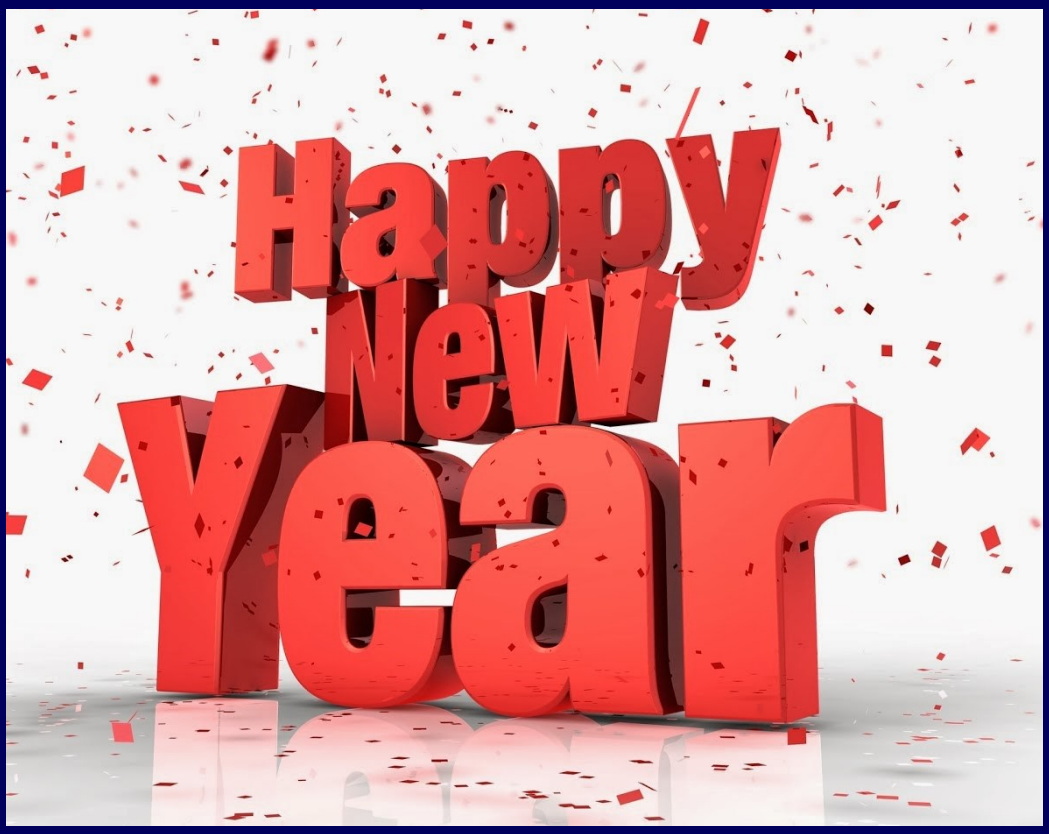
# Station News

The Connecticut Agricultural Experiment Station
Volume 10 Issue 1 January 2020




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** was interviewed about eastern equine encephalitis activity in the northeastern US this year and the prospects for next year by Will Healey, Journal Inquirer (December 5); presented an invited talk entitled, *Reflections on the Ecology and Epidemiology of Eastern Equine Encephalitis in the Northeastern United States* at the 65th Annual Meeting of the Northeastern Mosquito Control Association held in Milford, MA (approx. 150 attendees) (December 9-11) ; was granted "Honorary Membership" in the Northeastern Mosquito Control Association for scientific contributions to the association and mosquito control professionals in the Northeast (December 9); and was interviewed about the impact of global climate change on the mosquito-borne diseases by freelance journalist, Oscar Schwartz (December 12).

# ANALYTICAL CHEMISTRY

**DR. JASON C. WHITE** attended the monthly Laboratory Preparedness meeting at the Department of Public Health Laboratory in Rocky Hill (December 2); participated in an FDA webinar on future finding for the Animal Feed Regulatory Program Standards (December 4); participated in the weekly "all-hands" call for the Center for Sustainable Nanotechnology (CSN) (December 4, 18); gave a presentation at the CT Department of Agriculture Hemp Listening Session entitled "Industrial Hemp: Crop for the Future?" at the CAES Jones Auditorium (December 4); spoke with officials at the US Drug Enforcement Agency (DEA) about THC testing in hemp (December 5); hosted the quarterly CAES Safety Committee meeting (December 6); participated in a CSN ZOOM call to discuss progress on a manuscript to be submitted to Nature Nanotechnology (December 6); visited the University of Parma in Parma, Italy, and met with collaborators to discuss ongoing and future work (December 8-11); attended the NanoDay IV conference in Milan, Italy, and gave a presentation entitled "Nanotechnology in Agriculture: Balancing Applications and Implications" (December 12-15); was interviewed by David Freedman of *Scientific American* about nanotechnology in agriculture (December 17); and participated by ZOOM in the PhD Dissertation defense of Dr. Hyunho Kang of the University of Minnesota (I was a committee member) (December 18); hosted the monthly CAES J-1 Visa meeting (December 20).

**DR. CHRISTINA ROBB** participated in the Eastern Analytical Symposium board meeting and accepted the position of short-course chair for 2020 (December 6); participated in the FDA FERN monthly call (December 12); and received the Magnarelli Post-Doctoral award for the joint proposal with **DR. LINDSAY TRIPLETT** entitled "Plant hormones: Linking soil microbes and predators to crop health" (December 19).

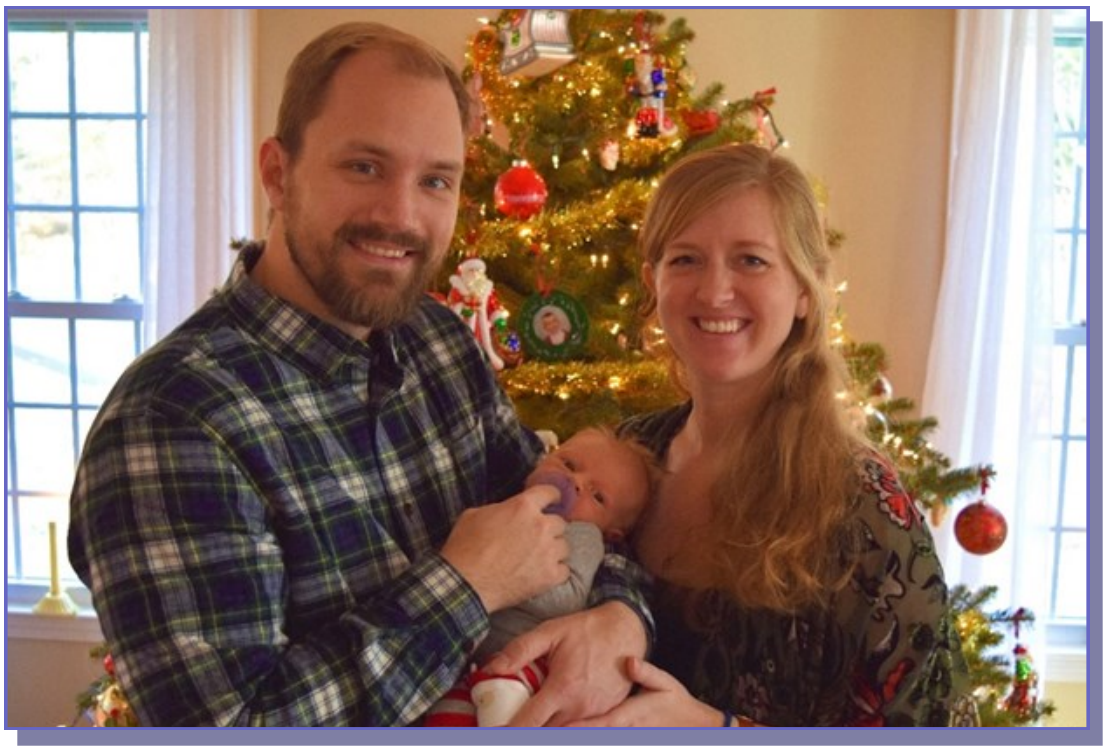
**DR. BRIAN EITZER** attended the monthly Tox Rounds at the Department of Public Health Laboratory held in Rocky Hill (December 12); was a participant in the phone call of the organizing committee of the North American Chemical Residue Workshop (December 12); and participated in the monthly FDA FERN cCAP WebEx call (December 12).

# ENTOMOLOGY

**DR. KIRBY C. STAFFORD III** presented a talk entitled "Tick Surveillance: A Review of Methods by Species" as part of tick surveillance webinar (191 attendees) (December 2); participated in a conference call of the Tick Biology, Ecology and Control subcommittee of the Tick Borne Disease Working Group (December 2, 16); spoke on managing an exploding expansion of tick and other vector-borne diseases at the Northeast Region Pesticide Safety Education & Certification meeting at the EPA Region 1 Laboratory in North Chelmsford, MA (40 attendees) (December 4).

**MS. KATHERINE DUGAS** attended the CT Pomological Society Meeting held in Middletown (December 3); and presented a talk on the spotted lanternfly and its recent interception in the state (December 3).

**DR. MEGAN LINSKE** On December 6th, Agricultural Post-Doctoral Research Scientist Dr. Megan Linske gave birth to her first child, Archibald Alfred Linske. Dad (Garrett), Archie, and Mom (photo) are doing very well despite being a tad overwhelmed.



**DR. GALE E. RIDGE** spoke at the annual Connecticut Environmental Council meeting in Wallingford about bed bug evolution, behavior, and biology (60 attendees) (December 3).

**DR. CLAIRE E. RUTLEDGE** participated in the 44th meeting of the EFSA-ALPHA working group on Pest Surveys on *Agrilus anxius* via telephone that was held in Parma, Italy (4 participants) (December 9); and helped administer the oral portion of the Tree Protection Exam held in New Haven (December 11).

**DR. VICTORIA L. SMITH** participated in a meeting of the Yale Biosafety Committee in New Haven (20 participants) (December 19).

**DR. KIMBERLY A. STONER** was interviewed by Lindsey Vickers of Metro West Daily News in Massachusetts about honey bee losses and pesticides (December 10); and spoke on "Planting for the Bees' Needs" to elementary school teachers and managers of nature centers at the Kellogg Environmental Center in Derby (16 attendees) (December 10).

# ENVIRONMENTAL SCIENCES

**DR. JOSEPH PIGNATELLO** participated in a conference call with group leaders from University of Maryland and Geosyntec Associates on a grant proposal to the Department of Defense's SERDP program (December 5); and presided over a meeting of the Radiation Safety Committee at CAES (December 6).

**DR. PHILIP ARMSTRONG** gave a talk entitled "Vector competence of *Aedes albopictus* populations from the northeastern US for chikungunya, dengue, and Zika viruses" at the 65th Annual Northeastern Mosquito Control Association Meeting held in Milford, MA (approx. 200 attendees; approx. 15 students) (December 10).

**MS. ANGELA BRANSFIELD** participated in the Centers for Disease Control and Prevention's webcast *Federal Partners Import Permit Regulations* (December 4).

**MR. GREGORY BUGBEE** spoke on "CAES Aquatic Plant Surveys of Cedar Lake and Management Options" at a meeting of concerned citizens at the Chester Town Hall (approx. 25 attendees) (December 4); and attended a meeting of the Northeast Aquatic Nuisance Species Panel via conference call (December 10-11).

**DR. JR McMILLAN** gave the talk entitled "Assessing the generality of multi-vector species contributions to arboviral transmission in the northeast U.S.", at the 65th Annual Northeast Mosquito Control Association's meeting held in Milford, MA (approx. 200 attendees; approx. 15 students) (December 10).

**DR. GOUDARZ MOLAEI** served as a community partner in Wesleyan University's Civic Engagement, Environmental Studies 281 GIS Service Learning Lab, where he advised students on tick infection mapping in Connecticut (approx. 20 students) (December 5); and was interviewed on the Lone Star tick and other tick issues by: the New England Journal of Medicine (https://www.nejm.org/doi/full/10.1056/NEJMp1911661) (December 5); Eyewitness News 3 (https://www.wfsb.com/news/lone-star-tick-a-growing-threat-to-humans-pets-as/article_1ed003de-1853-11ea-8d01-3be1d90cb66c.html) (December 6); the Hartford Courant (https://www.courant.com/news/connecticut/hc-news-insects-climatechange-spreading-deer-human-diseases-20191207-u5z74m5emvav7nqddhxfqr56pe-story.html) (December 6); the Vineyard Gazette (https://vineyardgazette.com/news/2019/12/19/rapid-spread-lone-star-ticks-alarms-experts) (December 9); WTNH News 8 (https://www.wtnh.com/top-news/lone-star-tick-population-increasing-expanding-in-connecticut/) (December 10); and WFUV news (NPR affiliate in New York City) (December 11).

**MS. TANYA PETRUFF** gave a talk entitled "Changes in Diversity of Connecticut Mosquitoes Since 2005" at the 65th Annual Northeast Mosquito Control Association Meeting in Milford, MA (approx. 200 attendees; approx. 15 students) (December 11)

**DR. SARA NASON** gave the talk entitled "Assessment of PFAS Phytoremediation at the Former Loring Air Force Base" at the Yale Symposium on Per- and Polyfluoroalkyl Substances: Challenges and Opportunities (approx. 40 attendees) (December 13); and mentored students on science fair projects at the Sound School in New Haven (December 5).

**MR. JOHN SHEPARD** gave an invited talk entitled "Arbovirus Activity in Connecticut, 2019" at a Pesticide Resistance Workshop at the 65th Annual Meeting of the Northeastern Mosquito Control Association held in Milford, MA (approx. 200 attendees; approx. 15 students) (December 9-11).

# FORESTRY AND HORTICULTURE

**DR. JEFFREY S. WARD,** along with **MR. JOSEPH P. BARSKY**, met with staff of CT NRCS and Regional Water Authority to view consequences of different forest management prescriptions (5 attendees) (December 9); administered practical and oral examination to arborist candidates for the Connecticut Tree Protection Examining Board (December 11); participated in NESAF 2020 planning committee conference call (December 17); along with **DR. SCOTT WILLIAMS** and **MICHAEL SHORT**, met with David Gumbart (TNC), Sophie Duncan (TNC), and Andrea Urbano (CT DEEP) at Burnham Brook Preserve in East Haddam to discuss forest management for species diversity and resiliency (December 23).

**DR. ABIGAIL A. MAYNARD** attended the annual meeting of the Pomological Society in Middletown (December 3); assisted teacher in third grade seed germination unit at Hamden Hall Country Day School in Hamden (1 teacher, 15 students) (December 5, 6, 9); organized and moderated the Specialty Vegetables session at the New England Vegetable and Fruit Conference in Manchester, NH (December 10); spoke on Globe Artichokes and Belgian Endive in the Specialty Vegetable Session at the New England Vegetable and Fruit Conference in Manchester, NH (114 attendees) (December 10); advised Wesleyan University students on their food composting operation (4 students, 1 teacher) (December 11, 18); discussed the New Crops Program with Joe Viauso of Viauso's farm in East Haven (December 12); discussed collaborative work in the New Crops Program with John Holbrook at the Holbrook Farm in Bethel (December 13); reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation in Hamden (11 attendees) (December 19); discussed collaborative work in the New Crops Program with Hank Offinger of Offinger's farm in Wilton (December 23); and visited Fair Meadow Acres for possible collaborative work in Rocky Hill (December 31).

**DR. SCOTT C. WILLIAMS** participated in a conference call for the Editorial Advisory Board for The Wildlife Society's publication, The Wildlife Professional (December 20).

**MR. JOSEPH P. BARSKY** participated in NESAF 2020 planning committee conference calls (December 3, 17); and participated in a New England Society of American Foresters Executive Committee conference call (December 18).

# PLANT PATHOLOGY AND ECOLOGY

**DR. WASHINGTON DA SILVA** attended the Connecticut Farm Wine Development Council meeting of 2019 at the CT Department of Agriculture Building in Hartford where he was elected to the Board as the representative from The Connecticut Agricultural Experiment Station (12 attendees) (December 5).

**DR. WADE ELMER** was an invited speaker for CanolaWeek in Saskatoon, Saskatchuen CANADA and gave a presentation entitled "NanoFertilizers for Crop Health" (240 participants) (December 6).

**DR. FRANK FERRANDINO** retired on 12/1/2019 after 38 years of service to the Connecticut Agricultural Experiment Station.

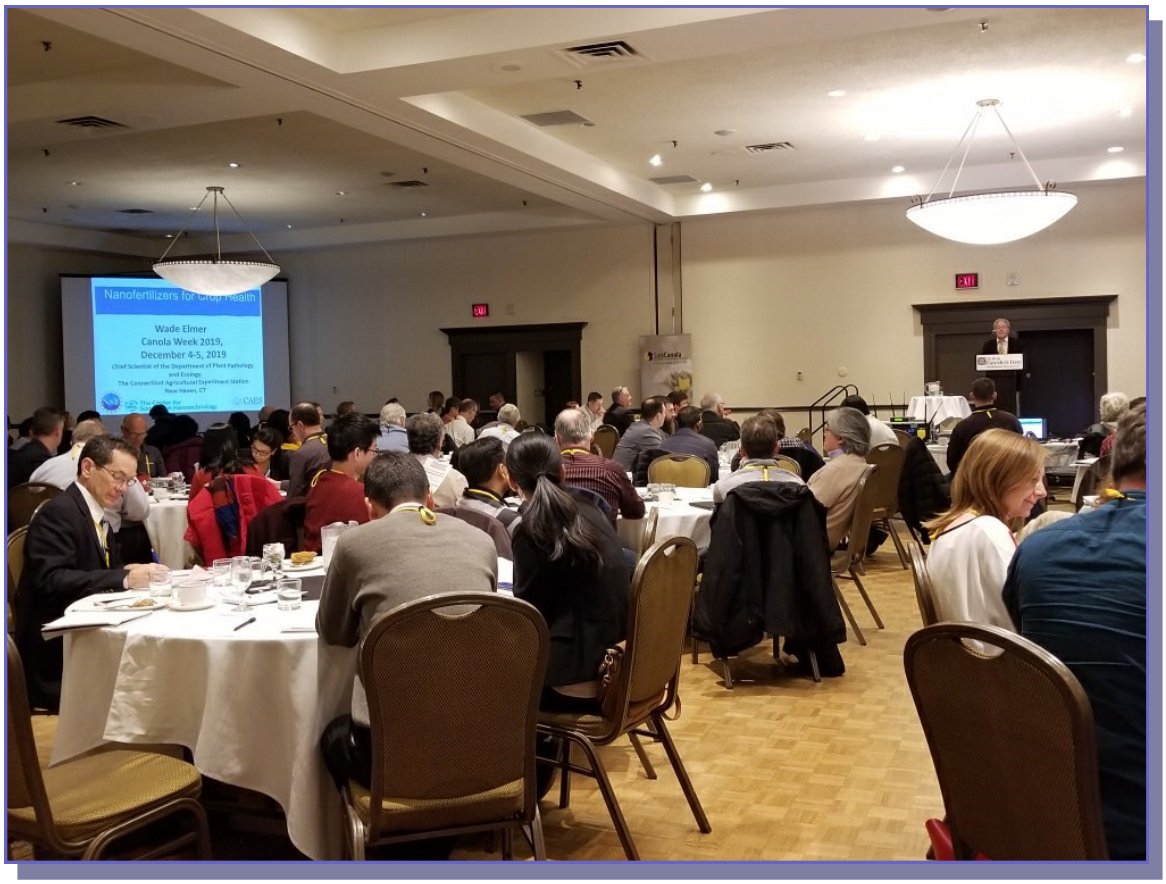
**DR. YONGHAO LI** staffed the Station booth at the Connecticut Pomological Society Annual Meeting in Middletown (December3); participated in a ZOOM meeting for the National Plant Diagnostic Network Web Communication Committee (8 adults) (December 9); and visited Dr. Yu Lei at the University of Connecticut to discuss collaborative research (December 23).

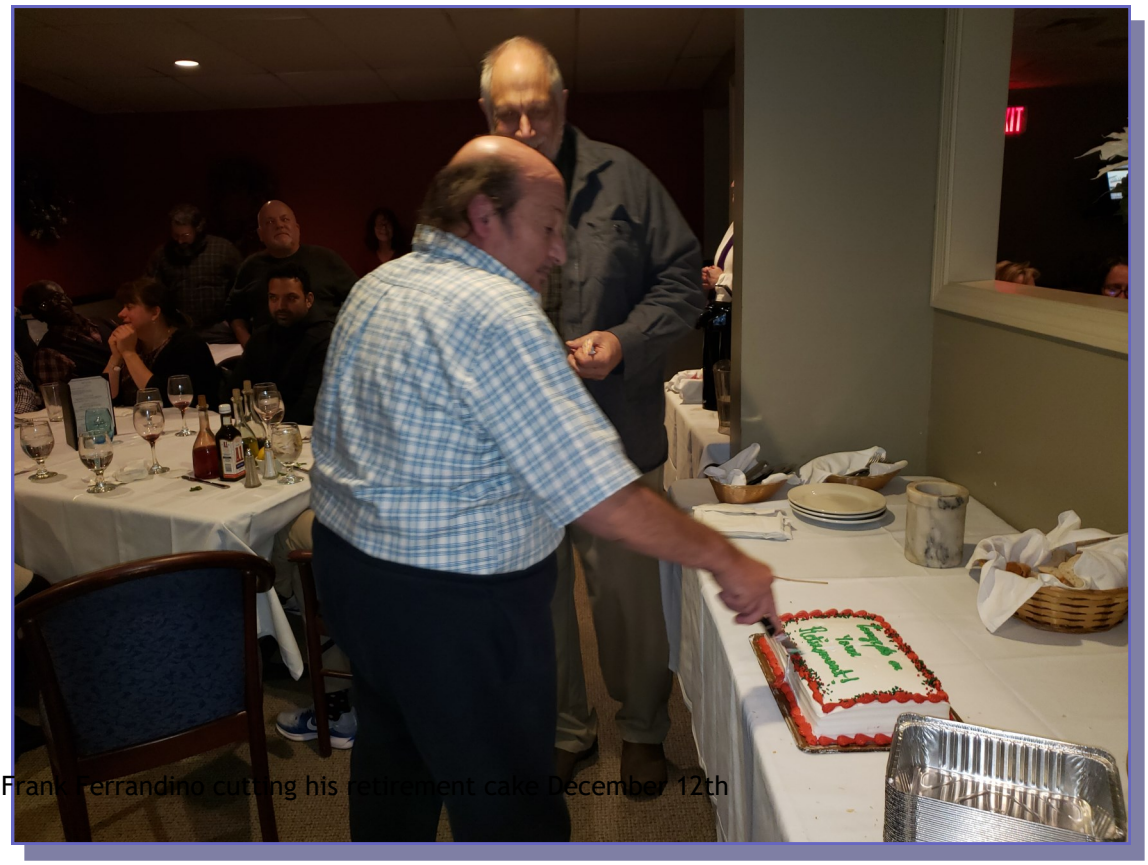
**DR. ROBERT E. MARRA** attended a zoom conference for the annual Joint Meeting of the Forest Ecosystem Monitoring Cooperative at the University of Vermont (December 12).

**DR. NEIL SCHULTES** attended the Annual Meeting of the Connecticut Pomological Society in Middletown (December 3).

**DR. LINDSAY TRIPLETT** was awarded the Louis A. Magnarelli Postdoctoral Fellowship Award along with **DR. CHRISTINA ROBB** for their proposal entitled "Plant hormones: Linking soil microbes and predators to crop health," which will employ postdoctoral **DR. RAVI PATEL** who brings extensive experience in analyzing phytohormone production in beneficial bacteria.

Wade Elmer speaking at CanoloWeek in Saskatoon, Saskatchewan CANADA on Nanofertilizers.





Frank Ferrandino cutting his retirement cake December 12th

## VALLEY LABORATORY

**DR. JATINDER S. AULAKH** reported the first case of Palmer amaranth, a highly invasive and destructive agronomic weed, from East Windsor (November 1); was interviewed about the first confirmed case of Palmer amaranth in Connecticut by Gregory Hladky from the Hartford Courant (November 13), Macenzie Maynard from News 8 TV Channel (November 14); and Patrick Skahill from Connecticut Public Radio (November 15); and attended the Connecticut Invasive Plant Working Group at the Windsor Valley Lab (November 14).

**DR. RICHARD COWLES** gave a talk entitled "Advanced Topics in Using Neonicotinoids" at the Connecticut Environmental Council meeting held in Wallingford (100 attendees) (December 2); presented a talk entitled "Chemical control of spotted wing drosophila" to blueberry growers at the New England Vegetable and Fruit Conference, Manchester, NH (70 attendees) (December 12); was interviewed by Michael Patrick of the Waterbury Republican-American regarding the benefits of real vs. artificial Christmas trees (December 5); and by the Danbury News-Times (December 10) and by Patrick Skahill of CT Public Radio on the subject of Christmas tree diseases (December 18) .

**DR. DEWEI LI** was interviewed about molds of washing machines by Kimberly Janeway, a journalist for Consumer Reports (December 16).

# DEPARTMENTAL RESEARCH UPDATES DECEMBER 2019

**Armstrong, P.M.**, Ehrlich, H.Y., Magalhaes, T., Miller, M.R., Conway, P.J., **Bransfield, A., Misencik, M.J., Gloria-Soria, A.**, Warren, J.L., **Andreadis, T.G.**, **Shepard, J.J.**, Foy, B.D., Pitzer, V.E., **Brackney, D.E.** (2019) Successive blood meals enhance virus dissemination within mosquitoes and increase transmission potential. *Nature Microbiology* doi: 10.1038/s41564-019-0619-y [Epub ahead of print].

Abstract- The recent Zika virus (ZIKV) and chikungunya virus epidemics highlight the explosive nature of arthropod-borne viruses (arboviruses) transmitted by *Aedes* spp. mosquitoes1,2. Vector competence and the extrinsic incubation period (EIP) are two key entomological parameters used to assess the public health risk posed by arboviruses3. These are typically measured empirically by offering mosquitoes an infectious blood meal and temporally sampling mosquitoes to determine the infection and transmission status. This approach has been used for the better part of a century; however, it does not accurately capture the biology and behaviour of many mosquito vectors that refeed frequently (every 2-3 d)4. Here, we demonstrate that acquisition of a second non-infectious blood meal significantly shortens the EIP of ZIKV-infected *Aedes aegypti* by enhancing virus dissemination from the mosquito midgut. Similarly, a second blood meal increases the competence of this species for dengue virus and chikungunya virus as well as *Aedes albopictus* for ZIKV, suggesting that this phenomenon may be common among other virus-vector pairings and that *A. albopictus* might be a more important vector than once thought. Blood-meal-induced microperforations in the virus-impenetrable basal lamina that surrounds the midgut provide a mechanism for enhanced virus escape. Modelling of these findings reveals that a shortened EIP would result in a significant increase in the basic reproductive number, R0, estimated from experimental data. This helps to explain how *A. aegypti* can sustain explosive epidemics such as ZIKV despite relatively poor vector competence in single-feed laboratory trials. Together, these data demonstrate a direct and unrecognized link between mosquito feeding behaviour, EIP and vector competence.

Eastwood, G., Donnellycolt, A.K., **Shepard, J.J., Misencik, M.J.**, Bedoukian, R., Cole, L., **Armstrong, P.M., Andreadis, T.G.** (2019) Evaluation of novel trapping lures for monitoring exotic and native container-inhabiting *Aedes* spp. (Diptera: Culicidae) mosquitoes. *Journal of Medical Entomology* doi: 10.1093/jme/tjz200. [Epub ahead of print].

Abstract- Surveillance for diurnal container-inhabiting mosquitoes such as *Aedes albopictus* (Skuse), *Aedes japonicus japonicus* (Theobald), and *Aedes triseriatus* (Say) have routinely relied on the deployment of multiple trap types, including CO2-baited light traps, gravid traps, oviposition traps, and BG-Sentinel. These trap configurations have met with varying degrees of effectiveness and in many instances likely under-sample these key mosquito vectors. Most recently, the BG-Sentinel trap used in conjunction with the human-scent lure has been largely accepted as the gold-standard for monitoring *Ae. albopictus*. However, its ability to attract other container-inhabiting *Aedes* species has not been fully evaluated. During 2018, we tested new scent lures, TrapTech Lure-A and Lure-H (Bedoukian Research, Inc.), using BG-Sentinel traps with CO2 in two regions of Connecticut, Stamford and Hamden, against the BG-Lure. Pooled mosquitoes were additionally screened for arbovirus infection. A total of 47,734 mosquitoes representing 8 genera and 32 species were captured during the study, with the Stamford site deriving on average three times as many mosquitoes per trap, adjusting for sampling effort. Lure-A and Lure-H outperformed the BG-Lure in terms of total numbers, diversity evenness, and the proportion of both *Ae. j. japonicus* and *Ae. triseriatus*. There were no significant differences among lures in capturing *Ae. albopictus*, and in terms of species richness. Fifty-seven isolates of virus (West Nile, Jamestown Canyon, and La Crosse viruses) were obtained during the study, with no significant difference between trap-lure. We highlight both novel lures as effective attractants for use in mosquito surveillance, which either outperform, or equal, BG-Lure.

**Gloria-Soria, A.,** Soghigian, J., Kellner, D., Powell, J.R. Genetic Diversity of Laboratory Strains and Implications for Research: The case of *Aedes aegypti*. *PLoS Neglected Tropical Diseases*. 12/9/2019, Vol. 13 Issue 12, pp. 1-17.

Abstract- The yellow fever mosquito (Aedes aegypti), is the primary vector of dengue, Zika, and chikungunya fever, among other arboviral diseases. It is also a popular laboratory model in vector biology due to its ease of rearing and manipulation in the lab. Established laboratory strains have been used worldwide in thousands of studies for decades. Laboratory evolution of reference strains and contamination among strains are potential severe problems that could dramatically change experimental outcomes and thus is a concern in vector biology. We analyzed laboratory and field colonies of Ae. aegypti and an Ae. aegypti-derived cell line (Aag2) using 12 microsatellites and ~20,000 SNPs to determine the extent of divergence among laboratory strains and relationships to their wild relatives. We found that 1) laboratory populations are less genetically variable than their field counterparts; 2) colonies bearing the same name obtained from different laboratories may be highly divergent; 3) present genetic composition of the LVP strain used as the genome reference is incompatible with its presumed origin; 4) we document changes in two wild caught colonies over ~16 generations of colonization; and 5) the Aag2 Ae. aegypti cell

line has experienced minimal genetic changes within and across laboratories. These results illustrate the degree of variability within and among strains of Ae. aegypti, with implications for cross-study comparisons, and highlight the need of a common mosquito repository and the implementation of strain validation tools. Author summary: Laboratory colonies provide the opportunity to study live organisms in a controlled environment and serve as phenotypic surrogates of their natural populations. Over time, these strains are prone to change as they face novel environments. We analyzed laboratory and field colonies of the yellow fever mosquito (Aedes aegypti), primary vector of dengue, Zika, and chikungunya fever and a model system in vector biology, and an Ae. aegypti-derived cell line (Aag2) to determine genetic similarity between laboratory strains and their wild relatives. We found lower levels of genetic diversity in laboratory populations compared to wild populations, with colonies of the same name diverging over time or likely contaminated. We also found that the genetic composition of the Liverpool strain, used as the reference genome for this species, is inconsistent with historical records that suggest an African origin and instead points to an outside Africa source. Finally, we did not find major genetic changes in Aag2 cell lines across laboratories. Laboratory evolution of reference strains and strain contamination are severe problems that can change experimental outcomes and complicate cross-study comparison. Our results illustrate the need of a common Aedes aegypti repository and the development of strain validation tools.

Heredia, Gabriela, **Li**, **D.**, Wendt, L., Réblová, M., Arias, R.M., Gamboa-Angulo, M., Štěpánek, V., Stadler, M., and Castañeda-Ruíz, R.F. 2020. *Natonodosa speciosa* gen. et sp. nov. and rediscovery of *Poroisariopsis inornata*; neotropical anamorphic fungi in Xylariales. ***Mycological Progress*** 19:15-30. https://doi.org/10.1007/s11557-019-01537-8

Abstract— *Natonodosa* is introduced as new genus based on morphology and multigene phylogenetic data, and the monotypic genus *Natonodosa*, typified by *N. speciosa*, is characterized by mononematous conidiophores, polyblastic, nodose conidiogenous cells and unicellular, fusiform, hyaline conidia. The other freshly collected material was identified as Poroisariopsis inornata, a species that since its original description had not been reported; it is characterized by synnematous conidiophores with polytretic, cylindrical and uncinate conidiogenous cells with percurrent extensions, and distoseptate, obclavate, brown conidia. A lectotype and an epitype for the species are established and referred since the original specimen of this microfungus has not been found in any herbarium. Placement of both taxa in Xylariales was ascertained by BLASTn searches. Maximum likelihood analysis of the combined sequence data of the ribosomal rDNA (ITS and partial LSU region), as well as partial gene regions coding for the second largest subunit of RNA polymerase II (RPB2) and beta-tubulin (TUB2), was performed. In addition, a new name, *Guarroa*, is proposed for replacing the illegitimate genus name *Phaeobotrys* M. Calduch, Gené & Guarro. A dichotomous key to the new genus and morphologically similar taxa is provided.

Hu, J.; Wu, X.; Wu, F.; Chen, W.; **White, J.C.**; Yang, Y.; Wang, B.; Xing, B.; Tao, S.; Wang, X. 2019. Potential application of titanium dioxide nanoparticles to improve the nutritional quality of coriander (*Coriandrum sativum* L.). *J. Hazard. Mat.* https://doi.org/10.1016/j.jhazmat.2019.121837.

Abstract- Metal oxide nanoparticles have been widely used in a large number of disciplines. However, information on whether metal oxide nanoparticles (NPs) can be used to improve the growth and nutritional quality of agriculture crops is limited. In this study, coriander (*Coriandrum sativum* L.) was treated with titanium dioxide nanoparticles ($nTiO_2$) at 0, 50, 100, 200, and 400 mg/L for 7 days to evaluate the potential of $nTiO_2$ to enhance plant growth and nutritional quality under hydroponic conditions. The data show that $nTiO_2$ at 50 mg/L facilitated the opening of water channels in the root cells, significantly elevating root moisture content by 4.6%. An elemental analysis showed that $nTiO_2$ amendment at this level promoted the shoot nutrient accumulation of K, Ca, Mg, Fe, Mn, Zn, and B, possibly by modulating metal transporters for specific elements. A $\mu$-XRF analysis demonstrated that $nTiO_2$ did not affect the spatial distribution of K, Ca, Fe, Mn, Cu and Zn in coriander leaves. The fresh biomass, as well as pigment and soluble protein contents, were not significantly affected by $nTiO_2$ at 50 mg/L. There was no evidence of $nTiO_2$ internalization or translocation to the shoots. Although 50-200 mg/L $nTiO_2$ showed no toxicity as determined by coriander growth, 400 mg/L significantly reduced the root fresh biomass by 15.8% and root water content by 6.7%. In addition, this high dose induced root cell membrane wrinkling, which is attributable to the aggregation and adsorption of $nTiO_2$ on root surfaces. At 100-400 mg/L, antioxidant defense systems were triggered in the shoots and roots, including SOD, CAT, and APX, likely to alleviate oxidative stress. At an appropriate dose (e.g., 50 mg/L), $nTiO_2$ can improve the nutrient quality of edible tissues without exerting toxicity on the plant or posing significant health risk to the consumers. The findings from the present study will substantially contribute to potential application of $nTiO_2$ as part of nano-enabled agricultural strategies.

Kache PA, Eastwood G, Collins-Palmer K, Katz M, Falco RC, Bajwa WI, **Armstrong PM, Andreadis TG**, Diuk-Wasser MA (2019) Environmental determinants of *Aedes albopictus* abundance at a northern limit of its range in the United States. *American Journal of Tropical Medicine and Hygiene* doi:

10.4269/ajtmh.19-0244. [Epub ahead of print].

Abstract- *Aedes albopictus* is a vector of arbovirus with high rates of morbidity and mortality. The northern limit of *Ae. albopictus* in the northeastern United States runs through New York state (NYS) and Connecticut. We present a landscape-level analysis of mosquito abundance measured by daily counts of *Ae. albopictus* from 338 trap sites in 12 counties during May-September 2017. During the study period, the mean number of *Ae. albopictus* caught per day of trapping across all sites was 3.21. We constructed four sets of negative binomial generalized linear models to evaluate how trapping methodology, land cover, as well as temperature and precipitation at multiple time intervals influenced *Ae. albopictus* abundance. Biogents-Sentinel (BGS) traps were 2.78 times as efficient as gravid traps and 1.49 times as efficient as CO2-baited CDC light traps. Greater proportions of low- and medium-intensity development and low proportions of deciduous cover around the trap site were positively associated with increased abundance, as were minimum winter temperature and March precipitation. The cumulative precipitation within a 28-day time window before the date of collection had a nonlinear relationship with abundance, such that as precipitation increased beyond approximately 70 mm, there was a decrease in abundance. We concluded that populations are well established in Nassau, Suffolk, and New York City counties in NYS; north of these counties, the species is undergoing population invasion and establishment. We recommend that mosquito surveillance programs monitoring the northward invasion of *Ae. albopictus* place BGS traps at sites chosen with respect to land cover.

Linske M. A., S. C. Williams, K. C. Stafford III, C. B. Lubelczyk, E. F. Henderson, M. Welch, and P. D. Teel. 2020. Determining effects of winter weather conditions on adult *Amblyomma americanum* (Acari: Ixodidae) survival in Connecticut and Maine, USA. Insects 11,13 https://doi.org/10.3390/insects11010013. Published 21 December 2019.

Abstract- The lone star tick (*Amblyomma americanum* L.) is native to the United States, with its primary range encompassing the Southeast and portions of the Midwest. It is an aggressive ectoparasite that actively seeks out hosts through detection of carbon dioxide and vibrations and can transfer ehrlichiosis-causing bacteria as well as a carbohydrate that causes alpha-gal syndrome (red meat allergy) in humans. It has become of increasing concern as its range has recently expanded into coastal regions of the Northeast. Historically, harsh northeastern winter weather conditions made these areas inhospitable for *A. americanum* survival, but a warming climate coupled with increased host availability seem to have facilitated their range expansion. We developed a study to observe the effects of weather conditions on adult *A. americanum* overwintering survival. The study was conducted over three years in Connecticut and Maine. Ground-level conditions were manipulated to determine the effects of differing combinations of natural insulative barriers (leaf litter and snow accumulation) on adult *A. americanum* survival. We determined that there was a significant difference in survival between the two states, between years in Maine, and between sexes within Connecticut. However, presence or absence of snow and/or leaf litter had no impact on survival. Overall, we found a positive correlation between mean hourly temperature and adult survival in Maine, where temperatures were consistently below freezing. The results of this study can be included in an adaptive, predictive analytic model to accommodate the expected fluctuations and range expansion of *A. americanum* that will most likely accompany an increase in temperatures throughout the Northeast.

**Molaei, G.*, Little, E.A.H., Williams, S.C., Stafford III, K.C.,** Bracing for the Worst — Range Expansion of the Lone Star Tick in the Northeastern United States, *New England Journal of Medicine,* Published December 4, 2019 https://www.nejm.org/doi/full/10.1056/NEJMp1911661

Abstract- Ticks and tickborne diseases are increasingly becoming a major health concern for humans, domesticated animals, and livestock. Reported cases of bacterial and protozoan tickborne disease doubled in the United States between 2004 and 2016. More than 90% of the nearly 60,000 cases of nationally notifiable vectorborne diseases reported in 2017 were linked to ticks. As the geographic ranges of multiple tick species continue to expand, invasive tick species are being discovered, new tickborne pathogens are emerging, and coinfections in ticks are surging. Rising global temperatures, ecologic changes, reforestation, and increases in commerce and travel are all important underlying factors influencing the rate and extent of range expansion for ticks and tickborne pathogens.

Peréz, C.D.P.; De La Torre Roche, R.; Zuverza-Mena, N.; Ma, C.; Shen, Y.; **White, J.C.;** Ampélio Pozza, E.; Pozza, A.A.A.; Elmer, W.H. 2019. Metalloid and metal oxide nanoparticles suppress Sudden Death Syndrome of soybean. *J. Ag. Food Chem.* doi.org/10.1021/acs.jafc.9b06082.

Abstract- Metal based nanoparticles (NPs) have been shown to have potential for suppressing crop disease and for promoting plant growth. In asymmetric greenhouse experiments with three cultivars of soybean (*Glycine max*), the efficacy of foliar applications of metalloid and metal oxide NPs of the essential elements boron (B), copper (Cu), manganese (Mn), molybdenum (Mo) and zinc (Zn), and of the nonessential metals, silver (Ag), cerium (Ce), silicon (Si), and titanium (Ti) against sudden death syndrome (SDS) caused by *Fusarium virguliforme* was evaluated. A single foliar application of 1-2 ml of NPs solution (500 or 1000 µg/ml; 0.5-2.0 mg per plant) was applied to V3 stage soybean seedlings and plants were subsequently grown in a 5-week pot study. Depending on cultivar, disease resulted in root rot values of up to 80% and biomass reductions of up to 68%, although

impacts on plant biomass were highly variable as the pathogen generally causes greatest damage at the flowering stage. In addition, significant cultivar variability was noted both with the impact of disease and on the efficacy of treatments. However, with select cultivars and experiments, one-time foliar amendments of NP CuO, B, $MoO_3$, or ZnO reduced root rot severity by 17-25%. The presence of disease induced significant changes in the root and shoot content of several micronutrients (B, Mg, P, S, Si, Zn, among others). Importantly, a number of the foliar nanoscale amendments to diseased plants restored the levels of several of these nutrients to the amounts present in uninfested controls. For example, the increased root Mg and Mn content induced by disease was reversed by NP B and Mn foliar amendment. Importantly, an *in vitro* assay showed at the concentrations tested, none of the NPs exerted direct toxicity on the pathogen. This, along with the findings of restoration of altered nutrient levels induced by disease and occasional increased element content in the roots of plants foliar treated with that particle, suggests that the positive impacts are a function of modulated plant nutrition and enhanced defense mechanisms. Foliar-applied nanoscale micronutrients to seedlings may be a new tool in promoting root health in soybeans by reducing root rot and disease damage caused by *F. virguliforme*.

Stafford III, K. C., S. C. Williams, J. G. van Oosterwijk, M. A. Linske, S. Zatechka, L. M. Richer, G. Molaei, C. Przybyszewski, and S. K. Wikel. 2020. Field evaluation of a novel oral reservoir-targeted vaccine against *Borrelia burgdorferi* utilizing an inactivated whole-cell bacterial antigen expression vehicle. Experimental and Applied Acarology. https://doi.org/10.1007/s10493-019-00458-1

Abstract- Blacklegged ticks (*Ixodes scapularis*) are the principal vector for *Borrelia burgdorferi,* among other infectious agents, in the northeastern, mid-Atlantic, and upper Midwestern USA. White-footed mice (*Peromyscus leucopus*) are the primary and most competent reservoir host of *B. burgdorferi* in the Northeast. Live reservoir-targeted vaccines (RTVs) to limit enzootic transmission of *B. burgdorferi* were previously developed and successfully evaluated in laboratory and controlled field trials. A novel, inactivated RTV was developed to minimize regulatory and market challenges facing previous RTVs based on live bacterial or viral vehicles. Thirty-two residential properties in Redding, Connecticut, participated in a field trial of an orally delivered, inactivated RTV efficacy study (2015–2016). During the two-year vaccination period, a significant decrease in the percentage of *B. burgdorferi* infected *I. scapularis* larvae parasitizing *P. leucopus* was observed, as was a significant reduction in the percentage of infected *P. leucopus* on RTV-treated properties when compared to control properties. This novel inactivated RTV was effective in reducing numbers of *B. burgdorferi*-infected *I. scapularis* and *B. burgdorferi*-infected *P. leucopus* on properties where it was distributed.

Wang Y. X., J. Y. Chen, X.W. Xu, **De-Wei Li**, and Q. Z. Wang. 2019. First report of brown apical necrosis of walnut caused by Fusarium avenaceum in Hubei, China. ***Plant Disease***. 103 (11): 2956-2957. https://doi.org/10.1094/PDIS-05-19-0954-PDN

Abstract—Brown apical necrosis (BAN) is a serious disease complex of walnut (*Juglans regia* L.) in France, Italy, Spain, and Turkey (Moragrega and Özaktan 2010). Since 2014, BAN has been observed in 50 to 70% of trees in over 40,000 ha of walnut orchards in Baokang County and other counties of Hubei Province, China. In the early fruit development stages, external apical necrosis was observed exclusively at the fruit stigmatic or blossom end with small lesions and brown color. The lesion enlarged up to the fruit surface, invaded and decayed the inner tissues, and premature fruit drop occurred for many trees. Sections of the fruit revealed that inner tissues contained a brown to black rot. A total of 165 symptomatic fruits (cultivar Qingxiang) were collected periodically from Baokang County from May 2016 to 2018, and 165 fungal isolates and 104 bacterial isolates were obtained from infected fruits. Among the bacterial isolates, *Pantoea agglomerans* was the dominant species and accounted for 45.2% (2-year average), in agreement with Yang et al. (2011). Among the fungal isolates, *Fusarium avenaceum* (Fr.) Sacc. was the dominant species and accounted for 28.7% (3-year avg.), and *Alternaria* spp. for 25.5% (3-year avg.) and *Colletotrichum* spp. for 24.1% (3-year avg.). The frequency of *F. avenaceum* isolation between diseased and healthy areas was higher than that from rotted areas, but the opposite was observed for *Alternaria* spp. and *Colletotrichum* spp. Two *Fusarium* isolates, JRBK-5 and JRBK-10, were characterized and identified as *F. avenaceum* (Leslie and Summerell 2006). The translation elongation factor 1α (TEF-1α) gene and partial β-tubulin (TUB2) gene of isolate JRBK-5 were respectively amplified and sequenced (Zhu et al. 2014). The TEF-1α sequence (GenBank accession no. KY475585) showed 99.8% identity with F. avenaceum (KP170732) and the TUB2 sequence (KY475586) showed 100% identity with F. avenaceum (EU357852). Phylogenetic analyses showed that JRBK-5 was in the same clade as other isolates of *F. avenaceum* with high bootstrap support over 93%. To confirm pathogenicity, *F. avenaceum* JRBK-5 and JRBK-10, *Alternaria* spp., *Colletotrichum* spp., and *P. agglomerans* (108 CFU ml−1) were used to inoculate the stylar end of the detached premature fruits using 5-mm-diameter mycelial plugs with a non-wound inoculation method. Controls were treated with water and a PDA plug without the fungi. All fruits were incubated in a growth chamber at 25°C and 80 to 90% RH. Six days after inoculation, brown necrotic spots appeared on the fruits inoculated with all individual species. *F. avenaceum* showed higher virulence than the other fungi. The lesion diameter of *F. avenaceum* was 25.0 ± 2.0 mm, and those of the other fungi were <9.3 ± 1.4 mm. Combinations of *F. avenaceum* with the other fungi

resulted in brown necrotic spots and virulence was the same as *F. avenaceum* alone. The inner tissues of inoculated fruits turned dark brown to black with decay. However, no symptoms developed on the control fruits. Reisolated *F. avenaceum* had the same cultural characteristics as the originally isolated *F. avenaceum*. The pathogenicity tests were repeated with similar results. Based on morphological characteristics, sequence analysis of the TEF-1α and TUB2, and Koch's postulates, the isolates JRBK-5 and JRBK-10 were identified as *F. avenaceum*. To our knowledge, this is the first report of *F. avenaceum* causing BAN disease of walnut in Hubei, China.

# JOURNAL ARTICLES APPROVED DECEMBER 2019

**Aulakh, Jatinder S.** Gemini G herbicide safety to *Sedum album* and *Sedum rupestre*. *Proceedings – Volume 5, The Northeastern Plant, Pest, and Soils Conference 2020*

**Hiskes, Rose**. Field guide and plant management calendar to selected terrestrial plants found in Connecticut. *CAES Fact Sheet*

**Hiskes, Rose**. Fungal leaf spot diseases of *Amelanchier*. *CAES Fact Sheet*

Hofmann, T., G. Lowry, S. Ghoshal, N. Tufenkji, D. Brambilla, J. Dutcher, L. Gilbertson, J. P. Giraldo, M. Kinsella, M. del Capio Landry, W. Lovell, R. Naccache, M. Paret, J. Pederson, J. Unrine, **Jason C. White**, and K. Wilkinson. Moving forward responsibly in nanotechnology enabled plant agriculture. *Nature Food*

**Hyde, Josephine**, Maria A. Correa, **Doug E. Brackney**, and **Blaire Steven**. Generation and rearing of axenic *Aedes aegypti* mosquitoes. *Protocol Exchange*

**Li, Yonghao**. Marssonina blotch of apple. *CAES Fact Sheet*

**Linske, Megan A.**, **Scott C. Williams**, **Kirby C. Stafford III**, C. B. Lubelczyk, E. F. Henderson, M. Welch, and P. D. Teel. Determining effects of winter weather conditions on adult *Amblyomma americanum* (Acari: Ixodidae) survival in Connecticut and Maine, USA. *Insects*

**Williams, Scott C.**, J. G. van Oosterwijk, **Megan A. Linske**, S. Zatechka, L. M. Richer, C. Przybyszewski, S. K. Wikel, and **Kirby C. Stafford III**. Administration of an orally-delivered substrate targeting a mammalian zoonotic pathogen reservoir population: Novel application and biomarker analysis. *Vector-Borne and Zoonotic Diseases*

Zhang, H., M. Huang, W. Zhang, J. L. Gardea-Torresdey, **Jason C. White**, R. Ji, and L. Zhao. Silver nanoparticles alter soil microbial communities and metabolite profiles in unplanted and cucumber-planted soil. *Environ. Sci. Technol.*

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## The Connecticut Agricultural Experiment Station

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The Connecticut Agricultural Experiment Station

Main Laboratories
123 Huntington Street
New Haven, CT 06511-2016
Phone: 203-974-8500

Lockwood Farm
890 Evergreen Avenue
Hamden, CT 06518-2361
Phone: 203-974-8618

Griswold Research Center
190 Sheldon Road
Griswold, CT 06351-3627
Phone: 860-376-0365

Valley Laboratory
153 Cook Hill Road
Windsor, CT 06095-0248
Phone: 860-683-4977


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