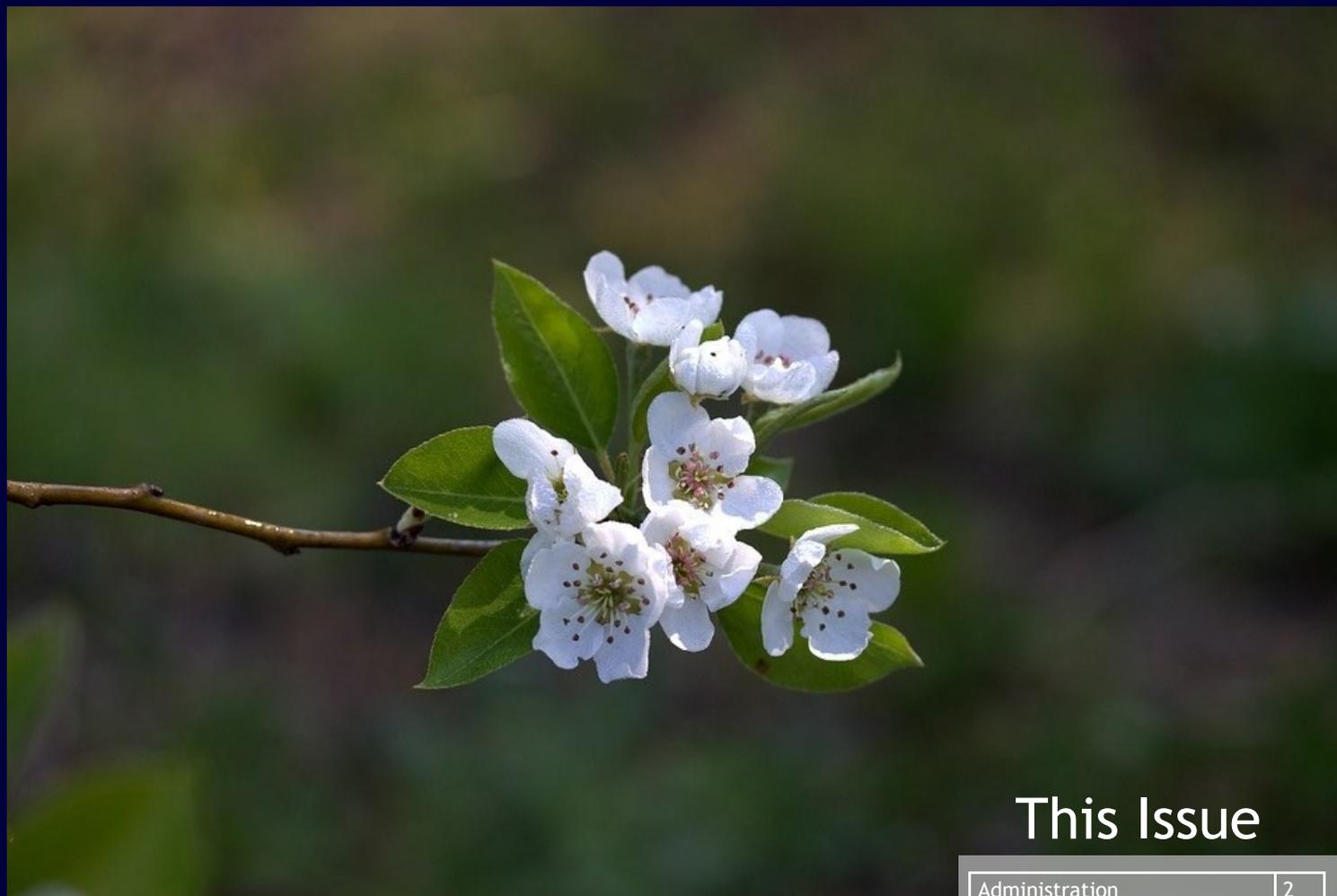


Station News

The Connecticut Agricultural Experiment Station
Volume 12 Issue 3 | March 2022



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



CAES

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875

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DR. JASON C. WHITE, with **DR. SARA NASON** and **DR. NUBIA ZUVERZA-MENA**, participated in a Zoom meeting with collaborators at the University of Minnesota and Yale University to discuss progress on a joint NIEHS grant (February 2); hosted representatives of Vulpes Corporation to discuss collaborative research projects on nano-enabled agriculture (February 2); participated in the PhD proposal defense of Mr. Sudhir Sharma of the University of Massachusetts Stockbridge School of Agriculture (February 4); hosted the monthly CSN Nanochemistry-Plant Zoom call (February 7); participated in the NSF Center for Sustainable Nanotechnology (CSN) weekly All-Hands call (February 9, 16, 23); held a Zoom call with Prof. Om Parkash Dhankher of the University of Massachusetts to discuss organization of a USDA-funded workshop on toxic metals in food (February 9); held a Zoom call with Dr. Hongda Chen of the USDA National Institute for Food and Agriculture (NIFA) to discuss a joint publication for the National Academy of Engineering (February 9); held a Zoom call with staff of Senator Richard Blumenthal's office to discuss additional funding for the CAES Tick Testing Laboratory (February 9); participated in a Zoom call with collaborators at Johns Hopkins University to discuss joint research projects (February 9); visited the University of Rhode Island and gave an invited lecture titled "Tuning Agrochemical Chemistry at the Nanoscale to Enhance Stress Tolerance, Crop Nutrition and Yield" (February 10); with **DR. WADE ELMER**, **DR. CHRISTIAN DIMKPA**, and **DR. CHAOYI DENG**, hosted a Zoom meeting with Professor Laurene Tetard and Professor Swadesh Santra of the University of Central Florida to discuss collaborative research (February 11); with **DR. JOSEPH PIGNATELLO**, participated in a Zoom call with staff at the University of Connecticut Technology Commercialization Services Office (February 11); with **DR. BLAIRE STEVEN**, participated in a Zoom call with Prof. Deb Jaisi of the University of Delaware to discuss a potential collaborative grant proposal (February 14); with **DR. YI WANG**, participated in a Zoom call with collaborators at Rutgers University to discuss a collaborative manuscript (February 14); participated in the monthly FDA Human/Animal Food and Food Defense Zoom calls (February 14); with **DR. WADE ELMER**, **DR. CHRISTIAN DIMKPA**, and **DR. JAYA BORGATTA**, hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA research project (February 15); participated in a Zoom call with collaborators at the University of Minnesota to discuss joint experiments (February 16); participated in a Zoom call with NIH staff regarding participation in an upcoming study section (February 16); hosted a Zoom call with collaborators regarding a session we are co-chairing at the ABCChem conference in Morocco in December 2022 (February 22); participated in a webinar hosted by the Environmental Health Project titled "Shale Gas and Public Health: Translating Science into Policy" (February 22); participated in a Zoom call with Prof. Vasilis Vasiliou of Yale University regarding a graduate student applicant for the Yale School of Public Health (February 22); participated in an FDA workshop on submitting applications for a new MFRPS grant program titled "Manufactured Food Flexible Funding Model Compliance and Enforcement Expansion Supplement" (February 23); participated in an FDA FERN-wide Zoom call (February 24); with **DR. YI WANG** and **DR. WADE ELMER**, hosted a Zoom call with collaborators at the University of Massachusetts to discuss ongoing experiments as part of a joint USDA project (February 25); participated in a Zoom call with collaborators at the University of Parma, Italy (February 28); and hosted the monthly CAES J-1 Visa recipient meeting (February 28).

ANALYTICAL CHEMISTRY

THE MANAGEMENT AND STAFF of the Department of Analytical Chemistry conducted a 2-day training session on “A2LA ISO/IEC 17025:2017 Requirements for Cannabis Testing Laboratories.” The training was conducted by Dr. Susan Audino of S. A. Audino & Associates, LLC, Wilmington, Delaware. The learning goals for the training included (i) understanding the process-based approach of the Standard; (ii) grasping new concepts in 17025:2017, including continual improvement (using PDCA and KPIs), verification and validation, decision rules, principles of impartiality, and risk based thinking; (iii) analyzing scenarios to identify non-conformities, risks, and opportunities related to the new requirements in the Standard; (iv) analyzing sample calibration records to demonstrate metrological traceability; and (v) identifying areas where documents and records are required under the new Standard.

DR. CHRISTINA ROBB worked with the *Journal of Liquid Chromatography* (February 2); was present at the Eastern Analytical Symposium (EAS) Board meeting (February 4), EAS Executive Committee meetings (February 7, 14, 21, 24, 28), EAS Treasury and Finance meeting (February 21); attended the American Public Health Laboratory (APHL) Food Chemistry Workgroup meeting (February 9); attended the Select Science Virtual Analytical Summit 2022 (February 15); met with the management of the Flanders Nature Centre and Land Trust to learn more about the mission of the center and the associated committees; participated in the A2LA ISO/IEC 17025:2017 for Cannabis Testing Laboratories (February 17, 18); attended the Select Science instructional webinar “Proficiency Testing: Optimizing and Maintaining ISO Certification” (February 22); attended the Emergency Response TIPS presentation, “Emerging Threats, Emerging Solutions: Responding to Chemical Suicides” (February 22); and attended the FDA 50 State Conference Call (February 25).

THE NANO RESEARCH GROUP in the Department of Analytical Chemistry, the Department of Plant Pathology and Ecology, the Department of Forestry (**DR. SUSANNA KERIÖ**), and Station Director **DR. JASON WHITE** held an onsite meeting with officials from Vulpes, including Rick Shang and his father, Mr. Shang, on February 2. During the meeting the nano staff gave short presentations of their research, followed by a discussion of potential research cooperation between The CAES and Vulpes. Vulpes has the capacity to scale up production of nano-materials. A post meeting follow-up channel will be coordinated by Dr. White.

ENTOMOLOGY

DR. KIRBY C. STAFFORD III conducted as co-chair a meeting of the Changing Dynamics of Tick Ecology, Personal Protection, and Tick Control subcommittee of the Tick-Borne Disease Working Group (13 attendees) (February 2, 9); with **DR. GOUDARZ MOLAEI**, discussed tick-borne disease policy recommendations for climate change and health issue brief with Dr. Laura Bozzi, Director of Programs, Center on Climate Change and Health (February 10); and participated and presented subcommittee findings to a meeting of the Tick-Borne Disease Working Group (28 attendees) (February 28).

MS. JAMIE CANTONI and **MS. KATHERINE DUGAS** staffed the CAES booth and display at the Connecticut Flower and Garden Show at the Connecticut Convention Center (February 24).

MR. MARK H. CREIGHTON attended a lecture on Bumble Bee Basics with Heather Holm sponsored by the Connecticut Beekeepers Association (February 3).

DR. GOUDARZ MOLAEI presented an invited talk (virtually) titled “Eco-epidemiology of Vector-borne Diseases and the Risk of Human Infection in the Northeastern USA” to the Central Connecticut State University (20 attendees) (February 23); directed the CAES Tick Testing Laboratory; of the 11 submissions, blood-engorged adult blacklegged ticks were tested for Lyme disease, babesiosis and anaplasmosis; results were reported.

DR. GALE E. RIDGE presented a talk on bed bugs and delusional infestation to pest management professionals and health departments personnel in a program hosted by the University of New Hampshire (55 attendees) (February 3); was interviewed about current cold winter weather and its impact on overwintering insects and ticks for an article in the News Times (February 8).

DR. CLAIRE E. RUTLEDGE taught “Insects that Attack Trees” for the Connecticut Tree Protective Association’s Arboriculture 101 class in Jones Auditorium at The CAES’s New Haven location (40 adults) (February 17); presented “Biocontrol of Emerald Ash Borer in Connecticut” for a seminar in Forest Ecosystem Health and Stability in a Changing Climate, Yale School of the Environment in New Haven (20 adults) (February 21).

DR. VICTORIA L. SMITH presented a webinar via Zoom for the Coalition for a Sustainable Cheshire and the Cheshire Library Adult Education Services titled, “Be on the Lookout: Spotted Lanternfly!” (February 7); participated via Teams in a meeting on export certification (February 16); participated via Zoom in the UMass Extension Invasive Insect Webinar Series (February 16-18); participated via Teams in a meeting on the new eFile system of the USDA (February 23).

DR. KIMBERLY A. STONER sent the “Recommendations from the Pollinator Advisory Committee to the Environment Committee of the Connecticut State Legislature on potential changes in policy or legislation to protect pollinator health” to the Co-Chairs, Vice-Chairs, and Ranking Members of the Environment Committee of the CT State Legislature (February 17); sent written testimony on behalf of the Pollinator Advisory Committee to the Environment Committee of the CT State Legislature on Senate Bill 120, An Act Concerning the Use of Chlorpyrifos on Golf Courses and Neonicotinoids for Nonagricultural Use (February 24); testified on behalf of the Pollinator Advisory Committee to the Environment Committee in their public hearing on Senate Bill 120, An Act Concerning the Use of Chlorpyrifos on Golf Courses and Neonicotinoids for Nonagricultural Use (February 25).

MS. TRACY ZARRILLO participated in a virtual meeting with Dr. John Ascher of the University of Singapore and **DR. KIMBERLY STONER** to discuss the Checklist of the Bees of Connecticut project (February 1); participated in a virtual meeting with the New England Bee Taxa Team, a sub-committee of the Northeast Fish and Wildlife Diversity Technical Committee, to discuss and finalize regional species of greatest conservation need and regional responsibility levels (February 9); participated in a virtual meeting with Bruce Young of NatureServe and Laura Saucier of CT-DEEP to discuss collaboration on an upcoming grant called, “Support for Pollinator Conservation in the Northeast” in preparation for the State Wildlife Action Plan update in 2025 (February 23).

DR. JOSEPH PIGNATELLO was appointed as Technical Editor of *Soil Science Society of America Journal* overseeing submissions handled by Associate Editors (February 1); met with co-investigators from the University of Maryland and Geo-Syntec Corp. on a SERDP grant (February 9); and met with Christopher Conners, Technology Commercialization Services, University of Connecticut, to discuss patent and licensing opportunities for an invention (February 11, 16).

DR. DOUG BRACKNEY gave the talk, “Navigating anatomical barriers to transmission: an arbovirus tale” in the Virtual Vector Biology Seminar Series (99 attendees) (February 25).

MS. ANGELA BRANSFIELD provided biosafety, biocontainment, security, and incidence response training to BSL3 laboratory personnel (16 attendees) (February 15); participated via Zoom in Yale’s Biosafety Committee Meeting (February 17); co-chaired a CAES DEI Committee Meeting (February 23).

MR. GREGORY BUGBEE chaired a meeting of the Northeast Aquatic Plant Management Society Scholarship Committee (January 7); as President of the Northeast Aquatic Plant Management Society, provided opening remarks for the 23rd Annual Conference and gave a talk titled “Hydrilla in the Connecticut River: The Management Conundrum” (approx. 200 attendees) (January 11); with **MS. SUMMER STEBBINS**, proctored the virtual pesticide license recertification program for the Northeast Aquatic Plant Management Society (approx. 50 attendees) (January 11-13); updated the National Aquatic Nuisance Species Task Force Research Committee on hydrilla in the Connecticut River (February 2, 24).

DR. SARA NASON met with collaborators from Yale and the University of Minnesota regarding collaborative research (February 2); participated in meetings of the Benchmarking and Publications for Non-Targeted Analysis working group (multiple days in February); hosted a virtual stakeholder event for the Benchmarking and Publications for Non-Targeted Analysis working group (12 attendees) (February 17); was interviewed by Grist Media regarding PFAS phytoremediation project (February 14); and gave an invited virtual seminar as part of the LC-GC PFAS Summit titled “Analysis of PFAS in Environmental and Human Samples” (221 attendees) (February 18).

DR. ITAMAR SHABTAI participated in a Zoom meeting with collaborators at Cornell University to discuss ongoing work on an NSF Signals in the Soil (SitS) project (February 3); participated in a video meeting with collaborators at the Technical University of Munich to discuss plans for a project employing the NanoSIMS facility (February 10); and held a Zoom call with a colleague at Purdue University to discuss a USDA grant proposal (February 22).

DR. ZHENGYANG WANG was appointed to serve as Guest Associate Editor for a special edition of *Frontiers in Environmental Chemistry* (started in February).

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD participated in a (FEMC) Forest Ecosystem Monitoring Cooperative Joint Committee virtual meeting (February 1); participated in a CFPA Governance Committee meeting (February 8); attended the virtual annual meeting of the Yankee Division, Society of American Foresters (February 15); was awarded the David M. Smith Outstanding Forester Award by the Yankee Division, Society of American Foresters (February 15); spoke on “Forest Carbon and Multi-Use Forest Management” for the Cornell University ForestConnect webinar series (277 attendees) (February 16); was interviewed about the status of maples in Connecticut by Robert Miller, *News-Times* (February 16).

DR. SUSANNA KERIÖ participated in a meeting of the Yale Biosafety Committee (February 17).

DR. LEIGH WHITTINGHILL met with Christ Sullivan of the Southwest Conservation District and two others virtually to discuss their roles and possible collaborations (February 3); participated in a listening session hosted by Jiff Martin at UConn Extension for an urban farmer tool share program they are starting (15 attendees) (February 17); participated in a virtual planning meeting for the CT DoAg Urban Agriculture webinar series (February 25); introduced herself to the I Got Next urban farming group and others who run a series of urban farmer trainings with assistance from Jiff Martin and others at UConn Extension at a virtual planning meeting (17 attendees) (February 25).

DR. SCOTT C. WILLIAMS gave an invited lecture over Zoom on the relationship between blacklegged ticks, tick-borne pathogens, and invasive exotic plant species to members of the Harwinton Garden Club (February 10).

MR. JOSEPH P. BARSKY attended the virtual annual meeting of the Yankee Division, Society of American Foresters (February 15).

PLANT PATHOLOGY AND ECOLOGY

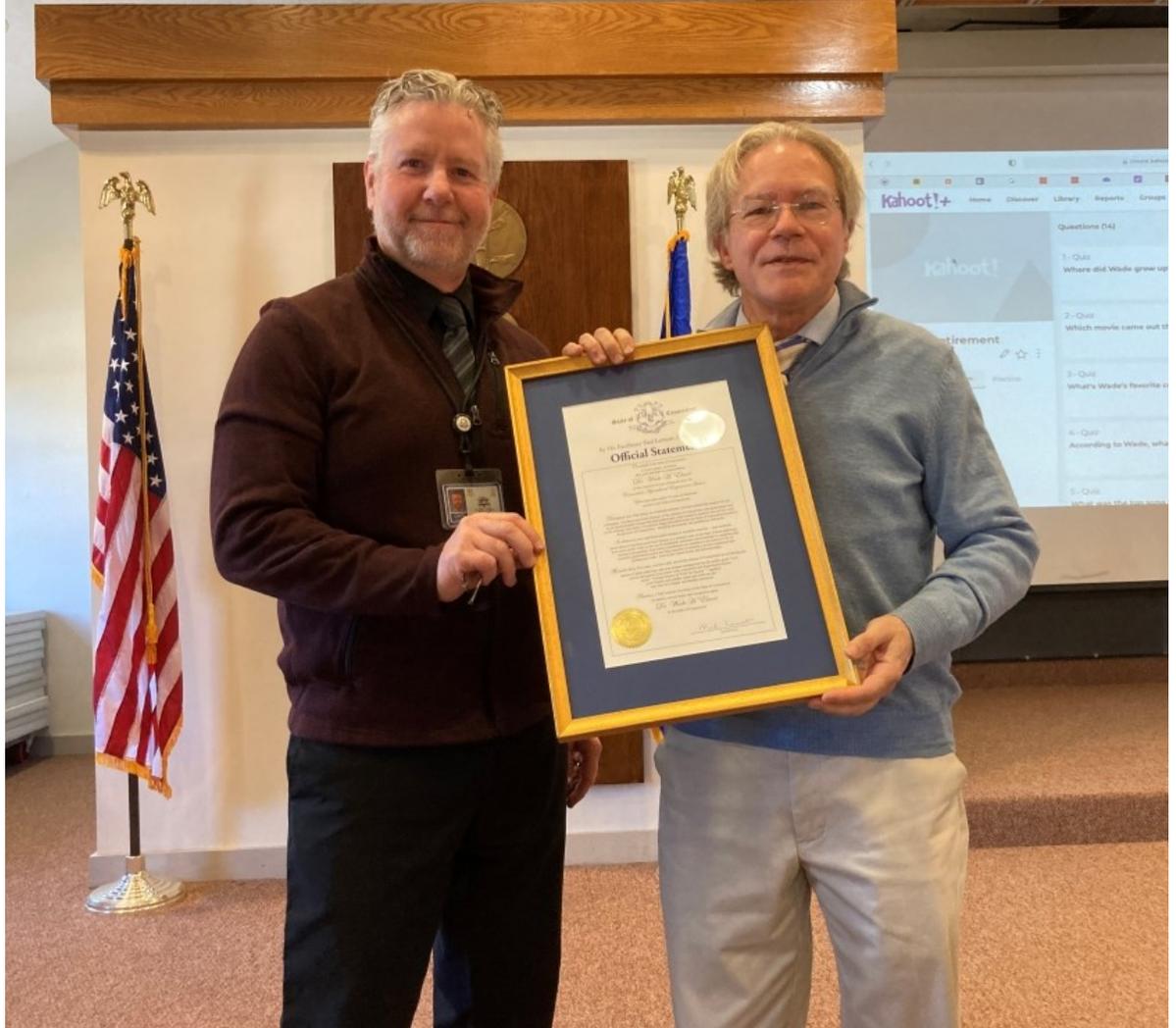
DR. YONGHAO LI participated in the National Plant Diagnostic Network Online Communication & Web Portal Committee meeting via Zoom (6 adults) (February 9); gave a lecture titled “Diseases of Trees” for the Connecticut Tree Protective Association Arboriculture 101 Course in Jones (40 adults) (February 10); and presented “Diagnosing Plant Disease Problems - Basics and Steps” at the CT NOFA Winter Conference via Zoom (42 adults) (February 16).

DR. QUAN ZENG organized and modulated a webinar titled “Antibiotic and Fungicide Resistance in Tree Fruit Pathogens” for the Northeast Tree Fruit Consortium winter webinar series (54 adults) (February 1); visited the Department of Plant Pathology at the University of Georgia where he met faculty members and graduate students and presented a seminar titled “Apple Flower Microbiome and Its Impact to Fire Blight Infection” (75 adults) (February 6-8), with **DR. SALMA MUKHTAR**, organized and presented in a virtual workshop titled “Visualizing Effectors During Plant-Pathogen Interactions” for the American Phytopathological Society (29 adults) (February 21).

MS. ROSE HISKES conducted a Connecticut Invasive Plant Working Group (CIPWG) Symposium planning committee meeting via Zoom (16 attendees) (February 3); participated in the Connecticut Invasive Plants Council virtual

meeting (February 15); set up and staffed the Connecticut Invasive Plant Working Group booth at The Connecticut Flower and Garden Show in Hartford (February 23, 26, 27); and staffed the CAES booth at The Connecticut Flower and Garden Show in Hartford (February 26, 27).

DR. NEIL SCHULTES gave three lectures on “Genetically Modified Plants in Agriculture” to Science Course Sci 031 at Yale University (12 students) (February 4, 11, 18).



Dr. Wade Elmer (right) at a lunch hosted by the Department of Plant Pathology and Ecology receiving his recognition award with **Dr. Jason White** (left), the Station Director. Governor Ned Lamont signed his award thanking Dr. Elmer for his 35 years of service to the State of Connecticut. Dr. Elmer retired on March 1, 2022.

VALLEY LABORATORY

DR. JAMES LAMONDIA and **DR. RICHARD COWLES** conducted a webinar hosted by Rainbow EcoScience about “Beech Leaf Disease in Connecticut” (231 attendees) (February 1); and participated in a virtual Boxwood Blight Insight Group Epidemiology meeting (17 attendees) (February 7).

ADMINISTRATION

1. Wang, D., Saleh, N. B., Byro, A., Zepp, R., Sahle-Demessie, E., Luxton, T. P., Ho, K. T., Burgess, R. M., Flury, M., White, J. C., Su, C. (2022). Nano-enabled pesticides for sustainable agriculture and global food security. *Nature Nano*. <https://doi.org/10.1038/s41565-022-01082-8>

Abstract: Achieving sustainable agricultural productivity and global food security are two of the biggest challenges of the new millennium. Addressing these challenges requires innovative technologies that can uplift global food production sustainably, while minimizing collateral environmental damage and preserving agroecosystem resilience against a rapidly changing climate. Nanomaterials with the ability to encapsulate and deliver the pesticidal active ingredients (AIs) in a responsive (e.g., controlled, targeted, and synchronized) manner offer new opportunities to increase pesticidal efficacy and efficiency when compared to conventional pesticides. Here, we provide a comprehensive analysis on the key properties of nanopesticides in controlling agricultural pests for crop enhancement compared to their non-nanoscale analogs, based on 36,658 Google Patents and 500 peer-reviewed papers published between 2015 and 2020. Our analyses show that when compared to non-nanoscale pesticides, their overall efficacy against target organisms is 31.5% higher (N = 314), including an 18.9% increased efficacy in field trials (N = 47). Notably, the toxicity of nanopesticides toward nontarget organisms is 43.1% lower (N = 59), highlighting a decrease in collateral damage to the environment. The premature loss of AIs prior to reaching target organisms is reduced by 41.1%, paired with a lower leaching potential of AIs by 22.1% in soils. Nanopesticides also render other benefits, including enhanced foliar adhesion, improved crop yield and nutrition, and a responsive nanoscale delivery platform of AIs to mitigate various pressing biotic and abiotic stresses (e.g., heat, drought, and salinity). Nonetheless, uncertainties associated with the adverse effects of some nanopesticides are not well-understood, requiring further investigations. Overall, our findings show that nanopesticides are potentially more efficient, sustainable, and resilient with lower adverse environmental impacts, compared to their conventional analogs. These benefits, if harnessed appropriately, can facilitate generating higher crop yields, and thus contribute towards achieving sustainable agriculture and global food security.

ANALYTICAL CHEMISTRY

1. Awio, T., Senthilkumar, K., Dimkpa, C. O., Otim-Nape, G. W., Struik, P. C., Stomph, T. J. (2022). Yields and yield gaps in lowland rice systems and options to improve smallholder production. *Agronomy*, 12(3), 552. <https://doi.org/10.3390/agronomy12030552>

Abstract: Increasing productivity per unit area, hence closing the yield gap, is key to meeting cereal demand in sub-Saharan Africa. We assessed, with 114 farmers, the contribution of recommended agronomic practices (RAP) with or without NPK fertilization on yield gaps, and options to intensify productivity. Treatments included farmers' practice (FP) as control, RAP with and without NPK, and farmer-selected best practices geared towards intensification (farmers' intensification practice, FIP). RAP without fertilization and FIP significantly increased grain yield, each by ca. 12%, whereas RAP+NPK application produced ca. 33% extra yield, over FP. RAP gave the highest mean net income (ca. USD 220 ha⁻¹), fertilizer costs made RAP+NPK gave the lowest mean net income

(ca. USD 50 ha⁻¹). Weeding and fertilization timing contributed most to yield variation among fields. Delay in weeding and fertilization created an average yield loss of 5.3 and 1.9 g m⁻², per day delay, respectively. Exploitable yield gap averaged 24 and 29%, respectively, across treatments and under FP. RAP, FIP, and RAP+NPK reduced the exploitable yield gap to 25, 26, and 12%, respectively. We conclude that different yield gap levels can be exploited by smallholder farmers in lowland rice systems as RAP, FIP, and RAP+NPK allow yield gap reduction, although fertilization poses a risk to profit at current rice and fertilizer prices. To realize yield gains, farmers with good water management should combine timely weeding with other crop management practices.

ENTOMOLOGY

1. Stafford, K. C. III, Molaei, G., Williams, S. C., Mertins, J. W. (2022). *Rhipicephalus capensis* (Acari: Ixodidae), A geographically restricted South African tick, returning with a human traveler to the United States. *Ticks and Tick-borne Diseases*, 13(3). <https://doi.org/10.1016/j.ttbdis.2022.101912>

Abstract: Accelerated frequency of recreational travel, globalization of business, and legal and illegal plant and animal trades have contributed to enduring introductions of exotic ticks into the United States. We herein report a new incursion of a female *Rhipicephalus capensis* on a human traveler returning to Connecticut from South Africa. Natural distribution of *R. capensis* is restricted to the Western Cape Province and southwestern portion of the Northern Cape Province of South Africa, an area called the Fynbos Biome, and adults of this species primarily parasitize large, wild ungulate hosts. Only one previous international introduction of this tick is documented on imported South African plant material into the United States in 1985. The specimen described here was identified initially by morphological means and subsequently, a partial DNA sequence for the mitochondrial ribosomal RNA gene was generated in a PCR assay, which showed 94.86% identity to an *R. capensis* sequence in GenBank. We also provide information on several other previously unreported or under-reported incursions by South African ticks into the United States in association with imported Fynbos floricultural materials and speckled Cape tortoises, *Chersobius signatus*. Documentation of these additional exotic tick species incursions highlights ongoing challenges of the international movement of humans, animals, and other goods carrying ticks of human and veterinary importance.

2. Molaei, G., Andreadis, T. The Connecticut Center for Vector Biology & Zoonotic Diseases: A long history of research partnership and outreach in public health entomology. Submitted to *Wing Beats* on February 25, 2022.

ENVIRONMENTAL SCIENCES

1. Anderson, J. F., Fish, D., Armstrong, P. M., Misencik, M. J., Bransfield, A., Ferrandino, F. J., Andreadis, T. G., Stenglein, M. D., Kapuscinski, M. L. (2022). Seasonal dynamics of mosquito-borne viruses in the southwestern Florida Everglades, 2016, 2017. *Am. J. Trop. Med. Hyg.* 106(2), 610-622. <https://doi.org/10.4269/ajtmh.20-1547>

Abstract: Mosquitoes were collected for 12 consecutive months beginning June 2016, from 11 locations in the Florida Everglades, Collier County, and tested for viruses by isolation in Vero cells and subsequent identification. One species

complex and 31 species of mosquitoes were identified from 668,809 specimens. *Ochlerotatus taeniorhynchus* comprised 72.2% of the collection. Other notable species were *Anopheles crucians* complex, *Culex nigripalpus*, *Cx. erraticus*, and *Cx. cedecei*. Seven species of virus were identified from 110 isolations: Everglades, Gumbo Limbo, Mahogany Hammock, Pahayokee, Shark River, Tensaw, and West Nile viruses. Everglades, West Nile, Tensaw, and Mahogany Hammock viruses were most frequently isolated. Largest numbers of viruses were identified from *Cx. cedecei*, *Cx. nigripalpus*, and *An. crucians* complex. Five species of virus were isolated from *Cx. cedecei*. Viruses were isolated from mangrove, cypress swamp, hardwood hammock, and sawgrass habitats. West Nile virus was isolated August through October when *Cx. nigripalpus* was most abundant. Everglades virus was the most frequently isolated virus from nine species of mosquitoes collected from June through August. Tensaw virus was isolated primarily from *Anopheles* species. Isolations were made in July, August, January, February, and April, suggesting that this virus may be present in host-seeking mosquitoes throughout the year. Mahogany Hammock, Shark River, Gumbo Limbo, and Pahayokee viruses were isolated primarily from *Cx. cedecei* from June through December. Shotgun metagenomic sequencing was used to document that seven pools of *Cx. cedecei* were infected with two arboviruses. As communities expand into the Everglades, more humans will become exposed to arboviruses.

PLANT PATHOLOGY AND ECOLOGY

1. Martins, S., Taerum, S. J., Triplett, L. R., Emerson, J. B., Zasada, I., de Toledo, B. F., Kovac, J., Martin, K., Bull, C. T. 20XX. Predators of soil bacteria in plant and human health. *Phytobiomes* in press, Early Look DOI: <https://doi.org/10.1094/PBIOMES-11-21-0073-RVW>

Abstract: Soil bacterial predators that use the biomass of bacterial hosts for growth (multiplication), energy, and/or replication have the potential to reduce bacterial populations in the wide variety of terrestrial ecosystems in which they are found. Bacterial predators including bacteria-feeding nematodes, protists, bacteria (*Bdellovibrio*, other BLOs, *Lysobacter*, and *myxobacteria*), and bacteriophages are responsible for bacterial turnover in soils that lead to many ecosystem services. The demonstrated the breadth and specificity of bacterial host ranges for these predators make them interesting targets for the management of bacterial plant and human pathogens. However, there remain significant gaps in knowledge that will need to be filled in order to effectively utilize these predators for disease management. Here we compared predatory strategies of the major groups of soil bacterial predators and outlined the gaps in knowledge or techniques that are limit research. We offered specific needs and next steps for integrating analyses of predator identity and impact into studies of soil ecosystems in natural and applied settings.

VALLEY LABORATORY

1. Ding, X., Guo, Y., Ye, J., Wu, X., Lin, S., Chen, F., Zhu, L., Huang, L., Song, X., Zhang, Y., Dai, L., Xi, X., Huang, J., Wang, K., Fan, B., Li, D.-W. (2022). Population differentiation and epidemic tracking of *Bursaphelenchus xylophilus* in China based on chromosome-level assembly and whole genome sequencing data. *Pest Management Science*, 78(3), 1213-1226. <https://doi.org/10.1002/ps.6738>

Abstract: *Bursaphelenchus xylophilus*, the pinewood nematode, kills millions of

pine trees worldwide every year, and causes enormous economic and ecological losses. Despite extensive research on population variation, there is little understanding of the population-wide variation spectrum in China. **RESULTS:** We sequenced an inbred *B. xylophilus* strain using Pacbio+Illumina+Bionano+Hi-C and generated a chromosome-level assembly (AH1) with six chromosomes of 77.1 Mb (chromosome N50: 12 Mb). The AH1 assembly shows very high continuity and completeness, and contains novel genes with potentially important functions compared with previous assemblies. Subsequently, we sequenced 181 strains from China and the USA and found ~7.8 million single nucleotide polymorphisms (SNPs). Analysis shows that the *B. xylophilus* population in China can be divided into geographically bounded subpopulations with severe cross-infection and potential migrations. In addition, distribution of *B. xylophilus* is dominated by temperature zones while geographically associated SNPs are mainly located on adaptation related GPCR gene families, suggesting the nematode has been evolving to adapt to different temperatures. A machine-learning based epidemic tracking method has been established to predict their geographical origins, which can be applied to any other species. **CONCLUSION:** Our study provides the community with the first high-quality chromosome-level assembly which includes a comprehensive catalogue of genetic variations. It provides insights into population structure and effective tracking method for this invasive species, which facilitates future studies to address a variety of applied, genomic and evolutionary questions in *B. xylophilus* as well as related species.

JOURNAL ARTICLES APPROVED FEBRUARY 2022

Li, Z., Jorn, R., Samonte, P. R. V., Mao, J., Sivey, J. D., **Pignatello, J. J.**, Xu, W. Surface-catalyzed hydrolysis by pyrogenic carbonaceous matter and model polymers: An experimental and computational study on functional group and nanopores. *Applied Catalysis B: Environmental*.

Pignatello, J. J. Organic chemicals. *Encyclopedia of Soils in the Environment, 2nd Edition*, Academic Press.

Prajapati, D., Pal, A., **Dimkpa, C.**, Harish, Singh, U., Devi, K. A., Chaudhary, J. L., Saharan, V. Chitosan nanomaterials: A prelim of next-generation fertilizers; existing and future prospects. *Carbohydrate Polymers*.

Rose, N., **Shepard, J.**, Ayala, D. Establishing colonies from field-collected mosquitoes: Special accommodations for wild strains. *Cold Spring Harbor Protocols*.

Wu, X., Jia, W., Hu, J., Yu, X., Yan, C., **White, J. C.**, Liu, J., Yang, Y., Tao, S., Wang, X. Simultaneous reduction of arsenic and lead bioaccumulation in rice (*Oryza sativa* L.) by TiO₂ nanoparticles: A mechanistic study. *Small*.

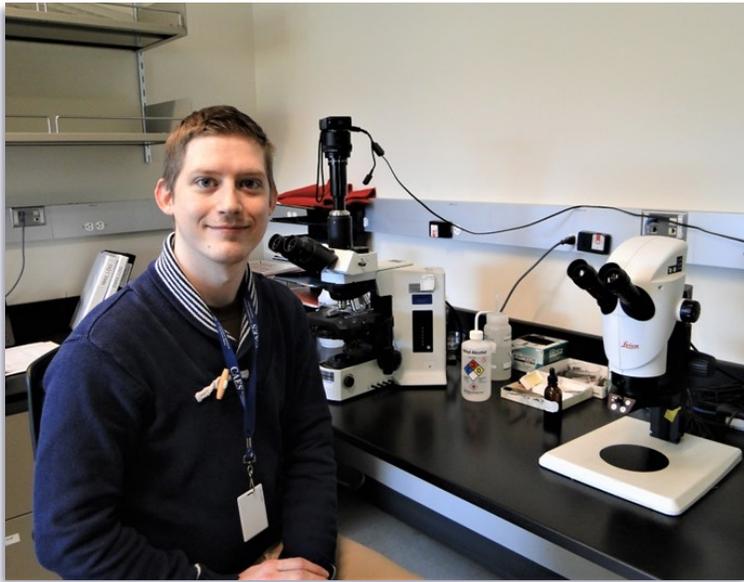
Zhao, Z., Xu, T., Pan, X., **White, J. C.**, Hu, X., Miao, Y., Demokritou, P., Ng, K. W. Green and sustainable nutrient substrates for enhanced seedling development in hydroponics. *Advanced Functional Materials*.



TRISTAN SMITH is a junior at Albertus Magnus College, intending to major in biology. He also plays baseball at Albertus. He is currently screening *Aedes albopictus* populations in Connecticut and surrounding states for Wolbachia with **Dr. Andrea Gloria-Soria**.

MEREDITH BAGGER is a first year MPH student in the epidemiology of microbial diseases department at Yale School of Public Health. She is originally from New Jersey but lived in Washington, DC for the past few years. Her research interests include insect-borne infectious disease epidemiology, vector biology, public health surveillance, and climate change. At The CAES she is working with **Dr. Andrea Gloria-Soria** on a project to screen mosquito populations for *Dirofilaria immitis* infection.





MR. MAARTEN MCSWEENEY is a spring intern at The CAES's Plant Disease Information Office (PDIO) in New Haven under **Dr. Yonghao Li** and **Ms. Katherine Dugas**. He will be assisting in plant inquiries and seed testing in the PDIO. He is a senior graduating from Central Connecticut State University with an undergraduate degree in General Biology.

MR. DEVIN HINES is a senior at Albertus Magnus College majoring in Biology. Devin is a local living in West Haven, CT. This spring, he will be performing an internship with **Dr. Neil Schultes** learning PCR and associated techniques for investigating molecular taxonomy of select *Fusarium* and *Phytophthora* species in conjunction with **Drs. Elmer, Li, and Cowles**.





CAES

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Putting Science to Work for Society since 1875

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