaris*) in cool-season forage grasses. *Invasive Plant Science and Management Journal* (June 23). Available online: DOI: <https://doi.org/10.1017/inp.2020.19>

Abstract - Mugwort (*Artemisia vulgaris L.*) is becoming increasingly problematic in cool-season pastures and grasslands. A 3-yr field experiment evaluated different rates of nitrogen and herbicides for *A. vulgaris* management in a permanent grassland. The main plot had three nitrogen rates, 0, 62, and 124 kg N ha⁻¹; the sub plot had three herbicides, aminopyralid, clopyralid, and glyphosate; and the sub-subplot had three herbicide rates, aminopyralid (61, 122, and 244 g ae ha⁻¹); clopyralid (140, 280, and 560 g ae ha⁻¹); and glyphosate (552, 1,104, and 2,208 g ae ha⁻¹). Results revealed that nitrogen had no effect on *A. vulgaris* control, rhizome biomass, and stem density. However, cool-season grass biomass was the highest (7,126 kg ha⁻¹) in the plots that received 124 kg N ha⁻¹ and 244 g ae ha⁻¹ of aminopyralid. Only glyphosate caused grass injury, which varied from 65% to 100% depending upon application rate. By 9 MAIT, *A. vulgaris* was controlled 60% to 98% with aminopyralid at ≥ 61 g ae ha⁻¹ or glyphosate at ≥ 552 g ae ha⁻¹. By 21 MAIT, aminopyralid at ≥ 122 g ae ha⁻¹ or glyphosate at $\geq 1,104$ g ae ha⁻¹ resulted in > 95% reduction in *A. vulgaris* stem density and rhizome biomass, and provided $\geq 98\%$ visual control. By 33 MAIT, complete control of *A. vulgaris* was confirmed in plots treated with aminopyralid at ≥ 122 g ae ha⁻¹ or glyphosate at $\geq 1,104$ g ae ha⁻¹. Clopyralid was not effective; *A. vulgaris* control was < 40% even after three annual applications at 560 g ae ha⁻¹. Results indicate that integration of nitrogen fertilization with aminopyralid did not improve *A. vulgaris* control, but was advantageous in enhancing cool-season grass productivity.

Hyde, Josephine, M. A. Correa, G. L. Hughes, Blaire Steven, and Doug E. Brackney. Limited influence of the microbiome on the transcriptional profile of female *Aedes aegypti* mosquitoes. *Scientific Reports*. (online July 2)

Abstract - The microbiome is an assemblage of microorganisms living in association with a multicellular host. Numerous studies have identified a role for the microbiome in host physiology, development, immunity, and behaviour. The generation of axenic (germ-free) and gnotobiotic model systems has been vital to dissecting the role of the microbiome in host biology. We have previously reported the generation of axenic *Aedes aegypti* mosquitoes, the primary vector of several human pathogenic viruses, including dengue virus and Zika virus. In order to better understand the influence of the microbiome on mosquitoes, we examined the transcriptomes of axenic and conventionally reared *Ae. aegypti* before and after a blood meal. Our results suggest that the microbiome has a much lower effect on the mosquito's gene expression than previously thought with only 170 genes influenced by the axenic state, while in contrast, blood meal status influenced 809 genes. The pattern of expression influenced by the microbiome is consistent with transient changes similar to infection rather than sweeping physiological changes. While the microbiome does seem to affect some pathways such as immune function and metabolism, our data suggest the microbiome is primarily serving a nutritional role in development with only minor effects in the adult.

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Keriö, Susanna, E. Terhonen, and J. M. LeBoldus. 2020. Safe DNA-extraction protocol suitable for studying tree-fungus interactions. *Bio-protocol* 10(11): e3634. DOI:10.21769/BioProtoc.3634

Abstract - We present a safe and low-cost method suitable for DNA extraction from mycelium and tree tissue samples. After sample preparation, the extraction takes about 60 min. Method performance was tested by extracting DNA from various tree tissue samples and from mycelium grown on solid and liquid media. DNA was extracted from juvenile and mature host material (*Picea abies*, *Populus trichocarpa*, *Pseudotsuga menziesii*) infected with different pathogens (*Heterobasidion annosum*, *Heterobasidion parviporum*, *Leptographium wagenerii*, *Sphaerulina musiva*). Additionally, DNA was extracted from pure cultures of the pathogens and several endophytic fungi. PCR success rate was 100% for young poplar material and fungal samples, and 48-72% for conifer and mature broad-leaved plant samples. We recommend using 10-50 mg of fresh sample for the best results. The method offers a safe and low-cost DNA extraction alternative to study tree-fungus interactions, and is a potential resource for teaching purposes.

Molaei, Goudarz, and Eliza A.H. Little. 2020. A case of morphological anomalies in *Amblyomma americanum* (Acari: Ixodidae) collected from nature. *Experimental and Applied Acarology* 81(2):279-285. 10.1007/s10493-020-00510-5 (Published 4 June 2020).

Abstract - We describe a case of morphological anomalies in *Amblyomma americanum*, a medically important species associated with several human diseases and medical conditions. Based on morphological characters using dichotomous morphological keys, high resolution light microscopy, and scanning electron microscopy imaging, the tick was identified as *Am. americanum* nymph exhibiting various morphological anomalies including ectromely associate with asymmetry, olygomely (lack) of the fourth left leg, and schizomely (bifurcation of palpus) on the right side. We believe this is the first report of the presence of several spontaneous anomalies in one *Am. americanum* specimen. Morphological identity of the specimen was corroborated by DNA sequencing of the mitochondrial 16S region. We discuss recent reports of morphological anomalies in ixodid ticks and emphasize the significance of additional studies of teratology in medically important tick species and its potential implications.

Tuula Jyske, T., K. Kuroda, Susanna Keriö, A. Pranovich, R. Linnakoski, N. Hayashi, D. Aoki, and K. Fukushima. 2020. Localization of (+)-Catechin in *Picea abies* phloem: responses to wounding and fungal inoculation. *Molecules* 25: 2952. doi:10.3390/molecules25122952

Abstract - To understand the positional and temporal defense mechanisms of coniferous tree bark at the tissue and cellular levels, the phloem topochemistry and structural properties were examined after artificially induced bark defense reactions. Wounding and fungal inoculation with *Endoconidiophora polonica* of spruce bark were carried out, and phloem tissues were frequently collected to follow the temporal and spatial progress of chemical and structural responses. The changes in (+)-catechin, (-)-epicatechin, stilbene glucoside, and resin acid distribution, and accumulation patterns within the phloem, were mapped using time-of-flight secondary ion mass spectrometry (cryo-ToF-SIMS), alongside detailed structural (LM, TEM, SEM) and quantitative chemical microanalyses of the tissues. Our results show that axial phloem parenchyma cells of Norway spruce contain (+)-catechins, the amount of which locally increases in response to fungal inoculation. The preformed, constitutive distribution and accumulation patterns of (+)-catechins closely follow those of stilbene glucosides. Phloem phenolics are not translocated but form a layered defense barrier with oleoresin compounds in response to pathogen attack. Our results suggest that axial phloem parenchyma cells are the primary location for (+)-catechin storage and synthesis in Norway spruce phloem. Chemical mapping of bark defensive metabolites by cryo-ToF-SIMS, in addition to structural and chemical microanalyses of the defense reactions, can provide novel information on the local amplitudes and localizations of chemical and structural defense mechanisms and pathogen-host interactions of trees.

Wang, Zhengyang, Santanu Bakshi, Chongyang Li, Sanjai J. Parikh, Hsin-Se Hsieh, and Joseph J. Pignatello. Modification of pyrogenic carbons for phosphate sorption through binding of a cationic polymer. *J. Colloid and Interface Science*, 579, 1 November 2020, 258-268; <https://doi.org/10.1016/j.jcis.2020.06.054>, online June 24.

Abstract - This study reports on the develop of modified pyrogenic carbonaceous materials (PCMs) for recovering orthophosphate (PO₄-P). The PCMs include softwood and

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hardwood biochars and a commercial granular activated carbon (GAC) that were modified by irreversible adsorption of the quaternary ammonium polymer, poly (diallyldimethylammonium) chloride (pDADMAC), which reverses electrokinetic charge and increases PO₄-P sorption. MgO-doped biochars were prepared by a literature method for comparison. Imaging and spectroscopic analyses characterize pDADMAC coverage, MgO doping, and binding of PO₄-P. At environmentally relevant concentrations, PO₄-P sorption by the pDADMAC-treated biochars was ~100 times greater than that of the corresponding unmodified biochars, and was comparable to that of the corresponding MgO-doped biochars on a coating content basis. The pDADMAC-coated carbons bind PO₄-P by ion exchange, while the MgO-doped biochars bind PO₄-P principally by forming an amorphous Mg phosphate species. Susceptibility to competition from other relevant anions (Cl⁻, NO₃⁻, HCO₃⁻/CO₃²⁻, SO₄²⁻) and poultry and dairy manure extracts was moderate and comparable for the two types of modified softwood biochars. Sorption to the pDADMAC-treated biochars appears to be more reversible than to the Mg-doped biochars using stepwise water extraction. Greater reversibility may be advantageous for trapping and recycling phosphate.

Zhang, C., B. Wu, B. Pan, S. Zhang, and Joseph J. Pignatello. Deep removal of arsenite from water with no need for pre-oxidation or in-line oxidation. *Chemical Engineering Journal* 401, 126046 (2020); <https://doi.org/10.1016/j.cej.2020.126046> (June 29).

Abstract - Arsenite is toxic and labile in subsurface media. Oxidation of arsenite to arsenate is a widely used strategy to enhance the removal of arsenic from water. However, the formation of unwanted oxidation byproducts is a major concern in drinking water treatment. Herein, a titanium xerogel (TAX) was fabricated with abundant surface hydroxyl groups and anchored acetylacetone (AA) molecules that served as powerful capturing sites for arsenic. The resultant xerogel had high adsorption capacity for arsenic without the need for any pre-treatment (306 and 254 mg/g for arsenate and arsenite, respectively, at pH 7.0). Columns packed with TAX could effectively lower arsenite concentration from 200 µg/L to less than 10 µg/L for up to 6000 bed volumes, which is more than 10 times greater than those achieved by well-developed iron or zirconium-based nanocomposites. Besides the excellent arsenite capturing ability, **the TAX was also effective in removing heavy metals** and commonly co-existing iron and manganese species in arsenic-contaminated groundwater. Moreover, the TAX had good antibacterial activity toward *Escherichia coli*. These attributes make the TAX **a promising point-of-use adsorbent** for residents in arsenic-contaminated areas, especially areas lacking infrastructure for water treatment.

Cui, Wen-Li, Xiao-Qiang Lu, Jin-Yue Bian, Xi-Ling Qi, De-Wei Li, and Lin Huang. 2020. *Curvularia spicifera* and *Curvularia muehlenbeckiae* causing leaf blight on *Cunninghamia anglerine*. *Plant Pathol.* 1139-1147. <https://doi.org/10.1111/ppa.13198>

Abstract - Curvularia includes plant pathogenic species with a worldwide distribution and a wide host range, particularly cereals and grass (Poaceae). Chinese fir (*Cunninghamia anglerine*) is an important afforestation tree species in southern China, with a high economic value. Leaf blight disease on Chinese fir was discovered in Hunan and Zhejiang, China, and two fungal species were found to be associated with the symptoms. Using morphological and phylogenetic approaches, they were identified as *Curvularia spicifera* and *Curvularia muehlenbeckiae*. They were determined to be the pathogens by fulfilling Koch's postulates. Both showed a pathogenicity on *Citrus reticulata* and *Citrus anglerine*, which have a similar geographic distribution to Chinese fir. The similar geographic distribution of these hosts may increase the risk of disease. Based on a literature review, leaf blight caused by *C. spicifera* and *C. muehlenbeckiae* is recorded here on a gymnosperm for the first time.

Li, De-Wei, R. F. Castañeda-Ruiz, and Neil P. Schultes. 2020. Phylogenetic placement of *Acrospeira*. *Mycotaxon* 135:299-308.

Abstract - The morphology of *Acrospeira mirabilis* is described and illustrated based on a collection from Florida, USA. Phylogenies generated from ITS and LSU DNA sequence analyses place the genus *Acrospeira* in *Ceratostomataceae*. Based on molecular data, *Sphaerodes inferior* (*Microthecium retisporum* var. *inferius*) is proposed as *Microthecium inferioris* comb. nov.

Funk, A. M., Regan B. Huntley, G. S. Mourad, and Neil P. Schultes, A nucleobase cation

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symporter 2, EaXanP, from *Erwinia amylovora* transports xanthine. *Journal of Plant Pathology* DOI: 10.1007/s42161-020-00584-5.

Abstract - *Erwinia amylovora* causes fire blight, one of the more serious diseases for apple and pear cultivation. Previous studies generated *E. amylovora* mutants in purine metabolic pathway that still retain the ability to grow on host tissue and produce limited disease symptoms. Here we show that the *E. amylovora* genome has a locus that encodes for a xanthine permease belonging to the nucleobase cation symporter 2 (NCS2) family and the encoded protein displays a high level of amino acid sequence similarity to the *Escherichia coli* XanP. Our hypothesis is to investigate if the lack of a xanthine transporter has an effect upon disease progression. Heterologous expression of EaXanP in nucleobase transporter-deficient *E. coli* strains, coupled with radiolabeled nucleobase uptake studies determined that EaXanP is a high affinity xanthine transporter with a K_m of 1.2 mM + 0.1 μ M and that confers sensitivity to growth on caffeine (1,3,7-trimethylxanthine). An *E. amylovora* DxanP::Cam^r mutant shows resistance to growth on caffeine, while over expression of EaXanP increases growth sensitivity to caffeine. While the EaXanP gene is expressed in infected immature pear fruitlets, an *E. amylovora* xanthine transport mutant is still able to grow and cause disease symptoms on immature pears and apple fruitlets.

Stoffer-Bittner, A. J., Regan B. Huntley, G. S. Mourad, and Neil P. Schultes. 2020. An *Erwinia amylovora* uracil transporter mutant retains fire blight virulence on immature apple and pear fruit. *Microbial Pathogenesis* <https://doi.org/10.1016/j.micpath.2020.104363>

Abstract - *Erwinia amylovora* is the causal agent of fire blight, a devastating disease of apples and pears. A previous study revealed that an *E. amylovora* uracil auxotroph was still virulent and can cause disease, suggesting that uracil can be obtained from the host environment. The *E. amylovora* genome contains a locus encoding for a uracil transporter belonging to the nucleobase cation symporter 2 family, displaying a high level of amino acid sequence similarity to the *Escherichia coli* UraA. Expression of *E. amylovora* UraA in nucleobase transporter-deficient *E. coli* strains, coupled with radiolabeled uptake studies reveal that *E. amylovora* UraA is a high affinity uracil transporter with a K_m of 0.57 mM. Both *E. coli* and *E. amylovora* carrying extra copies of *E. amylovora* UraA are sensitive to growth on the toxic analog 5-fluorouracil. An *E. amylovora* DuraA::Cam^r mutant is still able to grow and cause disease symptoms on immature pears and apples.

JOURNAL ARTICLES APPROVED JUNE 2020

Barry, A., S. K. Ooi, A. M. Helton, Blaire Steven, C. S. Elphick, and B. A. Lawrence. Vegetation zonation drives salt marsh soil carbon mineralization and microbial communities. *Ecosystems*

Borgatta, J. B., C. A. Lochbaum, Wade Elmer, Jason C. White, J. A. Pedersen, and R. J. Hamers. Biomolecular corona formation on nanoparticles in plants: CuO in xylem fluid. *Environmental Science: Nano*

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Bugbee, Gregory J., and Summer E. Stebbins. Taunton Lake, Newtown, CT Aquatic Vegetation Survey, Water Chemistry, Aquatic Plant Management Options - 2019. *Station Bulletin* (Web only)

Burtis, J. C., J. D. Poggi, Joseph R. McMillan, S. C. Crans, S. R. Campbell, A. Isenberg, J. Pulver, P. Casey, K. White, C. Zondag, J. R. Badger, R. Berger, J. Betz, S. Giordano, M. Kawalkowski, J. L. Petersen, G. Williams, Theodore G. Andreadis, Philip M. Armstrong,

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da Silva, Washington, and Gale Ridge. Grape tumid galls. *CAES Fact Sheet*

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