

Station News

The Connecticut Agricultural Experiment Station
Volume 7 Issue 7 July 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.



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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 Station's Tick Testing Program by Aaron Kupec, WTIC Radio (June 7); and participated in the joint summer meeting of the Northeastern Regional Association of State Agricultural Experiment Station and Extension Directors held in White Sulphur Springs, WV (June 12-14).

ANALYTICAL CHEMISTRY

DR. JASON C. WHITE held a conference call with Prof. Achintya Bezbaruah and others at North Dakota State University regarding a collaborative project on arsenic uptake by rice (June 5); along with **MS. KITTY PRAPAYOTIN-RIVEROS** participated in an FDA AFRPS Year 2 Quarter 3 wrap up call with LCDR Ruiqing Pamboukian, Ph.D. (June 5); 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 (June 8); met with Eli Aliaga of SCSU regarding an internship in the Analytical Chemistry Department this fall semester (June 9); participated in a teleconference call with Dr. Elijah Petersen of NIST and others regarding joint preparation of a manuscript focused on nanomaterial exposure test methods (June 9); spoke with Jan Spiegel, a reporter writing a story on nanotechnology and agriculture (June 12); hosted Professor Gregory Lowry of Carnegie Mellon University for a Lockwood lecture (June 13); along with **DR. WADE ELMER** hosted Jaya Borgatta and Natalie Hudson-Smith, two graduate students from the Center for Sustainable Nanotechnology (June 14-16); attended the Gordon Conference on Environmental Nanotechnology in Stowe VT and gave an invited lecture entitled "Nanomaterials and the food supply: Assessing the balance between applications and implications (125 attendees) (June 21-23); participated by WebEx in Ms. Ilya Aidee Medino Velo's Proposal B Defense at the University of Texas El Paso (June 27); and along with **MS. TERRI ARSENAULT, MR. MICHAEL CAVADINI** and **MS. KITTY PRAPAYOTIN-RIVEROS** participated in an FDA MFRPS call focused on sampling (June 28).

DR. CHRISTINA ROBB attended an Elexnet training course (June 1); participated in an annual board meeting and the program planning meeting for the Eastern Analytical Symposium (EAS) in Plainsboro, NJ (June 9); and along with **DR. WALTER KROL** joined in the FDA FERN wide conference call (June 22).

DR. KIRBY C. STAFFORD III participated on a regional gypsy moth conference call with state foresters for Connecticut, Massachusetts, and Rhode Island (June 1); participated in a Center of Excellence project conference call (June 5); interviewed by Cassandra Day, Middletown Press, about the gypsy moth (June 5); interviewed by Jeannette Ross, Wilton Bulletin, about the lone star tick (June 5); interviewed by Alan Aronow, about the gypsy moth fungus for the Haddam Bulletin (June 6); spoke on ticks and tick-borne diseases at Holcomb Farm in Granby (100 attendees, 2 children) (June 8); interviewed by Patrick Skahill, WNPR, about the gypsy moth (June 12); interviewed by Heather Burian, NBC Universal, about gypsy moth (June 16); interviewed by Anna Bisaro, New Haven Register, about local gypsy moth activity (June 16); staffed a display and answered questions about ticks at the Great Parks Pursuit event at Kettletown State Park, Southbury (ca. 200 adults and 300 children attendees) (June 17); interviewed by Mike Puffer, Republic American, about gypsy moth (June 19); interviewed by Susan Dunne, Hartford Courant, about managing gypsy moth droppings (June 19); interviewed by Mike Morrissette, WILI Radio Willimantic (June 20); interviewed by Madi Van Den Eynde, Journal Inquirer, Manchester (June 20); interviewed by Renee Chmiel, News8 TV, about ticks and ehrlichiosis (June 22); interviewed by Gregory Hladky, Hartford Courant, about the gypsy moth outbreak (June 26); interviewed by Shawn Bourgeois, WINY Radio in Putnam about the gypsy moth outbreak (June 26); and was interviewed by Jesse Buchanan, Record Journal, about the gypsy moth (June 29).

MR. MARK H. CREIGHTON attended the Connecticut Beekeepers Summer meeting at Lockwood Farm in Hamden and demonstrated several methods on mite detection in honey bee hives to approximately 65 members (June 10); was interviewed by Vanessa De La Torre from the Hartford Courant for an article on Schools and Beekeeping (June 11); spoke about beekeeping in general and about the beekeeping program at Common Ground High School and at West Rock Nature Center (June 11); attended Common Council meeting in West Hartford and spoke to city leaders on a pending Beekeeping Ordinance change that would allow beekeeping in West Hartford and the ordinance passed by a majority vote (June 13); was interviewed at Lockwood Farm along with **DR. RICHARD COWLES** by Patrick Skahill from National Public Radio on our Honeybee Queen rearing project to develop a Connecticut specific queen with mite tolerance genetics (June 14); and spoke to a group of 25 seniors at Elmwood Place in Danbury on honeybees and their role in pollination (June 15).

MS. MEGAN LINSKE presented invited lecture titled "Diversity and Dilution: The Impacts of Medium-Sized Mammal Diversity on *Borrelia burgdorferi* Prevalence in Fragmented and Unfragmented Habitats in Connecticut, USA" in the Zoonotic Disease Symposium at the International Urban Wildlife Conference at San Diego State University, San Diego, CA.

DR. GALE E. RIDGE identified a genus of minute brown scavenger beetle (Latridiinae: *Deinerella* spp.) and was confirmed by Smithsonian Entomology Laboratory (SEL) from a shipment of wooden candy sticks shipped from China (June 20) and intercepted a species of treehopper (Membracidae) from cacti bought from Walmart and SEL identified the species as *Ophiderma tricincta* Ball, native to Arizona and classified by them as a "new pest" (June 23).

DR. CLAIRE E. RUTLEDGE presented the talk “The emerald ash borer in Connecticut” to the Goshen Land Trust in Goshen (20 adults) (June 30).

DR. VICTORIA L. SMITH participated in a meeting of the Yale Biosafety Committee, held at 135 College Street, New Haven (20 participants) (June 15); and completed 40 hours of Agency Administrator Training in the State of CT eLicense system, held at 55 Farmington Avenue, Hartford (8 participants) (June 26-30).

DR. KIMBERLY A. STONER organized and led a meeting of the Connecticut Native Plant, Pollinator, and Wildlife Working Group, meeting with representatives of the CT Department of Transportation about progress toward creating native plant and pollinator habitat along state roadways at the Audubon CT Preserve, Stratford Point (16 participants) (June 14).

SEASONAL RESOURCE ASSISTANTS AND INTERNS: The Department of Entomology has ten seasonal resource assistants, three of which have worked here previously, and one intern that is working with the scientists and technicians over the summer and fall of 2017.

MR. SAWYER BADEY is majoring in biology at the College of the Holy Cross in Worcester, Massachusetts. He is very active in outdoor sports, particularly track and field, and has worked at a camp for special needs children. He is working with Dr. Kimberly Stoner on pollinators on her Specialty Crop Research Initiative grant.

MS. MALLERY BREBAN is a student at Southern Connecticut State University studying towards a B.S. in biology. She interned in the Tick Testing Laboratory with Dr. Goudarz Molaei and then joined the laboratory as a seasonal assistant in December 2016, continuing to assist with tick testing through the spring on the CDC tick management project, and rejoining the Tick Testing Laboratory for the summer.

MR. ZACHARY BROWN got an entomological and wildlife start working with the White Memorial Conservation Center in Litchfield on emerald ash borer surveillance along with some invasive plant and earthworm surveys. He joined CAES in 2015 to assist with the Cooperative Agricultural Pest Survey (CAPS) and Forest Pest Survey and Outreach Project. He obtained his Bachelor’s degree from the University of Connecticut in 2014 in Natural Resources and the Environment with a concentration in climate and water resources.

MS. BRIANNA BYRNE graduated in May 2017 with a Bachelor of Science degree in pathobiology with a minor in molecular and cell biology from the University of Connecticut. Brianna has extensive animal experience serving as an intern at a zoo and animal hospital. She plans to pursue a Master’s degree at Ohio State University in Public Health-Veterinary Public Health. Brianna joined the CAES tick team working with Dr. Kirby Stafford and Dr. Scott Williams on the USDA-ARS supported tick management project.

MS. DAMARIS CHENOWETH is a 2017 graduate in Ecology and GIS from Skidmore College. Damaris spent a semester with the Organization for Tropical Studies in South Africa on various projects and an internship at Kruger National Park where she did some field work on termite mound thermoregulation. She joined Dr. Kimberly Stoner’s team working on pollinators on her Specialty Crop Research Initia-

tive grant.

MR. JAMES DURRELL is a recent graduate with a Bachelor of Arts in Biology and Bachelor of Science in English from the University of Bridgeport. He serves as an adjunct professor at the University of Bridgeport teaching a laboratory ecology course, an entomology course, and maintaining the insect collection, among other projects. She joined Dr. Kimberly Stoner's team working on her pollinator habitat project.

MS. JULIE FITZGERALD is a native of Connecticut interning with Dr. Claire Rutledge. She will be transferring to Southern Florida State University in the Fall as a Cell and Molecular Biology major. Julie is a competitive horseback rider and an avid orchid and bonsai cultivator. Her project this summer is comparing the longhorned beetle fauna of ash and birch trees.

MS. SARAH HEMSTOCK is working on a Bachelor of Science degree in Veterinary Technology at Mount Eda College in Newton, MA. She has experience working with animals and is very active on various athletic teams such as the college's Women's Field Hockey Team and on the North Branford High School Softball Varsity Team and Field Hockey Varsity Team. Sarah joined the CAES tick team working with Dr. Kirby Stafford and Dr. Scott Williams on the USDA-ARS supported tick management project.

MS. JOANNE KLEIN has considerable experience working on invasive species management including the Asian longhorned beetle and hemlock woolly adelgid with the US Forest Service, USDA APHIS and The Nature Conservancy. She is an author or co-author on four publications. She joined CAES to assist with the Cooperative Agricultural Pest Survey (CAPS) and Forest Pest Survey and Outreach Project. Joanne received a Master's degree from Yale School of Forestry and Environmental Science in May 2104.

MS. IONELA MIOARA SCOTT graduated from Universitatea de Stiinte Agricole si Medicina Venterinira in Cluj, Romana with a 5 year degree in Agricultural Engineering. She has worked as a seasonal worker each summer at CAES since 2008. Over the years Mioara has worked on many projects including the Connecticut portion of a national survey for the Emerald Ash Borer (an invasive beetle that attacks ash trees), a study of *Cerceris fumipennis* (a native wasp that uses the beetles as food), behavioral studies of beetle mating and fecundity, field trapping studies on the pheromones of Cerambycidae and the field work that followed the discovery of Southern Pine Beetle in Connecticut last summer. Mioara made the first discovery of the emerald ash borer in Prospect in 2012.

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James Durrell



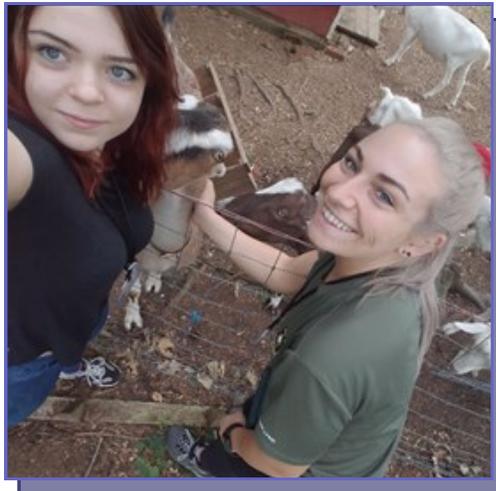
Zachary Brown



Sawyer Badey



Damaris Chenoweth



Brianna Byrne & Sarah Hemstock

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Joanne Klein



Mioara Scott



Mallery Breban



Julie Fitzgerald

ENVIRONMENTAL SCIENCES

DR. PHILIP ARMSTRONG was interviewed by the News Channel 3 about the statewide mosquito trapping and testing program (June 5); was interviewed by the CT radio network about mosquitoes and mosquito-borne viruses in CT (June 8 and June 15); was interviewed by the CT Post about precautions to prevent mosquito-borne diseases (June 20); and attended the Executive Council Meeting for the American Society of Tropical Medicine and Hygiene in Alexandria, VA (June 10-11).

MR. GREGORY BUGBEE with Amanda Massa gave a presentation on Invasive Aquatic Plants to a group of high school teachers at Bashan Lake in East Haddam (approx. 12 attendees) (June 19); and gave the talk “The Aquarium Trade As Source of Invasive Aquatic Plant Invasions” at the Long Island Invasive Species Managements Area Conference in Brentwood, Long Island (approx. 50 attendees) (June 22).

DR. GOUDARZ MOLAEI was interviewed by the Weather Channel on the contributing factors to the rising tick populations and infections with tick-borne pathogens (June 20); was interviewed by WCSU Radio: *This year worst on record for ticks - WTNH*” (June 21) <http://wtnh.com/2017/06/21/westconn-this-year-worst-on-record-for-ticks/>; hosted a group from Central Connecticut State University at the Tick Testing Laboratory (23 students and staff) (June 22); was interviewed by WQUN Radio, on the problems associated with tick activity, tick-associated diseases and prevention (June 22) https://www.transferbigfiles.com/b1b5c856-b49a-413c-97d5-5a0e41f40696/-5VB8yyh-zLg_bN7n9m9tgvlfjeYr4oTcT7bXnZGqY1; and was interviewed by the New Haven Register, “*Connecticut Agricultural Experiment Station in New Haven testing record number of ticks*” (June 23) <http://www.nhregister.com/general-news/20170623/connecticut-agricultural-experiment-station-in-new-haven-testing-record-number-of-ticks>.

DR. BLAIRE STEVEN gave an invited lecture “The Opportunities and Challenges of Phytobiome Research” to the Society of Plant Protection in Ste-Anne-de-Bellevue, Quebec, Canada (approximately 30 students and 20 other attendees) (June 8).



Left to right:
 Kristina
 D'Agostino
 (Quinnipiac
 Univ.), Alex-
 ander Diaz
 (Quinnipiac
 Univ.), Mal-
 lery Breban

(SCSU), Pauline Dutka (SCSU), Cora Ottaviani (Yale, School of Forestry and Env. Studies), Danielle Sohai (Univ. of Delaware), Demi Rodriguez (Clark Univ.), Sofia Moscovitz (Oberlin College), Summer Stebbins (Boston Univ.), Amanda Massa (SCSU), Abigail Weigand (SCSU), Courtney Gorham (Univ. of New Haven), Daniel Cole (UConn), David Guzhnay (Yale Univ.) Chris Driscoll (Stonehill College), Max Engel (UConn), Duncan Cozens (Quinnipiac Univ.), Noelle Khalil (UConn). Not pictured: Michael

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD administered practical and oral examination to arborist candidates for the Connecticut Tree Protection Examining Board (June 7); interviewed about the effects of weather on acorn production by Christopher Escobar of the Weather Channel (June 20); chaired the Executive Committee meeting of the New England Society of American Foresters in Concord, NH (June 21); met with Steve Johnson, Milford Natural Resource Agent, to discuss control of invasive species including running bamboo (June 23); and met with Jeffrey Sonnenfeld and Janice Gruendel (Juniper Point Association, Branford) to discuss tree risk assessment (June 30).

DR. ABIGAIL A. MAYNARD assisted with the vegetable garden at Hamden Hall Country Day School's summer camp (15 children, 4 adults) (June 22-28); visited and discussed artichoke culture at Ditta's Farm in Woodbridge (June 26); and visited Bishop's Farm in Guilford and discussed the New Crops Program (June 30).

DR. SCOTT C. WILLIAMS presented invited lecture titled "An Integrated Tick Management Program to Reduce Risk of Lyme Disease in a Residential Endemic Area" in the Zoonotic Disease Symposium at the International Urban Wildlife Conference at San Diego State University, San Diego, CA (50 attendees) (June 5); with **MR. MICHAEL SHORT** and **MS. MEGAN LINSKE**, was interviewed about ticks, rodents, and tick-borne diseases by two reporters from the Weather Channel (June 20); and spoke on "Ticked Off. The Lowdown on Ticks in Guilford" at the Guilford, CT Conservation Commission's Living With Wildlife Speaker Series (150 attendees) (June 21).

MR. JOSEPH P. BARSKY participated in the Executive Committee meeting of the New England Society of American Foresters in Concord, NH (June 21).

PLANT PATHOLOGY AND ECOLOGY

DR. WADE ELMER was interviewed by Jan Spiegel of The Mirror on how nanoparticles suppress plant diseases (June 12); along with Dr. Quan Zeng, and Dr. Zhouqi Cui met Dr. Greg Lowry from Carnegie Mellon University, and discussed future nanoparticle collaboration (June 13); and was visited by Ms. Jaya Borgatta (Univ. of WI) and Ms. Natalie Hudson-Smith (Univ. of MN) who both participated in a nanoparticle study on watermelon (June 14-16).

DR. YONGHAO LI presented a talk on “Spruce Needle Casts and Their Control” at the CCTGA twilight meeting in Brooklyn, CT (50 attendees) (June 7); and presented a talk “Disease Management in Organic Gardens” in the Heritage Village River Garden Club meeting in Southbury (32 adult attendees) (June 21)

DR. NEIL SCHULTES met with Drs. Lori Tausta and Tanya Berbasova both members of the Strobel Laboratory at the Molecular Innovations Center, West Campus, Yale School of Medicine in West Haven and discussed experimental aspects of heterologous expression and functional analysis of plant transporters in yeast and reviewed three dimensional protein modeling software for membrane protein structural predictions (June 9).

DR. QUAN ZENG attended a group meeting on fire blight infection and management at Arnold Arboretum with Andrew Gapinski, Michael Dosmann, William Friedman, and Kathryn Richardson (Harvard Arnold Arboretum), Daniel Cooley and Jon Clement (UMass) and collected fire blight infected tissues from uncommon plant hosts (20 different species including mountain ash, Indian plum, crabapple, and Asian sandy pear) (June 8th). Dr. Wade Elmer, Dr. Quan Zeng, and Dr. Zhouqi Cui met Dr. Greg Lowry from Carnegie Mellon University, and discussed potential future collaboration opportunities (June 13).



Dr. Quan Zeng, Andrew Gapinski (Arnold Arboretum) and Jon Clement (UMass) are collecting fire blight disease samples from a *Sorbus* (mountain ash) tree at Arnold Arboretum of Harvard University.

DR. JATINDER S. AULAKH gave a talk on management of perennial weeds at the Connecticut Christmas Tree Growers Twilight Meeting at Allen Hill Farm, Brooklyn (June 9). The meeting was attended by approximately 60 growers from Connecticut, Massachusetts, and Rhode Island.

DR. CAROLE CHEAH visited Waymart, PA, to tour the insect rearing laboratory of Tree-Savers, the only commercial source of *Sasajiscymnus tsugae*, the hemlock woolly adelgid predator from Japan which was discovered, studied and implemented by the CAES from 1995-2007, met with Director Jayme Bonewicz and staff to discuss cooperative research plans between CT and PA and received a generous donation of 2,000 *S. tsugae* beetles for research and release in Connecticut; released *S. tsugae* beetles at the American Legion State Forest with the assistance of Ralph Scarpino, President of the Friends of American Legion and People's State Forests (June 8); released beetles at the Pachaug State Forest at a valuable conservation area on Green Falls River with the assistance of Dan Evans and Emery Gluck, DEEP state foresters (June 9); released beetles at the Burlington State Fish Hatchery to protect trout production ponds and at the Nassahegon State Forest with the assistance of David Irvin, DEEP state forester, and volunteer John Weeks, Jr. (June 13); was interviewed by Judy Benson of the New London Day (June 12) on the *S. tsugae* biological control release at the Pachaug State Forest, Voluntown; with Donna Ellis (UConn) and Emmett Varicchio (CAES VL), released 2,000 *Rhinoncomimus latipes* weevils for biological control of mile-a-minute (MAM) weed at Glastonbury Meadows in cooperation with the Town of Glastonbury (June 14 and 22); presented an overview on the effects of winters on HWA and the biological control program in CT to Great Mountain Forest forestry interns and GMF Forest Manager, Jody Bronsen at the GMF Headquarters in Norfolk (4 attendees) (June 15); was interviewed by Marven Moss, of the Monroe Courier, on the *S. tsugae* biological control release at Webb Mountain Park, Monroe (June 16); released *S. tsugae* at the Mine Hill Preserve, Roxbury Land Trust, with the assistance of Ann Astarita, Executive Director, Jamie Curren, RLT land manager, and Ed Racz, RLT Board member at the Algonquin State Forest, Colebrook, and at Webb Mountain Park, Town of Monroe with the assistance of Dave Soleck, Monroe Park Ranger and Tree Warden (June 16); at the Great Mountain Forest, Canaan, with the assistance of GMF Forester Russell Russ, and GMF forestry interns Brandon Coleman, Zach Jaminet and Talia Stewart (June 26); hosted an evening summary meeting with Ralph Scarpino, President of FALPS, with volunteers who had conducted breeding bird surveys in June in hemlock stands at the People's and American Legion State Forests at the DEEP Pleasant Valley offices, Barkhamsted (8 attendees) (June 26); and released beetles at the Algonquin State Forest, Colebrook (June 30).

DR. RICHARD COWLES presented "Soil acidification to manage phytophthora and insect management" to the CT Christmas Tree Growers' Association, Brooklyn, (55 attendees) (June 7) ; was interviewed by Patrick Skahill from NEPR on the subject of genetic improvement of honey bees, Hamden, CT, (June 14); discussed "Insecticide trial for managing gypsy moths" at the RI Nursery and Landscape Association meeting, Kingston, RI (30 attendees)

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(June 21); and discussed “Soil acidification to manage phytophthora and insect management” at Cornell University’s Westchester County twilight meeting for Christmas tree growers, Yorktown Heights, NY (15 attendees) (June 27) .

DR. JAMES LAMONDIA spoke about hop production, diseases and IPM as a part of a Hops Workshop “Growing and using hops” held in Portland (14 attendees) (June 5); conducted oral exams for candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven (June 7); spoke about hops research and participated in the CT Hop Growers Association Farm Tour of Pioneer Hops in Morris (15 attendees) (June 10); was interviewed about the cigar wrapper tobacco crop in CT by Greg Hladky of the Hartford Courant (June 12); participated in farm tours and interviews by the Connecticut Agricultural Information Council to select the Connecticut Century Farm Award (June 13); with Katja Maurer was interviewed about hops and hops research in Connecticut by Mary Donoghue and Patrick O’Sullivan for Grating the Nutmeg, podcast for Connecticut Explored magazine (June 16); and spoke about integrated pest management of Connecticut hops at the Connecticut Hop Growers Association seminar, with **DR. KATJA MAURER** staffed a Station display at the Tradeshow/hop show, and attended the CHGA fundraiser dinner event in Northford (30 attendees) (June 17).

DR. KATJA MAURER was interviewed with **DR. JAMES LAMONDIA** by Mary Donoghue about hops for Grating the Nutmeg - The podcast of Connecticut History (Connecticut Explored) (June 16); and participated in Connecticut Hop Growers Association (CHGA) Seminars and Demonstrations at DeFrancesco Farms held in Northford (30 attendees) (June 17).

Pagano, L.; Pasquali, F.; Majumdar, S.; De La Torre-Roche, R.; Zuverza-Mena, N.; Villani, M.; Zappettini, A.; Marra, R.; Isch, S.M.; Marmioli, M.; Maestri, E.; Parkash Dhanker, O.; White, J.C.; Marmioli, N. 2017. Exposure of *Cucurbita pepo* to binary combinations of engineered nanomaterials: Physiological and molecular response. *ES: Nano* 10.1039/C7EN00219J.

Abstract- Although engineered nanomaterial (ENM) uptake, transport and response mechanisms in plants have received increased attention in the recent years, many questions regarding ENM risks to the environment and to food safety remain unanswered. The impact of ENM interactions with co-existing organic and inorganic contaminants, including secondary ENMs, remains poorly understood. The physiological and molecular response of zucchini (*Cucurbita pepo* L.) under conditions of nanomaterial co-contamination (NMCC) with binary combinations of nanoparticle (NP) cerium oxide (CeO₂), lanthanum oxide (La₂O₃), copper oxide (CuO), zinc oxide (ZnO) and cadmium sulfide quantum dots (CdS QDs) were tested and compared with respective individual (NMIT) and bulk material (BMT) treatments. ICP-MS results within specific tissues upon exposure to NMCC or NMIT treatments demonstrated that metal content varied significantly upon co-contaminant exposure, including instances of antagonistic effects: La uptake was significantly decreased upon CeO₂ NP co-exposure whereas La₂O₃ NP caused a complete deregulation of Cu uptake upon CuO NP co-exposure. Expression analysis of specific genes previously shown to be responsive to ENM exposure confirmed the involvement of the chloroplast in plant response: ORF31, a chloroplastic electron carrier down-regulated in all treatments, showed potential as a biomarker of exposure/effect. Principal component analysis (PCA) on plant physiological and molecular response provided insight into the nature of phytotoxicity under NMIT and NMCC exposure. This systematic approach is highly useful for characterizing the risk associated with ENMs by providing a mechanistic interpretation and a holistic perspective for more complex systems of contamination.

Deng, R.; Lin, D.; Zhu, L.; Majumdar, S.; White, J.C.; Gardea-Torresdey, J.L.; Xing, B. 2017. Nanoparticle interactions with co-existing contaminants: Joint toxicity, bioaccumulation and risk. *Nanotox.* <http://dx.doi.org/10.1080/17435390.2017.1343404>.

Abstract- With their growing production and application, engineered nanoparticles (NPs) are increasingly discharged into the environment. The released NPs can potentially interact with pre-existing contaminants, potentially leading to biological effects (bioaccumulation and/or toxicity) that are poorly understood. Most studies on NPs focus on single analyte exposure; the existing literature on NPs/co-contaminant interactions is somewhat limited but beginning to develop rapidly. This is the first review paper evaluating the current state of knowledge regarding NPs interactions with co-existing contaminants. Here, we review: 1) methods for investigating and evaluating joint NPs-contaminant effects; 2) simultaneous toxicities from NPs co-exposed with organic contaminants, metal/metalloid ions, dissolved organic matter (DOM), inorganic ligands, and additional NPs; and 3) the influence of NPs co-exposure on the bioaccumulation of organic contaminants and heavy metal ions, as well as the influence of DOM on NPs bioaccumulation. In addition, future research needs are discussed so as to better understand risk associated with NPs/co-contaminant exposure.

Teja Shidore, Corey D Broeckling, Jay S Kirkwood, John J Long, Jiamin Miao, Bingyu Zhao, Jan E Leach, and Lindsay R Triplett, 2017. The effector AvrRxo1 phosphorylates NAD *in planta*. PLoS Pathogens 13: e1006442.

Abstract-Gram-negative bacterial pathogens of plants and animals employ type III secreted effectors to suppress innate immunity. Most characterized effectors work through modification of host proteins or transcriptional regulators, although a few are known to modify small molecule targets. The *Xanthomonas* type III secreted avirulence factor AvrRxo1 is a structural homolog of the zeta toxin family of sugar-nucleotide kinases that suppresses bacterial growth. AvrRxo1 was recently reported to phosphorylate the central metabolite and signaling molecule NAD *in vitro*, suggesting that the effector might enhance bacterial virulence on plants through manipulation of primary metabolic pathways. In this study, we determine that AvrRxo1 phosphorylates NAD *in planta*, and that its kinase catalytic sites are necessary for its toxic and resistance-triggering phenotypes. A global metabolomics approach was used to independently identify 3'-NADP as the sole detectable product of AvrRxo1 expression in yeast and bacteria, and NAD kinase activity was confirmed *in vitro*. 3'-NADP accumulated upon transient expression of AvrRxo1 in *Nicotiana benthamiana* and in rice leaves infected with *avrRxo1*-expressing strains of *X. oryzae*. Mutation of the catalytic aspartic acid residue D193 abolished AvrRxo1 kinase activity and several phenotypes of AvrRxo1, including toxicity in yeast, bacteria, and plants, suppression of the flg22-triggered ROS burst, and ability to trigger an R gene-mediated hypersensitive response. A mutation in the Walker A ATP-binding motif abolished the toxicity of AvrRxo1, but did not abolish the 3'-NADP production, virulence enhancement, ROS suppression, or HR-triggering phenotypes of AvrRxo1. These results demonstrate that a type III effector targets the central metabolite and redox carrier NAD *in planta*, and that this catalytic activity is required for toxicity and suppression of the ROS burst.

LaMondia. J. A. 2017. *Pachysandra* species and cultivar susceptibility to the boxwood blight pathogen, *Calonectria pseudonaviculata*. Plant Health Progress 18:41-43

Abstract-This research was conducted to answer grower questions regarding potential differences in susceptibility in *Pachysandra* species and cultivars to the boxwood blight pathogen *Calonectria pseudonaviculata*. Five cultivars of *P. terminalis*, one cultivar of *P. axillaris*, and one selection of *P. procumbens* were evaluated using whole plants and detached leaves. *Pachysandra* species and cultivars differed somewhat in susceptibility to *Calonectria* leaf spot, with more significant differences observed between species and cultivars using whole plants than with detached leaf assays. All *Pachysandra* species and cultivars were susceptible to the pathogen and sporulation occurred on lesions, therefore all of these cultivars may serve as inoculum reservoirs for the boxwood blight pathogen. This should be taken into account when developing Best Management Practices for landscapes, garden centers and nurseries to prevent harboring or spread of the pathogen by movement of pachysandra.

Carole A. S-J. Cheah. 2017. Climate-Change Impacts in the Northeast on HWA and its Coccinellid Predator from Japan, *Sasajiscymnus tsugae*. (The Connecticut Agricultural Experiment Station, Windsor, CT; carole.cheah@ct.gov).

Abstract - *Adelges tsugae*, (Hemlock Woolly Adelgid [HWA]) is a serious and invasive pest of *Tsuga canadensis* (Eastern Hemlock) and *Tsuga caroliniana* (Carolina

Hemlock) in the eastern United States, with its lineage source in southern Japan. Its native Japanese coccinellid predator, *Sasajiscymnus* (formerly *Pseudoscymnus*) *tsugae*, was also collected from southern Honshu, Japan, and was the first biological control agent of HWA introduced into the eastern United States. Research showed that *S. tsugae* was readily established in Connecticut from 1995 to 2001. Long-term research in Connecticut has recently shed light on the role and impact of unpredictable winters in the northeast on populations of HWA. The winter-spring generation of HWA in Connecticut has recently been dramatically reduced by consecutive adverse winters, with consequences for introduced adelgid predators. As the Northeast climate changes, Eastern Hemlock ecosystems are also increasingly threatened by frequent and prolonged droughts and other biotic and abiotic stressors. The biology and predation plasticity of *S. tsugae* is highlighted to indicate the often-overlooked ability of this species to exploit fluctuating HWA populations on hemlocks over an extended season in an unpredictable climate.

Available online at : https://www.eaglehill.us/NENHC_2017/program/NENHC2017-oral-abstracts.pdf

Soghigian J, Ridge G, Stafford, K, Molaei, G.,* The First Evidence of Nanism in *Ixodes (Ixodes) scapularis* (Acari: Ixodidae), Found Parasitizing a Human Host. *Journal of Medical Entomology* (2017) 2017, 1-5 doi: 10.1093/jme/tjx111.

Abstract-*Ixodes scapularis* Say 1821, the primary vector of several human pathogens in the northeastern and upper Midwestern United States, has considerable genetic and morphological variation throughout its range. Recently, developmental or teratological abnormalities have been observed in this species for the first time, further complicating morphological identification. Here, we report the first evidence of nanism (dwarfism) in *I. scapularis*, found parasitizing a human host. We used molecular methods and scanning electron microscopy to identify the specimen. Morphological identification confirmed that the specimen is substantially smaller, approximately half the size, than a typical *I. scapularis* female. Here we discuss the recent reports of teratological abnormalities in *I. scapularis*, particularly from the Hudson River valley region of the northeastern United States, and highlight the need for additional studies of teratology in this important species and its potential implications in disease transmission.

Fauver, J.R., Gendernalik, A., Weger-Lucarelli, J., Grubaugh, N.D., Brackney, D.E., Foy, B.D., and G.D. Ebel. The use of xenosurveillance to detect human bacteria, parasites and viruses in mosquito bloodmeals. *American Journal of Tropical Medicine and Hygiene* 2017. Online: 30 May 2017. DOI: <https://doi.org/10.4269/ajtmh.17-0063>

Abstract-Infectious disease surveillance is hindered by several factors, including limited infrastructure and geographic isolation of many resource-poor regions. In addition, the complexities of sample acquisition, processing, and analysis, even in developed regions, can be rate limiting. Therefore, new strategies to survey human populations for emerging pathogens are necessary. Xenosurveillance is a method that utilizes mosquitoes as sampling devices to search for genetic signatures of pathogens in vertebrates. Previously we demonstrated that xenosurveillance can detect viral RNA in both laboratory and field settings. However, its ability to detect bacteria and parasites remains to be assessed. Accordingly, we fed *Anopheles gambiae* mosquitoes blood that contained *Trypanosoma*

brucei gambiense and *Bacillus anthracis*. In addition, we determined whether two additional emerging viruses, Middle East Respiratory Syndrome Coronavirus and Zika virus could be detected by this method. Pathogen-specific real-time reverse transcription polymerase chain reaction was used to evaluate the sensitivity of xenosurveillance across multiple pathogen taxa and over time. We detected RNA from all pathogens at clinically relevant concentrations from mosquitoes processed up to 1 day postbloodfeeding. These results demonstrate that xenosurveillance may be used as a tool to expand surveillance for viral, parasitic, and bacterial pathogens in resource-limited areas.

Hsieh HS, and Pignatello, JJ,* Activated Carbon-Mediated Base Hydrolysis of Alkyl Bromides, *Applied Catalysis B: Environmental*, 211, 68-78 (2017).

Abstract-Activated carbon (AC) is widely used as an adsorbent in water and air purification, but recent studies show that AC can also mediate chemical reactions at ambient temperature, including electron-transfer, redox, free radical, and dehydrohalogenation. Here, we expand the repertoire of such reactions to S_N2 base hydrolysis of alkyl bromides. Detailed studies were carried out on the quarantine and pre-shipment fumigant, methyl bromide (MeBr), whose removal from fumigation vent streams is sought due to its ozone-depleting potential. Mixed with a 1 M solution of NaOH, ACs are effective adsorbents, but also participate in hydrolysis of MeBr to bromide, methanol, and dimethyl ether. MeBr decay is first order in MeBr and obeys a two-term rate law corresponding to aqueous- and adsorbed-state reactions. The adsorbed-state reaction is, *i*) unassisted by surface groups, as shown by cycling experiments; *ii*) 0.83 order in aqueous hydroxide concentration suggesting participation of adsorbed hydroxide; *iii*) accelerated by pre-adsorption of quaternary ammonium surfactants, which also shift the zeta potential into the positive region; and *iv*) inhibited by competing inert anions in the order of their chromatographic retention time on ion-exchange resins: $Br^- < NO_3^- < ClO_4^-$. The results support an anion exchange mechanism in which hydroxide is attracted to positive sites on the carbon. Normalized to aqueous-phase rate constants, adsorbed-state rate constants for RBr followed the order, R = methyl > ethyl > propyl.

Han, J., W. Qiu, E. C. Campbell, **Jason C. White**, and B. Xing. Toothbrush components retain significant levels of triclosan and other chemicals from toothpastes: assessment of contaminant accumulation and release. *Environmental Health Perspectives*

Jiri, V., M. Hylis, I. Fiala, V. Sacherová, and **Charles Vossbrinck**. Microsporidia of the genus *Berwaldia* Larsson, 1981 (Microsporidia), parasites of daphnids (Crustacea): structure, biology and a corrected molecular phylogeny. *European Journal of Protistology*

Ma, C., **Jason C. White**, and B. Xing. Uptake of engineered nanoparticles by food crops: characterization, mechanisms, and implications. *Annual Review of Food Science and Technology*

Maurer, Katja and **James A. LaMondia**. Guidelines for integrated pest management for hops in Connecticut. *CAES Bulletin*

Medina-Velo, I. A., O. E. Dominguez, L. Ochoa, A. C. Barrios, J. A. Hernández-Viezcas, **Jason C. White**, J. R. Peralta-Videa, and J. L. Gardea-Torresdey. Nutritional quality of bean seeds harvested from plants grown in different soils amended with coated and uncoated zinc oxide nanomaterials. *Environmental Science: Nano*

Skaff, N. K., **Philip M. Armstrong**, **Theodore G. Andreadis**, and K. S. Cheruveli. Wetland characteristics linked to broad-scale patterns in *Cs. melanura* abundance and eastern equine encephalitis virus infection. *Parasites & Vectors*

Stoner, K.A. 2017. Threats to bees - Honey bees, bumble bees and others. *The Natural Farmer*, Summer, 2017. B-3-4.

Stoner, K.A. 2017. (excerpted by Jack Kittredge, editor). Excerpts from a citizen's guide to creating pollinator habitat in Connecticut. *The Natural Farmer*, Summer, 2017. B-22-25.

Zhang, L., C. Lei, K. Yang, **Jason C. White**, and D. Lin. Cellular response of algae to oxidized multi-walled carbon nanotubes. *Environmental Science and Technology*

Zhang, W., P. Schwab, **Jason C. White**, and X. Ma. Adsorption of cerium oxide nanoparticles on sand and kaolin: impact of nanoparticle surface properties. *Journal of Environmental Quality*

ARTICLES OF INTEREST JUNE 2017

GYPSY MOTH OUTBREAK 2017

The summer of 2017 saw another gypsy moth (*Lymantria dispar*) outbreak, which follows that in 2015 and 2016 when approximately 204,000 acres were defoliated in Connecticut, mainly in Middlesex, New London, and Windham Counties. Again this year, many homeowners have reported 100% defoliation of oaks and some other tree species, particularly in eastern towns, and more extensive defoliation is evident along many eastern CT roads than in 2016. In contrast to 2015 and 2016, Connecticut received rain in the spring and early summer in 2017 and there was widespread activity by the gypsy moth fungus, *Entomophaga maimaiga*, across the state in late June with reports of dead and dying caterpillars from at least 85 towns. However, there are some areas where caterpillar and adult moth activity have been reported. Aerial surveys by Deputy State Entomologist Dr. Victoria Smith and Plant Inspector Tia Blevins are currently underway and will delineate the extent of defoliation in 2017, which was extensive.



Aerial view of forest defoliation by the gypsy moth around Green Fall Pond, in Voluntown (Photo by Ms. Tia Blevins, June 30, 2017).

On June 5th the CAES/SCSU Summer Undergraduate Fellows in Plant Health and Protection program welcomed its first crop of ten interns. Eight of them are doing nine-week projects at the Station under the mentorship of Drs. **Zeng, Triplett, Steven, Elmer, Arango-Velez, Rutledge, White, and Marra**. They are also conducting a joint field experiment with **Dr. Wade Elmer** and taking several field trips and workshops to increase their communication skills and awareness of agricultural career options. They will be showing off their Chrysanthemum field plot at Plant Science Day, and giving brief presentations at a symposium on Thursday, August 4th - Please stop by if you can!



The 2017 Plant Health and Protection Fellows. Clockwise from left: Benson Chan (Elmer laboratory), Jada Ward (Steven laboratory), Jesse Farrell (Arango-Velez laboratory), Joe Clark (Siladly laboratory at SCSU), Mia Forgiione (Marra laboratory), Claire Walsh (Triplett laboratory), Alexa Orenstein (Roberts laboratory at SCSU), Julie Fitzgerald (Rutledge laboratory), and Taylor Abendroth (White laboratory). Not pictured: Courtney Haigler (Zeng laboratory).

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STATION NEWS

GRANTS RECEIVED JUNE 2017

New Contract with US Environmental Protection Agency. Coupling Pesticide Exposure Assessment in a Plant Nursery Setting to Direct Measures of Immunocompetence and Colony Condition in Bumble Bees \$69,982.



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