Phenology of Container-Breeding Mosquitoes in Southwest Virginia

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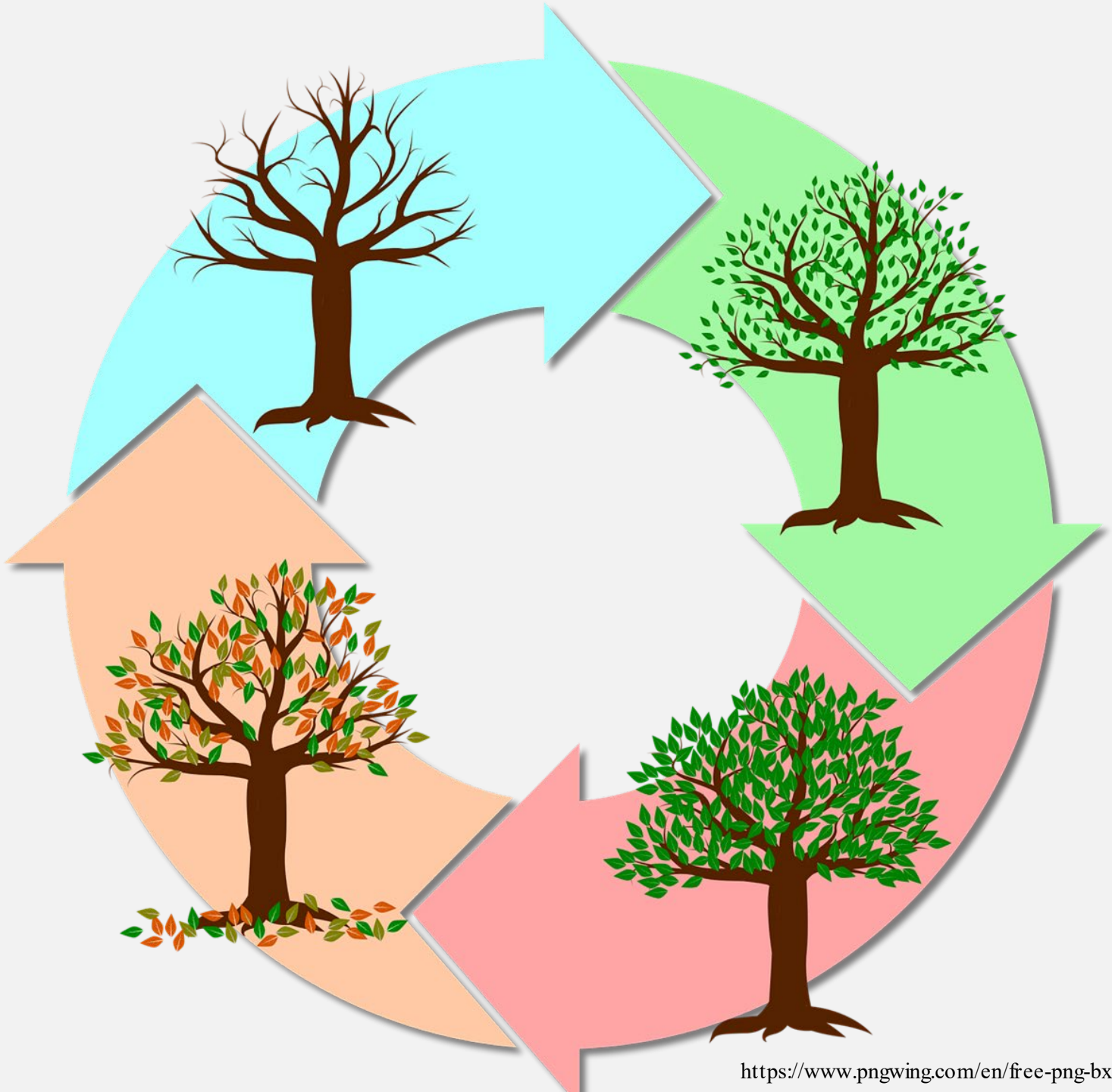
What is phenology?

- The study of natural events that occur seasonally throughout plant and animal populations.
- Temperature and precipitation are important factors.



https://www.pngwing.com/en/free-png-bxwpx

USA NPN National Phenology Network. Why Phenology? | USA National Phenology Network. (n.d.). Retrieved November 16, 2021, from https://www.usanpn.org/about/why_phenology.

Why phenology?

Can be used to gauge climate change and the impacts it has on insect populations.

Helps with understanding of the spread of mosquito-borne diseases.

An indicator of when certain vector-borne diseases might be a greater risk.

Provides information on when to test mosquito populations for diseases and spray for mosquito control.

1. Gentes, Z. (2021, March 24). *Mosquito forecasting: How phenology data is powering new advances*. Entomology Today. Retrieved November 16, 2021, from https://entomologytoday.org/2021/03/24/mosquito-forecasting-phenology-data-new-advances/#:~:text=We%20may%20not%20be%20as,spread%20of%20mosquito%2Dborne%20diseases.
2. *USA NPN National Phenology Network*. Why Phenology? | USA National Phenology Network. (n.d.). Retrieved November 16, 2021, from https://www.usanpn.org/about/why_phenology.

Photo Credit: http://trashtalkinlynn.blogspot.com/2017/09/get-rid-of-mosquito-breeding-old-tires.html

Photo Credit: Christopher Waldrop

Container-Breeding Mosquitoes

- Lay their eggs in areas where standing water collects such as man made objects or tree holes.
  - Tires
  - Birdbaths
  - Wheelbarrows
- Eggs are deposited on the sides of the containers (typically on substrates) above the water line and stick like glue.
- Eggs can withstand being dried out for up to 8 months and hatch when flooded with water again.

Blog Administrator. (2016, March 22). *Zika, mosquitoes, and standing water*. Centers for Disease Control and Prevention. Retrieved January 19, 2022, from https://blogs.cdc.gov/publichealthmatters/2016/03/zika-and-water/

Focus was on Three Specific Container-Breeding VA Mosquito Species

Figure 1: *Aedes triseriatus*
Photo credit: Ohio Department of Health

Figure 2: *Aedes japonicus*
Photo credit: Wikipedia

Figure 3: *Aedes albopictus*
Photo credit: James Gathany, USCDCP

Aedesjaponicus
(Asian bush mosquito)

Key characteristics: Light coloration with golden lines formed by scales located on the scutum

- Invasive species in the United States (native to Korea Japan, Russia, Southern China)
- White-tailed deer is the main host followed by humans
- Active during the day and at sunset
- Very adaptable and a potential nuisance
- Competent vectors of: Chikungunya, Dengue, Easter equine encephalitis, West Nile virus, La Crosse virus

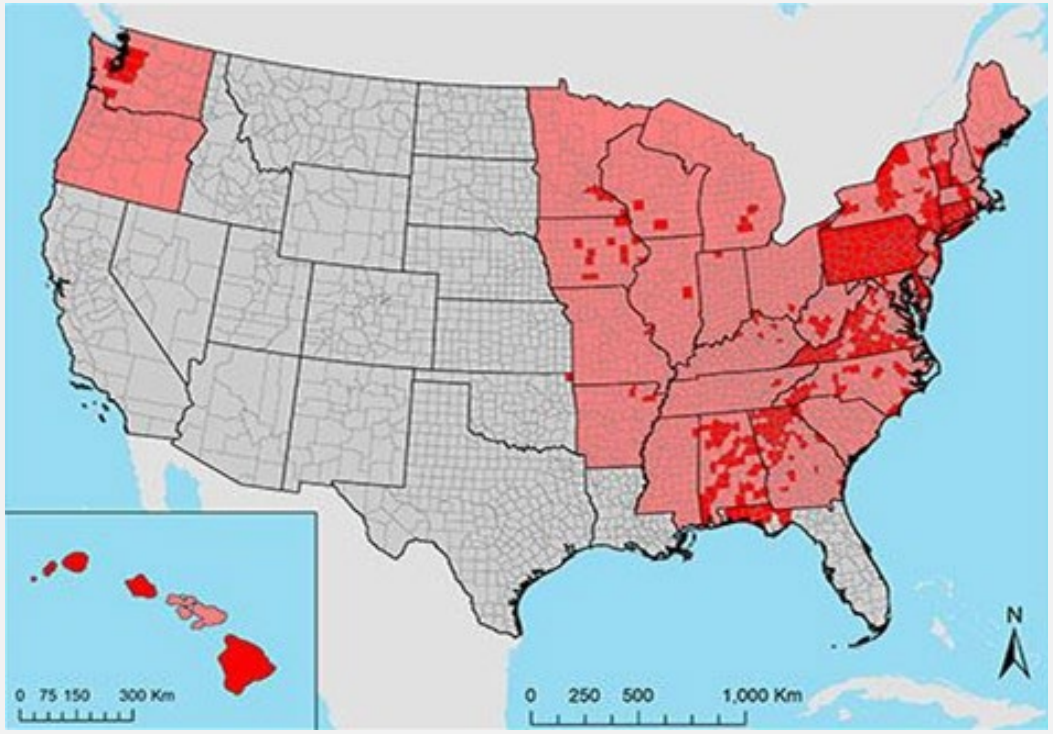


Figure credit: https://entnemdept.ufl.edu/creatures/AQUATIC/aedes_japonicus.html

East Asian Bush or Rock Pool Mosquito. Mosquito Alert. (2021, July 14). Retrieved January 25, 2022, from http://www.mosquitoalert.com/en/info-mosquitoes/aedes-japonicus/

Lippi, C., Kaufman, P., & Buckner, E. A. (n.d.). *common name: Asian bush mosquito, Asian rock pool mosquito scientific name: Aedes japonicus japonicus (Theobald, 1901) (Insecta: Diptera: Culicidae)*. Aedes japonicus japonicus. Retrieved January 19, 2022, from

Aedes albopictus
(Asian tiger mosquito)

Key characteristics: Small with black and white colorations and white bands on the legs.

- Invasive species, originated from Southeast Asia
- Active during day from the early morning to the late afternoon.
- Significant nuisance species with high phenotypic plasticity
- Opportunistic feeder, but prefer human blood
- Known vectors of Dengue and Chikungunya virus

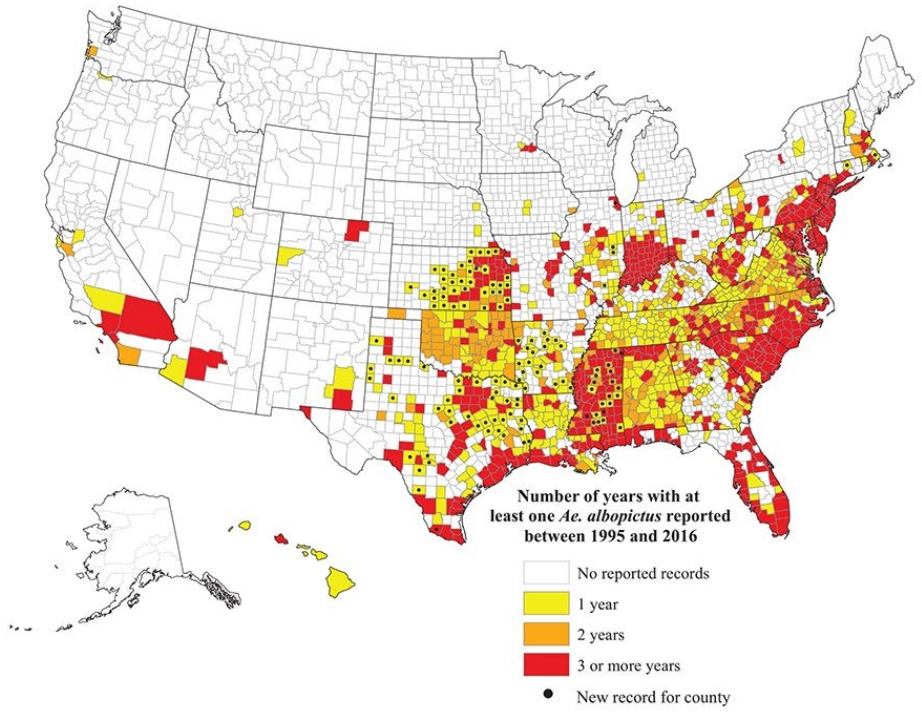


Figure credit: https://us.biogents.com/aedes-albopictus-asian-tiger-mosquito/

Aedes albopictus factsheet for experts. European Centre for Disease Prevention and Control. (2021, October 25). Retrieved January 20, 2022, from https://www.ecdc.europa.eu/en/disease-vectors/facts/mosquito-factsheets/aedes-albopictus

Aedestriseriatus
(Eastern tree hole mosquito)

Key characteristics: Dark legs that are unbanded with a black band running down the middle of their scutum

- Most active early in the morning and late in the afternoon
- Native vector of La Crosse virus
  - Disease typically occurs between July and September.
- Typically found in wooded areas
- Prefer biting deer and squirrels, but will feed on humans too

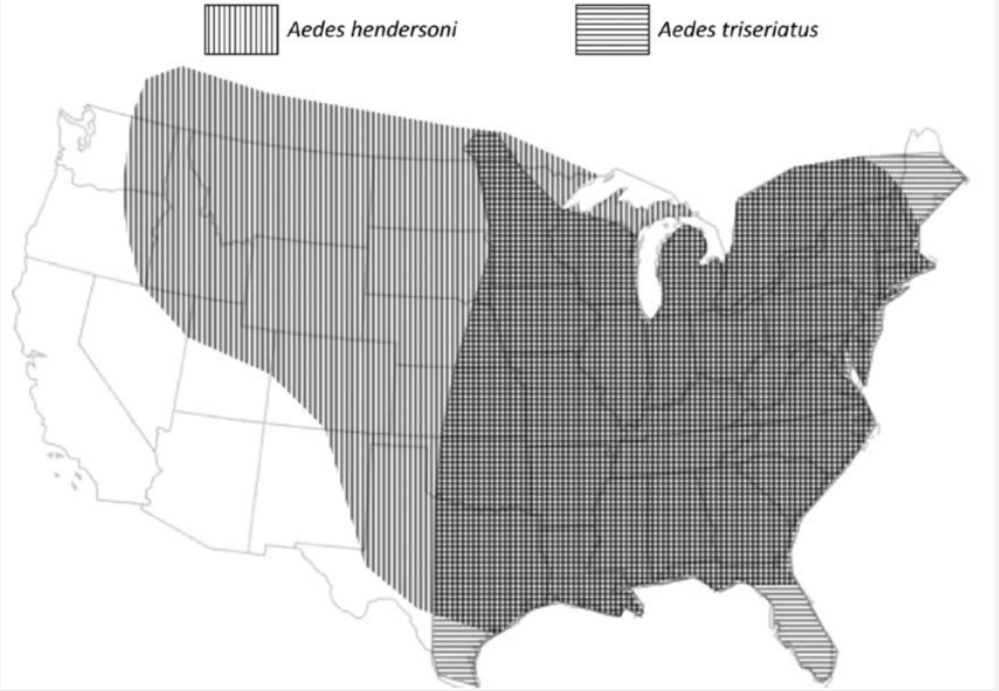


Figure credit: https://www.researchgate.net/figure/Ranges-for-Aedes-triseriatus-horizontal-lines-and-Aedes-hendersoni-vertical-lines_fig1_326904513

Aedes triseriatus factsheet for experts. European Centre for Disease Prevention and Control. (2021, June 1). Retrieved January 20, 2022, from https://www.ecdc.europa.eu/en/disease-vectors/facts/mosquito-factsheets/aedes-triseriatus

What time of year are container breeding mosquitoes actively laying eggs?

Collection of Mosquito Eggs

- Oviposition cups set out at multiple locations around the Blacksburg, VA area.
  - Black cups to resemble tree holes
- Seed germination papers
- Papers collected weekly
- Embryonation
- End of June to beginning of October

Oviposition Cup

Locations of Field Sites

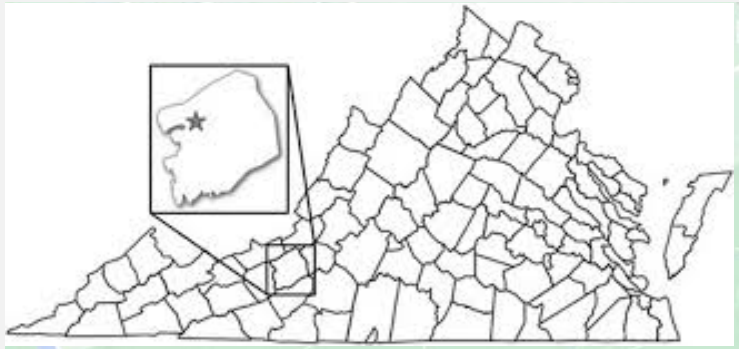
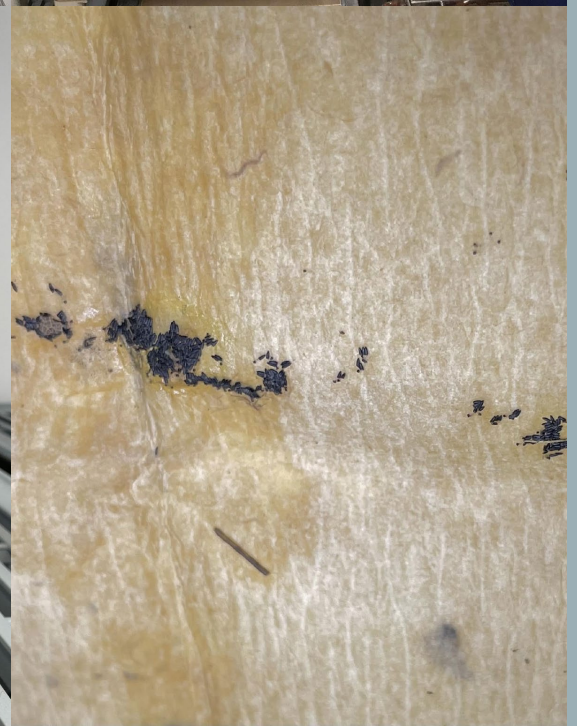


Figure Credit: Joseph Andrew Vinson, Scott M. Barrett, W. Michael Aust, Chad Bolding

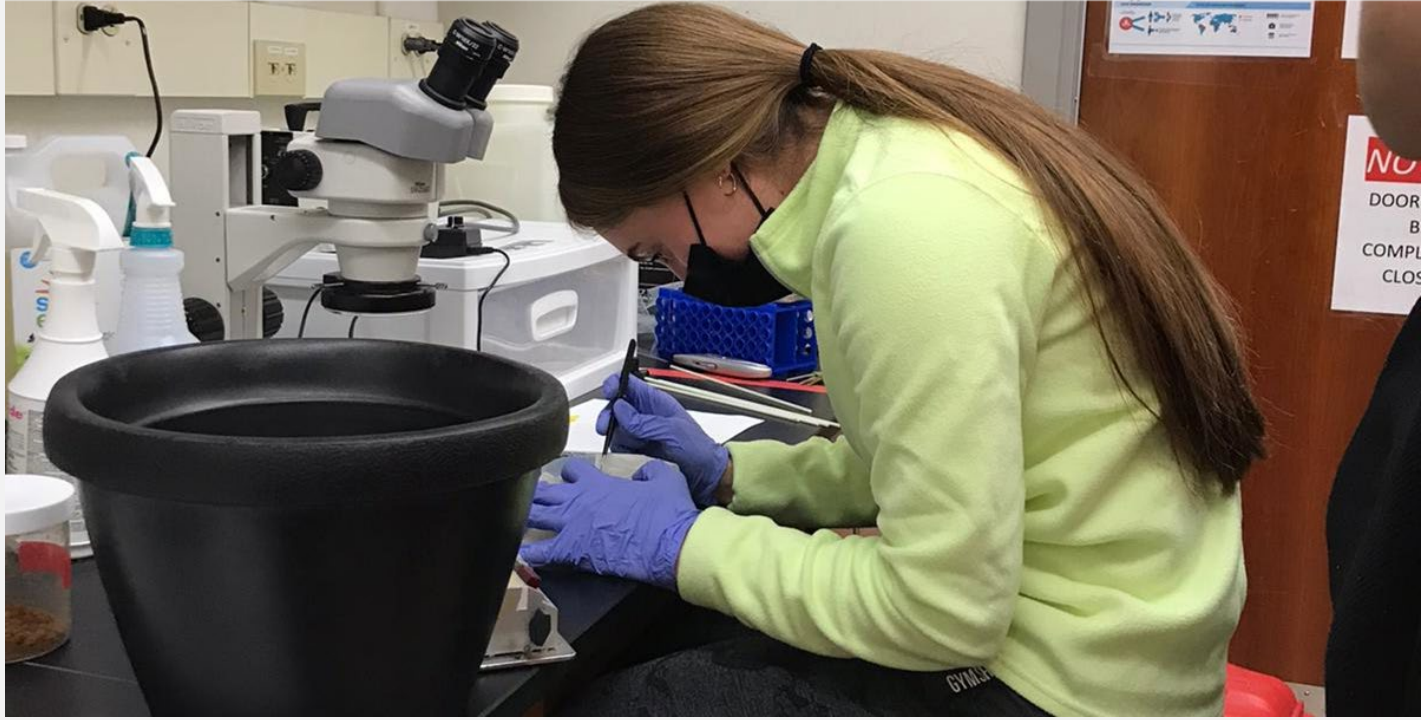


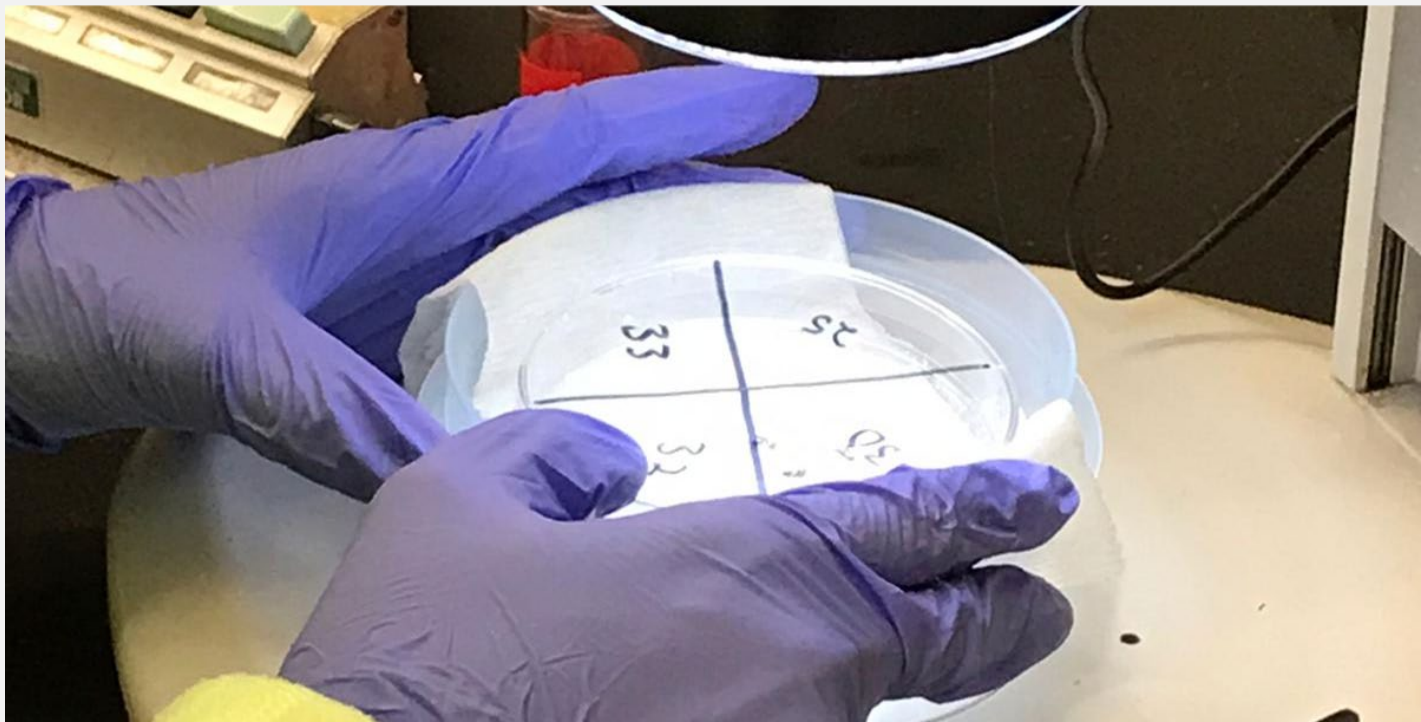
Rearing of Mosquito Eggs

- Liver-yeast powder (3:2)
- Two floods per paper
- Pupae separated from larvae and put into emergence containers.
- Adults chilled for morphological I.D.
- 470 egg papers
  - 168 already flooded
  - June 28, 2021 – August 26, 2021

Identification of Adult Mosquitoes

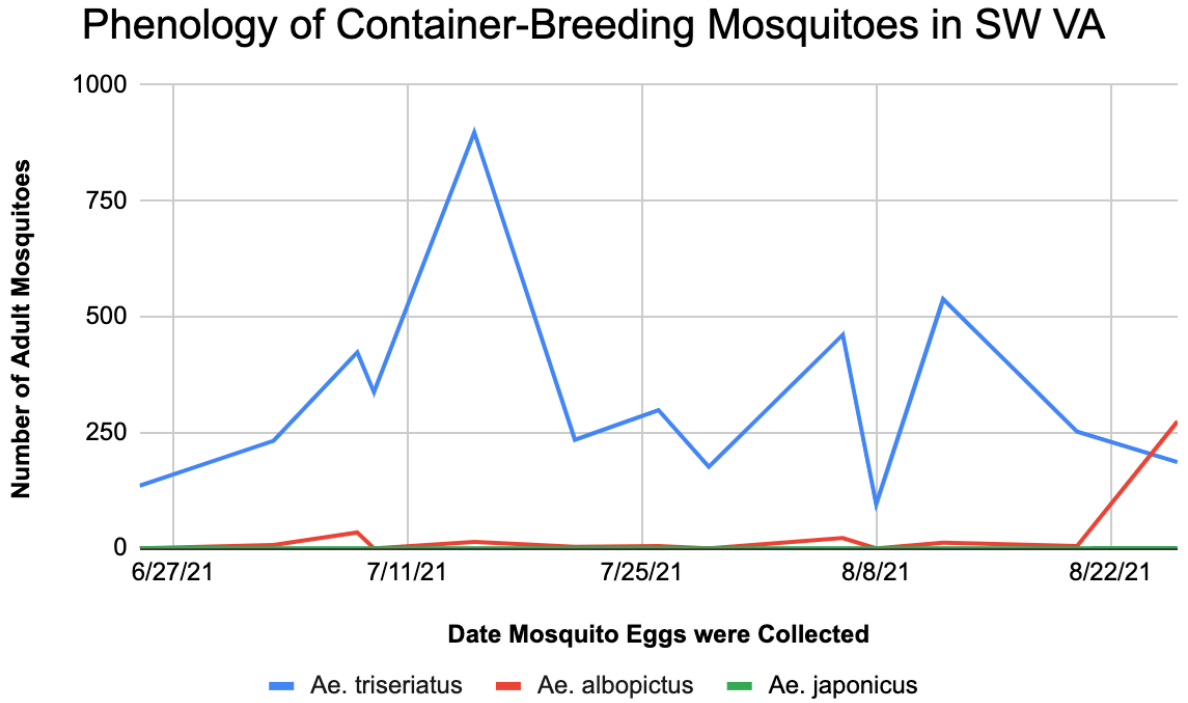
- Adult mosquitoes collected from cages with aspirators.
- Vials of mosquitoes chilled in ice.
- Viewed under microscope for morphological I.D with a dichotomous key.
- Separation of species.
- Segmented petri dish for counting.

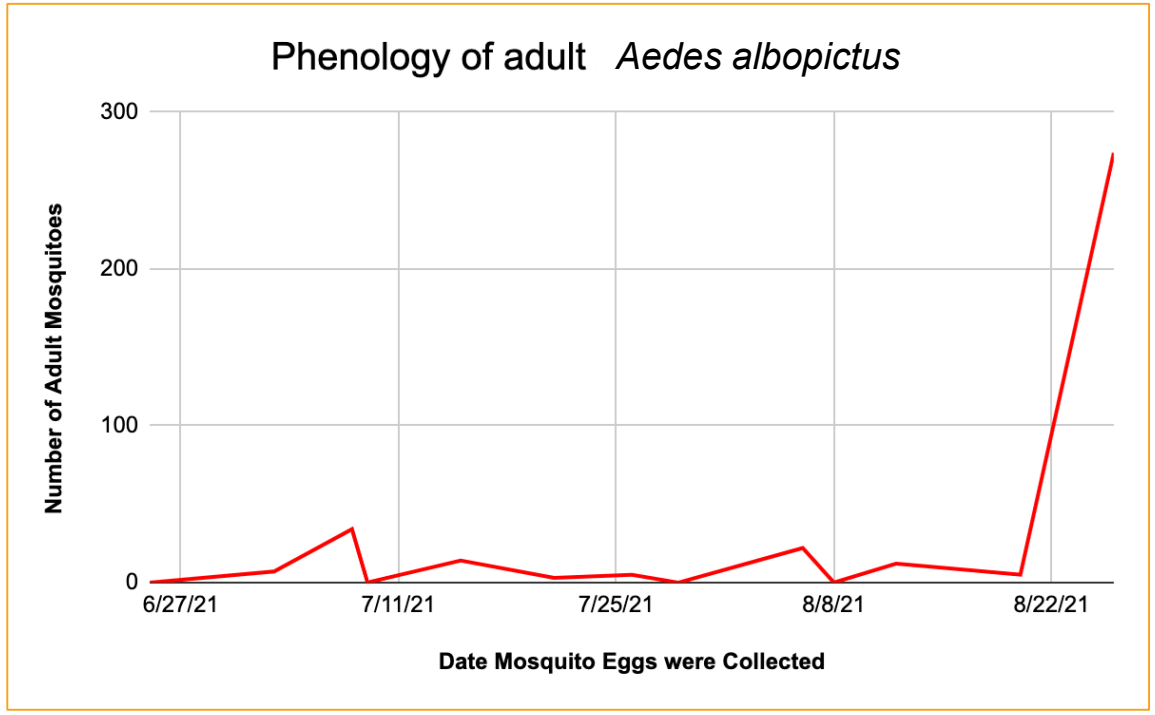


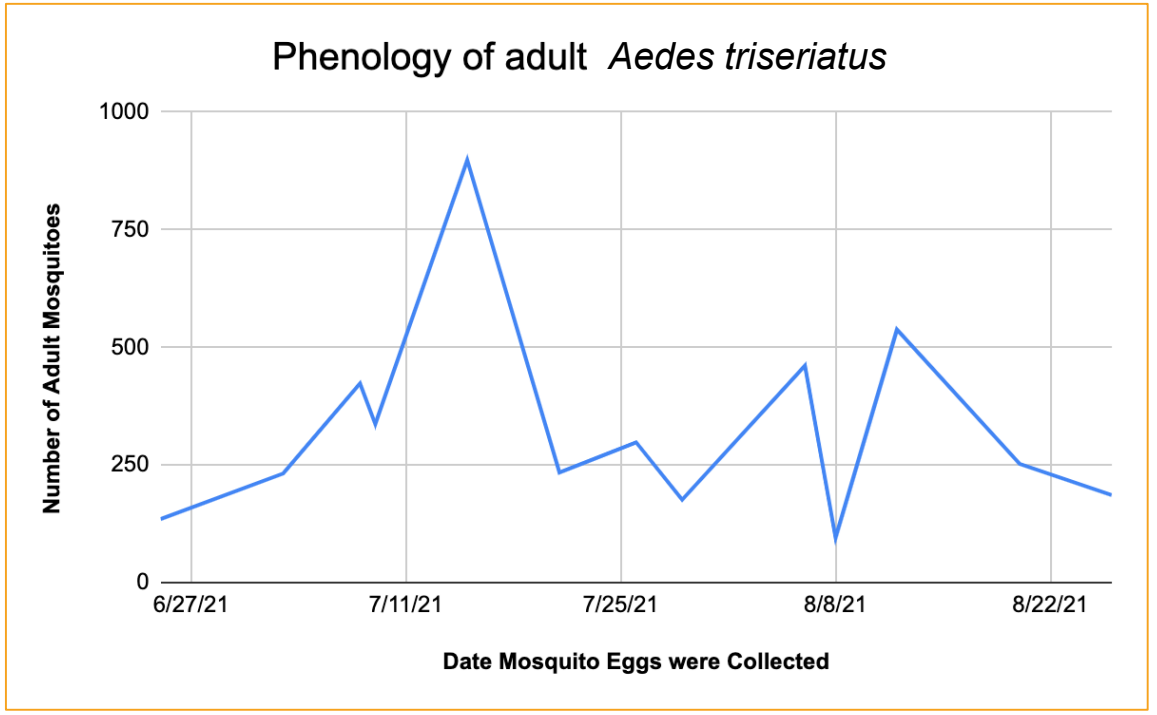


Results (to date)

- Total of 470 mosquito egg papers from June 26, 2021 – October 8, 2021
  - 168 papers flooded so far
- 4,641 adult F1 mosquitoes
- Totals:
  - 4,265 adult Ae. triseriatus
  - 376 adult Ae. albopictus
  - 0 adult Ae. Japonicus







Individual Phenology Graphs by Species

FUTURE DIRECTIONS

- Still in the process of flooding mosquito papers (about 300 more)
- Can expect to see more *Ae. albopictus* and *Ae. japonicus* adults.
- Will evaluate seasonal patterns of these loc mosquitoes.
- May look at variations in mosquito species based on type of site location.

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EASTWOOD LAB

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Questions?

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