2015 Western Colorado Pest Management Workshop

Public Health (110)

Overcome Obstacles in Mosquito Control

Kevin Gallagher
Van Diest Supply Company
Fort Collins, CO

What I Do For a Living:

• Full line distributor for:
  – Turf & Ornamental Market
  – VM, Range & Pasture Market
  – Aquatic Market
  – Mosquito Control Market

Cell Phone Management – Turn On Mute, Take Pictures of Slackers

Large Droplets

Tree Spraying
West Nile Virus - Colorado

West Nile Virus Peaked in 2003 when there were 2,847 cases, resulting in 63 deaths.

### 2013 West Nile Cases Colorado - 318

- Alamosa County - 24
- Arapahoe County - 5
- Bent County - 1
- Boulder County - 51
- Broomfield County - 6
- Chaffee County - 1
- Crowley County - 1
- Delta County - 14
- Denver County - 12
- Douglas County - 2
- Eagle County - 1
- El Paso County - 2
- Elbert County - 1
- Fremont County - 5
- Jefferson County - 3
- Lake County - 5
- Larimer County - 89
- Lincoln County - 1
- Logan County - 7
- Mesa County - 9
- Montrose County - 2
- Morgan County - 16
- Otero County - 3
- Prowers County - 6
- Pueblo County - 4
- Sedgwick County - 1
- Summit County - 1
- Weld County - 45

---

Comparison of Acute Oral Toxicity

<table>
<thead>
<tr>
<th>Material</th>
<th>Toxicity Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboititz (methylene)</td>
<td>34.6</td>
</tr>
<tr>
<td>Vectoide (Bk)</td>
<td>30</td>
</tr>
<tr>
<td>Vectoide (Bsp)</td>
<td>30</td>
</tr>
<tr>
<td>Alate (lomefloxacin)</td>
<td>10</td>
</tr>
<tr>
<td>Sea Water</td>
<td>10</td>
</tr>
<tr>
<td>Azel (aurothioglu)</td>
<td>10</td>
</tr>
<tr>
<td>Teflon (methylacryl)</td>
<td>5.5</td>
</tr>
<tr>
<td>Ethanol (perethanol)</td>
<td>5.5</td>
</tr>
<tr>
<td>Methylmer (chlorpyri</td>
<td>1.6</td>
</tr>
<tr>
<td>Table Salt</td>
<td>1.4</td>
</tr>
<tr>
<td>Aspirin</td>
<td>1.2</td>
</tr>
</tbody>
</table>

The longer the bar, the less toxic the material.

---

Outbreak of West Nile-like Viral Encephalitis -- New York, 1999

An outbreak of arbovirus encephalitis was first recognized in New York City in late August of 1999. At least 22 cases have been identified in neighboring states as well. Most patients were adults aged 30-60 years, although only 4% had direct exposure to birds or bird habitats. The majority of patients had fever, headaches, and confusion. A rapid diagnosis of West Nile encephalitis was confirmed by a combination of testing methods, including rapid testing for West Nile virus RNA and serologic testing for West Nile virus IgM and IgG antibodies.

On August 18, 1999, an infectious disease physician from a hospital in northern Queens contacted the New York State Department of Health (NYS DOH) to report two patients with encephalitis. The patients had had prior exposure to waterfowl or birds. The physician was concerned about the possibility of West Nile virus, and requested a rapid diagnostic test. On August 19, the patients were hospitalized, and a rapid diagnostic test confirmed the presence of West Nile virus RNA in the blood. The patients were then transferred to a hospital in Queens, where they were treated with antiviral drugs. The diagnosis was confirmed by serology, and the patients recovered.

---

Outbreak of West Nile-like Viral Encephalitis -- New York, 1999

An outbreak of arbovirus encephalitis was first recognized in New York City in late August of 1999. At least 22 cases have been identified in neighboring states as well. Most patients were adults aged 30-60 years, although only 4% had direct exposure to birds or bird habitats. The majority of patients had fever, headaches, and confusion. A rapid diagnosis of West Nile encephalitis was confirmed by a combination of testing methods, including rapid testing for West Nile virus RNA and serologic testing for West Nile virus IgM and IgG antibodies.

On August 18, 1999, an infectious disease physician from a hospital in northern Queens contacted the New York State Department of Health (NYS DOH) to report two patients with encephalitis. The patients had had prior exposure to waterfowl or birds. The physician was concerned about the possibility of West Nile virus, and requested a rapid diagnostic test. On August 19, the patients were hospitalized, and a rapid diagnostic test confirmed the presence of West Nile virus RNA in the blood. The patients were then transferred to a hospital in Queens, where they were treated with antiviral drugs. The diagnosis was confirmed by serology, and the patients recovered.
On August 23, 1999, an infectious disease physician from a hospital in northern Queens contacted the New York City Department of Health (NYCDOH) to report two patients with encephalitis. The Spanish called the mosquito “musketas” while native Hispanic Americans called them “zancudos” which in Spanish means “long-legged” Mosquitoes are vectors for many serious diseases. The use of the word mosquito is apparently of N. American origin and dates back to about 1583 2,700 species worldwide - 176 species in U.S.

Fun Facts

- Most species live 2-3 weeks although some can overwinter. They fly on average around 1-1.5 mph. Salt marsh mosquitoes can migrate up to 40 miles for a meal. Usually range up to 30 feet up.
- Bigger people are often more attractive to mosquitoes due to more CO2 & lactic acid.
- Active or “fidgety” people are more attractive to mosquitoes.

Serious Facts

- Mosquitoes are vectors for many serious diseases in the U.S. and abroad: Malaria, yellow fever, dengue, filariasis and encephalitis including St. Louis, Western Equine, LaCrosse, Japanese, Eastern Equine and West Nile Virus.
- Can hamper recreation activities and impact animal production.

Fun Facts

- Women are usually more attractive to mosquitoes than men because of the difference in hormones
- Blondes tend to attract more mosquitoes than brunettes.
- Smelly feet are attractive to mosquitoes.
- Dark clothing attracts mosquitoes.
- A full moon increased mosquito activity 500% in one study.

Fun Facts

- Mosquito is a Spanish word meaning “little fly”. The Spanish called the mosquito “musketas” while native Hispanic Americans called them “zancudos” which in Spanish means “long-legged”
- The use of the word mosquito is apparently of N. American origin and dates back to about 1583
- 2,700 species worldwide - 176 species in U.S.
- The state with the fewest is West Virginia with 26 species, the most is Texas with 85 species. Colorado has about 46 species statewide.

1946

Todd Shipyard made the first thermal mosquito fogger by down sizing a smoke generator that the Navy used to hide ships during World War I. DDT was the first adulticide used and was mixed with Kerosene.
Don’t forget to turn off the pilot light

ULV Aerosol Application

Biology and Species

Most Problematic

Flood River Mosquito
Aedes taeniorhynchus

Aedes aegypti/albopictus
Asian Tiger Mosquito

Culex spp.

Anopheles
Mosquito Life Cycle

Life Cycle

• 170 different species in North America
• They all have 1 thing in common: they must have water for their early stages.
• All mosquitoes undergo the same 4-stage adult life cycle: egg, larva, pupa, adult.
• The 2nd and 3rd stages (larva & pupa) are aquatic.

Life Cycle - Egg

• Egg shape and color vary with species.
• Approximately 1 hour after they’re laid the eggs darken and become opaque, for camouflage.
• Eggs may hatch within a few days, after being laid, depending on temperature.
• Eggs laid out of water or are subject to drying will remain dormant until ideal conditions are met for hatching.

Life Cycle - Larva

• In most species the larvae feed on microorganisms.
• They stay suspended just below the water surface.
• When disturbed, they will dive deeper.
• As it feeds, it will enlarge, outgrowing its exterior covering.
• Larval stage includes 4 instars, and 4 molts. Last molt results in pupa.
• Larval stages range from 4 to 10 days, varying with species, water temperature, and food availability.

Life Cycle - Pupa

• Pupa does not feed, but like larva, it’s sensitive to shadows, ripples, and similar disturbances in water.
• Like the larva, the pupa also has a breathing apparatus, called trumpets.
• After 1 ½ - 4 days (depending on temperature) the pupa’s skin splits along the back, and the adult slowly struggles out and rests on the water surface.

Life Cycle - Adult

• Males usually emerge first and linger near the breeding sites, where they wait for females.
• Mating must occur quickly, adult mortality rate is high.
• In some species, 1/3 of adult populations die daily; so females compensate by producing large number of eggs.
• Males usually live 6 – 7 days.
• With ample food, some species of females can live up to 5 months.
• Female needs blood to nourish her developing eggs.
Life Cycle – Adult cont.
- Females locate victims (animals) by the chemicals they emit.
- They are sensitive to carbon dioxide, amino acids, and sex hormones.
- Convection currents around warm, perspiring humans are particularly attractive to mosquitoes.
- Range is usually 5 to 10 miles, but as far as 40 miles to obtain a blood source.
- After each blood meal, the female lays her eggs and the life cycle is renewed.

Culex
- Culex known to overwinter in cold damp dwellings
- Prevalent in mid-to-late summer
- Will readily breed in polluted water, septic tanks, sanitary plants
- Main Vector of the West Nile Virus
- Also can transmit SLE, Malaria and Heartworm

Culex
- Survivability rate of female eggs that overwinter is greater in mild winters.
- Warmer than normal ambient temperatures increase female egg production.
- Metamorphous process is much quicker in hot, dry temperatures.
- WNV is transmitted through the bite of an infected mosquito. Mosquitoes become infected with the virus by biting a wild bird that has the virus. Though the birds are the primary host of WNV, it is not transmitted directly from birds to people.
Mosquito Habitats

Adult Mosquito Control

FLIGHT RANGE

- 15 MILES
- 10 MILES
- 5 MILES
- Hundreds of feet

Herborage Areas

Residential Areas
Potential breeding sites

- Abandoned tires
- Ponds
- Puddles
- Low-lying areas

Moving vegetation around the yard may reduce potential breeding sites.
Larvae Dip Count
How Many Adults Will Hatch

- 1 acre wetland area
- Residential setting
- 10 larvae/dip
- 8 dippers/square feet
- 43,560 square feet/acre
- (10 x 8 dippers) x 43,560 = 3,484,800 adult hatches

ULV Spraying

ULV spraying fills a 20-foot column with an ultra low volume of active ingredient
ULV Droplet = 17 Microns Volume Median Diameter (VMD)

150 DROPLETS TO CROSS THE HEAD OF A PIN

Aerial/Ground ULV Application Label

Aerial Application: Spray equipment must be adjusted so that the volume median diameter produced is less than 60 microns (Dv 0.5 < 60 um) and that 90% of the spray is contained in droplets smaller than 115 microns (Dv 0.9 < 115 um). The effects of flight speed and, for non-rotary nozzles, nozzle angle on the droplet size spectrum must be considered. Directions from the equipment manufacturer or vendor, pesticide registrant, or a test facility using a wind tunnel and laser-based measurement instrument must be used to adjust equipment to produce acceptable droplet size spectra. Application equipment must be tested at least annually to confirm that pressure at the nozzle and nozzle flow rate(s) are properly calibrated.

Determining Costs of Your Adulticiding Program

- Costs of adulticides are hard to pin down
- A $205 per gallon insecticide may be cheaper to use than a $45 one
- Never go below label rates because of
  - efficacy
  - resistance

Example #3

Economic Cost For Adulticide Spray For 640 Acres (1 Section)

- Acres sprayed/hour @ 10 mph = 363.6 acres
- Time to spray area = 1.76 hours
- Ounces of product/acre = 1.023 ounces
  - Rate is 6.2 ounces/minute
- Time to spray 1 mile = 6 minutes/mile
- Pounds of ai/acre = 0.00112 pounds
- Time to spray/acre = 6.06 acres/minute
- Gallons of Anvil 2 + 2 needed = 5.12 gallons
- Chemical cost/acre = $ 0.53/acre
  - Anvil 2 + 2 cost/gallon = $ 68.90/gallon
- Chemical cost/section (640 acres) = $ 339.20
“Mosquito adulticiding may be the only practical control technique available in situations where surveillance data indicate that is necessary to reduce the density of adult mosquito populations quickly to lower the risk of WNV transmission to humans.” (EPA WNV Guideline – Aug. 2003)

“Aerial application is capable of covering larger areas in shorter time periods than a ground-based application. This is a critical positive attribute when large residential areas must be treated quickly. In addition, aerial application is less prone to patchy coverage than ground-based application in areas where road coverage is not adequate. One limitation of aerial application is that many applicators will not fly at night, potentially reducing the effectiveness of the applications in Culex species control efforts. Cost benefits of aerial application over ground application may not be realized unless relatively large areas are treated.” (EPA WNV Guideline – Aug. 2003)

When West Nile Virus arrives, it is too late to larvicide

**Adulticiding Checklist**

Insecticide choices such as:

- Anvil 2+2  
- Biomist 3+15  
- Scourge 4+12 *  
- Fyfanon ULV  
- Mosquito Master 412  
- Mosquitomist 1.5 ULV AquA Anvil  
- Duet  
- Scourge 18+54  
- Permethrin 57% OS  
- AquaHalt  

(* Restricted Use Pesticide)