LACROSSE VIRUS IN THE APPALACHIANS

RESPONSE TO TWO CASES IN A NORTH GEORGIA STATE PARK

Raymond R. King – District Director of Environmental Health
LaCrosse (LACV) Review

1. An arboviral encephalitis native to North America circulated among the Eastern Tree Hole Mosquito, chipmunks, gray squirrels and fox squirrels.
La Crosse encephalitis was discovered in 1965, after the virus was isolated from preserved brain tissue and spinal cord of a child who died from the unknown infection in La Crosse, Wisconsin in 1960. The cause of La Crosse encephalitis is an RNA virus of the same name. In areas endemic for La-Crosse virus, the annual incidence of the disease is approximately 10 to 30 cases per 100,000 in individuals younger than 16 years.
LACV is the most common cause of arboviral encephalitis in children. Ranges from mild febrile illness to severe neuroinvasive form that can result in lifelong disabilities or death. Most children recover without sequelae.
2. Other laboratory vector-competent species include *Ae. albopictus*, *Ae. japonicus*, *Ae. aegypti*, *Ae. canadensis*, and certain *Culex* sp.
3. Estimated human fatality rate of 0.5% to 1.9%. LACV is rapidly becoming a leading cause of encephalitis in the United States. As in these two cases, the severe neuroinvasive form of the disease occurs most often in children under the age of 16. LACV disease can have a wide range of lifelong neurological consequences.
4. Since the mid-1990’s Appalachia has emerged as a new focus for LACV cases.

Previously most LACV cases were associated with forested midwestern areas of the United States.
2009 to 2018

Source: ArboNET, Arboviral Diseases Branch, Centers for Disease Control and Prevention
La Crosse virus neuroinvasive disease average annual incidence by county of residence, 2009–2018

BY COUNTY
In the summer of 2018 two adolescents acquired LACV at Fort Mountain State Park, Murray County, Chatsworth, GA. Both cases were severe neuroinvasive. One was air-lifted to Erlanger Medical Center in Chattanooga, TN. One male, one female. Both less than 16 years old.
Both required intensive hospital care and rehabilitation. One was an out-of-state visitor to park with her family, and the boy was child of a park employee. Incubation periods and dates of onset put them both at the park for most likely times of exposure.
2018 - STRATEGY TO PREVENT FURTHER CASES

1. Meeting of all concerned parties:
   - Public Health (District and County Environmental Health)
   - Park and Regional Administration
   - City of Chatsworth (Mosquito Control Program)
2. Barrier sprays and backpack sprayer provided to park staff by P.H.
3. City of Chatsworth will provide ULV spraying (reimbursement by P.H. and D.N.R.) spraying an average twice/month.
4. Public Health will larvicide in campgrounds and other park areas.
5. Public Health will perform routine collections of mosquitoes, larvae and adults.
6. Public Health will create educational posters and notices for visitors and staff.
7. Public Health will provide repellants to visitors when possible.
Protect yourself and your children. Always use mosquito repellents when outdoors.

Wester Nile, Zika, LaCrosse, Eastern Equine, St. Louis, Chikungunya.....

PROTECTS YOU FROM TICK DISEASES TOO!

*Aedes triseriatus* – The Treehole Mosquito
Aedes triseriatus larvae in holes

Holes filled by State Park Personnel in Winter

SHALLOW SOILS (12-18") IN FLOOD-PLAIN

ROCK STRATA

Aedes triseriatus larvae in holes
This floodplain area was treated twice in 2018 and three times (one more pending) in 2019 with Altosid blocks and granules placed in holes and other suspect areas in the park.
Of course there are innumerable trees in
and around the park, so plenty of
habitats for Aedes *triseriatus*. We never
located a tree hole with larvae. Twenty
larvae traps in campgrounds never found
Aedes *triseriatus* larvae in them.
Aedes *triseriatus* is almost never abundant in its range making evaluation of control measures difficult. Mosquito species richness, composition, and abundance generally decrease with increasing altitude and slopes. There have been no further human cases associated with the park, and we assume control measures were effective, but can’t be certain.
La Crosse infections rarely result in symptomatic disease. Males account for the majority of cases. Cases have more to do with age and susceptibility to neuroinvasive form than actual exposure. *Aedes triseriatus* overwinter as eggs located in dry nesting sites that become flooded in spring, but in warm areas may also overwinter as adults.
Females will lay eggs in man-made water holding containers, particularly discarded tires like *Aedes albopictus*. Feeding activity is largely crepuscular.

Can be a daytime biter.
Populations of eastern treehole mosquitoes have a high level of plasticity and vary among regions and even from year to year. This is also due to delayed hatchings, amount of rainfall, temperature, and resource availability. As a result, there are usually multiple adult populations and all instar stages present at once. Some populations have been observed with only one population per year. Interestingly, females infected with La Crosse encephalitis virus are more efficient at mating than non-infected females.
IDENTIFICATION
- Medium Sized
- Scutum with jet-black median stripe bordered with large patches of silvery white scales.

- Abdomen black, also with silvery white patches on lateral margin of each segment. Legs dark except for beginning and underside of femur. Proboscis dark.

- *Aedes hendersoni* and *Aedes triseriatus* adults difficult to distinguish. Larvae differ little (anal papillae.) Overlap in range.
Rodent reservoirs are not essential to the persistence of LACV in nature and the mosquito itself can be a reservoir host. A transovarian-infected female *Aedes triseriatus* is able to transmit the virus at its first blood feeding without previously having taken an infectious blood meal. Also, *Aedes triseriatus* males, infected transovarially, can transfer LAC virus to females via mating (i.e., venereal transmission.)
OBSERVATIONS AND COMMENTS
Large numbers of chipmunks in both campgrounds. Asian Tiger Mosquitoes were present whose larvae probably compete with larvae of Aedes triseriatus, but research indicates Tiger mosquitoes are probably not responsible for more human LACV cases nor new emergence in Appalachians.
- Other factors including:
  - DIFFERENT MOSQUITO SPECIES
  - CLIMATE CHANGES
  - CHANGES IN WILDLIFE DENSITIES (e.g., chipmunks and squirrels)
    & other unknown ecological factors
  - HUMAN ACTIVITIES
2019: 14 SPECIES – 137 mosquitoes

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<tr>
<th>SPECIES 2019</th>
<th>NUMBER</th>
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<tr>
<td>Aedes japonicus</td>
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<td>Aedes albopictus</td>
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<td>Anopheles punctipennis</td>
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<td><strong>Aedes triseriatus</strong></td>
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<td>Culex quinquefasciatus</td>
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<td>Psorophora cyanescens</td>
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SPECIAL THANKS TO:
CITY OF CHATSWORTH,
Mayor Tyson Haynes
I confess. I destroyed two light traps.

Questions?
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