



# MOSQUITOES!

## Their Biology and Ecology

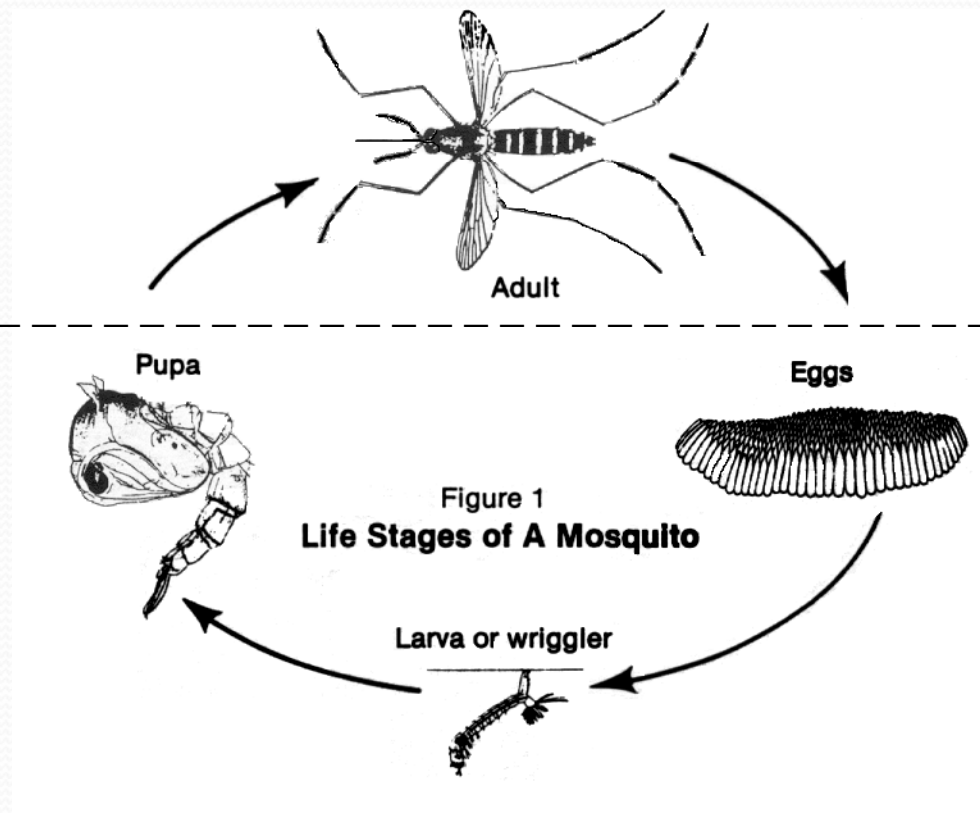
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# Mosquito Biology

- 60- plus species in Maryland in 10 genera
  - 10 or more can vector disease
  - Many cause annoyance problems
- Many different habits and habitat requirements
- Quick life cycle; many generations per season

# Mosquito Life Cycle



All stages below the dotted line are aquatic

Complete Metamorphosis

# Eggs

- Laid either in rafts, or singly on water surface or on dry ground



*Culex* laying egg raft



Egg rafts may contain up to 300 eggs



Eggs laid singly,  
*Aedes* or  
*Ochlerotatus*

# Larvae

- Must live in water
- Must breathe air, usually at the water surface
- Very active; light- and movement-sensitive



Notice the long siphon tubes on these larvae, probably Culex

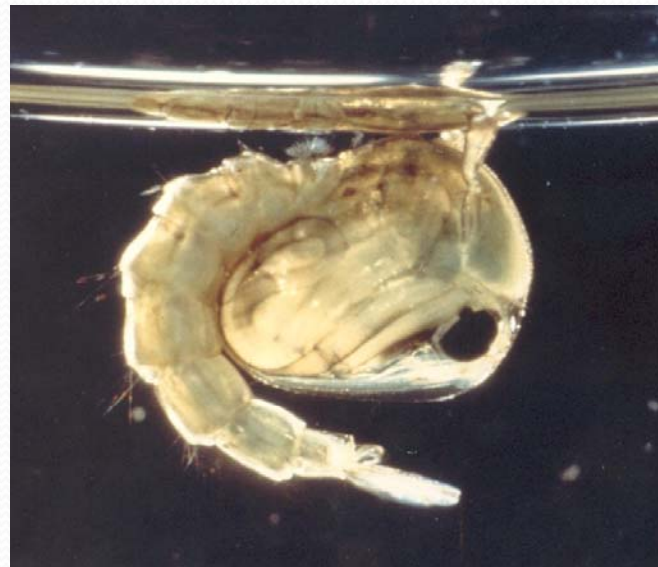
Some species' larvae will congregate together in a 'knot' or 'ball' in their breeding habitat



Anopheles larvae lack a siphon tube

# Pupae

- The 'resting' stage - undergoing their complete transformation into the flying adult
- Very active - tumble through the water when disturbed
- Must breathe air, usually at the water surface
- Do not feed!



# Adults

- Both male and female feed on nectar or plant juices - energy for flight
- Only females bite - need blood (protein) for egg development
- Wide variety of flight ranges, host preferences and habitats



*Ochlerotatus* bloodfeeding - notice her pointed abdomen

*Aedes albopictus*, the Asian tiger mosquito



*Anopheles* feeding - notice the 'headstand' position she takes

# Where To Lay Eggs...

Just a sampling of potential egg-laying habitat





# Types of Breeding Areas

- Permanent or semi-permanent water
  - *Culex* and *Anopheles*
- Floodwater
  - *Aedes*, *Ochlerotatus* and *Psorophora*
- Treeholes and man-made containers
  - *Aedes*, *Ochlerotatus* and *Culex*

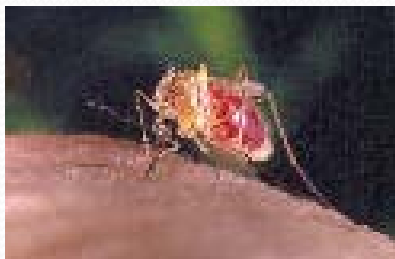


# Mosquito Habits

- Flight Range



*Aedes albopictus* - less than 200 yards  
*The Asian tiger mosquito*



*Culex and Anopheles* - 1 to 2 miles



*Ochlerotatus*, various - 5 to 50 miles

# Mosquito Habits

## Host Preference examples:

- Birds - *Cs. melanura*, *Cx. erraticus*



- Mammals - *Ps. columbiae*



- Reptiles & Amphibians -  
*Cx. territans*



Many species will feed on any vertebrate, leading to disease transmission from birds to mammals.

# SURVEILLANCE METHODS

## LARVAL

Larval Dipping



Sieving



## ADULT



BG Sentinel traps



CDC light traps



Pipette

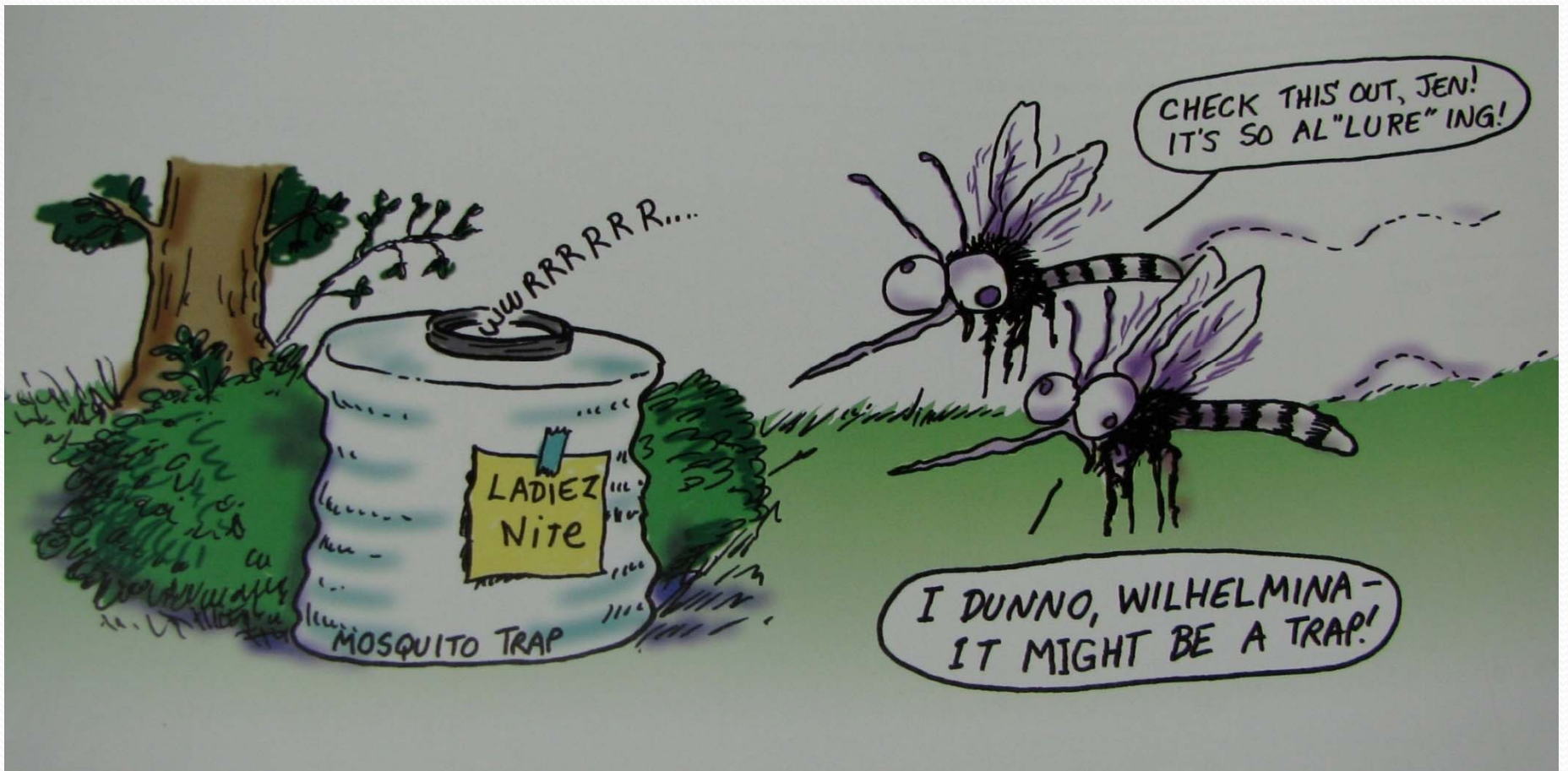


Gravid traps

Landing Counts



# Trapping - The BG Sentinel



Cartoon courtesy of Fairfax County Health Department



# CONTROL METHODS

## SOURCE REDUCTION



Getting  
rid of  
standing  
water

## BIOLOGICAL CONTROL

Fish eat mosquito larvae



# CONTROL METHODS

## LARVICIDING



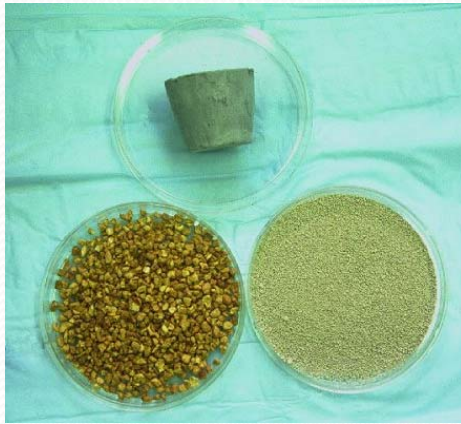
Killing  
larvae in  
the  
standing  
water  
where  
they  
develop





# CONTROL METHODS

## SOME LARVICIDE PRODUCTS



## PRODUCTS HOMEOWNERS CAN USE



# CONTROL METHODS

## ADULTICIDING



This is the most recognizable form of mosquito control - and the **only** one many people know about!



# Mosquito-Borne Diseases in MD

## Endemic Diseases in Maryland

- Eastern Equine Encephalitis
- West Nile virus
- St. Louis Encephalitis
- Dog Heartworm

## Possible imported diseases:

- Chikungunya virus (Caribbean, C. & S. America)
- Zika virus (C. & S. America)



## Container-breeding Aedes

- Bite anytime of day
- Interrupted feeding
- Hard to treat - must have access to private property
- Do not come to standard CDC traps - need BG Sentinel traps
- Readily enter homes & cars

## Culex

- Bite mainly at dusk & dawn
- Not skittish biters
- Often in water on public property; can also utilize containers
- Readily come to baited CDC traps.
- Do not readily enter homes

# The Trouble With Tigers



- *Aedes albopictus* introduced into Maryland in 1987
- Closely associated with human habitation - develops only in bamboo shoots, treeholes & containers
- Capable vector of several diseases, including WNV and Zika
- Incredibly annoying
  - Bites mainly during the day, unlike most of our species
  - Readily enters homes, cars, etc
  - Very persistent and aggressive biter
  - Difficult to eliminate unless egg-laying containers are eliminated
  - Many homeowners stop using their yards once this species is established

# Tiger Larval Habitats

Any Of These Places Hold Enough Water To Support Tiger Populations



# More Tiger Habitats



# Still More Tiger Habitat





# Even More Tiger Habitat



# Other Problem Species



*Oc. sollicitans* - annoyance and disease transmission



*Anopheles* (not ours) - malaria vector

*Oc. japonicus* - excellent vector in lab



*Cx. restuans* - vector species

# WHAT HOMEOWNERS CAN DO:

- Check yard weekly and tip or remove any water holding containers
- Talk to neighbors about "tiger" breeding areas - problem cannot be fixed by cleaning only one yard
- Work with community officials to educate whole community about "tigers"





Homeowners can use these products in their own yards to treat water in containers. Mosquito Dunks (left) and Mosquito Torpedoes (right) are both available commercially.





# WHAT COMMUNITIES CAN DO:

- **Volunteers** - distributing information or doing yard inspections; church groups, scouts, HS students
- **Organize community clean-ups:** help elderly clean gutters/yards; arrange tire pick-up
- **Newsletters** - put information in anything going to homeowners
- **Display booth** - we have exhibits we can lend
- **Stock ponds** - ornamental ponds can be stocked with mosquito-eating fish
- **Covenants/Codes** - put something in codes about creating mosquito nuisance and ENFORCE it!



# WHAT AGENCIES CAN DO:

- Inspect yards to find 'tiger' breeding areas.
- Educate the homeowner on methods for eliminating mosquito breeding.
- Leave a door hanger if the resident is not home.
- If inspecting a yard, it's always good to look at neighboring properties (or better yet, get permission to inspect there too).
- Public Education - workshops, talks, games, exhibits, flyers & bookmarks.

# Public Education



Teacher Workshops



Library display



Community meeting



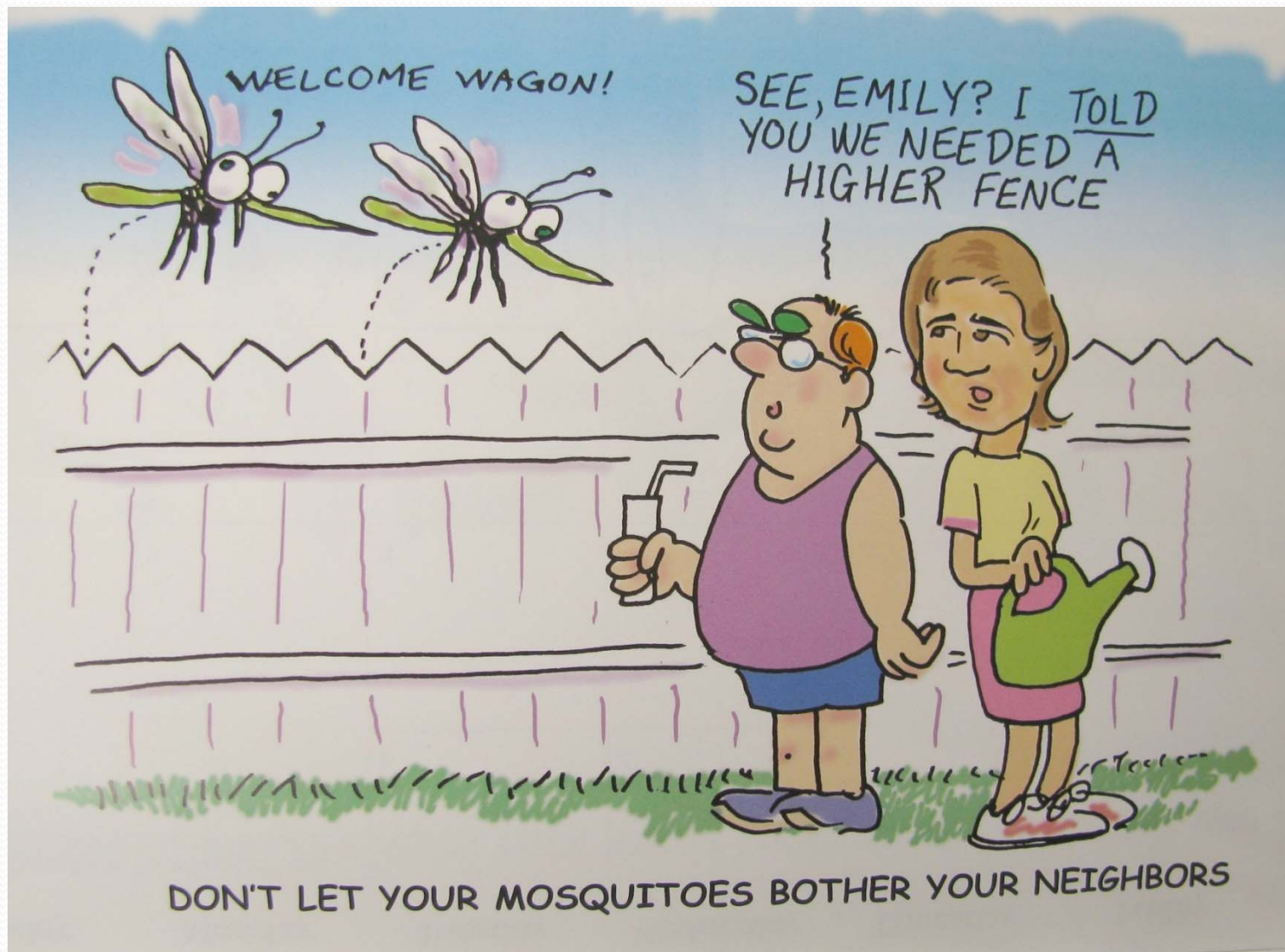
MDA's Open House



# PROBLEMS ENCOUNTERED

- Asian Tiger Mosquitoes - **MUST** be a community effort - no one wants to take responsibility for their own property
- Budget - constant cuts over 15+ years
- Staffing - as our staff ages, trouble replacing entomologists; hiring freeze
- Spray Objectors - pervasive fear of insecticides in much of the population





Cartoon courtesy of Fairfax County Health Department



# QUESTIONS?

## Contact Information for MDA Mosquito Control offices:

- Baltimore, Harford counties: 443-875-9551
- Prince George's, Montgomery, Howard, western MD counties: 301-422-5080
- Anne Arundel : 410-841-5870
- Southern Maryland: 301-373-4263
- Eastern Shore: 410-543-6626