

# Insecticide resistance testing informs integrated mosquito management program decisions at the local level



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CATEGORY: **Epidemiology and Laboratory Capacity (ELC)**

The Texas Department of State Health Services (DSHS) Arbovirus/Entomology Laboratory provides mosquito species identification, mosquito counts, arbovirus testing, and insecticide resistance testing to assist local jurisdictions with their Integrated Mosquito Management programs. The information is used by local agencies to monitor mosquito population levels, to detect areas of human risk for mosquito-borne virus activity, and to inform public education and mosquito control activities.



## The “What”

The State of Texas is vulnerable to mosquito-borne disease transmission because of its unique ecosystems that support high densities of vector mosquito populations, areas with significant poverty, and periodic climatic disturbances such as hurricanes, floods, and droughts. In addition, the Texas-Mexico border is a frequently crossed border, increasing the risk of mosquito-borne diseases being introduced, like chikungunya, Zika, and yellow fever. The most prevalent endemic mosquito-borne virus in Texas is West Nile virus (WNV), with hundreds of human disease cases typically reported each year. With human vaccines lacking for mosquito-borne arboviral diseases, this leaves mosquito control as the primary disease prevention strategy. It is important for local jurisdictions to follow Integrated Mosquito Management (IMM) practices in order to reduce mosquito populations, efficiently use mosquito control resources, and maintain a quality environment. One of the core components of IMM is monitoring for insecticide resistance to ensure that mosquito control products are effective.

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mosquito control activities. Monitoring insecticide resistance is particularly important as resistance can result in ineffective mosquito control applications and increased risk for mosquito-borne disease transmission.

The insecticide resistance testing program at the Texas DSHS Arbovirus/Entomology Laboratory was established using Epidemiology and Laboratory Capacity for the Prevention and Control of Emerging Infectious Diseases (ELC) funding. Specifically, funds were used for purchasing equipment and supplies needed to maintain functional insectary space for housing susceptible mosquito colonies (used as control samples) and mosquito collections submitted for insecticide resistance testing by local jurisdictions. ELC funds were also used to purchase the supplies needed to conduct the CDC bottle bioassay insecticide resistance testing, including glass bottles, aspirators, and pipettors. In addition, the CDC Arboviral Diseases Branch (ADB) provides the active ingredients at diagnostic dose concentrations, so the insecticide solutions can be easily resuspended in acetone for testing purposes. ADB staff also provide standard protocols and recommendations for conducting the testing and result interpretation.

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## The “So What”

In 2022, the Arbovirus/Entomology Laboratory was able to provide insecticide resistance testing for five (5) agencies in Texas. *Culex quinquefasciatus* mosquitoes were the target species for each agency, as they are considered the primary vector for WNV transmission in Texas. Different active ingredients were evaluated for each agency, depending on their mosquito control product usage. If insecticide resistance was detected using the CDC bottle bioassay, additional active ingredients were evaluated to inform product rotation decisions. The Texas DSHS State Medical Entomologist was able to make IMM recommendations to the local agencies based on the testing results.

With the information obtained through insecticide resistance testing, local mosquito control efforts can be more effective at decreasing or stopping mosquito-borne virus transmission in Texas. Provision of this testing at the Texas DSHS Arbovirus/Entomology Laboratory has benefited jurisdictions that do not have the capability to conduct it in their own facilities. Positive feedback was received from each agency regarding the utility of this testing as a tool for making informed mosquito control decisions. The monetary component was an important factor, as local jurisdictions have limited budgets and want to purchase products that are effective. Conducting additional bioassays on potential rotational products was beneficial for planning future mosquito control product purchases.

## The “Now What”

With continued ELC funding, insecticide resistance testing can continue to be offered to local jurisdictions in Texas. Information about all testing services provided by the Texas DSHS Arbovirus/Entomology Laboratory is presented at trainings and workshops statewide in hopes of increasing participation. If we can increase "informed" mosquito control decisions in Texas, we can decrease mosquito populations that are responsible for transmitting viruses of public health concern.

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Key contributors to this project include Arbovirus/Entomology Laboratory Team, Texas Department of State Health Services.