

Global Mosquito Resistance Management Summit
Thursday, March 24, 2022
10am to 2pm (EST)

Sponsored and hosted by Valent BioSciences

10:00 am Welcome - Leanne Lake and Carolina Torres Gutierrez, PhD.
Technical Development Specialists at Valent BioSciences, LLC

10:10 am “Resistance mechanisms, testing, and how (not) to start statewide surveillance”
Presented by: Nicholas Delisi
Entomologist/Lab Manager, St. Tammany Parish Mosquito Abatement, LA

An introduction to types of resistance mechanisms, how resistance develops and methods to develop a statewide surveillance program. The presentation will also include methods of testing for resistance in local adult mosquito populations.

Speaker Bio:

Nick DeLisi is the lab manager at St. Tammany Parish Mosquito Abatement and the head of Louisiana Mosquito Control's insecticide resistance committee. As committee head, Nick continues to develop a statewide resistance surveillance program started in 2019. Nick earned a MS in entomology from Louisiana State University with a thesis focusing on larvicide susceptibility and mechanisms of resistance. When he isn't advocating for the topical bioassay, Nick enjoys long walks on the bayou, and painting miniature models... of bugs. Email: ndelisi@stpmad.org

10:30 am “Review of resistance in US mosquitoes”
Presented by: Jennifer Henke
Laboratory Manager, Coachella Valley Mosquito and Vector Control District, CA

A general review of the insecticide resistance status in the United States will be presented, with focus on the main disease vector species (Aedes and Culex populations) to which adulticides are losing lethal effect.

Speaker Bio:

Jennifer A. Henke is the laboratory manager at the Coachella Valley Mosquito and Vector Control District. She has a B.S. in biology from the University of Alabama and an M.S. in entomology from the University of Georgia. Jennifer began at the district in 2011 as the environmental biologist. Since 2015 she has managed the Surveillance and Quality Control Department, which conducts adult mosquito surveillance, tests for arboviruses, examines pesticide product efficacy, and evaluates control products and strategies targeted at mosquitoes and fire ants. Her work includes collaborating with researchers from universities and government agencies to explore novel control strategies for vectors in the desert. In addition to her responsibilities at the District, Jennifer is an active participant in the mosquito control community through service in professional organizations. Jennifer is the Vice President-Elect for the Entomological Society of America and serves on several committees in the ESA. She chaired the Regulatory Affairs Committee of the Mosquito and Vector Control Association of California from 2017 until 2020 and is still an active member. Jennifer has been a member of the American Mosquito Control Association's Science and Technology Committee since 2017 and is the current chair. Email: JHenke@cvmosquito.org

10:50 am “Molecular drivers of insecticide resistance in malaria vectors”

Presented by: Charles S. Wondji

Welcome Trust Senior Research Fellow, Vector Biology Department, Liverpool School of Tropical Medicine

Executive Director, Centre of Research in Infectious Diseases (CRID), LSTM Research Unit

Malaria control relies on insecticide-based interventions such as insecticide-treated nets or indoor residual spraying. However, increasing resistance to main insecticides in malaria vectors threatens the continued success of these tools. To maximize the effectiveness of insecticide-based interventions, it is crucial to elucidate the genetic basis of resistance and establish its impact on malaria control.

Recent studies have revealed a complex genomic evolution of resistance in malaria vectors in Africa which is likely to impact the efficacy of control tools. Target site resistance mechanisms notably knockdown resistance (kdr) markers are spreading extensively in *Anopheles gambiae* populations. There are extensive reports of metabolic resistance to insecticides in major malaria vectors such as *An. gambiae* and *An. funestus* with evidence that it is reducing the efficacy of pyrethroid-based interventions. Transcriptomic and genomic analyses have revealed that cytochrome P450 gene are playing a major role beside other genes including glutathione S-transferases. Whole genome sequencing has detected selective sweep footprints in mosquito populations associated with scale up of insecticide-treated nets. Furthermore, a complex evolution of metabolic resistance has selected evolutionary features including copy number variation (CNV) and structural variations. Moreover, DNA-based markers of metabolic resistance are being detected including in *An. funestus* and *An. gambiae*. These DNA-based markers are allowing to assess the resistance impact on the efficacy of insecticide-treated nets using experimental hut trials. Additionally, resistance impact is now evaluated on epidemiological parameters such as fitness cost and malaria transmission. Improvement in our understanding of molecular basis of resistance will undoubtedly implement suitable control interventions while improving resistance management strategies across Africa.

Speaker Bio:

Charles Wondji is a professor of vector biology and genetics at the Liverpool School of Tropical medicine (LSTM) and Executive Director of the Centre for Research in Infectious Diseases (CRID) in Cameroon. His research aims at understanding the genetic basis of insecticide resistance in mosquitos' vectors of malaria or arboviruses by detecting molecular resistance markers using genomic/genetic tools and designing suitable molecular assays to track resistance in field populations to assess its impact on control interventions in Africa. He is sponsor of several research fellows across Africa (Welcome Trust, DELTA, PIIVEC). He is member of several research consortiums, of the WHO prequalification team (vector control) and of the external Scientific Advisory committee of IVCC. Email: Charles.Wondji@lstmed.ac.uk

11:10 am Break

11:20 am “Surveillance of insecticide resistance and operational research with *Aedes aegypti* in Mexico: the experience from Yucatan”
Presented by: Gabriela González Olvera, PhD.
Collaborative Unit for Entomological Bioassays, University of Yucatan, Mexico.

Description of operational research to control *Aedes aegypti* in Yucatan.

Speaker Bio:

My professional interests include the characterization and understanding of insecticide resistance of disease vectors and the evaluation of vector control interventions, with emphasis on *Aedes aegypti*. I am responsible of the Laboratory for Entomological Bioassays and Insecticide Resistance Monitoring of the Collaborative Unit of Entomological Bioassays (UCBE-UADY) from the Autonomous University of Yucatan, currently under the process of Good Laboratory Practices (GLP) certification by the World Health Organization. UCBE-UADY is also the Unit of Bioassays of Yucatan (UIEB-Yucatán) through a cooperative agreement with the Ministry of Health of Yucatan, with support from the Ministry of Health of Mexico (CENAPRECE). At UCBE-UADY we regularly perform insecticide susceptibility bioassays and evaluate traditional/innovative insecticide molecules/formulations/delivery methods under laboratory, semi-field (experimental huts/houses) and field conditions to support the integrated Management of *Aedes aegypti*. Email: gabygzzo@gmail.com

11:40 am “Susceptibility Status of Insecticides Used for Mosquito Control in Asia”
Presented by: Dr. Nazni Wasi Ahmad
Ministry of Health Malaysia

An explanation of the status of insecticide resistance in mosquito control throughout Asia.

Speaker Bio:

Dr. Nazni Wasi Ahmad is a Senior Research Officer in the Ministry of Health. She started her career as a researcher in the Medical Entomology Unit, Institute for Medical Research (IMR), Malaysia. Her works in insecticide resistance against houseflies and mosquitoes, led her to develop the Rapid Insecticide Resistance Test Kit which is used in operational vector control programs. Nazni also has her skills in forensic entomology, and she developed the maggot debridement therapy which is used in modality for wound therapy in Malaysia. Currently she is involved in dengue research where she is the principal investigator for replacement strategy with Wolbachia infected *Aedes*, Sterile Insect Technique and autodissemination traps. To date, she has published 150 papers in local and international peer-reviewed journals and presented more than 230 papers in scientific meetings locally and internationally. She has 11 patents with several countries.

12:00 pm “Life after insecticide resistance was detected”
Presented by: Dina M. Fonseca
Rutgers University Center for Vector Biology, New Jersey, USA Presentation

Insecticide resistance (IR) in mosquitoes happens. I will provide an overview of case studies of IR to discuss what is known about the causes and prevalence of IR in US mosquitoes, especially in the NE US, and its operational impact especially known or

predicted effects on public health. My aim is to create a framework for collaborative studies to address IR in NJ mosquitoes.

Speaker Bio:

Tenured professor in the department of Entomology at Rutgers University School of Environmental and Biological Sciences and a member of the graduate programs in Entomology, Ecology and Evolution, Microbiology - <https://fonseca-lab.com>. Director of the Rutgers Center for Vector Biology - <https://vectorbio.rutgers.edu>, a program that provides accreditation, continuing education and broadly supports the extended Mosquito Control community. 26 years of experience in Medical and Veterinary Entomology. Recent focus as a member of the CDC funded Northeast Center of Excellence in Vector Borne Diseases, NEVBD - <https://www.neregionalvectorcenter.com>, on the development and field-testing of enhanced approaches to detect, prevent and manage the spread of insecticide resistance. Founding member of the Worldwide Insecticide resistance Network - <https://win-network.ird.fr>. Has published ~100 peer-reviewed articles related to mosquitoes and ticks and an additional 20 peer-reviewed articles on other entomological and ecological fields. h-index = 45; ~7200 citations. Email: dina.fonseca@rutgers.edu

12:20 pm Break

12:30 pm “If every problem is unique, can the answer be the same?”

Presented by: Janet McAllister, PhD

Medical Entomologist, Arboviral Diseases Branch of the Division of Vector-Borne Diseases

Insecticide resistance (IR) was discovered shortly after the first synthetic chemicals were developed necessitating the need for management of IR. Three theories were developed to accomplish IR management that have not changed much in the interceding 75 years. How these theories fit into modern vector control programs given the current environment of treatment limitations will be discussed. Filling in gaps in our knowledge and strategies or questions to guide actions requires testing for IR and following through with evaluation of how local populations change in response to control changes.

Speaker Bio:

Janet McAllister is a Board-Certified Medical Entomologist. She received her undergraduate and master’s degrees from LSU. Her PhD in Entomology is from the University of Arkansas. She currently works at the Centers of Disease Control in Ft. Collins CO where she is a Research Entomologist with the Division of Vector-Borne Infectious Diseases. Dr. McAllister conducts field and laboratory research on vector control and insecticide resistance in important vectors of arboviruses. Current projects focus on evaluating how larvicide applications using trucks and aircraft effect populations of mosquitoes that use small containers in the urban environment. In addition, Dr. McAllister serves as the subject matter expert and point of contact for vector control after disasters, deploying to Louisiana, Texas and US Virgin Islands in response to Hurricanes Katrina, Harvey and Maria. Dr. McAllister also served as vector control team lead for the CDC Zika virus response and numerous West Nile Virus outbreaks. Dr. McAllister is active in the American Mosquito Control Association and Entomological Society of America. She has served as the President of the American Mosquito Control Association, West Central Mosquito and Vector Control Association, and Louisiana Mosquito Control Association. Email: jvm6@cdc.gov

12:50 pm “Transient tolerance to pyrethroids in gravid mosquitoes: Implications for viral transmission and ULV control”
Presented by: Mark Clifton, PhD
Northshore Mosquito Abatement District, IL

Mosquito tolerance to pesticides is a complex multi-layered phenomenon with genetic, molecular, metabolic, physiological, and even physical mechanisms working together to produce a “resistant” phenotype. Vector *Culex pipiens* mosquitoes in the Chicago, Illinois region routinely demonstrate high levels of tolerance to pyrethroid control materials. Surveys utilizing the CDC bottle Bioassay were conducted in 2018, 2019 and 2020 and demonstrated geographically and temporally widespread resistance to sumithrin, permethrin and to a lesser extent, malathion. Operational field trials in 2020 with natural *Culex* spp. mosquito populations and caged field trials in 2021, further corroborated a lack of susceptibility to ground based ULV methodologies. These studies also demonstrated a unique pattern of tolerance to pyrethroid materials based on the gonotrophic state of vector mosquitoes. The various components of pesticide tolerance observed have important implications for viral transmission and operational methods of ULV-based mosquito control.

Speaker Bio:

Mark Clifton is the Executive Director of the North Shore Mosquito Abatement District outside of Chicago, Illinois. He earned his B.S. in Biology from Eastern Connecticut State University and his Ph.D. from Florida International University where he studied the reproductive endocrinology of the yellow fever mosquito *Aedes aegypti*. Currently, Mark serves as the North Central Regional Director for the American Mosquito Control Association. Email: mclifton@nsmad.com

1:10 pm “Insecticide resistance status and management in Collier County, Florida”
Presented by: Keira Lucas, PhD
Deputy Executive Director, Collier Mosquito Control District, FL

The Collier Mosquito Control District historically performed mosquito control through aerial application of organophosphate-based adulticides. In 2018, the District dramatically increased usage of pyrethroid-based adulticides and, at the same time, identified pyrethroid resistance in two disease vector species, *Aedes aegypti* and *Culex quinquefasciatus*. The District also began to see resistance and developing resistance to the organophosphate, naled, in *Aedes aegypti*. This new knowledge represented a challenge for reducing disease vector populations and while reducing organophosphate-based adulticide usage in the District. This presentation covers the insecticide resistance status of Collier’s disease vector species, identification of *kdr* and metabolic resistance and the integrated management tools used to combat resistance in Collier County Florida.

Speaker Bio:

Bio: Keira Lucas is the Deputy Executive Director at the Collier Mosquito Control District headquartered in Naples FL. Dr. Lucas earned her B.S. in Molecular, Cellular and Developmental Biology at California State University, Fresno, and her Ph.D. in Genetics, Genomics and Bioinformatics at University of California, Riverside. Her dissertation research focused on the molecular and hormonal regulators of mosquito

reproduction for species-specific mosquito control. Dr. Lucas is active in the American Mosquito Control Association and Florida Mosquito Control Association. She currently serves as Subject Editor for Pesticide Efficacy/Evaluation for the Journal of the American Mosquito Control Association and Journal of the Florida Mosquito Control Association. Email: klucas@cmcd.org

1:30 pm Open Discussion Q and A

1:50 pm Closing – Leanne Lake and Carolina Torres Gutierrez, PhD.
Technical Development Specialists at Valent BioSciences, LLC