Mosquito Control

Claudia Riegel, Ph.D.
New Orleans Mosquito & Termite Control Board

General Biology of Mosquitoes

- Insects that belong to Order DIPTERA which includes all the flies.
- Have four life stages:
  - Egg -- laid on surface or edge of water
  - Larvae -- live only in water.
  - Pupae -- live only in water.
  - Adults

Eggs

- Singly on surface or edge of water.
- Some species lay eggs in rafts on surface of water.
- Some sp. hatch 24-36 hrs.
- Some hatch after one, two or three years.
- Overwintering stage for some species

Larvae

- Four stages: 1st, 2nd, 3rd, 4th instars.
- Called “wigglers”, very active, most come to surface for air.
- Total time- 6-12 days
- Some species even weeks.

Larvae

- Basic biology important for management
  - Type of larvicide
  - Emergent and floating vegetation management
  - Larval habitat for species of medical importance

Pupae

- Stage that changes from larva to adult.
- Called “tumblers” very active, come to surface for air.
- Stage lasts from 3-6 days.
Classification Based on Larval Habitat

- Floodwater mosquitoes
- Permanent water mosquitoes
- Container mosquitoes

Classification Based on Larval Habitat (cont.)

- Floodwater mosquitoes
- Permanent water mosquitoes
- Container mosquitoes

Need to have an overall understanding of the types of mosquitoes in order to properly address the homeowner’s pest concerns.

• address the conducive conditions first.

Flood Water Mosquitoes

- Includes mosquitoes in genera *Aedes* and *Psorophora*
- Some species from these genera are the most important pest species.
- Bite humans, livestock, pets
- Can have very large populations spring and early summer.

Floodwater Mosquitoes (cont.)

- Eggs are laid on the soil surface at the edge of standing pools of water that are left from heavy rains or floods.
  — often woodland pools, roadside ditches, low areas along creeks rivers that collect flood water, marsh, wetlands.
- Eggs hatch when flooded by runoff from heavy rains, flood water, high tides

Adult (Male)

• Emerges first
• Feeds on nectar sources for energy.
• Mates within 2 to 7 days and dies

Adult (Females)

• Emerges and feeds on nectar.
• Mates, usually only once.
• Searches for blood meal.
• Needs blood meal to develop eggs.
• 1-5 blood meals over life of 7 to 28 days.
Floodwater Mosquitoes (cont.)

- Eggs are over wintering stage. In most cases must spend winter in egg case, called diapause stage.
- Can survive in egg stage for several years until flooded.
- However, can have different hatches within several days if increased water levels hatch new eggs.

Floodwater Mosquitoes (cont.)

- Adult populations peak in late April, May, and June, species hatch with late summer fall rains.
- Adults die quickly during hot weather.
- Any flooded pools usually dry up too fast to support in hot weather.
- Females most active around sunset or in shady area disturbed, some are active the day*. *biology will vary with species.

Inland Floodwater Mosquito

*Aedes vexans*

- Inland Floodwater Mosquito

*Aedes vexans*

Greenspace (park, soccer fields etc.) close to a subdivision.

Tan Floodwater Mosquito

*Aedes sollicitans*

- Tan Floodwater Mosquito

*Aedes sollicitans*

- 40 – 50 mile flight range
- Aggressive
- Daytime, dawn, dusk
Permanent Water Mosquitoes

- Genera Anopheles, Coquillettida, Mansonia, some Culex spp.
- Found in quiet bodies of freshwater with sunlight, much surface vegetation, and very little wave action.
- Shallow edges of ponds, some lakes backwaters of rivers even slow moving streams.
- Never in main lake or pond areas with much wave action.

Permanent Water Group (cont.)

- Anopheles sp. lay eggs singly on surface of water, each egg with a float.
- Eggs hatch in 24-36 hrs. Many generations a year tend to peak mid late summer.
- Adults overwinter; triggered by photoperiod.
- Deep south perhaps cycle can go all year, slower in winter.

Mosquito Species of Greatest Concern

- Belong to Genus Culex
- C. tarsalis
- C. pipiens
- C. restuans, C. salinarius,
- C. quinquefasciatus (southern house mosquito)
- Note: all are permanent water mosquitoes, populations peak in summer through fall at same time virus activity peaks
- Feed on birds and mammals.
- Vector WNV, SLE, EEE

Culex quinquefasciatus Laying Eggs
Permanent Water Group (cont.)
• Populations of these mosquitoes low in spring.
• Populations build through the summer.
• Peak abundance July-October (varies slightly depending on location).
• Many species prefer birds as hosts, feed on mammals.
• Are often best vectors of viruses.
• Bite more readily at night.

Container Mosquitoes
• 99% = Culex or Aedes
• In nature larvae live in tree holes, rock pools even leaf axils.
• Many species now associated with man made containers or materials that hold water.
  – Tires, cans, buckets, birdbaths, gutters, pet water dishes, plant container bottoms that catch water, even cans, paper cups.

These are the mosquitoes most encountered by PMPs.

Culex spp. prefer nasty, smelly water

Typical Container Mosquito Habitat
Asian Tiger Mosquito

- *Aedes albopictus*
- Larvae in containers of any size
- Adults active during the day

*Aedes albopictus* Eggs in Container

- Efficient container breeder utilizing available sources.
- Eggs laid on surface of water, on sides of container, and on stick.
- Immediate egg hatch of some eggs, delayed hatch for others.

*Aedes aegypti*

- Container breeder
- Prefer more sunlight
- Dengue

Integrated Pest Management

- Surveillance
- Source Reduction
- Larvicides
- Biological Control Agents
- Adulticides – “when not to spray”
- Public Education
  - Reduce conducive conditions
  - Eliminate containers holding water
  - Repellents

Sampling Equipment

- Dipper
- Pipette
- Aspirator
- Flashlight
- Aspirator
- Larval Container
- Bag for extra vials, pens, labeling tape, etc.

Landing Rates

- Landing rates are used to measure adult mosquito activity in a specific area.
- This is achieved by counting the number of mosquitoes that land on a person in a given amount of time, usually one minute.
- The counts are generally performed by the same inspector at each location for consistency.
Surveillance

Traps for Adult Mosquitoes

• Your local mosquito control district can provide assistance on how to use the traps
• Identify the mosquitoes

Resources Available

• Local Mosquito Abatement Districts
  – Surveillance data
  – Identification
  – Coordination of management areas (what’s surrounding the property?)
• Local universities
• USDA-ARS

2011
3 Mosquito Pools
0 human
2 veterinary

CDC Miniature Light Trap
• Developed by CDC for portable collection of mosquitoes and sand flies.
• Standard survey tool for mosquito collections.
• Operates on

Attractants
• CO₂ is the standard attractant for mosquitoes (dry ice).
• Increases trap collections.
• 200ml/min is average release rate.
• CO₂ plus Octenol increases trap catch for some species.

CDC Gravid Trap
• Designed to catch gravid Culex females.
• Females are attracted to the hay/fish oil infusion as an oviposition site.
• May be used for virus detection.
• Operates on 6 volts.

Mosquito Magnet
Surveillance or control?

How do you Survey for Larval Mosquito Habitats?
Floodwater Mosquitoes
Common Mosquito Habitat

Container Breeding Mosquitoes

- *Aedes albopictus* and some *Culex* spp.
- Old tires or tire dumps, containers of any type in dumps, industrial areas, backyards.
- Birdbaths, flower pot containers, abandoned swimming pools or kiddy pools, pet water dishes, tarps, rain gutters, water gardens without good water flow.

*Aedes albopictus* Eggs
INTEGRATED PEST MANAGEMENT

• Surveillance
• Source Reduction

Eliminate mosquito breeding sites

• Hurricane Katrina
• Foreclosed houses.

- Surveillance
- Source Reduction

Eliminate mosquito breeding sites
Chemical Control

- Stop them at their source - larvicides
- Kill the population that remains - adulticides
- Erect barriers against the ones you miss
- Advocate personal protection as the final layer of protection - repellents

INTEGRATED PEST MANAGEMENT

- Surveillance
- Source Reduction
- Larvicides

Types of Larvicides

- Oils
  - Suffocation – mechanical barrier at surface
  - Suffocation – oil entering the siphon blocking the passage of air
  - Poisoning due to toxic properties of the volatiles
- Bacterial (Bti, B. sphaericus)
- Chemicals (organophosphate-temephos, Abate®)
- IGR (growth hormones - methoprene)
- Fish, copepods, turtles

Target the larvae!

INTEGRATED PEST MANAGEMENT

- Surveillance
- Source Reduction
- Larvicides
- Adulticides
ULV hand fogger and portable mist blowers
• Organophosphates
• Portable mist blowers
• Large droplet size

Barrier treatments
Misting systems
• Pyrethrum/Pyrethroids
  • Restrictions around water
  • Fish kill
• Often on a timer –
  • indiscriminate use of a pesticide
• Spray on demand
• Homeowners not typically educated on beneficial vs. pest arthropods
• Does not follow an IPM plan
• Tolerance/resistance

Equipment
• B&G
• Backpack Mister
• Misting systems

Where to spray
Residual period
Barrier treatments
• Equipment
  • B&G
  • Backpack Mister
  • Misting systems
• Where & how to spray
  • Porches
  • Areas that are protected by rain
  • Underside of leaves
  • Spray to runoff
• Residual period
  • Depends on rain/weather but can get several months with an application

Last Resort or First Line of Defense
• Personal
  – Topical repellents (cdc.gov)
  – Clothing
    • Textile
    • Chemical treatment
• Household
  – Area repellent systems
    • Passive chemical dispersion
    • Active chemical dispersion

INTEGRATED PEST MANAGEMENT
• Surveillance
• Source Reduction
• Larvicides
• Adulticides
• Biological Control Agents

30-50 Gambusia affinis/pool

Katrina Foreclosures

Copepods

Turtles
INTEGRATED PEST MANAGEMENT

- Surveillance
- Source Reduction
- Larvicides
- Public Education

- Household
  - Structure of walls, roof
  - Screens
  - Doors, interior and exterior

Integrated Pest Management

- Surveillance
- Source Reduction
- Larvicides
- Biological Control Agents
- Adulticides – “when not to spray
- Public Education
  - Reduce conducive conditions
  - Eliminate containers holding water
  - Repellents

Are you prepared?

- Staff
- Communication
- Insurance
- Data and Records
- Equipment
- Temp housing
- City, state, and federal disaster plans

In the Wake of Calamity: Recovery from Disaster

- Staff
- Communication
- Insurance
- Data and Records
- Equipment
- Temp housing
- City, state, and federal disaster plans
Slow cleanup:
No water or low water pressure.

Military

Media

Canal Street

Vehicles and property secures
Working with the CDC and LADHH
Rodent treatments began in FQ in critical use buildings (hospitals, etc).
Provide treatment in populated areas. Have contracts established prior to the disaster.

Treatment along the Mississippi River.

Infrastructure Damaged:
Trash piles begin growing.

First type of trash includes:
Appliances, food, wet/damaged items.

Eventually, trash/debris services begin.

- Garbage pickup is 1 time/week (if you are lucky) for household solid waste.
- Other debris: whenever it gets picked up.

The major problem are the containers! Clean-up is extremely slow.

- The trash/debris accumulates because there is no pick up.
- Drywall, carpet, etc.
Gutted houses

Pests of Immediate Concern

- Mosquitoes
- Flies
- Rodents
- Wildlife (raccoons, snakes, etc.)
- Stray animals

Hurricane: mosquitoes typically not be a problem for the first couple of weeks. Mosquitoes are killed, blown out of the area, washed out to sea with a hurricane.

Massive flooding (dam break, extended periods of rain), mosquitoes will reproduce in 7 to 10 days if the conditions (temperature) are conducive.

Power outages for extended periods of time: mosquitoes will reproduce in fountains, pools, ponds, etc., expect mosquitoes in 7 to 10 days.

Survey

- Lost most traps
- CDC
- Landing rates virtually no mosquitoes in September
- Find our trucks with ULV units

C130 Hercules US Air force Reserve
910th Airlift Wing at Youngstown Air Reserve Station, Ohio

September 13-23, 2005

- Capacity 60,000 acres/day
- Dibrome (naled)
- ½ and ¾ ounce/acre

Staff Sgt. Jacob N. Bailey
Filth Flies: Green bottle fly

Algiers (Westbank – not flooded)

October 16, 2005

Tan Salt Marsh Mosquito
*Anopheles sollicitans*

February, October & November, 2006
High populations of this mosquito
Tan Salt Marsh Mosquito (*Aedes sollicitans*)
Fish

Backyard pools, ponds, and fountains could become major breeding sites

Inspect and treat
* Vectolex WDG (donated)
* Use of mosquitofish

Long term problem!!

The major problem are the containers! This problem will likely exist for years. Clean-up is extremely slow. The potential for very high numbers of mosquitoes exist.

Educating FEMA and the State about mosquito concerns.
Questions

criegel@nola.gov