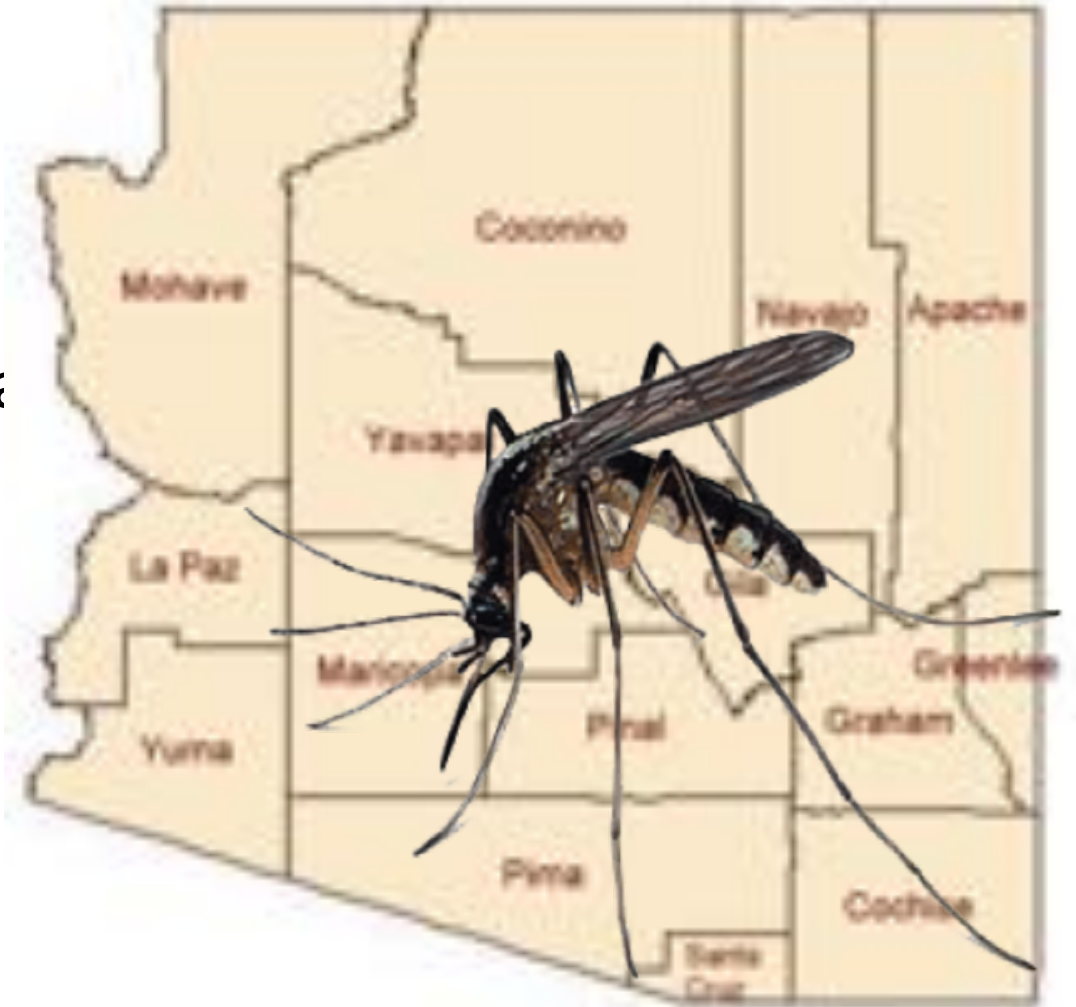


Mosquitoes:  
Arizona **bloodsuckers** and the  
diseases they can carry

# Overview

- Bloodfeeding basics
- How bloodfeeders can carry diseases
- Some Arizona bloodfeeding mosquitoes & their diseases:
  - Culex – West Nile virus
  - Aedes aegypti – Dengue, Zika



# Why bugs bite you

- Some arthropods get most/all nutrition from vertebrate blood:
  - Ticks
  - Fleas
  - Lice
  - Certain True Bugs (e.g kissing bugs, bed bugs)
- Some arthropods use vertebrate blood to provide nutrition for egg production:
  - Certain flies: mosquitoes, blackflies, horseflies.



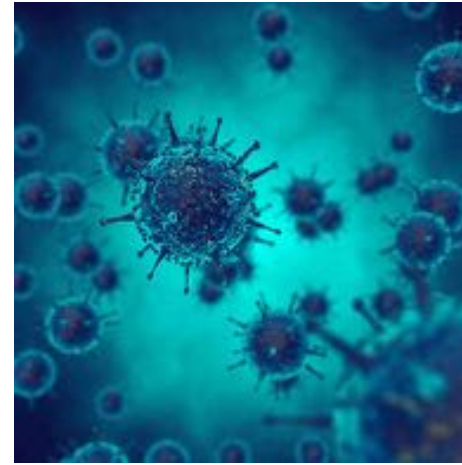
# How do arthropods spread disease?

- Mechanical transmission
  - the pathogen is transmitted between hosts without amplification or development within the vector, usually by contaminated mouthparts.
- **VERY RARE!**
- Biological transmission
  - the pathogen has an obligate developmental or amplification period within the vector.
  - the pathogen co-opts the blood-feeding insect to transport it between hosts.
- **VERY COMMON!**



What determines the risk of mosquito-vectored disease in humans and other animals?

- **Pathogen**, **vector** and **host** in one physical **location** at the same point in **time**, with supportive **environmental conditions**



Pathogen



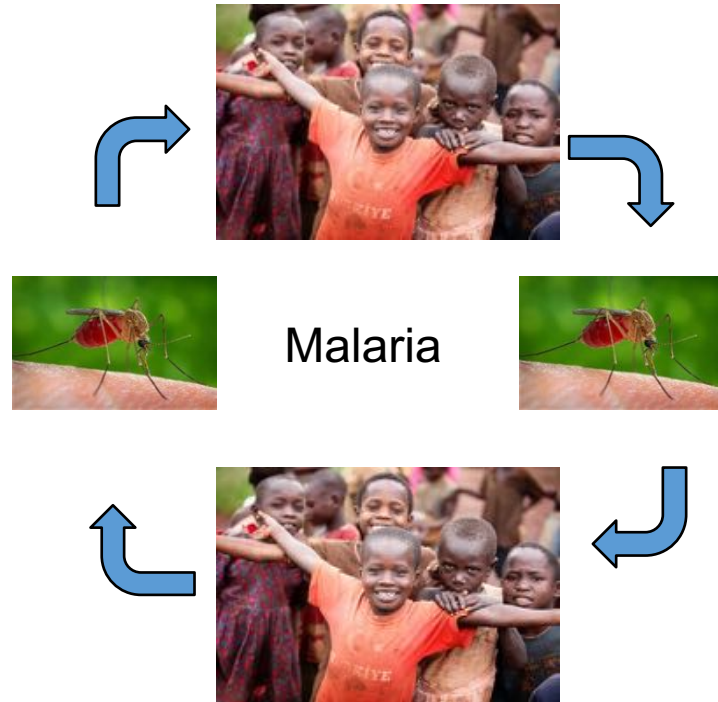
Vector

Host

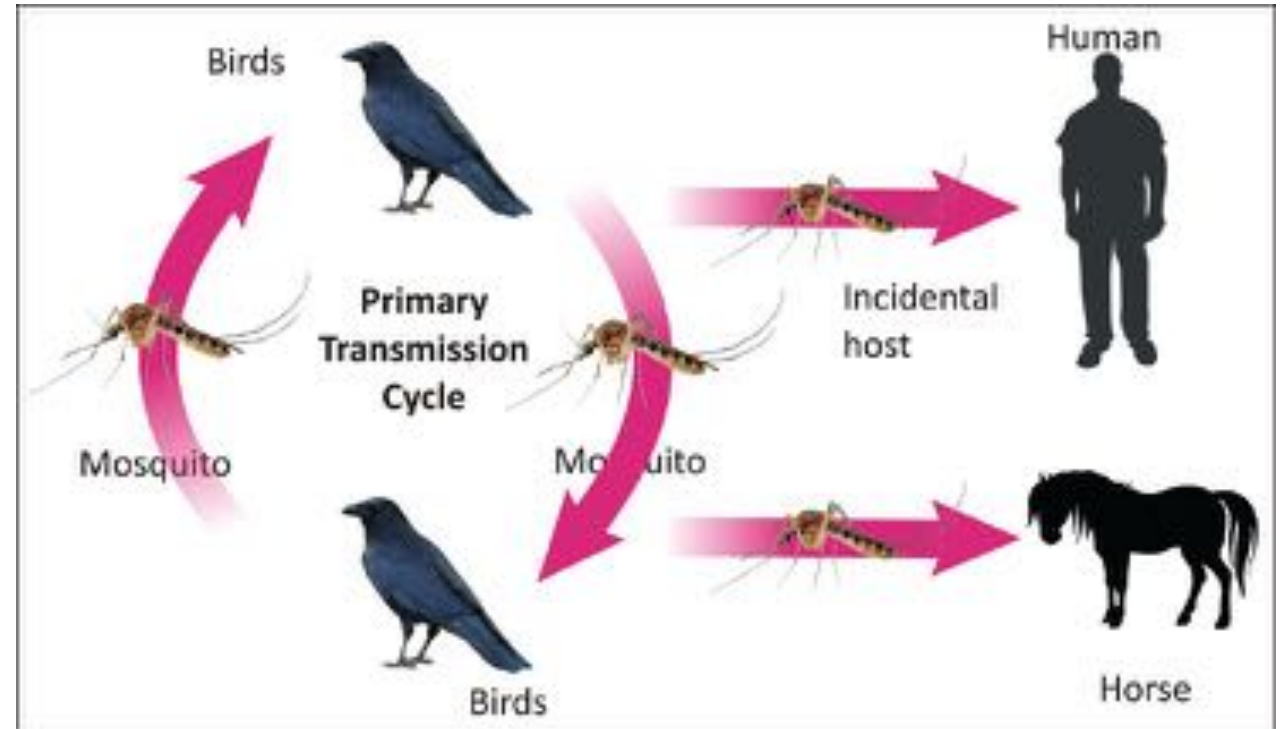


# Host – Vector – Pathogen Interactions

- Single transmission cycle – e.g. human is the only host of pathogen



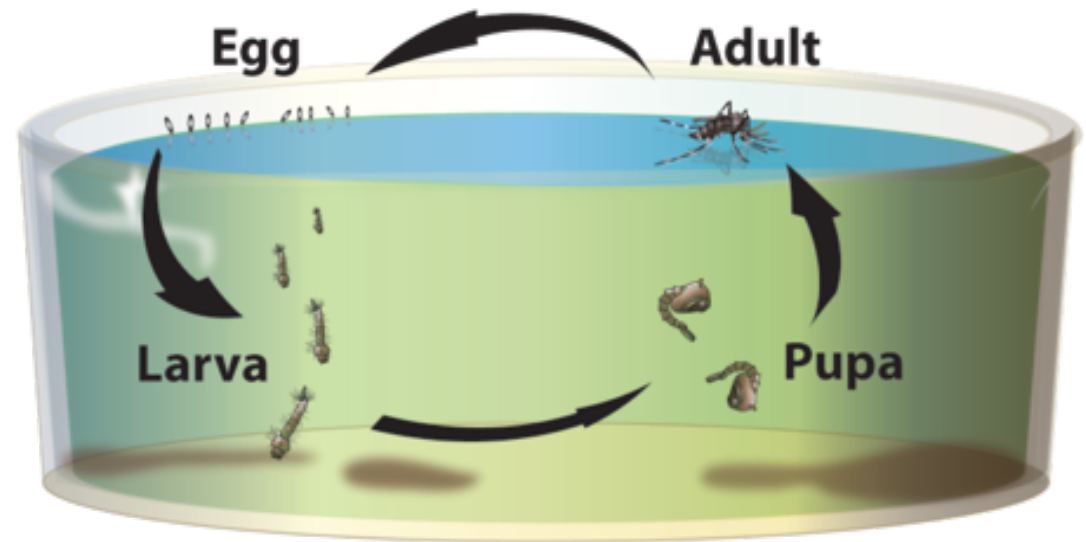
- Secondary cycle – the primary host of the pathogen is not human. Example – West Nile virus





# Basic Mosquito Biology

- Over 3000 mosquito species world-wide
  - About 180 species in the United States
  - About 40 species in Arizona
- Mosquitoes have 4 life stages. The egg, larvae and pupal stages are aquatic.
- Only adult **females** bite and they use the blood to make eggs.
- Different mosquito species prefer different host animals for blood and lay their eggs in specific habitats.



# Males

- Emerges first
- Feeds on nectar
- Mates within 2 -7 days multiple times
- Short lived







## Females

- Feed on nectar
- Mate usually once
- Needs blood meal -eggs
- 1-5 blood meals
- Lives 7 - 28 days

# Mosquitoes grouped by larval habitat

- Floodwater mosquitoes - eggs laid in damp areas
- Permanent and semi-permanent water mosquitoes
- Containers mosquitoes



# Flood water mosquitoes

- Bite humans, livestock, pets
- Can have **very** large populations in spring, early summer, and fall
- Day biters



*Psorophora  
columbiana*

*Aedes  
vexans*





# Permanent & semi-permanent water

- Quiet bodies of freshwater with sunlight, surface vegetation, and little wave action
- Shallow edges of ponds, some lakes, backwaters of rivers, slow moving streams
- Never in lakes with wave action



# Permanent & semi-permanent water

- Populations low in spring
- Peak July-October (varies by location)
- Prefer birds as hosts, feed on mammals
- Bite more readily at night



*Anopheles franciscanus*

*Culex tarsalis*



# Container breeders

- Natural –
  - Tree holes, rock pools, leaf axils
- Man-made containers -
  - Tires, cans, buckets, birdbaths, gutters, pet water dishes, plant pots and saucers, cans, paper cups, plastic bottles, etc.



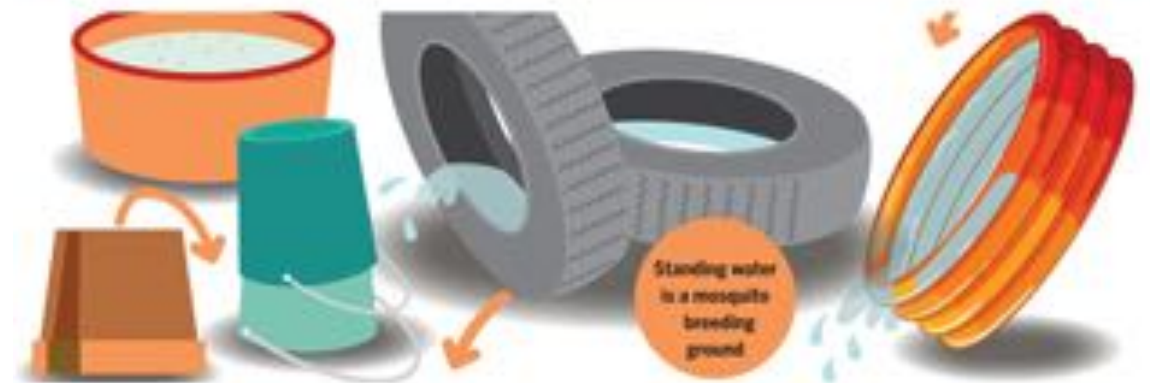
*Aedes aegypti*



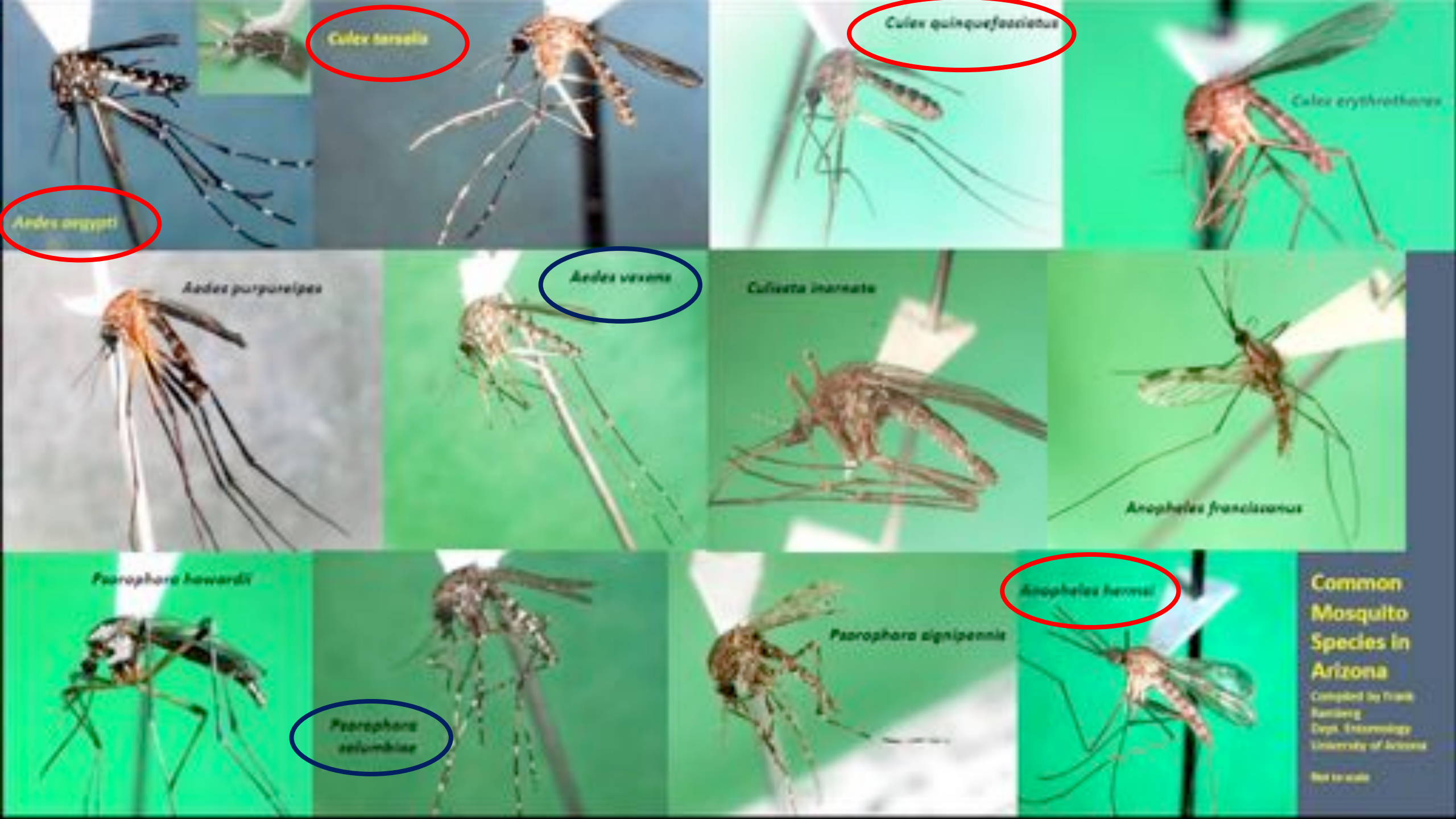
*Culex quinquefasciatus*

## CONTROL MOSQUITOES TIP 'n TOSS

Mosquitoes breed in standing water. To reduce the mosquito population around your home and property, eliminate all standing water and debris.







*Culex tarsalis*

*Culex quinquefasciatus*

*Culex erythrothorax*

*Aedes aegypti*

*Aedes purpureipes*

*Aedes vexans*

*Culiseta inornata*

*Anopheles francisxonus*

*Pedrophiara howardii*

*Pedrophiara columbica*

*Pedrophiara signipennis*

*Anopheles fernesi*

**Common Mosquito Species in Arizona**

Compiled by Frank Ramirez  
Dept. Entomology  
University of Arizona

Not to scale

# Main Arizona mosquito vectors of human diseases

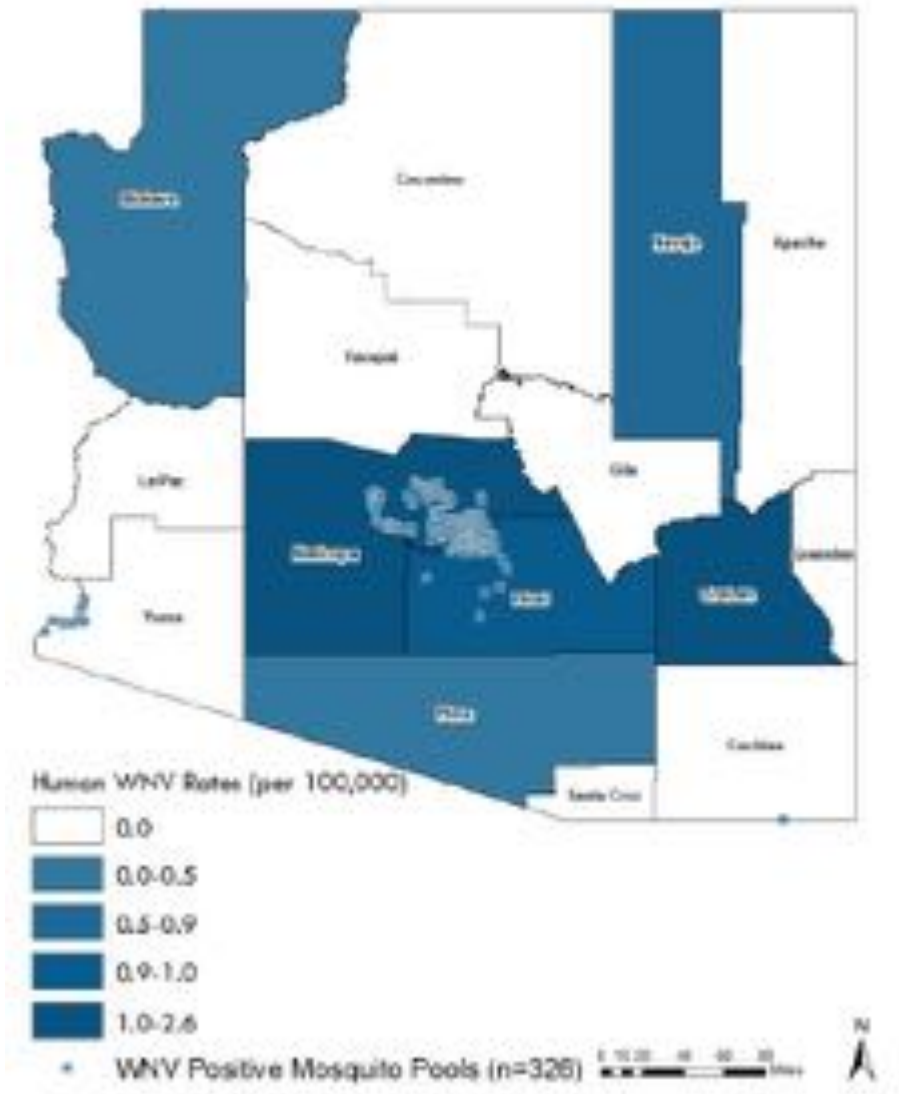


*Culex tarsalis*, Western encephalitis mosquito

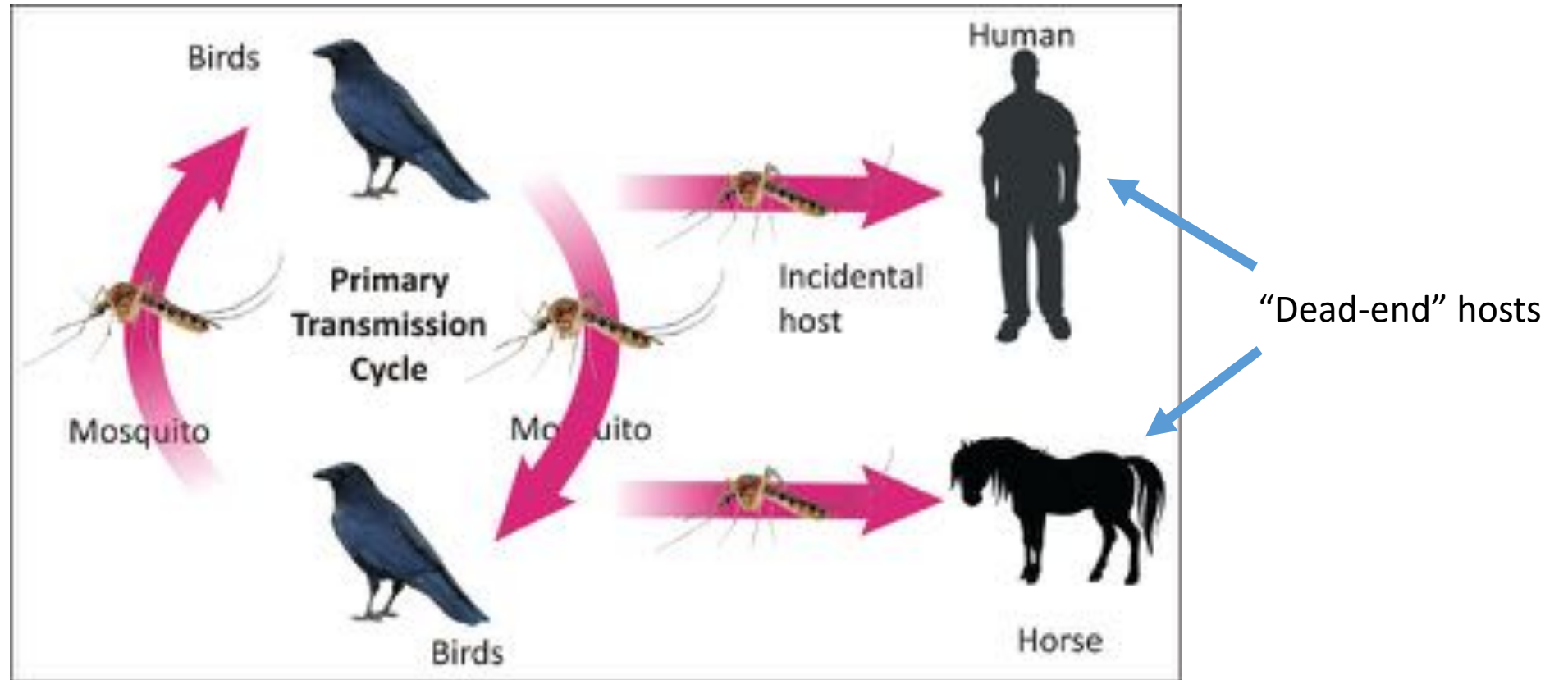


*Culex quinquefasciatus*, Southern house mosquito

- These Culex mosquitos are the main vectors of West Nile Virus (WNV) and St. Louis encephalitis in AZ.
- 1999 - WNV appeared in NY.
- 2003 – WNV appeared in AZ.
- About 100 reported human cases per year (usually serious neuro-invasive symptoms) and 8-10 deaths.



# WNV is really a bird disease

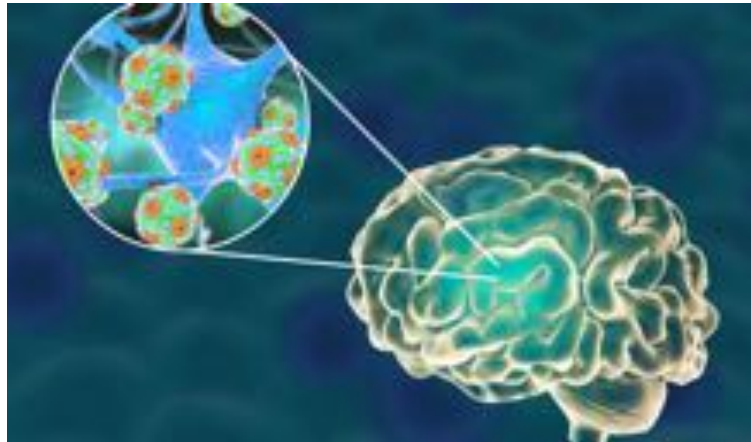




# About 80% of people infected with WNV show no symptoms

About 20% show mild symptoms lasting a few days to weeks:

- Fever
- Headache
- Body aches
- Vomiting
- Diarrhea
- Fatigue
- Skin rash



About 1% have serious neuro-invasive symptoms that can last months or even years:

- High fever
- Severe headache
- Stiff neck
- Disorientation or confusion
- Stupor or coma
- Tremors or muscle jerking
- Seizures
- Partial paralysis or muscle weakness

# Know your WNV vector

*Culex tarsalis*



- Breeds in ponds, streams and agricultural areas where water stands for weeks.
- Adults can fly 2 to 10 miles in a single night to find a bloodmeal.
- Prefers to feed on birds, but will also bite mammals (including humans) and reptiles.

*Culex quinquefasciatus*



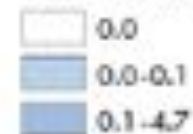
- Breeds in many waterbodies, including abandoned swimming pools as well as smaller containers and doesn't mind high organic content (i.e. latrines)
- Adults can fly 1 – 5 miles in a single night.
- Feeds on birds and mammals.

# St. Louis Encephalitis (SLE)

- SLE is a rare mosquito-borne virus in Arizona that mainly infects birds.
- Like WNV, the vectors are *Culex* mosquitoes.
- Most humans infected (99%) have no symptoms, but a few will have serious neuroinvasive disease, including meningitis and encephalitis.
- SLE outbreak in 2015 – 24 serious human cases, almost all in Maricopa Co.
- SLE virus found in *Culex* mosquitoes collected in Cochise Co. in 2017.



Human SLE Rates (per 100,000)



• SLE Positive Mosquito Pools (n=152)





# *Aedes aegypti* – the yellowfever mosquito

- Is not currently transmitting any disease in Arizona, but can transmit several viruses to humans:
  - Dengue fever, Chikungunya, Yellow Fever, Zika
- Uses small, temporary containers of water to raise its offspring
- Eggs can dry out and remain alive for months, waiting for more water.
- Lives with people (enters homes, feeds on human blood, uses human-made containers for egg-laying.
- Bites during the day, often preferring ankles.



How to recognize it:

Adults – black and white markings, lyre-shaped pattern on back.



Larvae – aquatic, worm-like, breathing tube (siphon)



Pupae – aquatic, horned, vaguely like tadpoles

# *Aedes aegypti* lifecycle



# Where to find *Aedes aegypti*

- In Arizona, *Aedes aegypti* is only found in close association with humans:
  - Lives in or around homes, **NOT** in native desert areas or agricultural fields.
  - Lays eggs in small water containers, **NOT** ditches or ponds. Even abandoned swimming pools are probably not attractive to them.
  - Prefers to feed on human blood, but will feed on other mammals (dogs and cats).







# DENGUE

- RESTLESSNESS
- RED SPOTS OR PATCHES ON THE SKIN
- LOSS OF APPETITE
- BLEEDING FROM GUMS OR NOSE
- JOINT PAIN
- HEADACHES
- HIGH FEVER
- PAIN BEHIND EYES
- NAUSEA AND VOMITING

# CHIKUNGUNYA

SEVERE JOINT PAIN MAINLY IN THE ARMS AND LEGS

RED SPOTS OR PATCHES ON THE SKIN

- HEADACHES
- MUSCLE PAIN
- HIGH FEVER



# ZIKA

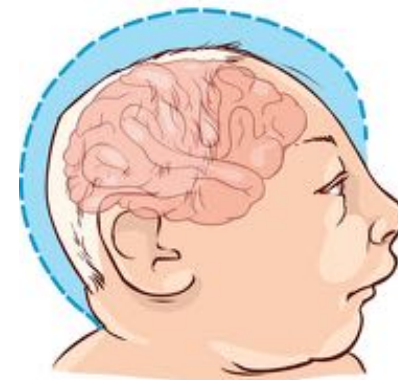


- JOINT AND MUSCLE PAINS
- BACK PAIN
- HEADACHES
- MILD FEVER
- RED EYES
- RED AND WHITE PATCHY SKIN RASH

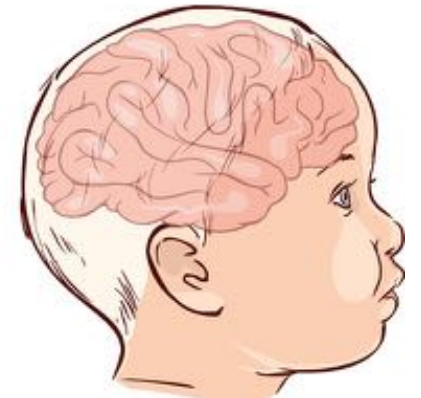
Symptoms of viruses transmitted by *Aedes aegypti* but not currently in Arizona.

Special risk associated with Zika infection during pregnancy

Microcephaly



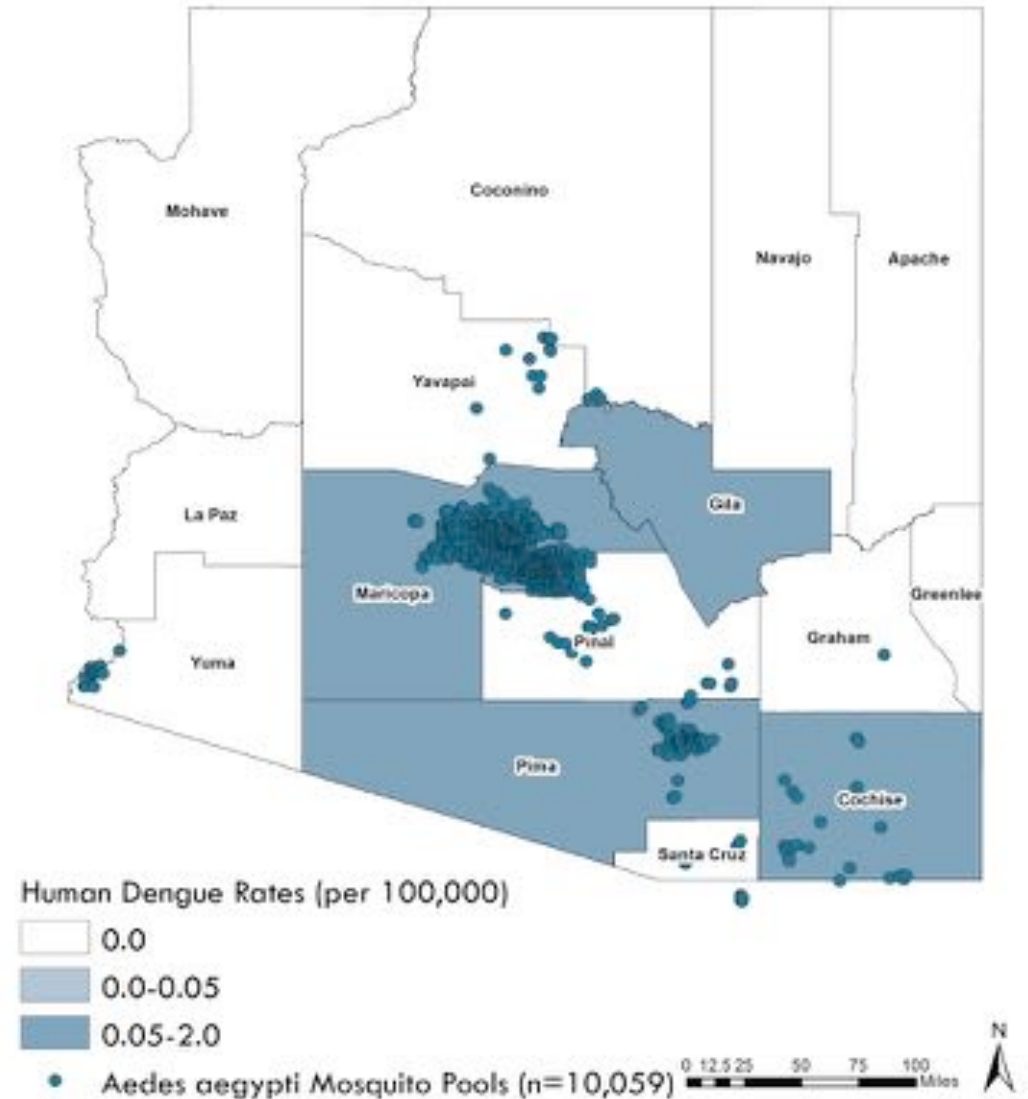
Normal head size



# *Aedes aegypti* in Arizona

- Historical records from the early 1900s.
- Disappeared in the 1940s-50s.
- Reappeared in Tucson in 1994.
- Now established in towns and cities throughout south and central AZ.

AZ Dept. of Health Services 2018 data



# Should we be worried about *Aedes aegypti*?



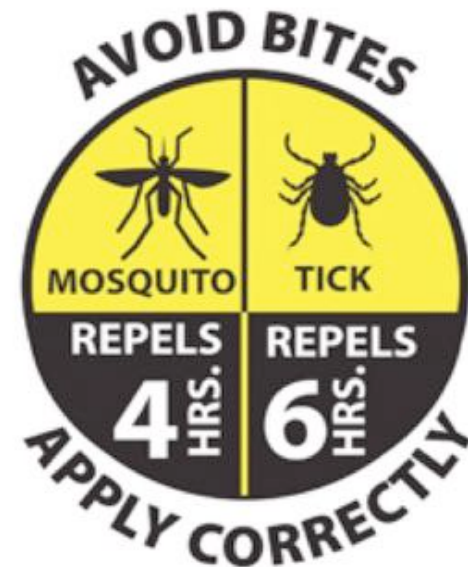


# Protecting yourself from mosquito-borne diseases

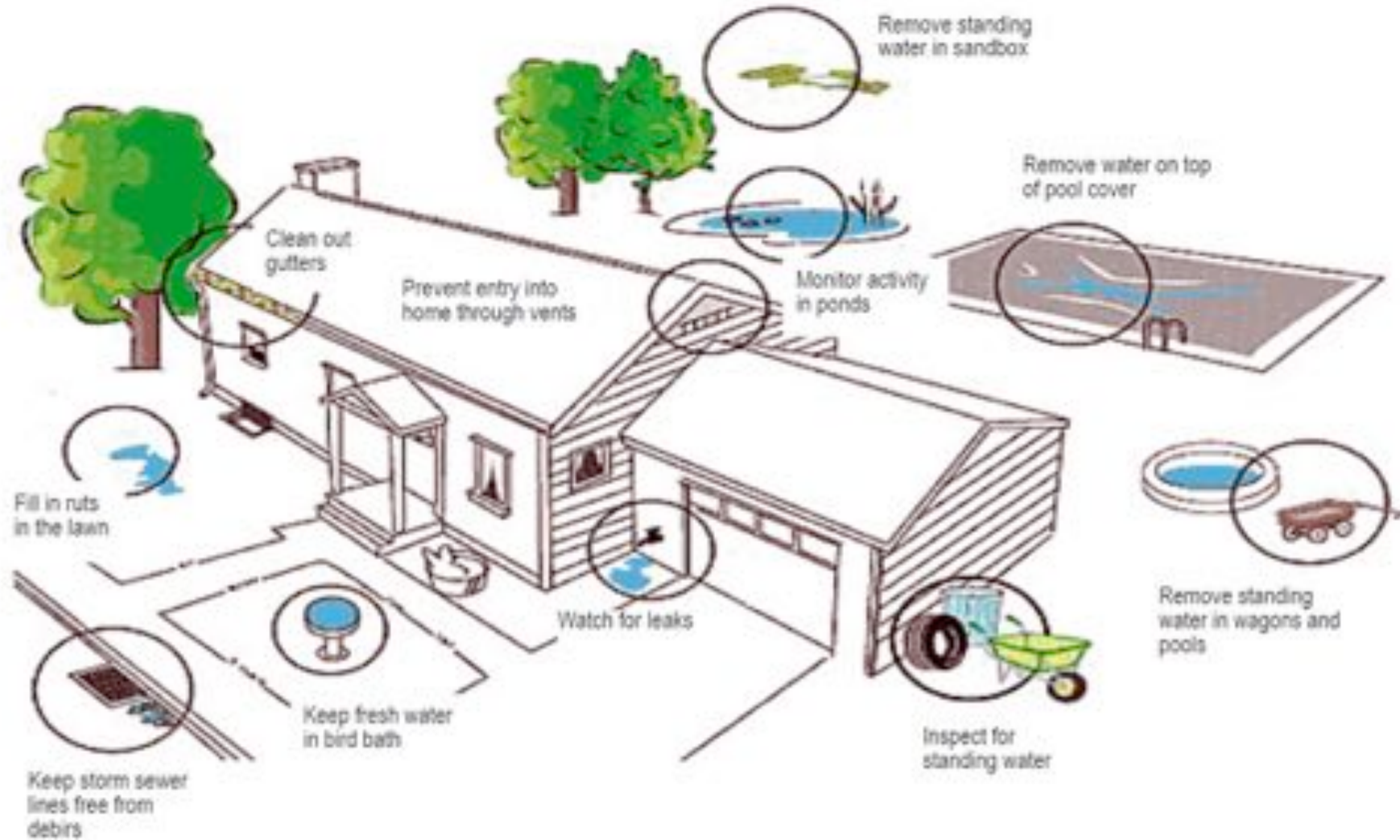
- Personal protection – avoid mosquito bites
  - Wear repellent
  - Use window and door screens to keep mosquitoes out.
- Remove mosquito larval habitat on your property.

Effective repellents contain one of these active ingredients:

1. DEET
2. Picaridin
3. Lemon Eucalyptus Oil



# Don't be a mosquito farmer!



# Mosquito surveillance and control

## Surveillance

- Inspection of water bodies or containers for larvae.
- Regular trapping of mosquitoes to track phenology and estimate density.
- Testing of collected adult mosquitoes for pathogens. (mosquito 'pools')



## Control

Example (*Culex* mosquitoes in Maricopa Co.)

- Periodic larviciding of public drains in high-mosquito neighborhoods.
- Truck-mounted or hand-held ULV pyrethroid adulticide applications 1-mile block in response to:
  1. > 30 *Culex* in trap catch.
  2. Presence of WNV or other virus in collected mosquitoes.

CURRENT SPRAYING TECHNIQUES DO NOT CONTROL Aedes Aegypti



# Alternative methods for controlling *Aedes aegypti* – lethal GAT traps



# In2Care traps





# Different ways to trap your mosquito

- Most mosquitoes (including Culex)



CO2 trap – attracts females looking for blood



Gravid trap – attracts females looking for egg-laying sites

- Aedes mosquitoes



BG Sentinel trap – attracts Aedes females looking for blood



Oviposition trap – attracts females looking for egg-laying sites



## How to recognize mosquitoes

The insect body is divided into three basic sections:

1. **head** – includes eyes, proboscis, palps & antennae

2. **thorax** – three pairs of legs & two wings attached

3. **abdomen**

4. **legs**

wings



# Is it a mosquito or not?



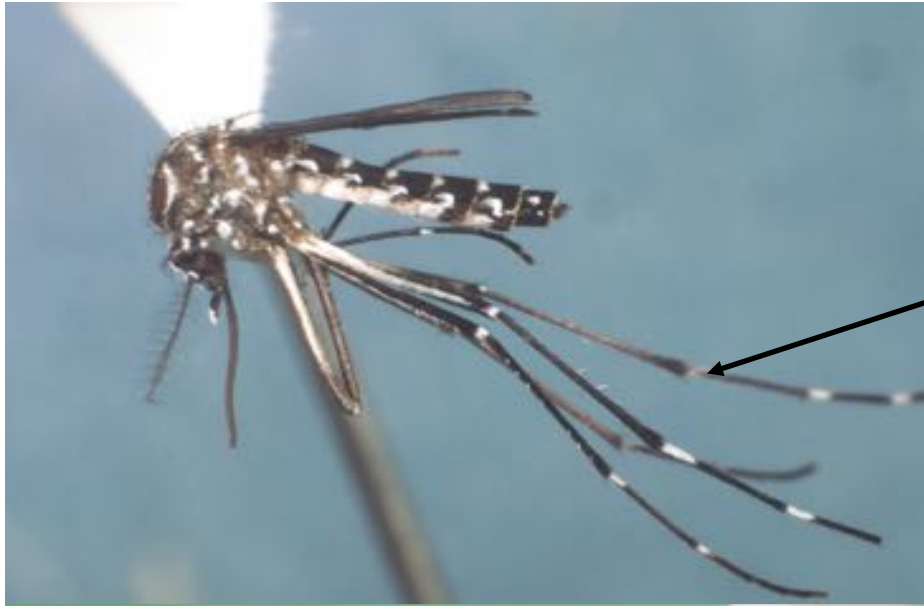
Crane fly

Mosquitoes with proboscis

A mosquito always has a long, slender proboscis. Other flies, like the crane fly at left may have an elongated face, but it will not be as long or slender as the mosquito proboscis.

elongated snout on crane fly head

# *Aedes aegypti* – vector of dengue fever, Zika



Black and white mosquito with distinctive striped legs.



Lyre or harp shape on back of thorax

*Culex quinquefasciatus* – vector of West Nile virus



proboscis dark, unbanded

legs unbanded



**Thank you**



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