

Station News

The Connecticut Agricultural Experiment Station
Volume 7 Issue 6 June 2017



This Issue

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



CAES

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875

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ADMINISTRATION

DR. THEODORE ANDREADIS was interviewed about the current status of ticks and tick-borne diseases in the state and the Station's Tick Testing Program by Jill Konopka, NBC 30 Connecticut (May 1); was interviewed about ticks and tick-borne diseases by Lucy Nalpathanchil, on WNPR's, "Where We Live" show in Hartford (May 2); was interviewed about the current status of ticks and tick-borne diseases in the state and the Station's Tick Testing Program by Edmond Mahoney, Hartford Courant (May 2); was interviewed about the rising tick population in the state by Hayley Miller, Huffington Post (May 4); with **DR. JASON WHITE** hosted Dr. Rick Rhodes, Executive Director of the Northeast Regional Association of Experiment Station Directors and gave an overview of the Station's research, regulatory and public service programs and a tour of Station facilities (May 10); participated in a meeting of principal investigators of the four Regional Vector-Borne Centers of Excellence Visit held at the Centers for Disease Control and Prevention Division of Vector-Borne Diseases in Fort Collins, CO (May 18-19); presented welcoming remarks and an overview of the Experiment Station and its various research, regulatory and public service programs for a "Behind the Scenes Tour" for Experiment Station Associates held at the Station (12 attendees) (May 24); was interviewed about the establishment of the Asian tiger mosquito, *Aedes albopictus* in CT by NBC Connecticut (May 24); and was interviewed about the outlook for mosquitoes and West Nile virus and the start of the Mosquito Trapping and Virus Testing Program for the 2017 season by Amanda Cuda, Connecticut Post (May 30).

ANALYTICAL CHEMISTRY

DR. JASON C. WHITE attended the monthly Laboratory Preparedness meeting at the CT Department of Public Health Laboratory in Rocky Hill (May 1); gave a lecture at the Harvard School of Public Health entitled "Engineered Nanomaterials in Agriculture: Implications and Application" (25 attendees) (May 3); participated in an FDA Method Coordination Committee conference call (May 4); discussed Department of Analytical Chemistry programs and research to student attendees at the CT Agriscience Fair (20 students) (May 4); attended the Center for Sustainability Nanotechnology's NSF Center for Chemical Innovation site visit at the University of Wisconsin Madison (May 7-9); along with **DR. THEODORE ANDREADIS** met with Dr. Rick Rhodes, who is the Executive Director of the Northeastern Regional Association of State Agricultural Experiment Station Directors (NERA), and discussed Station programs and research (May 10); along with **DR. BRIAN EITZER, DR. CHRISTINA ROBB, DR. WALTER KROL, MS. TERRI ARSENAULT, MR. CRAIG MUSANTE, MR. MICHAEL CAVADINI** and **MS. KITTY PRAPAYOTIN-RIVEROS** participated in the monthly FDA FERN cCAP teleconference call (May 11); participated in the monthly all faculty Web-Ex for the Center for Sustainable Nanotechnology (May 17); attended the annual USDA NIFA Project Directors meeting in Washington, DC and gave a presentation entitled "Nanoscale Elements Suppress Plant Disease, Enhance Micronutrient Use Efficiency, and Increase Crop Yield" (30 attendees) (May 18-19); was an invited speaker at the International Symposium on Emerging Contaminants and Environmental Nanotechnology which was held at Nankai University in Tianjin China and gave a lecture entitled "Accumulation of Engineered Nanomaterials in Terrestrial Food Chains: Correlating Physiological and Molecular Response" (50 attendees) (May 22-26); and along with Dr. Wade Elmer participated in a WebEx with faculty at the Center for Sustainable Nanotechnology to discuss specifics of an upcoming visit by two Ph.D. students from the Center (Universities of Wisconsin and Minnesota) (May 31).

DR. BRIAN D. EITZER was a participant in a conference call of the North American Chemical Residue Workshop's Organizing Committee call (May 11) and provided an update on the analysis of azide in a poisoning investigation during the Food Emergency Response Network Northeast Regional call (May 25).

MR. MICHAEL J. CAVADINI presented information about the field of analytical chemistry and CAES's work in PCB analysis to students at the North Branford High School Environmental Science Fair (~30 student and 5 adult attendees) (May 19).

DR. CHRISTINA S. ROBB and **MS. TERRI ARSENAULT** demonstrated a children's science experiment involving kinetic sand to the 1st and 5th graders from St. Thomas's Day School (45 students) (May 23).



Dr. Jason C. White attended Center for Sustainability Nanotechnology's NSF Center for Chemical Innovation site visit at the University of Wisconsin Madison.



Dr. Jason C. White attended the International Symposium on Emerging Contaminants and Environmental Nanotechnology which was held at Nankai University in Tianjin China.

ENTOMOLOGY

DR. KIRBY C. STAFFORD III was interviewed by Heather Burian, NBC Connecticut, about the gypsy moth (May 3); was interviewed by Mark Sims, Connecticut Radio Network, about the potential for gypsy moth control by the fungus with current rains (May 5); was interviewed by Mary Biekert, Norwich Bulletin, about the gypsy moth fungus (May 9); was interviewed by Judy Benson, The New London Day, about the gypsy moth (May 9); was interviewed by Ms. Sloan Brewster, The Valley Press, about ticks and tick-borne diseases (May 10); spoke on the prevention of tick-associated diseases at the Global Lyme Alliance program in Stamford (100 attendees) (May 11); spoke at the Edith Wheeler Memorial Library in Monroe on ticks and tick-borne diseases (50 adult attendees) (May 16); participated in a Cooperative Agricultural Pest Survey (CAPS) meeting at CAES (12 attendees) (May 17); and was interviewed by Heather Burian, NBC, about gypsy moth (May 30).

MS. KATHERINE DUGAS attended and assisted in a mollusk survey with USDA surveyors Ken DiVito, Chuck Baker and Eric Chamberlain in Darien (May 10) and organized and ran the Statewide CAPS committee meeting held in Slate Laboratory (12 attendees) (May 17).

MR. MARK H. CREIGHTON spoke at Lake Street School in Vernon about honey bees and their role in pollination (22 student attendees) (May 1); was interviewed by the Hartford Courant on bee health issues; the story appeared on the cover page of the Sunday edition (May 2); assisted **DR. RICHARD COWLES** with the setting up of swarm traps in Yale Myers Forrest in an attempt to capture wild bees in support of our Queen Rearing Grant (May 3); met with a student at Amity High School to develop a bee talk about bee health to be presented on June 19th (May 9); spoke at the East Hartford Garden Club on bee health and pollination (70 attendees) (May 15); attended a Science Fair at Amity High School and listened to a presentation on bee health by a student he proctored (May 19); attended the Backyard Beekeepers Annual meeting and spoke to 90 members on bee health and the state honey bee registration program (May 23); responded to Bradley International Airport to collect a swarm of honey bees interfering with staff alongside the United Airlines runway gate (May 30), the honey bees were donated to the New Canaan Nature Center for their observation hive; and spoke to the Backyard Beekeepers Association about bee health issues (110 attendees) (May 30).

DR. CHRIS T. MAIER participated in a meeting of the Advisory Committee of the Cooperative Agricultural Pest Survey (CAPS) at CAES (May 17).

DR. GALE E. RIDGE presented talks on bed bugs at two webinars. The first was for the regional Municipal Waste Disposal Program for Connecticut, Massachusetts, and Rhode Island and the second was as a panelist on bed bugs in schools for the EPA during a nationwide webinar (May 9); spoke at the YHouse (YMCA) in Torrington (37 attendees) (May 10); talked about bed bug protection to mattress recyclers in Bridgeport (21 attendees) (May 12); presented a talk at an Infectious Nurses Association of Connecticut New Haven meeting (27 attendees) followed by a keynote speech to the graduating science class of 2017 at Amity Senior High School in Woodbridge (200 attendees) (May 19); talked about bed bugs as part of the Tilde Café series of lectures held at the James Blackstone Memorial Library in Branford (25 attendees) (May 20); and welcomed and talked about insects to two groups from St. Thomas's Day School (1st grade 20 students and chaperones followed by 5th grade 15 students and chaperones) (May 23).

DR. VICTORIA L. SMITH participated in the spring Cooperative Agricultural Pests Survey meeting, held in the Slate Board Room (10 attendees) (May 17) and participated in a meeting of the Yale University Biosafety Committee, held at 135 College Street, New

Haven (20 attendees) (May 18).

DR. KIMBERLY A. STONER served as a judge of presentations by high school student teams on permaculture designs at the annual Envirothon at the Tolland County Extension Center in Vernon (May 18).

ENVIRONMENTAL SCIENCES

DR. JOSEPH PIGNATELLO gave the talk, “Bioaccessibility of native PAH and PAH derivatives in a fuel soot using an *in vitro* GI model,” at the Society of Environmental Toxicology and Chemistry (SETAC) Europe in Brussels, Belgium (approx. 75 students and 75 other attendees) (May 7-11).

DR. PHILIP ARMSTRONG was interviewed by the New Haven Register and Connecticut Post about the northward expansion of the Asian Tiger mosquito (May 23); was interviewed by Wired Magazine about monitoring ticks for Powassan virus (May 24); and was interviewed by News 8 about the invasive Asian Tiger mosquito in Connecticut (May 30).

MR. GREGORY BUGBEE participated as a judge at the Future Farmers of America Science Fair held in the Jones Auditorium (May 4); spoke to the Bethany Garden Club on “Composting” at the Bethany Town Hall (approx. 25 attendees) (May 8); and spoke on “Soil Testing” and “Invasive Aquatic Plants” as part of the Experiment Station Associates CAES Tour (approx. 10 attendees) (May 24).

DR. GOUDARZ MOLAEI was interviewed by CNN, “*Experts warn of increases in tick-borne Powassan virus*” (<http://www.cnn.com/2017/05/03/health/powassan-tick-virus/index.html>) (May 2); was interviewed by NBC Channel 3, “*Connecticut Scientist Predicts ‘Difficult’ Season for Lyme Disease*” (<http://www.nbcconnecticut.com/news/local/Connecticut-Scientist-Predicts-Difficult-Season-for-Lyme-Disease--415618923.html>) (May 4); was interviewed by NPR on the impact of climate change and other ecological factors on recent increases in tick abundance and prevalence of infection in northeastern USA (May 4); joined WTNH-Facebook, “*Facebook Live Q&A: Dr. Molaei on Ticks + Powassan Virus*” (<https://www.facebook.com/events/1446889178943717/>) to answer questions regarding ticks and tick-borne diseases (May 9); joined WTNH Live, “*Doctor teaches how to identify ticks*” (wtnh.com/2017/05/12/local-doctor-talks-about-identifying-tick-dangers/) (May 12); was interviewed by WTNH, “*Tick season ramping up in Connecticut*” (<http://wtnh.com/2017/05/12/local-doctor-talks-about-identifying-tick-dangers/>) (May 12); attended the “*11th Annual Lyme Connection Patient Conference*” in Western Connecticut State University, Danbury and discussed research and services at the CAES on ticks and tick-associated diseases (May 18); was interviewed by CNN, “*What you need to know about ticks*” (<http://www.cnn.com/2017/05/23/health/tick-explainer/>) (May 22); and was interviewed by WIRED, “*Lyme Isn’t the Only Disease Ticks Are Spreading This Summer*” (<https://www.wired.com/2017/05/lyme-isnt-disease-ticks-spreading-summer/>) (May 24).

DR. BLAIRE STEVEN gave a talk on “*Generation of axenic mosquitoes demonstrates live bacteria are not necessary for mosquito development*” at the Connecticut Symbiosis Symposium at the University of Connecticut in Storrs (30 students and 15 other attendees) (May 9).

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD spoke on roadside forest management at the Stormwise Workshop in Durham (14 attendees) (May 23) and participated in the Yankee Division - Society of American Foresters meeting in Tolland (May 26).

DR. ADRIANA ARANGO VELEZ gave a short talk “Sugar Maple Health” at the Behind the Scenes Tour to the Experiment Station Associates (7 attendees) (May 24).

DR. ABIGAIL A. MAYNARD discussed growing plants at the Learning Garden at Hamden Hall Country Day School (4 teachers, 24 students) (May 1-11); reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation at Lockwood Farm (19 adults) (May 4); assisted with the composting operation at Hamden Hall Country Day School (1 teacher, 6 students) (May 16-22); participated in a meeting discussing the formation of the Connecticut Vegetable and Berry Growers Alliance in Wallingford (May 16); attended a meeting of the State Technical Committee in Vernon (May 24); and discussed the New Crops Program with Don and Hank Offinger at their farm in Wilton (May 25).

DR. SCOTT C. WILLIAMS hosted the 1st grade and 5th grade classes of St. Thomas's Day School with short informational talks by **MS. AMANDA MASSA**, **MR. MARK CREIGHTON**, **MS. KATHERINE DUGAS**, **DR. GALE RIDGE**, **DR. CHRISTINA ROBB**, and **MS. TERRI ARSENAULT** (37 students, 6 teachers) (May 24).

MR. JOSEPH P. BARSKY co-organized the 2017 Connecticut AgriScience Fair and led student tours (44 students, 10 teachers) (May 4); participated in the quarterly meeting of the Connecticut State Consulting Committee for Agricultural Science and Technology Education, and provided an update on CAES research (8 attendees) (May 9); and participated in the Yankee Division SAF Meeting in Vernon (May 26).

PLANT PATHOLOGY AND ECOLOGY

DR. WADE ELMER met with the CAES Greenhouse Committee along with the architect, Chris Williams, and a greenhouse consultant, James Smith, and the DAS building manager to discuss the greenhouse renovation project (May 4); hosted Dr. Ben Niu from Harvard Medical School (May 17); and presented a webinar to the Center for Sustainable Nanotechnology on “How nanoparticles of micronutrients can affect plant disease resistance” (22 attendees) (May 24).

DR. YONGHAO LI presented a talk titled “Pruning 101” to the Caudatowa Garden Club in Ridgefield (19 attendees) (May 2); gave a talk titled “Backyard Small Fruits” to the Branford Garden Club in Branford (13 attendees) (May 2); gave a talk titled “Spring and Summer Gardening Tips” to the Tower One/Tower East Garden Club in New Haven (15 attendees) (May 10); gave a talk titled “Gardening Tips” at the Danbury Senior Center in Danbury (May 18); and discussed tree health issues with Board Members of the Edgerton Park Conservancy in Hamden (May 15).

DR. ROBERT MARRA analyzed an elm tree for internal decay, using sonic and electrical-resistance tomography, on Route 63 in Litchfield (May 3); presented a talk titled “Fungi of the Forest” to the Branford Garden Club (60 attendees) (May 4); analyzed elm trees for internal decay, using sonic and electrical-resistance tomography, on the National Mall, Washington, DC and provided an impromptu presentation to the public (17 children, 3 adults) (May 8-10); and along with **DR LINDSAY TRIPLETT** and **MS. LINDSAY PATRICK**, served as special-award judge for the Greater New Haven Science Fair, on behalf of the CAES Special Award “for the best project related to food, plants, insects, or the environment.” Two awards were given this year, one to the 1st-grade class of Ms. Jane Hosen of the Wexler-Grant School for their presentation, “Up, Up, and Away: Which Plant Transpires the Least?” and the second to the 3rd-grade class of Ms. Andria West of the Mauro-Sheridan Interdistrict Magnet School, for their presentation “Erosion Invaders” (May 15-17).

DR. NEIL SCHULTES met with Dr. Rosemary Whelan, the Coordinator for Biology, Genetics and Biotechnology Programs, at University of New Haven, to discuss student Internship opportunities and gave a short tour of the Station (May 17) and attended the Yale Plant Biology Symposium held at the Station (May 26).

DR. TEJA SHIDORE presented “Modification of a host central metabolite via a bifunctional type III secreted effector” to the inaugural New Haven Plant Symposium in Jones Auditorium (40 attendees) (May 26).

DR. LINDSAY TRIPLETT was awarded a community-based faculty appointment as Assistant Clinical Professor in the Department of Medical Sciences of the Frank H. Netter MD School of Medicine at Quinnipiac University, effective January 1st 2017; and presented a talk entitled “A decoy for a decoy? New layers of the arms race between rice and bacteria” to the inaugural New Haven Plant Symposium, held in Jones Auditorium (40 attendees) (May 26).

DR. QUAN ZENG gave a presentation “How does the “fire” spread around in your orchards?” at the twilight meeting of the CT Pomological Society at March Farm in Bethlehem (40 attendees) (May 19); presented the talk “Disease epidemiology and management of fire blight, a bacterial disease of apple” and his visiting postdoctoral scientist, **DR. ZHOUQI CUI** presented “Dynamic expression of T3SS genes in single cells of *Dickeya dadantii* during the interaction with potato” to the inaugural New Haven Plant Symposium held in Jones Auditorium (40 attendees) (May 26).



DR. ROBERT MARRA giving an impromptu presentation about trees and tomography to schoolchildren visiting the National Mall in Washington DC. The tree is the Jefferson Elm, a rare sterile triploid American elm noteworthy for its very high tolerance of Dutch elm disease.



DR. YONGHAO LI and the Board Members of Edgerton Park Conservancy in Hamden, CT.

MR. ISAAC BILDAD was sworn in as a new citizen of the United States of America in a naturalization ceremony held in Hartford, CT on May 5, 2017.

DR. CAROLE CHEAH gave an overview of the importance of hemlock habitat to breeding bird species to members of the Friends of America Legion and People's State Forests (FALPS) and others, and to plan for volunteer birder surveys of hemlock stands in state forests at DEEP Forestry Headquarters at Pleasant Valley, Barkhamsted (10 attendees) (May 5); met with Metropolitan District Commission Forester, Andy Hubbard, to check the state of salvage hemlocks severely damaged by elongate hemlock scale on watershed MDC lands around the Nepaug Reservoir in New Hartford and Canton (May 8); met with Ralph Scarpino (FALPS president) and volunteer birders at the American Legion and People's State Forests, (May 15) and at Tunxis State Forest, (May 24), to mark transects for avian surveys in hemlock stands; met with Rory Larson, Steep Rock Preservation Conservation Easement Manager, to check hemlock and spruce problems on private easement property in Washington (May 31); and met with Ann Astarita, Executive Director of the Roxbury Land Trust, to check hemlock stands affected by HWA and EHS on Mine Hill Preserve in Roxbury (May 31).

MS. ROSE HISKES gave a talk on "The Silent Invaders" at the Simsbury Library (9 attendees) (May 4); gave a short talk and walk on "Gypsy Moth in our Forests" to the Northern Connecticut Land Trust group at the Glover property in Somers (10 attendees) (May 13); participated in the Cooperative Agricultural Pest Survey (CAPS) meeting in New Haven (May 17); and provided insect samples and a microscope to Diane Bernier, Windsor Garden Club member, for a class on pollinators for second graders at the Kennedy Elementary School in Windsor.

DR. JAMES LAMONDIA participated in a meeting of the Connecticut Agricultural Information Council at the Valley Laboratory to select the Connecticut Century Farm Award nominees (May 31).

CAES



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STATION NEWS

Armstrong, P. M., Andreadis, T. G., Shepard, J. J., and Thomas, M. C. 2017. Northern range expansion of the Asian tiger mosquito (*Aedes albopictus*): Analysis of mosquito data from Connecticut, USA. *PLOS Neglected Trop. Dis.* 11(5): e0005623. <https://doi.org/10.1371/journal.pntd.0005623>.

Abstract: The Asian tiger mosquito (*Aedes albopictus*) is an invasive species and important arbovirus vector that was introduced into the U.S. in the 1980's where it continues to expand its range. Winter temperature is an important constraint to its northward expansion, with potential range limits located between the 0° and -5° C mean cold month isotherm. Connecticut is located within this climatic zone and therefore, *Ae. albopictus* was monitored statewide to assess its northern range expansion and to delineate where populations can stably persist. Surveillance for *Ae. albopictus* females was conducted at fixed trapping sites throughout Connecticut from June-October over a 20-year period, 1997-2016. In addition, *Ae. albopictus* larvae and pupae were collected from tire habitats and tires were retrieved from the field in the spring and flooded to evaluate overwintering success of hatching larvae. *Ae. albopictus* was first detected during statewide surveillance when a single adult female was collected in 2006. This species was not collected again until 2010 and was subsequently detected each successive year with increasing abundance and distribution except following unusually cold winters. *Ae. albopictus* mosquitoes were most abundant in urban and suburban locations along the southwestern shoreline of Connecticut; however, single specimens were occasionally detected in central parts of the state. Field-collected females were also screened for arbovirus infection yielding two isolations of Cache Valley virus and one isolation of West Nile virus, highlighting the threat posed by this mosquito. *Ae. albopictus* overwintered in Connecticut under mild winter conditions as shown by recovery of hatched larvae from field collected tires in spring and by early season detection of larvae and pupae. This study documents the establishment and expansion of *Ae. albopictus* at the northern boundary of its range in northeastern USA and provides a baseline for monitoring the future spread of this species anticipated under climate change.

Krupke, C.H.; Holland, J.D.; Long, E.Y. and Eitzer, B.D. 2017. Planting of neonicotinoid-treated maize poses risks for honey bees and other non-target organisms over a wide area without consistent crop yield benefit. *Journal of Applied Ecology* doi: 10.1111/1365-2664.12924.

Abstract: 1. Neonicotinoid insecticides are routinely used as seed treatments on most grain and oilseed crops in the USA, yet the extent and likelihood of spread of insecticide residues during planting has not previously been quantified. 2. Honey bees, *Apis mellifera*, are highly mobile and highly sensitive to neonicotinoid residues, presenting an opportunity to estimate non-target exposures to neonicotinoids in mobile insects. We measured neonicotinoid dust drift during maize sowing and used sites of maize fields, apiary locations and honey bee foraging radii to estimate likelihood of forager exposure. We performed a concurrent multi-year field assessment of the pest management benefits of neonicotinoid-treated maize. 3. Our results indicate that over 94% of honey bee foragers throughout the state of Indiana are at risk of exposure to varying levels of neonicotinoid insecticides, including lethal levels, during sowing of maize. We documented no benefit of the insecticidal

seed treatments for crop yield during the study.⁴ Synthesis and applications. We demonstrate movement of neonicotinoid residues well beyond planted fields occurs during maize sowing in Indiana. Based on locations of maize fields and apiaries in the state, the likelihood of neonicotinoid exposure for foraging honey bees is high. Other non-target organisms are also likely to encounter neonicotinoid residues; we conservatively estimate that deposition of neonicotinoid residues on non-target lands and waterways will occur on over 42% of the state of Indiana during the period of maize sowing. However, we also demonstrate that the risk to pollinators and other non-target organisms may be rapidly and dramatically reduced without yield penalties, by aligning use rates of neonicotinoid insecticides with pest incidence.

Lui, H.; Ma, C.; Chen, G.; White, J.C.; Parkash Dhankher, O.; Xing, B. 2017. Titanium dioxide nanoparticles alleviate tetracycline toxicity to *Arabidopsis thaliana*. *ACS Sustain. Chem. Eng.* DOI: 10.1021/acssuschemeng.6b02976.

Abstract: *Arabidopsis thaliana* was used as a model plant to investigate the biochemical and molecular response upon co-exposures to tetracycline (TC) and titanium oxide nanoparticles (TiO₂ NPs). Results showed that 1 mg/L TC severely reduced *A. thaliana* biomass by 33.3% as compared with the control; however, the presence of 50 and 100 mg/L TiO₂ NPs alleviated TC toxicity, increasing fresh biomass by 45% and 28%, respectively, relative to the TC alone treatment. Antioxidant enzyme activity, including superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX), peroxidase (POD), in *A. thaliana* shoot and root tissues indicated that TC significantly increased the activity of reactive oxygen species (ROS) scavengers. However, in the co-exposure treatments, TiO₂ NPs reduced antioxidant enzyme activity back to the control levels. The relative expression of genes encoding sulfur assimilation and glutathione biosynthesis pathways was separately measured in shoots and roots of *A. thaliana*. Interestingly, the relative expressions of adenylytransferase (ATP), adenosine-5'-phosphosulfate reductase (APR), and sulfite reductase (SiR) in *A. thaliana* roots across all three treatments (TC alone, TiO₂ NPs alone, and TC+TiO₂ NPs treatment) were 2-3.5 fold higher than the control. The expression of γ -glutamylcysteine synthase (ECS) and glutathione synthetase (GS) was increased in *A. thaliana* treated with either TiO₂ NPs or TC alone. At harvest, the results showed that almost 93% reduction of the pod biomass was evident in the TC alone treatment as compared with the control; however, TiO₂ NPs increased the pod biomass by 300% in the co-exposed *A. thaliana* relative to the TC alone treatment. These findings provide important information for understanding the interactions of metal-based NPs and co-contaminants such as antibiotics in plant systems.

Doug E. Brackney*, Implications of autophagy on arbovirus infection of mosquitoes. *Current Opinions in Insect Science*. 2017. 22:1-6.

Abstract: Arthropod-borne (arbo-) viruses, like all viruses, are obligate intracellular parasites that have evolved mechanisms to subvert cellular processes and evade anti-viral defenses to replicate and persist. An increasing body of research is beginning to recognize the intimate relationship between arboviruses and the cellular autophagy pathway. As a result, new therapeutic approaches that modify the autophagic response to viral infection have shown great promise. The preponderance of work thus far, however, has originated from vertebrate systems. Efforts to elucidate the role of autophagy during arbovirus infection of invertebrates have emerged, providing new insights into arbovirus-vector interactions; interactions that could be exploited for novel control strategies

Ward, J.S., T.E. Worthley, T.J. Degnan, and J.P. Barsky. 2017. STORMWISE: Integrating arboriculture and silviculture to create storm resilient roadside forests P. 119-132 *In* Proceedings 20th Central Hardwood Conference. USDA Forest Service General Technical Report NRS-P-167. 313 p.

Abstract: The band of trees within 30 m of roads (i.e., roadside forests) is often left unmanaged during traditional forest management activities because of liability concerns about inadvertently causing a vehicular accident or damaging utility lines during harvests. The trees in these same neglected forests often cause extensive utility outages and road blockages during extreme weather. Building on the prescriptions developed in Connecticut, the authors, utility companies, state foresters, highway departments, and forest landowners initiated a collaborative project—Stormwise—that is developing and testing practical, cost-effective, and proactive protocols that integrate silvicultural and arboricultural practices. The goals are to reduce the risk of damage during extreme storms, increase habitat diversity, recover underused volume, and maintain aesthetic appeal. Immediately adjacent to utility and road corridors, trees are pruned using ANSI standards, and at-risk trees are removed. To the interior, crop tree management is used to develop trees with wind-firm, open-grown characteristics along with subcanopies of short-stature trees, native shrubs, and herbs. Seven study areas have been established along 2.3 km of roadside forests. Lessons learned about tree selection and coordination from implementation at three areas are being incorporated into treatments scheduled at the remaining sites. Results of treatments and monitoring will be used to inform communities and stakeholders about the management of roadside forests.

ELMER W. H. 2017. Improving Plant Disease Resistance: Can Nanoparticles Deliver. *Scientia Global* <http://www.scientia.global/dr-wade-h-elmer-improving-plant-disease-resistance-can-nanoparticles-deliver/>

Abstract: Crop disease can have an enormous impact on farming productivity and profits. A plant's resistance to disease has been previously linked to micronutrients, which control key biochemical processes. Dr Wade Elmer of the Connecticut Agricultural Experiment Station has carried out research showing that nanoparticles can provide an effective, practical method of getting vital micronutrients such as copper into crops.

Leach, J.E., L.R. TRIPLETT, C.T. Argueso, and P. Trivedi. Communication in the Phytobiome. *Cell* 169: 587-596.

Abstract: The phytobiome is composed of plants, their environment, and diverse interacting microscopic and macroscopic organisms, which together influence plant health and productivity. These organisms form complex networks that are established and regulated through nutrient cycling, competition, antagonism, and chemical communication mediated by a diverse array of signaling molecules. Integration of knowledge of signaling mechanisms with that of phytobiome members and their networks will lead to a new understanding of the fate and significance of these signals at the ecosystem level. Such an understanding could lead to new biological, chemical, and breeding strategies to improve crop health and productivity.

PATEL, R.R., Sundin, G.W., Yang, C.H., Wang, J., HUNTLEY, R.B., Yuan, X., and ZENG, Q. (2017) Exploration of using antisense peptide nucleic acid (PNA)-cell penetrating peptide (CPP) as a novel bactericide against fire blight pathogen *Erwinia amylovora*. *Front. Microbiol.* | doi: 10.3389/fmicb.2017.00687

Abstract: *Erwinia amylovora* is a Gram-negative bacterial plant pathogen in the family Enterobacteriaceae and is the causal agent of fire blight, a devastating disease of apple and pear. Fire blight is traditionally managed by the application of the antibiotic streptomycin during bloom, but this strategy has been challenged by the development and spread of streptomycin resistance. Thus, there is an urgent need for effective, specific, and sustainable control alternatives for fire blight. Antisense antimicrobials are oligomers of nucleic acid homologs with antisense sequence of essential genes in bacteria. The binding of these molecules to the mRNA of essential genes can result in translational repression and antimicrobial effect. Here, we explored the possibility of developing antisense antimicrobials against *E. amylovora* and using these compounds in fire blight control. We determined that a 10-nucleotide oligomer of peptide nucleic acid (PNA) targeting the start codon region of an essential gene *acpP* is able to cause complete growth inhibition of *E. amylovora*. We found that conjugation of cell penetrating peptide (CPP) to PNA is essential for the antimicrobial effect, with CPP1 [(KFF)3K] being the most effective against *E. amylovora*. The minimal inhibitory concentration (MIC) of anti-*acpP*-CPP1 (2.5 μ M) is comparable to the MIC of streptomycin (2 μ M). Examination of the antimicrobial mechanisms demonstrated that anti-*acpP*-CPP1 caused dose-dependent reduction of *acpP* mRNA in *E. amylovora* upon treatment and resulted in cell death (bactericidal effect). Anti-*acpP*-CPP1 (100 μ M) is able to effectively limit the pathogen growth on stigmas of apple flowers, although less effective than streptomycin. Finally, unlike streptomycin that does not display any specificity in inhibiting pathogen growth, anti-*acpP*-CPP1 has more specific antimicrobial effect against *E. amylovora*. In summary, we demonstrated that PNA-CPP can cause an effective, specific antimicrobial effect against *E. amylovora* and may provide the basis for a novel approach for fire blight control.

Huang L, Li Q-C, Hou Y, Li G-Q, Yang J-Y, Li D-W, Ye J-R. 2017. *Bacillus velezensis* strain HYE5-6 as a potential biocontrol agent against anthracnose on *Euonymus japonicus*. *Biocontrol Science and Technology* 27(5) 636-653. <https://doi.org/10.1080/09583157.2017.1319910>

Abstract: Anthracnose is a foliar disease of the *Euonymus* shrub caused by *Colletotrichum gloeosporioides*. In this study, the bacterium HYE5-6 was isolated from inside one-year-old branches of healthy *Euonymus japonicus* and showed significant antifungal activities against various phytopathogenic fungi, including *C. gloeosporioides* s.s. HYCG2-3, in dual culture experiments. The HYE5-6 isolate significantly decreased lesion diameter and disease index caused by *C. gloeosporioides* inoculation on detached leaves of *E. japonicus*. The effects of HYE5-6 metabolites on the invading structure of the fungus were investigated. Bacterial metabolites inhibited conidial germination, the growth of the germ tube and appressorium formation, possibly through protease and glucanase of HYE5-6 by managing the mycelial cell wall. The HYE5-6 isolate also produced a massive biofilm, which might facilitate leaf colonisation. These results indicate that HYE5-6 has the potential for use as a biological control agent against *C. gloeosporioides*. The HYE5-6 isolate was identified as *Bacillus velezensis* based on its biochemical characteristics and its 16S rRNA gene sequence.

Cheah, C.A.S.-J. 2017. Predicting winter mortality of hemlock woolly adelgid in Connecticut by climatic divisions. *Northeastern Naturalist* Volume 24, Special Issue 7, 2017: Winter Ecology: Insights from Biology and History, 2017 B90-118 . Available online at: <https://www.eaglehill.us/NENAonline/articles/NENA-sp-7/17-Cheah.shtml>

Abstract: Hemlock Woolly Adelgid (HWA) is a devastating non-native pest of North American *Tsuga canadensis* (Eastern Hemlock) and *Tsuga caroliniana* (Carolina Hemlock). I analyzed 15 years of data collected during the period 2000-2015 to determine important winter variables influencing HWA mortality in the 3 Connecticut climatic divisions. Absolute minimum daily winter temperature, the number of subzero days (temperature drops below -17.8°C [0°F]), and a new interaction variable—negative degree days (NDD)—were identified as significant predictors of HWA winter mortality. The absolute minimum daily winter temperature was the most critical factor. Minimum daily winter temperatures of -24°C , 5.5 subzero days, and -130 NDD in Division 1 (Northwest); -22.4°C , 6 subzero days, and -100 NDD in Division 2 (Central); and -21.2°C , 2.6 subzero days, and -45 NDD in Division 3 (Coastal) resulted in 90% HWA mortality. Patterns of HWA winter mortality in coastal Division 3 were distinct from the interior and suggest cold adaptation in northern interior populations. Recent, consecutive, arctic cold air outbreaks associated with weak polar vortex events have greatly reduced HWA populations statewide, with implications for the survival, spread, and control of HWA in the northeastern US.

JOURNAL ARTICLES APPROVED MAY 2017

Bugbee, Gregory J. and Jennifer M. Fanzutti. Mamasasco Lake, Ridgefield, CT: Aquatic vegetation - water chemistry - aquatic plant management 2016. *Station Bulletin* (online only)

Bugbee, Gregory J. and Jennifer M. Fanzutti. Monitoring report - invasive aquatic plants: Candlewood Lake, Squantz Pond, Lake Zoar, Lake Lillinonah 2016. *Station Bulletin* (online only)

Bugbee, Gregory J. and Jennifer M. Fanzutti. Moodus Reservoir, East Haddam, CT: Aquatic vegetation - water chemistry - aquatic plant management 2016. *Station Bulletin* (online only)

DeLoid, G. M., Y. Wang, K. Kapronezai, L. Rubio Lorente, R. Zhang, G. Pyrgiotakis, N. V. Konduru, M. Ericsson, **Jason C. White**, **Roberto De La Torre-Roche**, D. J. McClements, and P. Demokritou. An integrated methodology for assessing interactions with food, transformations across the gastrointestinal tract, biokinetics and toxicology of ingested engineered nanomaterials. *Particle and Fibre Toxicology*

Ward, Jeffrey S. and **Scott C. Williams**. Effect of tree diameter, canopy position, age, and browsing on stump sprouting in southern New England. *Forest Science*

Ward, Jeffrey S., **Scott C. Williams**, and **Megan A. Linske**. Influence of invasive shrubs and deer browsing on regeneration in temperate deciduous forests. *Canadian Journal of Forest Research*

2017 Connecticut State AgriScience Fair

On Thursday, May 4, 2017, The Connecticut State AgriScience Fair was held at The Connecticut Agricultural Experiment Station. This annual event is sponsored by the 19 regional high schools that offer Agricultural Science and Technology Education (ASTE) Programs in Connecticut. A record number of students participated in the event this year, with 44 students preparing 34 exhibits. Students may work either as a team or design their own project. The projects can cover many topics, including: animal science, environmental services/natural resource systems, food products and processing systems, plant systems, social systems and power, structure, and technology systems. The winning projects in each category are eligible to participate in the Northeast Regional AgriScience Fair, held at The Eastern States Exposition in September and the National FFA AgriScience Fair held in Indianapolis, IN, October 25-27, 2017.

Tours of various programs at the experiment station were given to the participants, advisors and chaperones attending the AgriScience Fair. **Brian Eitzer**, **Gale Ridge**, and **John Shepard** offered presentations of their research programs to students during the tour. Students were afforded the opportunity to see and speak with the researchers and learn about their ongoing research to assist Connecticut's agricultural industry.

Several individuals volunteered to serve as judges for the event, including: Kevin Anstett, **Mr. Gregory J. Bugbee**, **Mrs. Vickie Bomba-Lewandoski**, Michele Dischino, Gordon Gibson, Bob Klancko, Katie Golembeski, Laura Mantz, George Page, Kirk Shadle, **Dr. Blaire Steven**, and **Dr. Nubia Zuverza**. The participating ASTE high schools included: Bridgeport, Glastonbury, Middletown, Northwestern, Southington, Stamford, and Wamogo. The event was organized by Harold Mackin of the Connecticut State Department of Education, and **Mr. Joseph P. Barsky** of The Connecticut Agricultural Experiment Station.

The agricultural science and technology education program serves secondary students in full and shared time programs. Each program, located at a comprehensive high school, includes instruction in agricultural science and technology education. The purpose is to prepare individuals for entry-level employment or higher education and to develop leadership skills in the field of agriculture. Programs include instruction in plant and animal science, agricultural mechanics, food science, Biotechnology, aquaculture, agribusiness, natural resources and the environment. The agricultural science and technology education program includes interrelated components such as classroom instruction, laboratory experience, leadership training and supervised agricultural work experience.



Mr. John Shepard of The Connecticut Agricultural Experiment Station provided an overview of the mosquito monitoring program. Photo courtesy of Mr. Joseph P. Barsky.



Dr. Brian Eitzer discusses some chemistry techniques employed at the Connecticut Agricultural Experiment Station. Photo courtesy of Mr. Joseph P. Barsky.



Dr. Gale Ridge shares an overview of The Connecticut Agricultural Experiment Station's entomological holdings. Photo courtesy of Mr. Joseph P. Barsky.



Students setting up their exhibits for the 2017 Connecticut State Agriscience Fair. Photo courtesy of Mr. Peter Lawlor.



MS. PAMELA SLETTEN retired after 32 years of service to the station on Thursday, June 1, 2017.

CAES



The Connecticut Agricultural Experiment Station

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STATION NEWS

GRANTS RECEIVED MAY 2017

DR. JATINDER S AULAKH received a grant from Syngenta for weed control trials. (\$15,000)

MR. GEGORY BUGBEE received annual installment in the amount of \$84,061.50 from FirstLight Power Resources for invasive aquatic plant monitoring in Lakes Candlewood, Lillinonah, Zoar, and Squantz Pond (May 5); and was awarded a grant from FirstLight Power Resources “Housatonic River Project Fund” for \$3,700 to be used for upgrades to the CAES IAPP boats (May 30).



CAES

The Connecticut Agricultural Experiment Station

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The Connecticut Agricultural Experiment Station

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Station News was prepared and edited by Dr. Theodore G. Andreadis, Ms. Vickie Bomba-Lewandoski, Ms. Sandra Carney, and Ms. Brandi Marks.

Volume 7 Issue 6
June 2017

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