Station News

The Connecticut Agricultural Experiment Station
Volume 8 Issue 8 August 2018

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

CAES

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875

This Issue

ADMINISTRATION

DR. THEODORE ANDREADIS attended the CT Nursery & Landscape Association Summer Field Day held at Lockwood Farm in Hamden (July 25); and was interviewed for a story about the research, diagnostic, and service activities of the Experiment Station by Kathy Czepiel, Nutmeg Press (July 26).

ANALYTICAL CHEMISTRY

DR. JASON C. WHITE participated in the "All Hands" WebEx for the Center for Sustainable Nanotechnology (July 11, 18, 25); along with all Department staff welcomed, Mr. Riccardo Rossi to the laboratory; Riccardo is a Ph.D. student at the University of Parma and will be working in the Department for 6 months (July 11); hosted Professor Om Parkash and his Ph.D. student, Ms. Ayousha Shahi; I am co-advisor of her Ph.D. research (July 20); held a planning call with Dr. Mathews Paret of the University of Florida regarding a joint USDA grant proposal (July 24); participated remotely in the Ph.D. Dissertation defense of Dr. Wenjun Cai; I was on her Ph.D. committee as an external member (July 26); and was interviewed by Ed Stannard of the New Haven Register regarding release of our Technical Bulletin 19 which described our pesticide and arsenic surveillance of the CT food supply (July 30).

DR. BRIAN EITZER presided over two sessions at the North American Chemical Residue Workshop held in Naples, FL (July 22-25), and was interviewed for an e-book by LCGC magazine that was published along with the conference.

DR. NUBIA ZUVERZA-MENA presented a "flash talk" of her presentation to be given at the International Congress of Plant Pathology at the CAES ICPP 2018 Preview Symposium held in Jones (35 attendees) (July 26).

ENTOMOLOGY

DR. KIRBY C. STAFFORD III was interviewed by Louis Carta, community health educator at the Middletown Health Department, on WIHS 1933 radio about ticks, mosquitoes, and associated diseases (July 5); was interviewed by Alexia Farrell, News 12 CT, about the lone star tick (July 17); participated in the CT Nursery & Landscape Association Summer Field Day, held at Lockwood Farm in Hamden (275 attendees) (July 25); and presented a talk on the historical and cultural aspects of ticks at the Northampton Historical Society & Museum in Northampton, MA (24 attendees) (July 31).

MS. KATHERINE DUGAS staffed a CAES and CAPS table at the CT Tree Protective Association summer meeting held at the Farmington Club in Farmington (July 19); and staffed a CAES and CAPS table at the CT Nursery & Landscape Association Summer Field Day held at Lockwood Farm in Hamden (July 25).

MR. MARK H. CREIGHTON demonstrated the proper techniques to open hives and discussed building the apiary program at The Sound School in New Haven (7 students and advisors) (July 5); visited the apiary at The Sound School in New Haven and dropped off new beekeeping equipment to further develop the apiary program (July 12); assisted with a honey bee program of instruction at Lockwood Farm in Hamden for 6 students affiliated with a Yale University program for disadvantaged youths (July 14); visited the apiary and provided beekeeping supplies, and honey extractor for the school program at Montessori School of Greater Hartford in New Hartford (July 16); demonstrated bee-hive assembly at Lockwood Farm in Hamden for students affiliated with a Yale University program for disadvantaged youths (6 students) (July 21); visited the apiary and dropped off a honey extractor and beekeeping supplies at Common Ground High school in New Haven (July 23); and instructed and assisted eight students with bee-hive painting at Lockwood Farm in Hamden for students affiliated with a Yale University program for disadvantaged youths (July 29).

DR. GALE E. RIDGE received reports of unusually shaped bald-face hornet *Dolichovespula maculate* nests in the Huntington/Shelton area from pest management professionals (see image); was interviewed by Steven Rosenbaum from NBC News about the lone star tick and was visited by the Yale University biosafety group to teach them about bed bug management (July 13); and was interviewed by Harlan Levy, Journal-Inquirer, about good bugs and bad bugs in and around the home (July 23).

DR. CLAIRE E. RUTLEDGE led a Wasp Watcher training for citizen-scientists participating in biosurveillance for emerald ash borer and other non-native buprestids in Westbrook and Orange (10 adults) (July 5, 6).

DR. VICTORIA L. SMITH presented a talk entitled “Nursery and Forest Health

Inspection" to the 2018 class of CAES interns, with Lindsay Triplett, in the PP & E Conference Room of the Jenkins/Waggoner Building (15 participants) (July 18); and participated in the CT Nursery & Landscape Association Summer Field Day, held at Lockwood Farm in Hamden (275 participants) (July 25).

DR. KIMBERLY A. STONER was co-leader of a tour of Native Plant Meadows and Pollinator Habitat in South-Central Connecticut (along with Kathy Connolly, landscape designer), visiting sites in Westbrook, Killingworth, Chester, and Old Saybrook (2 sites); and presented information on crop pollination, bee diversity, life cycles of native bees, and diverse plants providing floral resources to pollinators over the growing season (43 adult attendees) (July 28).

ENVIRONMENTAL SCIENCES

DR. JOSEPH PIGNATELLO hosted Prof. Bruce Brownawell from Stonybrook University, School of Marine and Atmospheric Sciences, to discuss collaborative work (July 10).

DR. PHILIP ARMSTRONG was interviewed about the statewide mosquito surveillance program and the spread of West Nile virus in Connecticut by the Connecticut Post (June 17), WTIC (July 17 and 19), and the New London Day (July 24).

MS. ANGELA BRANSFIELD hosted Benjamin Fontes and Peter Reinhardt from Yale University's Office of Environmental Health and Safety and, with **DR. PHILIP ARMSTRONG** , discussed the Station's Biosafety Level 3 laboratory (July 13).

MR. GREGORY BUGBEE gave the talk "Connecticut's Invasive Aquatic Plant Problem – The State of the State" and administered the multistate aquatic license recertification program, both at the 58th Annual Meeting of the National Aquatic Plant Management Society in Buffalo, NY (approx. 125 attendees) (July 16-18); and updated the Bashan Lake Association on the control of phragmites and variable watermilfoil at their annual meeting held in East Haddam (approx. 75 attendees) (July 26).

DR. GOUDARZ MOLAEI was interviewed on the current status of tick activity, tick-borne diseases in Connecticut, and tick bite prevention by WNPR http://wnpr.org/post/connecticut-s-tick-crisis-won-t-be-going-away-anytime-soon (July 2); and was interviewed on the current status of lone star tick activity and its potential public health threat by NBC Connecticut https://www.nbcconnecticut.com/news/local/Heavy-Population-of-Lone-Star-Tick-Found-in-South-Norwalk-488316391.html (July 17).

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD spoke on "Independent effects of invasive shrubs and deer herbivory on plant community dynamics and forest management implications" for a CT DEEP sponsored teacher's workshop at Connecticut Forest & Park Association in Middlefield (25 attendees) (July 10); gave invited co-lectures with Dr. Mark Ashton (Yale) on "Silvics of individual species and stand dynamics" and "Silvicultural systems and practices " at the Northeast Silviculture Institute for Foresters Mixed Oak-Hickory Symposium held in Sturbridge, MA (53 attendees) (July 12); and co-presented a field workshop on oak management and ecology for the Northeast Silviculture Institute for Foresters Mixed Oak-Hickory Symposium in Union (45 attendees) (July 13).

DR. ABIGAIL A. MAYNARD attended a meeting of the Connecticut Vegetable & Small Fruit Growers' Association in Wethersfield (July 16); discussed the New Crops Program at White Gate Farm in East Lyme (July 19); talked about growing vegetables to campers at Hamden Hall Summer Camp (55 children, 5 adults) (July 23); and spoke with growers about the New Crops Program at a farmers' market in Hamden (July 26).

DR. SCOTT C. WILLIAMS spoke about "Tick-Borne Disease Ecology: Concerns for Forest and Public Health Alike" for a CT DEEP sponsored teacher's workshop in New Haven (50 attendees) (July 11); gave an invited lecture with DEEP Wildlife Division Biologist Michael Gregonis titled "Acorn Abundance Patterns and Their Implication for Wildlife" at the Northeast Silviculture Institute for Foresters Mixed Oak-Hickory Symposium held in Sturbridge, MA (53 attendees) (July 12); with **DR. MEGAN LINSKE**, participated in a conference call of the Executive Committee of the Northeast Section of The Wildlife Society (July 16); with **DRS. KIRBY STAFFORD** and **MEGAN LINSKE**, participated in a conference call with USDA collaborators Dr. Andrew Li and Laura Beimfohr on the ongoing ITM project (July 17); presented an invited lecture at the Annual Meeting of the CT Tree Protective Association about the positive relationship between blacklegged ticks and invasive plants in Farmington (350 attendees) (July 19); with DR. MEGAN LINSKE, participated in a conference call of the Executive Committee of the Northeast Section of The Wildlife Society (July 25); and with **DR. MEGAN LINSKE** and **MR. MICHAEL R. SHORT**, gave a field demonstration of rodent trapping and tick-borne disease research to South Central Connecticut Regional Water Authority interns in North Branford (15 students) (July 27).

MR. JOSEPH P. BARSKY attended the Connecticut Society of American Foresters summer field meeting held in Sharon (July 26).

PLANT PATHOLOGY AND ECOLOGY

DR. WASHINGTON DA SILVA presented a talk entitled "Grapevine Virus Diseases" at the Connecticut Winegrape Growers Twilight Meeting held at Paradise Hills Vineyards in Wallingford (40 adults, 10 children) (July 29); and attended and presented a poster entitled "Does transmission mode shape PVY quasispecies? Insights from Illumina deep sequencing" at the International Congress of Plant Pathology held in Boston, MA (100 attendees) (July 29 – 3 August).

DR. WADE ELMER gave an invited talk entitled "Using nanoparticle to control plant disease" at the Ag Innovate Conference held in San Francisco, CA (33 attendees) (July 11-13); participated in a workshop on data entry and analysis to the 2018 Plant Health Fellows program (10 students) (July 18); attended and presented a poster entitled "Using nanoparticles of metalloids and metallic oxides in plant disease suppression" at the International Congress of Plant Pathology held in Boston, MA (100 attendees) (July 29– August 3).

DR. YONGHAO LI presented "Plant Disease Diagnostics" to the Summer Undergraduate Fellows in Plant Health and Protection program in New Haven (10 adults) (July 18); staffed the CAES booth at the CT Protective Association Summer Meeting held in Farmington (July 19); was interviewed by Ms. Linda Lambeck at the CT Post about growing palm trees in Connecticut (July 24); talked about common disease problems of Christmas trees at the CT Christmas Tree Growers Association twilight meeting held in New Milford (40 adults) (July 24); attended the International Congress of Plant Pathology held in Boston, MA (July 30–August 3).

DR. ROBERT E. MARRA co-organized and co-led a forest pathology field trip in Myles Standish State Park, Carver, MA, for the International Congress of Plant Pathology. The field trip took place in various parts of Myles Standish State Park, in Carver, MA. Dr. Marra and colleagues introduced the international group to the cooperative and complementary roles of scientists and staff from federal and state agencies and universities. Site visits and subjects included: cranberry bogs; white pine, pitch pine, and red pine stands to discuss the ecology and management of diseases affecting these trees; salt marshes and Sudden Vegetation Dieback; nondestructive detection and quantification of internal decay using tomography (56 adults) (July 28).

DR. NEIL SCHULTES hosted Sumeyra Yavuz, a student in biotechnology from Manchester Community College, for an internship (June 18-July 26).

DR. LINDSAY TRIPLETT presented a workshop on data entry and analysis to the 2018 Plant Health Fellows program, in which students analyzed chrysanthemum height data (10 students) (July 18); organized and presented at a lunchtime mini-symposium highlighting the contributions of nine CAES scientists to the 2018 International Congress of Plant Pathology (40 attendees) (July 26); chaired a meeting of the Annual Phytopathological Society's Committee on Bacteriology as Chairperson (62 attendees) (July 30), and participated in a meeting of the APHIS Widely Prevalent Bacterial Diseases Committee as the representative for CT, MA, NH, and RI (5 attendees) (July 31); co-authored five formal research presentations at the International Congress of Plant Pathology: "Exception to the norm: Inactive TAL effectors trigger an atypical resistance mechanism in rice"; "Automated primer design for DNA-based detection of the emerging potato pathogen *Dickeya dianthicola*"; "Characterization of a bacterial leaf streak of rice resistance locus aided by nanopore sequencing"; "*hok-sok* toxin-antitoxin system plays important roles in morphological plasticity, bacterial persistence, and catalase activity in *Erwinia amylovora*"; and "Type II toxin-antitoxin systems are essential for the survival of *Erwinia amylovora* under lethal stress conditions."

DR. QUAN ZENG attended the International Congress of Plant Pathology (ICPP2018) in Boston, MA (July 27-August 2); co-organized a workshop "Effector Detector Plants" (21 attendees) (July 28); and led a field trip to the Arnold Arboretum of Harvard University (105 attendees) (July 29).

Dr. Quan Zeng delivering his lecture to Arnold Arboretum

VALLEY LABORATORY

DR. JATINDER S. AULAKH spoke about "Weed control in Christmas trees" at the Christmas Tree Grower's Association twilight meeting" held in Broad Brook (45 attendees) (July 24).

DR. RICHARD COWLES participated in the CT Beekeeper's Association workshop on making overwintering nucleus colonies in Hamden (35 attendees) (July 7); presented "Managing armored scales" and "Phytophthora root management" for the Christmas Tree Farmers' Association of New York, Ballston Spa, NY (100 attendees) (July 13, 14); and spoke about "Gypsy moths, spruce budworm, and phytophthora," at the Christmas Tree Growers Association twilight meeting held in Broad Brook (45 attendees) (July 24).

ROSE HISKES participated in the Symposium Planning Committee meeting of the Connecticut Invasive Plant Working Group held in Windsor (July 18).

DR. JAMES LAMONDIA participated in the Connecticut Hop Growers Association Summer Quarterly meeting, conducted a research plot tour with **DR. ELISHA ALLAN-PERKINS** and spoke about integrated pest management of hops during the Connecticut Agricultural Experiment Station Hops Summer Meeting and Field Day (16 attendees) (July 14); conducted a tour of research plots with Roger Black and Rene Ramos of Imperial Tobacco, and Michael Hartley, Greg Seamster and Marc Mentzer of Lancaster Leaf (July 19); attended the annual meeting of the Society of Nematologists in Albuquerque, NM, and participated in a meeting of the Journal of Nematology Editorial Board (July 23); chaired a contributed paper session on nematode management and presented "Rotation crops for management of *Pratylenchus penetrans* in Connecticut" (100 attendees) (July 24).

DR. DEWEI LI participated in the 11th International Mycological Congress (IMC11) held in San Juan, Puerto Rico (July 15-21) and two pre-congress field trips on July 14-15. A poster "*Botryotrichum domesticum* sp. nov., a new hyphomycete from an indoor environ-

ment" by De-Wei Li, A. Jalsrai, and Neil P. Schultes was presented during the congress. DeWei Li and Neil Schultes visited Dr. Donald H. Pfister and Farlow Library, Harvard University on July 30 and three unavailable mycological literature items were obtained during the visit.

MS. MICHELLE SALVAS and **MR. JAMES PRESTE** presented "Growing Hops in Connecticut" at the CT Nursery & Landscape Association Summer Field Day at Lockwood Farm (20 attendees) (July 25).

DEPARTMENTAL RESEARCH UPDATES JULY 2018

Adisa, I.; Pullagurala, V.L.R.; Rawat, S.; Hernandez-Viezcas, J.A.; Dimkpa, C.O.; **Elmer, W.H.**; **White, J.C.**; Peralta-Videa, J.R.; Gardea-Torresdey, J.L. 2018. Role of cerium compounds in Fusarium wilt suppression and growth enhancement in tomato (*Solanum lycopersicum*). *J. Agric. Food Chem*. 66:5959-5970.

Abstract- The use of nanoparticles in plant protection may reduce pesticide use and contamination, and increase food security. In this study, three week-old Solanum lycopersicum seedlings were exposed by root or foliar pathways to CeO2 nanoparticles (nano-CeO2) and cerium acetate (CeAc) at 50 and 250 mg/L prior to transplant into sterilized soil. One week later, the soil was inoculated with the fungal pathogen Fusarium oxysporum (1 g/kg) and plants were cultivated to maturity. Disease severity, biomass/yield, biochemical and physiological parameters were analyzed in harvested plants. Disease severity was significantly reduced by 250 mg/L of nano-CeO2 and CeAc applied to the soil (53% and 35%, respectively) or foliage (57% and 41%, respectively), respectively, as compared with infested controls. Foliar exposure of nano-CeO2 at 250 mg/L increased the fruit weight of infested and non-infested plants by 37% and 60 %, respectively. Overall, the findings show that nano-CeO2 has potential to suppress fusarium wilt and increase production of tomato plants.

Bugbee, G.J and Stebbins, S., 2018. Monitoring Report, Invasive Aquatic Plants, Candlewood Lake, Lake Lillinonah, Lake Zoar 2017. CAES Bulletin 1052.

Abstract - Invasive aquatic plants pose a threat to the ecological, recreational and possibly the hydrogenerating capacity of lakes Candlewood, Lillinonah, Zoar and Squantz Pond. Eurasian watermilfoil dominates the plant communities in all lakes and is the most troublesome. The Eurasian watermilfoil acreage increases and decreases in Candlewood Lake and Squantz Pond in response to deep and shallow winter drawdowns. Recent grass carp introductions may be reducing vegetation in certain coves but not in the main body of the lake. The shallow drawdown was performed in 2017 was the second in a row and Eurasian watermilfoil coverage was nearly 500 acres. This was similar to 2016 the most since our surveys began in 2007. Invasive minor naiad and curlyleaf pondweed are also present in Candlewood Lake but not at nuisance levels. Only five native plant species were present in Candlewood Lake in 2017 which is extremely low for such a large lake. Native plant populations are likely reduced by winter drawdowns and possibly by grass carp. Eurasian watermilfoil covered 32 acres of Squantz Pond in 2017 and was not nearly the nuisance it posed in 2016. Although the coverage was only down seven acres, it rarely reached the surface. Minor naiad coverage dropped to only six acres in 2017 and was the lowest of the three survey years. The direct connection with Candlewood Lake, under the Route 39 causeway, allows for invasive plant control via the Candlewood Lake drawdown and grass carp. We cannot rule out the possibility that some of the grass carp introduced into Candlewood Lake in 2015 have migrated into Squantz Pond and caused our observed reduction in the nuisance

plants. We found seven native plant species in 2017 and this was the same as 2016. Eurasian watermilfoil showed a dramatic increase in Lake Lillinonah from our previous surveys. We found 154 acres in 2017 compared to a previous high of 90 acres in 2013. Typically the milfoil was to the surface, covered with mats of filamentous algae, and an extreme nuisance. Reasons for this large increase may be associated with low flow rates during the recent droughts. Small populations of minor naiad and curlyleaf pondweed were present in 2017 and have changed little through our surveys. We observed isolated small patches of water chestnut in Lake Lillinonah and their population appears under control by hand harvesting. Nine native species were present on the Lake Lillinonah transects which eclipsed the previous high of eight found in multiple years. Zebra mussels were attached to plants and they could begin to reduce plant growth. Our 2017 survey of Lake Zoar's transects found Eurasian watermilfoil, minor naiad and curlyleaf pondweed. European water clover was present but not on transects. Eurasian watermilfoil and minor naiad occurred on 37 and 30 percent of the points respectively and changed little from 2016. Curlyleaf pondweed was found on eight percent of the points compared to 17 percent of the points in 2016. Ten native species were found in Lake Zoar in 2017. Although a low number for such a large lake, this number represents an increase from most past years and may be the result of the herbicide applications reducing the competition from Eurasian watermilfoil. Fluctuating water levels and zebra mussels may also be factors.

Bugbee, G.J., Stebbins, S., and Wiegand, A.C. 2018. Aquatic Vegetation Survey, Water Chemistry, Aquatic Plant Management Options, Taunton Lake 2017. CAES Bulletin 1053.

Abstract - Since the 1950's, Taunton Lake has changed from a water body with a sandy/gravelly bottom with few plants to a silty/organic bottom with luxuriant plant growth. Our surveys in 2009, 2010, 2014 and 2017 found 8 -14 plant, with the fewest in 2009 and the greatest 2014. With the exception Eurasian watermilfoil and curlyleaf pondweed, all were native. In 2017, dense stands of Eurasian watermilfoil were typically covered with filamentous algae. An increase in the aquatic plant species richness and frequency of occurrence of both invasive and native species occurred between 2009 and 2017 but the abundance of native species declined. Effects of the 2015 introduction of grass into Taunton Lake might be reflected in changes in the plant community between our 2014 and 2017 surveys. Our data found no significant changes in species richness or frequency of occurrence. Because grass carp feed from the plants top downward, a better measure of change might be species abundance. Unfortunately, our plant abundance showed a significant increase in Eurasian watermilfoil and a downward trend in native species. This could indicate that in the early years of the grass carp introduction, the fish are preferentially feeding on native species. With time and grass carp growth, greater control of Eurasian watermilfoil is expected. Taunton Lake's water has increased in clarity and declined in total phosphorus from 2014 to 2017. This could be due to P uptake by the greater biomass of aquatic plants, changes in watershed inputs or random events. Other water chemistry parameters showed the lake to have moderately high pH, alkalinity and conductivity. This creates conditions favoring invasive curlyleaf pondweed, Eurasian watermilfoil and minor naiad which are already present, as well as zebra mussels that are not yet present.

Bugbee G.J. and **Wiegand, A.C**. 2018. Monitoring Report, Invasive Aquatic Plants, Lake Housatonic CAES Bulletin 1054 (Web Only)

Abstract - Lake Housatonic was surveyed using the protocol in use for Lake Candlewood, Lillinonah, Zoar and Squantz Pond for the first time in 2017. Twenty one

plant species were documented of which Eurasian watermilfoil, curlyleaf pondweed and brittle waternymph are invasive (non-native). Eurasian watermilfoil and curlyleaf pondweed dominates the plant communities along with a number of native species. Populations of all invasive species and most native species have increased dramatically since the 2005 CAES IAPP survey. For instance, Eurasian watermilfoil covered 5 acres in 2005 compared to 139 acres in 2017. And summer curlyleaf pondweed acreage increased from 0.1 to 12.9. Curlyleaf pondweed is more prevalent in the spring but this was not measured until our 2017 survey when 50 acres were present. Although not yet recorded in Lake Housatonic, there is a risk that water chestnut could infest the waterbody due to its location upstream in Lake Lillinonah. Yearly surveillance and removal of any pioneer infestations in Lake Housatonic is suggested. Aquatic plant management options include a continuation of current harvesting practice, utilization of targeted herbicide applications such as being performed in Lake Zoar, using a winter drawdown, exploring grass carp introduction as underway in Lake Candlewood and localized use of benthic barriers.

De La Torre Roche, R.; Pagano, L.; Majumdar, S.; **Eitzer, B.D.; Zuverza-Mena, N.**; Ma, C.; Servin, A.; Marmiroli, N.; Parkash Dhankker, O.; **White, J.C.** 2018. Co-exposure of imidacloprid and nanoparticle Ag or CeO_2 to *Cucurbita pepo* (Zucchini): Contaminant bioaccumulation and translocation. *NanoImpact* 11:136-145.

Abstract- The use of engineered nanomaterial (ENMs) has increased dramatically and the possible interaction of these materials with soil-borne organic co-contaminants is largely unknown. Imidacloprid (IMDA) is a neonicotinoid insecticide and one of the most widely used pesticides in the United States and significant concerns have risen due to unknown role of these insecticides in pollinator decline. As such, understanding ENM interactions with these agrochemicals is important. In this study, the bioaccumulation, translocation, and toxicity of IMDA (10 mg/kg) to Cucurbita pepo L (zucchini) was evaluated upon simultaneous exposure to CeO2 or Ag in bulk (CeBulk or AgBulk) or nanoparticle (CeNP or AgNP) form at 100 mg/kg under soil-grown conditions. Additionally, expression analysis of seven genes (related to stress, photosynthesis, and elemental transport) previously identified as putative biomarkers of nanoparticle (NPs) exposure in zucchini was also performed. Total IMDA and metabolites accumulation in plant root and aerial tissues (shoot- stem and leaf, flower, and stamen) was equivalent to controls (soil with IMDA minus NPs) in both CeO2 exposures. However, co-exposure to AgBulk and AgNP significantly suppressed IMDA accumulation in zucchini aerial tissues by 30% and 33%, respectively. The Ag and Ce concentration in aerial tissues exposed to NPs alone were 85.4% and 79.2%, respectively, higher than plants co-exposed to NPs with IMDA. The expression level of the seven genes studied shows that the response mechanisms of zucchini to IMDA and NPs are different. Moreover, no synergistic effects were observed in gene expression upon IMDA-NPs co-exposure. These findings show that ENMs may not only affect the bioavailability and translocation of currently used pesticides but that the reverse is true as well; these interactions should be considered when assessing the exposure and risk of these materials in the environment.

Stafford III, K.C., Molaei, G., Little, E.A.H., Paddock, C. D., Karpathy, S.E., Labonte, A.M., Distribution and Establishment of the Lone Star Tick in Connecticut and Implications for Range Expansion and Public Health, *Journal of Medical Entomology*; tjy115, https://doi.org/10.1093/jme/tjy115 Published: 25 July 2018.

Abstract- In the United States, the lone star tick, *Amblyomma americanum* (L.) (Acari: Ixodidae), is an aggressive southeastern species whose range has reportedly been steadily expanding northward. The number of *A. americanum* specimens

submitted to the Tick Testing Laboratory (TTL) at the Connecticut Agricultural Experiment Station (CAES) increased by 58% from the period of 1996–2006 (n = 488) to 2007–2017 (n = 773), mainly from Fairfield County in the southwestern corner of the state. The greatest numbers of *A. americanum* submissions to the CAES-TTL were from the City of Norwalk and a few adjacent municipalities. We also report the discovery of a large infestation of adult and nymphal lone star ticks detected on a dead male white-tailed deer, *Odocoileus virginianus* (Zimmerman) (Artiodactyla: Cervidae), on Manresa Island, Norwalk, in June 2017, indicating a long established, undetected population along the southwestern coast. A sample of nymphal and adult host-seeking *A. americanum* collected July 2017 from Manresa Island were tested and a proportion were positive for *Ehrlichia chaffeensis*, *Ehrlichia ewingii*, and *Anaplasma phagocytophilum*. The *A. americanum* tick and its associated disease pathogens are expected to become an increasing public health concern in southern New England.

Kotsakiozi, P., **Gloria-Soria, A.**, Schaffner, F., Robert, V. and Powell, J.R., 2018. Aedes aegypti in the Black Sea: recent introduction or ancient remnant?. *Parasites & Vectors*, *11*(1): 396.

Abstract- The yellow fever mosquito *Aedes aegypti* transmits viral diseases that have plagued humans for centuries. Its ancestral home are forests of Africa and ~400–600 years ago it invaded the New World and later Europe and Asia, causing some of the largest epidemics in human history. The species was rarely detected in countries surrounding the Mediterranean Sea after the 1950s, but during the last 16 years it re-appeared in Madeira, Russia and in the eastern coast of the Black Sea. We genotyped *Ae. aegypti* populations from the Black Sea region to investigate whether this is a recent invasion (and if so, where it came from) or a remnant of pre-eradication populations that extended across the Mediterranean. We also use the Black Sea populations together with a world reference panel of populations to shed more light into the phylogeographical history of this species. Microsatellites and ~19,000 genome-wide single nucleotide polymorphisms (SNPs) support the monophyletic origin of all populations outside Africa, with the New World as the site of first colonization. Considering the phylogenetic relationships, the Black Sea populations are basal to all Asian populations sampled. Bayesian analyses combined with multivariate analyses on both types of markers suggest that the Black Sea population is a remnant of an older population. Approximate Bayesian Computation Analysis indicates with equal probability, that the origin of Black Sea populations was Asia or New World and assignment tests favor the New World. Our results confirmed that *Ae. aegypti* left Africa and arrived in New World ~500 years ago. The lineage that returned to the Old World and gave rise to present day Asia and the Black Sea populations split from the New World approximately 100–150 years ago. Globally, the Black Sea population is genetically closer to Asia, but still highly differentiated from both New World and Asian populations. This evidence, combined with bottleneck signatures and divergence time estimates, support the hypothesis of present day Black Sea populations being remnants of older populations, likely the now extinct Mediterranean populations that, consistent with the historic epidemiological record, likely represent the original return of *Ae. aegypti* to the Old World.

Kotsakiozi, P., Evans, B.R., **Gloria-Soria, A.**, Kamgang, B., Mayanja, M., Lutwama, J., Le Goff, G., Ayala, D., Paupy, C., Badolo, A., Pinto, J., Sousa, C.A., Troco, A.D., and Powell, J.R. 2018. Population structure of a vector of human diseases:

Aedes aegypti in its ancestral range, Africa. *Ecology and Evolution* 00:1–14. https://doi.org/10.1002/ece3.4278

Abstract- *Aedes aegypti*, the major vector of dengue, yellow fever, chikungunya, and Zika viruses, remains of great medical and public health concern. There is little doubt that the ancestral home of the species is Africa. This mosquito invaded the New World 400-500 years ago and later, Asia. However, little is known about the genetic structure and history of *Ae. aegypti* across Africa, as well as the possible origin (s) of the New World invasion. Here, we use ~17,000 genome-wide single nucleotide polymorphisms (SNPs) to characterize a heretofore undocumented complex picture of this mosquito across its ancestral range in Africa. We find signatures of human-assisted migrations, connectivity across long distances in sylvan populations, and of local admixture between domestic and sylvan populations. Finally, through a phylogenetic analysis combined with the genetic structure analyses, we suggest West Africa and especially Angola as the source of the New World's invasion, a scenario that fits well with the historic record of 16th-century slave trade between Africa and Americas.

Krol, W.J.; Eitzer, B.D.; Robb, C.; Arsenault, T.; Musante, C.; White, J.C. 2018. Pesticide residues and arsenic found in produce sold in Connecticut in 2017: MFRPS ISO 17025:2005 food testing. Connecticut Agricultural Experiment Station Technical Bulletin 19.

Abstract- The Department of Analytical Chemistry (DAC) at the Connecticut Agricultural Experiment Station (CAES) has tested food samples for pesticide residues for the Connecticut Department of Consumer Protection (DCP) and published the findings since 1963. The CAES is the *de facto* laboratory used by the DCP to provide regulatory enforcement analysis of pesticide residues found on domestic and imported food sold within the state. This program was established: 1) to ensure that pesticides on food products are used in accordance with their label and 2) to ensure that the public is protected from the deliberate or accidental misuse of pesticides. This Bulletin presents the findings of our 2017 surveillance.

Liao, Y.Y.; Strayer-Scherer, A.; **White, J.C.**; Mukherjee, A.; **De La Torre-Roche, R.**; Ritchie, L.; Clark, D.; Vallad G. E.; Freeman, J.; Jones, J. B; Paret, M.L. Nano-Magnesium oxide: A novel bactericide against copper-tolerant *Xanthomonas perforans* causing tomato bacterial spot. *Phytopathol. J.* https://doi.org/10.1094/PHYTO-05-18-0152-R.

Abstract- Bacterial spot caused by Xanthomonas perforans causes significant damage on tomatoes in Flor-ida. Due to the presence of copper (Cu)-tolerant X. perforans strains, current copper-bactericides are not effective in disease management. Thus, there is a critical need for finding alternatives to copper. In this study, the antibacterial activity of the nanoparticle magnesium oxide (Nano-MgO), and other metal oxide nanoparticles, were evaluated for bactericidal activity against Cu-tolerant and sensitive X. perforans strains. In vitro experiments demonstrated that Nano-MgO had high antibacterial activity against both strains compared to the equivalent concentration of a standard Cu-based bactericide. Two greenhouse experiments with a copper-tolerant strain demonstrated that disease severity on tomato was significantly reduced by Nano-MgO at 200 µg/ml compared to copper-mancozeb, the grower standard, and the untreated control ($p = 0.05$). In three field experiments, Nano-MgO at 200 µg/ml significantly reduced disease severity compared to the un-treated control ($p = 0.05$). There was no negative impact on the yield due to Nano-MgO treat-ments. Elemental analysis of fruit samples showed that Nano-MgO treatments did not differentially accu-

mulate Mg, Cu, Ca, K, Mn, P and S compared to the untreated control. This study demonstrates the antibacterial potential of Nano-MgO against X. perforans and its potential for control of bacterial spot of tomato.

Ranciato, J.; Zuverza-Mena, N.; Eitzer, B.; White, J.C. 2018. Analysis of Animal Feed Products Sold in Connecticut 2017. Connecticut Agricultural Experiment Station Technical Bulletin 18.

Abstract- In the State of Connecticut, The Agricultural Commodities Division of The Department of Agriculture is responsible for the regulation and inspection of animal feeding products and pet foods. These products are delivered to The Department of Analytical Chemistry at The Connecticut Agricultural Experiment Station for analysis to ensure label compliance. This Bulletin presents the findings of our 2017 surveillance.

Rui, M.; Ma, C.; **White, J.C.**; Tang, X.; Yang, J.; Jiang, F.; Hao, Y.; Ali, A.; Rui, Y.; Cao, W.; Xing, B. 2017. Metal oxide nanoparticles alter peanut (*Arachis hypogaea* L.) physiological response and reduce nutritional quality: A life cycle study. *Environ. Sci.: Nano*. 10.1039/c8en00436f.

Abstract- We investigated the effects of the metal oxide nanoparticles (NPs) iron oxide (Fe2O3), copper oxide (CuO), and titanium oxide (TiO2) NPs at 50 and 500 mg/kg on peanut (Arachis hypogaea L.) in a full life cycle study. After 145 day exposure, all three NPs had no impact on plant growth in terms of biomass, shoot height, and per plant yield, with the exception the 500 mg·kg−1 CuO NP which reduced fresh shoot biomass by 44% relative to the control. However, exposure to all the three NPs significantly decreased the 1000-grain weight by 10-31%, with the greatest reduction being in the 500 mg·kg−1 CuO NP treatment. The elemental analysis showed that the Cu concentration in grains increased in a dose-dependent manner; however, exposure to Fe2O3 and TiO2 NPs did not increase the Fe and Ti contents in the grain regardless of dose. In order to evaluate crop quality as affected by NPs treatment, the amino acid and fatty acid profiles were analyzed in peanut grains. NPs CuO induced greater changes than the other two NPs in amino acid content as related to glycolysis, the citric acid cycle, and defense related pathways. Elevated resveratrol content in CuO and TiO2 NP treated peanut grains were indicative of plant stress response. Taken together, our results suggest that metal-based NPs could alter peanut crop yield and more importantly, nutritional quality. These findings raise concerns over how to safely and sustainably apply NP incorporated agrichemicals so as to protect food quality and security.

Williams, S.C., Little, E.A.H., Stafford III, K.C., Molaei, G., Linske, M.A., Integrated control of juvenile *Ixodes scapularis* parasitizing *Peromyscus leucopus* in residential settings in Connecticut, United States, *Ticks and Tick-borne Diseases*; 9(5): 1310-1316, 2018

Abstract- Lyme disease continues to be the most common vector-borne disease in the United States with an estimated 330,000 human cases annually. In the eastern United States, the blacklegged tick, *Ixodes scapularis*, is the primary vector of the Lyme disease spirochete, *Borrelia burgdorferi*, and the white-footed mouse, *Peromyscus leucopus*, is a primary reservoir host. In four residential neighborhoods in Connecticut over three years, we tested the effectiveness of different low-toxicity integrated tick management approaches to control larval and nymphal *I. scapularis* parasitizing *P. leucopus*. Combinations of white-tailed deer, *Odocoileus virginianus*, reduction, broadcast application of the entomopathogenic fungus *Metarhizium anisopliae*,

and distribution of fipronil-based rodent-targeted bait boxes were evaluated against an experimental control. Deer reduction with no other intervention likely forced juvenile *I. scapularis* to obtain blood meals from available reservoir hosts, resulting in increased exposure of *P. leucopus* to *B. burgdorferi* compared to control sites. The *M. anisopliae*/bait box and the deer reduction/*M. anisopliae*/bait box treatment combinations resulted in 94% and 85% reductions in larvae parasitizing *P. leucopus* that tested positive for *B. burgdorferi*, respectively, compared to control. Deer reduction alone resulted in only a 3% reduction, likely because parasitizing juvenile *I. scapularis* were not targeted by bait box-delivered fipronil. Unless there is community support to reduce and maintain deer at very low densities (<5 deer/km2), it is clear that a combination of *M. anisopliae*/fipronil-based bait boxes offers an effective, localized, low-toxicity option for reducing *I. scapularis* parasitizing *P. leucopus* without complications from host switching.

Stoffer-Bitner, A.J., Alexander, C.R., **Dingman, D.W.**, Mourad, G.S., **Schultes, N.P.**, The solute transport and binding profile of a novel nucleobase cation symporter 2 from the honey bee pathogen *Paenibacillus larvae*. FEBS OpenBio doi:10.1002/2211-5463.12488

Abstract - A novel nucleobase cation symporter 2 encoded in the genome of the Honey bee bacterial pathogen *Paenibacillus larvae* reveals high levels of amino acid sequence similarity to the *Escherichia coli* and *Bacillus subtilis* uric acid and xanthine transporters. This transporter is named *P. larvae* uric acid-permease like protein (PlUacP). Even though PlUacP displays overall amino acid sequence similarities, has common secondary structures, shares functional motifs and functionally important amino acids with *E. coli* xanthine and uric acid transporters these commonalities are insufficient to assign the transport function to PlUacP. The solute transport and binding profile of PlUacP was determined by radiolabeled uptake experiments via heterologous expression in nucleobase transporter-deficient *Saccharomyces cerevisiae* strains. PlUacP transports the purines adenine and guanine and the pyrimidine uracil. Hypoxanthine, xanthine and cytosine are not transported by PlUacP, but along with uric acid, bind in a competitive manner. PlUacP has strong affinity for adenine K_m 7.04 ± 0.18 ▫M and, as with other bacterial and plant NCS2 proteins, PlUacP function is inhibited by the proton disruptor carbonyl cyanide m-chlorophenylhydrazone. The solute transport and binding profile identify PlUacP as a novel nucleobase transporter.

Zhang, H.; Du, W.; Peralta-Videa, J.R.; Gardea-Torresdey, J.L.; **White, J.C.**; Guo, H.; Ji, R.; Zhao, L. 2018. Metabolomics reveals how cucumber (*Cucumis sativus*) reprograms metabolites to cope with silver nanoparticle-induced oxidative stress. *Environ. Sci. Technol.* 52:8016-8026.

Abstract- Due to their well-known antifungal activity, the intentional use of Ag nanoparticle (NPs) as sustainable nano-fungicides is expected to increase in agriculture. However, the impacts of AgNPs on plants must be critically evaluated to guarantee their safe use in food production. In this study, 4-week-old cucumber (Cucumis sativus) plants received a foliar application of AgNPs (4 or 40 mg per plant) or Ag+ (0.04 and 0.4 mg per plant) for seven days. Gas chromatography-mass spectrometry (GC-MS) based non-target metabolomics enabled the identification and quantification of 268 metabolites in cucumber leaves. Multivariate analysis revealed that all the treatments significantly altered the metabolite profile. Exposure to AgNPs resulted in metabolic reprogramming, including activation of antioxidant defense systems (up-regulation of phenolic compounds) and down-regulation of photosynthesis

(up-regulation of phytol). Additionally, AgNPs enhanced respiration (up-regulation of TCA cycle intermediates), inhibited photorespiration (down-regulation of glycine/serine ratio), altered membrane properties (up-regulation of pentadecanoic and arachidonic acid, down-regulation of linoleic and linolenic acid), and reduced of inorganic nitrogen fixation (down-regulation of glutamine and asparagine). Although Ag ions induced some of the same metabolic changes, alterations in the levels of carbazole, indoleactate, raffinose, adenosine, lactamide, erythrose, and p-benzoquinone were AgNPs-specific. The results of this study offer new insight into the molecular mechanisms by which cucumber responds to AgNPs exposure and provide important information to support the sustainable use of AgNPs in agriculture.

JOURNAL ARTICLES APPROVED JUNE 2018

Cao, Y., **Chuanxin Ma**, J. Zhang, S. Wang, **Jason C. White**, B. Xing, and G. Chen. Accumulation and spatial distribution of copper in willow as affected by soil flooding: a synchrotron-based X-ray fluorescence study. *Science of the Total Environment*

Centrella, M., L. Russo, N. Moreno, **Brian Eitzer**, M. van Dyke, B. Danforth, and K. Poveda. The direct, indirect, and interactive effects of landscape simplification, pesticide exposure and diet diversity on solitary bee performance in agroecosystems. *Journal of Applied Ecology*

Cowles, Richard S. Prospects for using mating disruption to protect Douglas-fir from Zimmerman pine moth. *The Real Tree Line*

Hao, Y., P. Feng, **Chuanxin Ma**, **Jason C. White**, et al. Engineered nanomaterials inhibit *Podosphaera pannosa* infection on rose leaves by regulating phytohormones. *Environmental Research*

Juanillas, V. M. J., A. Dereeper, N. Beaume…**Lindsay Triplett**, et al. Rice Galaxy: an open resource for plant science. *GigaScience*

Krol, Walter J., **Brian D. Eitzer**, **Christina S. Robb**, **Terri Arsenault**, **Craig Musante**, and **Jason C. White**. Pesticide residues and arsenic found in produce sold in Connecticut in 2017: MFRPS ISO 17025:2005 Food Testing. *CAES Technical Bulletin*

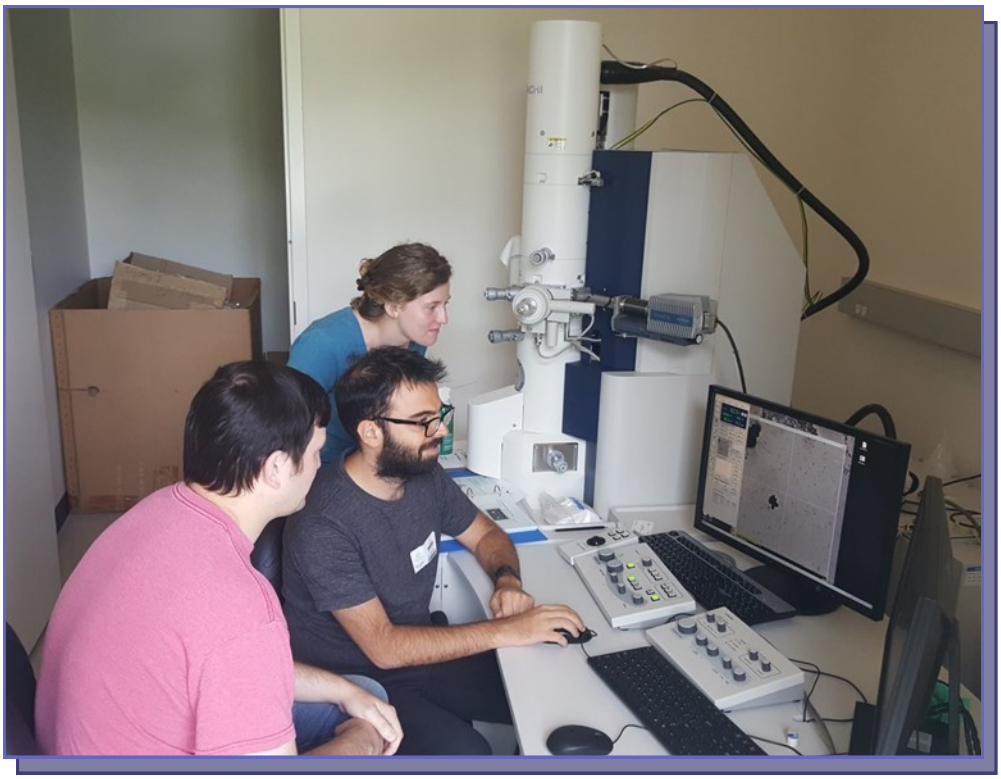
Ostiguy, N., F. A. Drummond, K. Aronstein, **Brian Eitzer**, J. D. Ellis, M. Spivak, and W. Shepard. Pesticide exposure to honey bees in a four-year nationwide study. *Insects*

Ranciato, John R., **Nubia Zuverza-Mena**, and **Jason C. White**. Analysis of animal feed products sold in Connecticut in 2017. *CAES Technical Bulletin*

Singh, D., W. Wohlleben, **Roberto De La Torre Roche**, **Jason C. White**, and Philip Demokritou. Thermal decomposition/incineration of nano-enabled coatings and effects of nanofiller/matrix properties and operational conditions on byproduct release dynamics: potential environmental health implications. *Environmental Science & Technology*

Zuverza-Mena, Nubia and **Jason C. White**. Engineered nanomaterials in terrestrial systems: trophic transfer and interactions with co-existing contaminants. *Current Opinion in Environmental Science and Health*

ARTICLES OF INTEREST JULY 2018



Visiting Graduate Student- Mr. Riccardo Rossi of the University of Parma (center) will be working in the Department of Analytical Chemistry until the end of December 2018. His work will focus on the impact of engineered nanomaterial exposure on gametogenesis in plants. He is seen here working on the scanning/transmission electron microscope at the CT Public Health Laboratory with Ms. Collette McMahon, a REU student from Ave Maria University and Mr. Eric Bias, an REV student from Maricopa County Community College.

Hops Research Meeting Held at the Valley Laboratory

Sixteen people attended the Connecticut Hop Growers Association Summer Quarterly meeting and Connecticut Agricultural Experiment Station Hops Summer Meeting and Field Day held Saturday, July 14, 2018 at the Valley Laboratory. CHGA President Alex DeFrancesco welcomed growers and spoke about current issues for the Hop Growers Association. Drs. Jim LaMondia and Elisha Allan-Perkins spoke about research plots and gave a tour of hop and barley field plots. Jim Preste demonstrated the HopsHarvester combine and barley combine. Dr. Jim LaMondia spoke about "Integrated pest management of hops" and Mark Zotti of the Department of Agriculture spoke about "FISMA and hops." Nathan L'Etoile of Four Star Farms in MA presented information on "Drying and storing hops for processing" and Alex DeFrancesco spoke about "Terroir and hops marketing." Talks were followed by a tour of Thrall Family Malt. The meeting qualified for 3.5 pesticide applicator re-certification credits.

NEW STAFF, STUDENTS, AND VOLUNTEERS JULY 2018

Nubia joined the Department of Analytical Chemistry as an Assistant Scientist II in early July, although she had been an Agricultural Post-Doctoral Research Scientist since September of 2016. Nubia got her Ph.D. in Materials Science and Engineering from the University of Texas El Paso in the summer of 2016. Prior to that, she received her B.S. in Chemistry in 2006 and her M.S. in Metallurgical and Materials Engineering in 2009; both from the University of Texas El Paso. After receiving her M.S. in 2009, Nubia worked as a Manufacturing Engineer for Cordis de Mexico (a Johnson and Johnson Company) for two years before beginning her Ph.D. research. Her Ph.D. research was focused on the impact of engineered nanomaterials on food crops. At CAES, she was hired as a Post-Doctoral Research Scientist on the Department's FDA funded Animal Feed Regulatory Program Standard (AFRPS). Under this program, she worked closely with other Department staff to bring AFRPS under the laboratories Scope of Accreditation in February of 2018. Also as a post-doc, Nubia continued to conduct experiments investigating the impact of nanomaterials on plant and worm species. As an Assistant Scientist, Nubia will begin investigating emerging contaminants in food; she will initially likely focus on microplastics and their potential to act as a carrier for other contaminants. Nubia was born and raised in northern Mexico: Ciudad Juarez, Chihuahua. She is the oldest of two, and most of her family resides in Chihuahua and in Texas. She has three dogs back in Mexico (Ocho, Picky and Cookie) and she loves cars, both driving and working on them. She is also currently involved with vermicomposting with her brother and sister-in-law.

Dr. Washington da Silva joined The Connecticut Agricultural Experiment Station (CAES) - Main Laboratories, New Haven - as a Plant Virologist to work on fruit crop viruses. The top two priorities of his research program are to develop and improve molecular diagnostics for viruses of importance to Connecticut agriculture and to investigate plant-virus-vector interactions with the goal of developing improved disease management strategies. Dr. da Silva earned his Ph.D. from Cornell University where he used high-throughput technologies to advance our understanding on potato virus Y infections. He received his M.Sc. degree in plant health from Louisiana State University and his engineering degree (B.Sc.) from Universidade Federal de Viçosa in Brazil. Washington has moved his wife (Rachel) and daughter (Aurelia) from the *Gorges* of Ithaca, NY to beautiful Guilford, CT.

Dr. Josephine Hyde is a new post-doctoral research scientist who is working with Dr. Blaire Steven and Dr. Doug Brackney in the Department of Environmental Sciences.

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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.

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