



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

Assessment of ornithophilic mosquito attraction to bird-scent baited traps

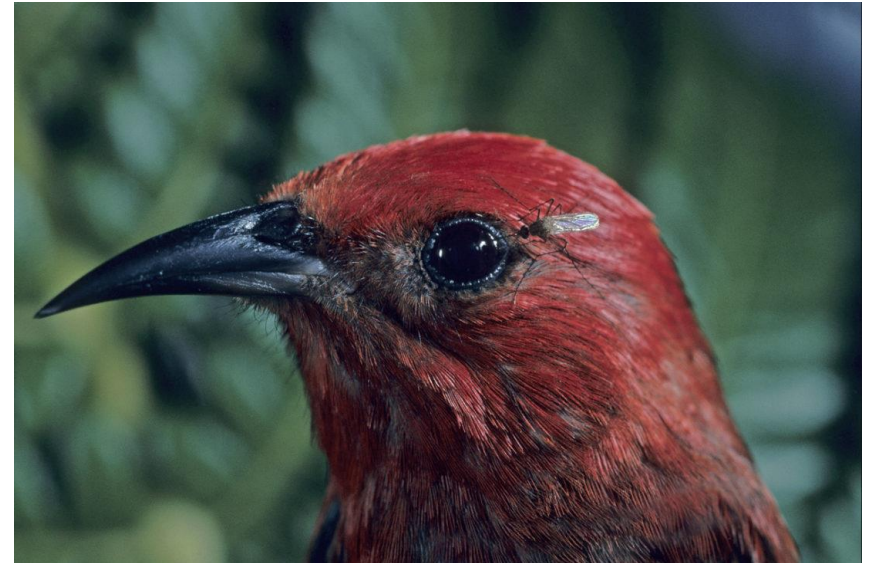


NALANY A. RICHARDSON^{1,2}, DANICA M. SHANNON^{1,2}, MARY BEARD^{1,2}, SKYLER NICHOLS^{1,2}, AND DANIEL PEACH^{1,2}

¹Savannah River Ecology Laboratory, University of Georgia, Aiken, SC, 29802, USA, ²Department of Infectious Disease, University of Georgia, Athens, GA, 30602, 2025 Georgia Mosquito Control Association Meeting | October 15th, 2025

What is an ornithophilic mosquito?

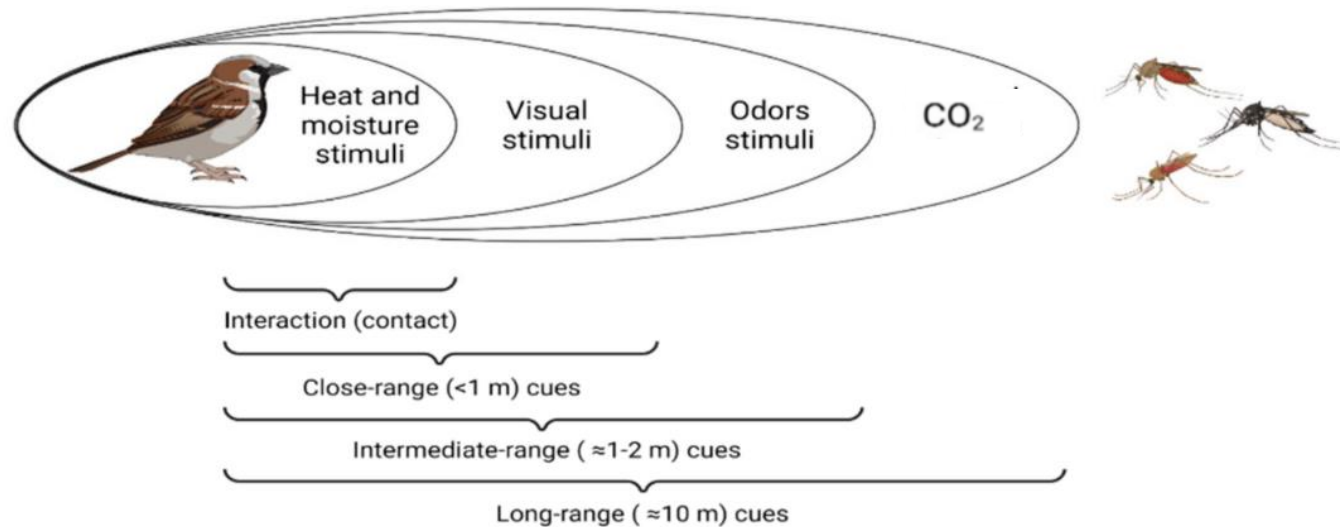
- Ornithophilic → preferentially feed on birds
- Anthropophilic → preferentially feeds on humans
- Examples
 - *Culex* spp.
 - *Culiseta melanura*



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

Mosquito attraction is multi-modal

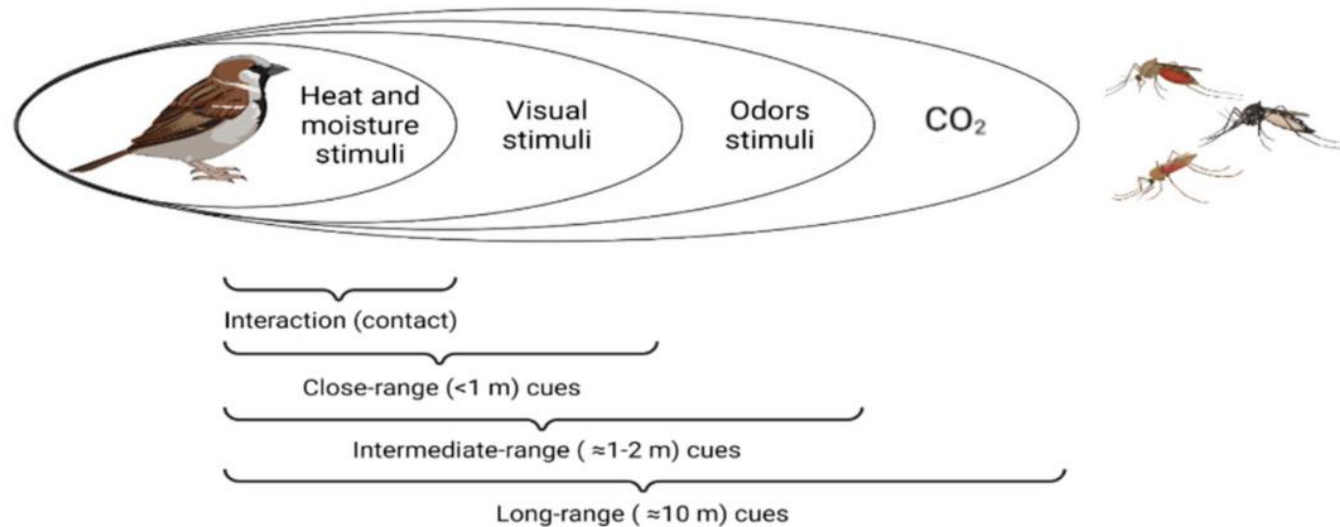
- CO₂ → “activator”
- Olfaction → VOCs from environment/host
- Vision → dark colors, shapes and contrast
- Heat & moisture



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

Mosquito attraction is multi-modal

- $\text{CO}_2 \rightarrow$ “activator”
- **Olfaction $\rightarrow$ understudied in mosquito-avian interactions**
- Vision $\rightarrow$ dark colors, shapes and contrast
- Heat & moisture



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA



Significance of *Culiseta melanura*

- Ornithophilic mosquito
 - “bird-loving”
- Primary hosts
 - **Passerines** (e.g., cardinals, sparrows...)
- Eastern Equine Encephalitis Virus (EEEV) vector
- **Spillover risk**
- Significant vector competence
 - **Early buildup in environment**
- Overwinters as larvae
 - Crypt-dwelling



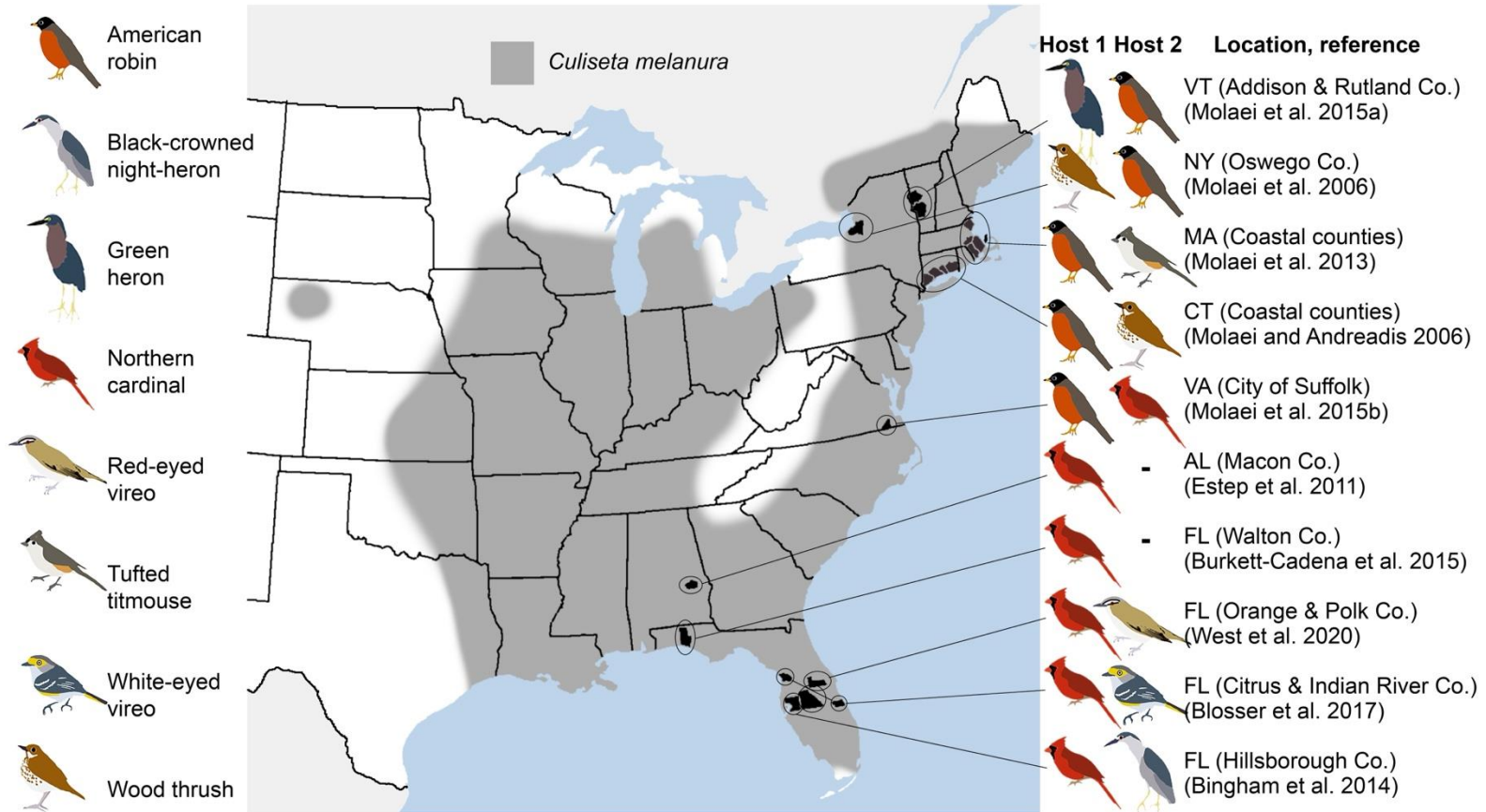
Image courtesy of the CDC Public Health Image Library



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

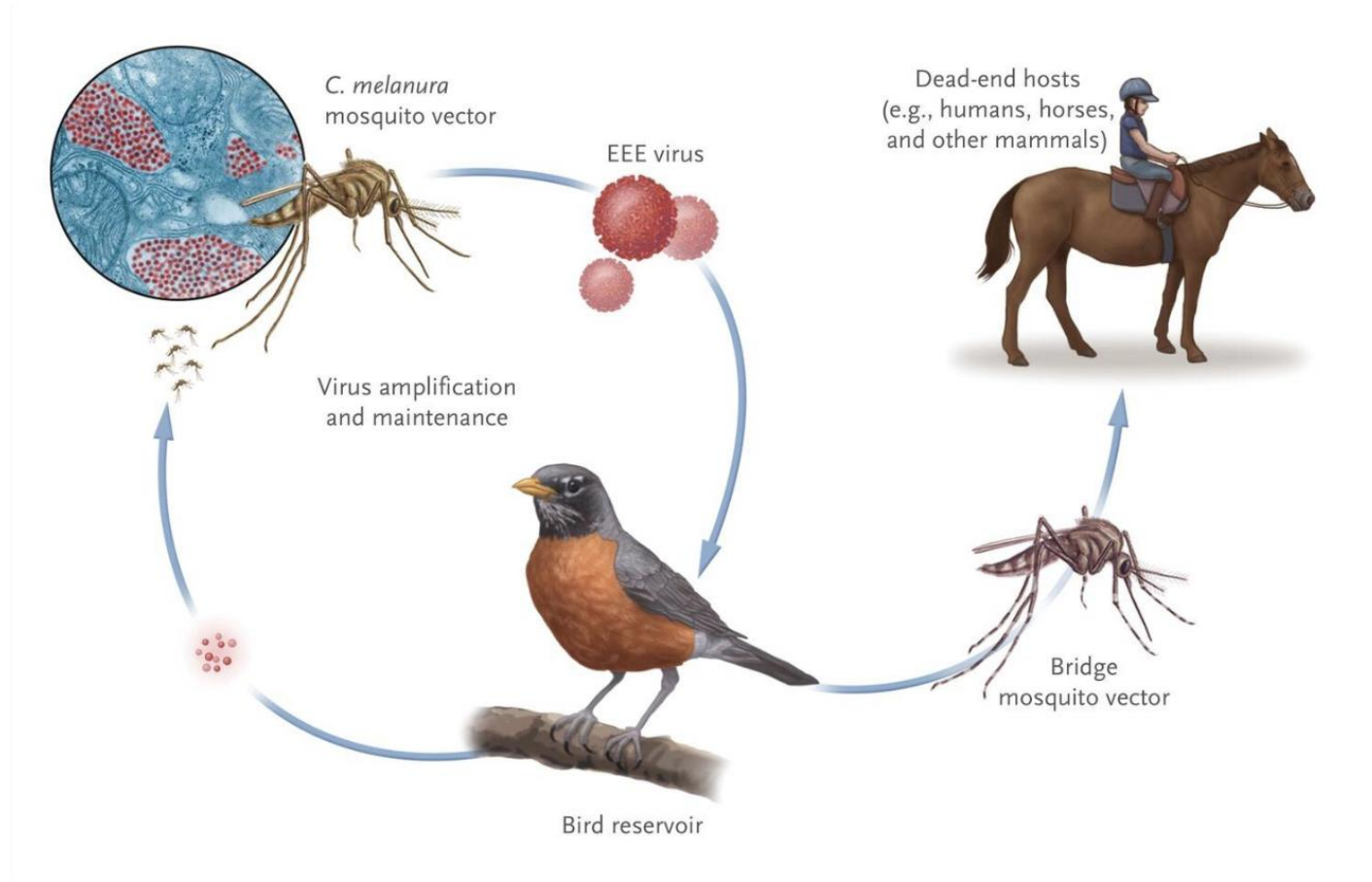


Range of *Culiseta melanura*



**Savannah River
Ecology Laboratory**
UNIVERSITY OF GEORGIA

EEEV transmission cycle



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

West, R. G. *et al.* (2020).

EEEV bridge vector examples



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

Image credits: FL medical entomology
laboratory and the CDC

Eastern equine encephalitis

- Encephalitic alphavirus
- Select agent
 - **Highest case fatality of any alphavirus**
 - Potential bioterrorism weapon
- **No vaccine** or specific treatment for **humans**
- Signs/symptoms
 - Febrile illness
 - Meningitis, encephalitis, altered mental status, & coma

Eastern equine encephalitis virus human disease cases by year of illness onset, 2003-2023

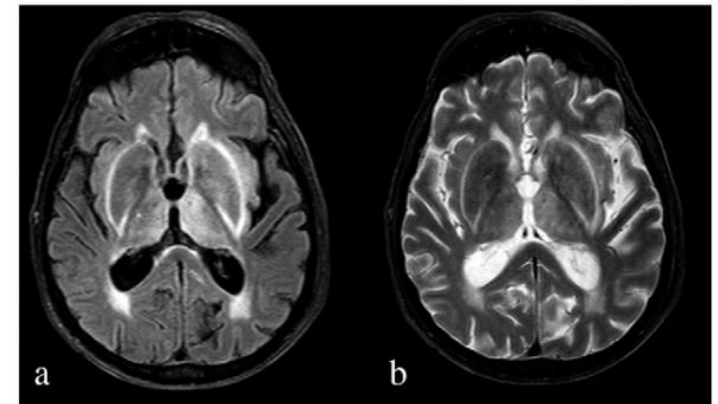
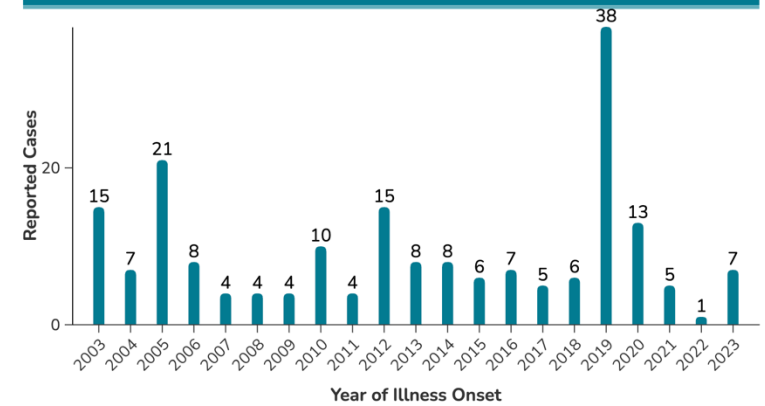


Fig. 1. T2 FLAIR (A) and T2-weighted (B) images from Subject 1 demonstrate T2 prolongation in the basal ganglia, thalami, and subinsular white matter with marked hyperintense signal in the external capsules bilaterally.

Alternative surveillance tool

- Sentinel chickens
 - \$\$, husbandry, animal use permits + training
- Bird-scented traps
 - Low cost
 - Rapid deployment
 - No specialized personnel
 - Used in conjunction with CDC light traps



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

Image credit: Christina House / For The Times. 2014. 'Sentinel chickens' form a front line of defense against West Nile'

Aim: “Do synthetic bird-derived odor blends increase trap capture rates?”

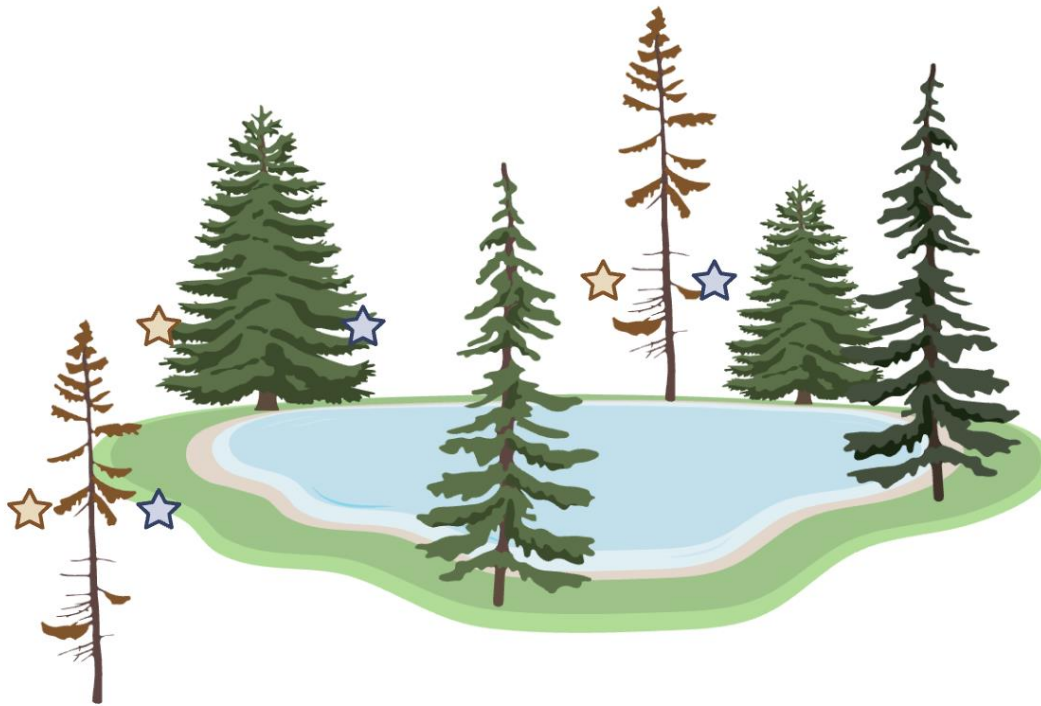
Hypothesis: The more accurately odors mimic real avian hosts, the stronger the attraction. Therefore, a whole-body blend should be more attractive.



**Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA**

Experimental design: field site

- Paired traps were spaced 5-6ft apart
- Pairs were spaced 20-60ft apart



 12-24hr



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

Experimental design: chemical blends

- Blend 'a'
 - 1 ul heptanal
 - 5 ul octanal
 - 50 ul nonanal
 - 10 ul decanal
 - 5 ul 3-octanone
 - 7 ul sulcatone
 - 2 ul benzaldehyde
 - Chicken headspace extract
- Blend 'b'
 - 21 ul hexanal
 - 12 ul alpha-pinene
 - 12 ul benzaldehyde
 - 23 ul myrcene
 - 32 ul nonanal
 - Chicken feather extract

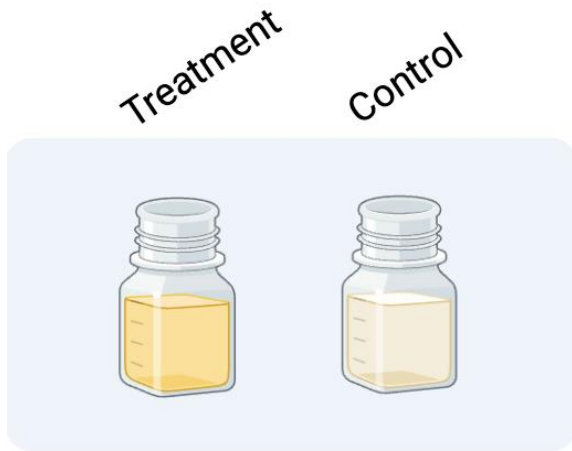


Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

Current trapping method



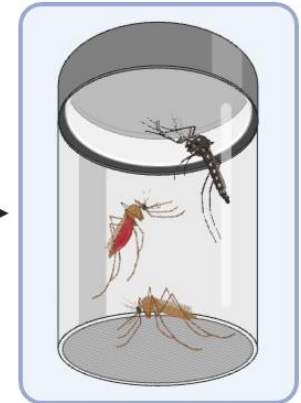
12-24hr



Produce chemical blends from the literature (e.g., chicken odors)



Deploy treatment (blend) and control (pentane) trap to field sites



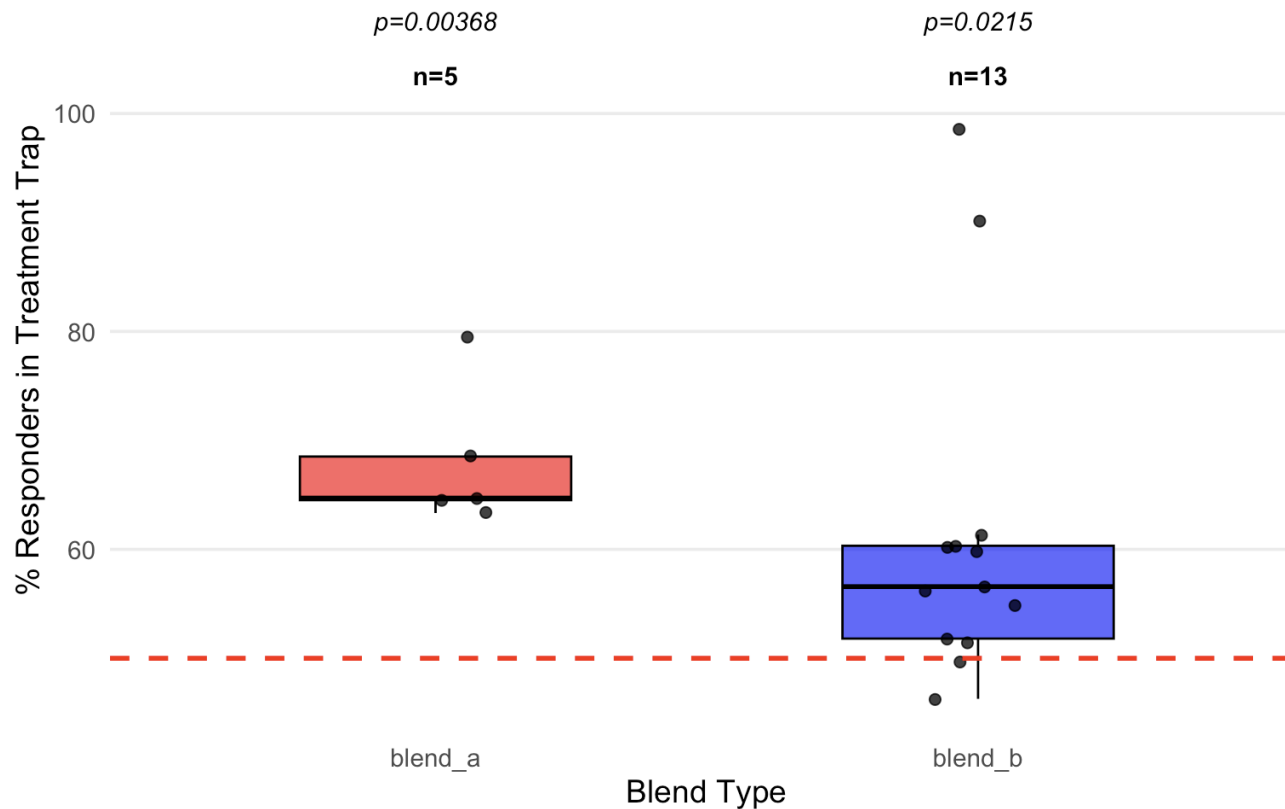
Assess capture rates and morphologically ID samples



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

Results

% Attraction to Treatment Trap by Blend



Future Aim: Identify what passerine-derived volatiles attract *Culiseta melanura* to avian hosts

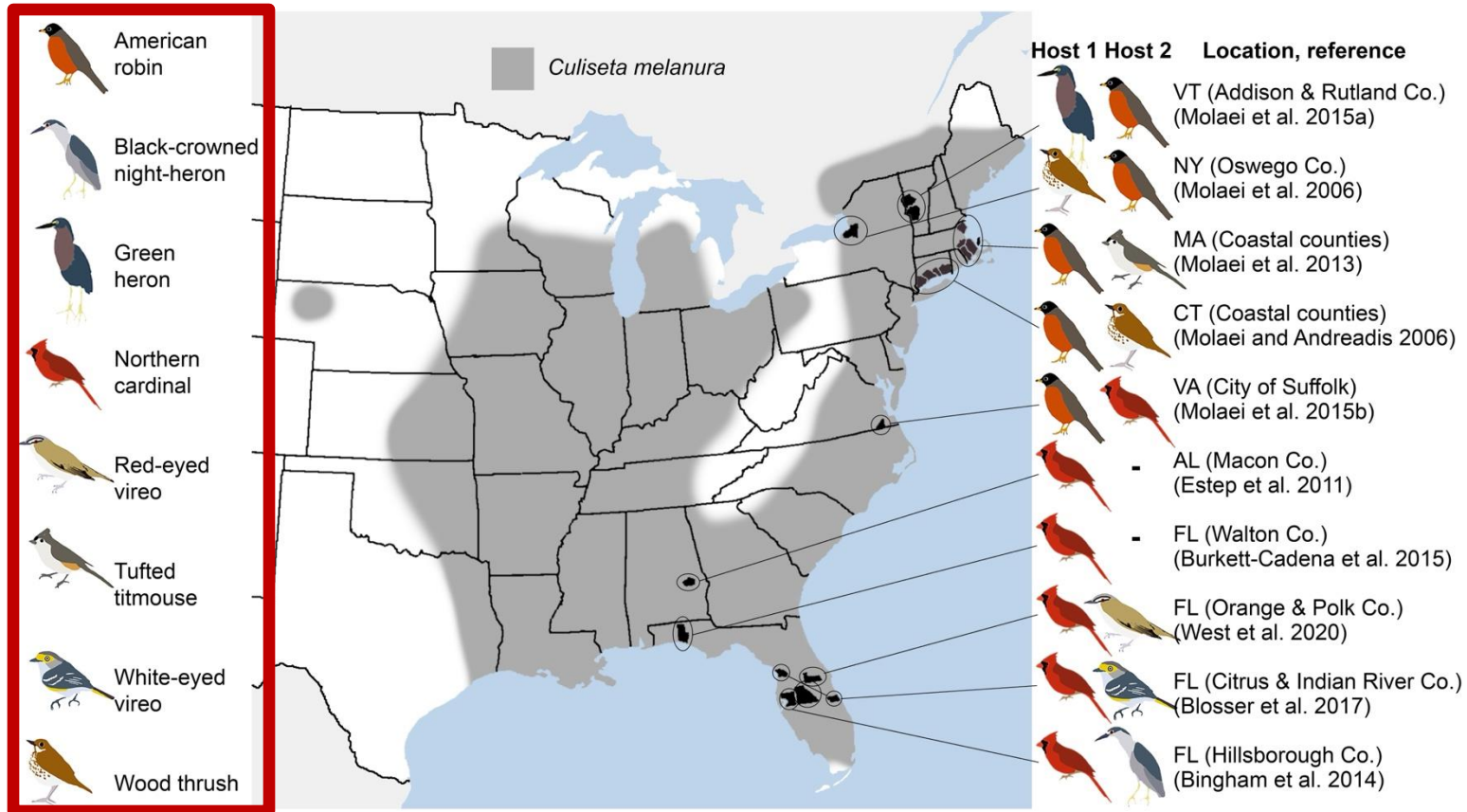
Hypothesis: Synthetic odor blends derived from *Cs. melanura* host species whole-body odors will elicit greater attraction than traditional trapping methods, and partial or whole-body blends from non-target birds.



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA



Cs. melanura host examples



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

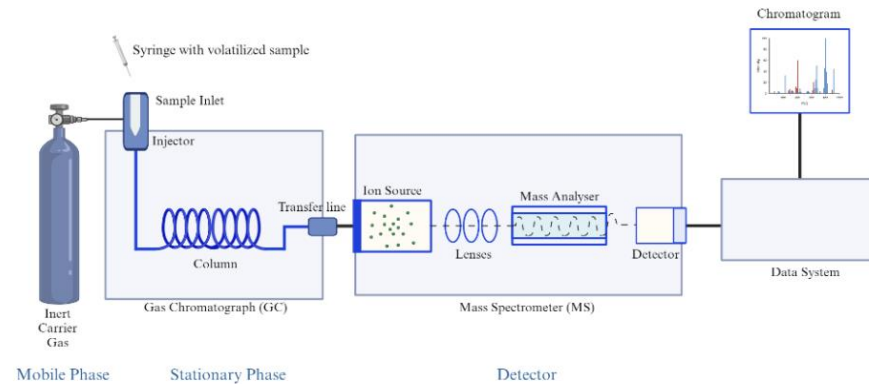
Methods for next steps



Mist-net songbird +
assess physical metrics



Dynamic headspace aeration
(DHA)



Gas chromatography mass spectrometry
(GC-MS)

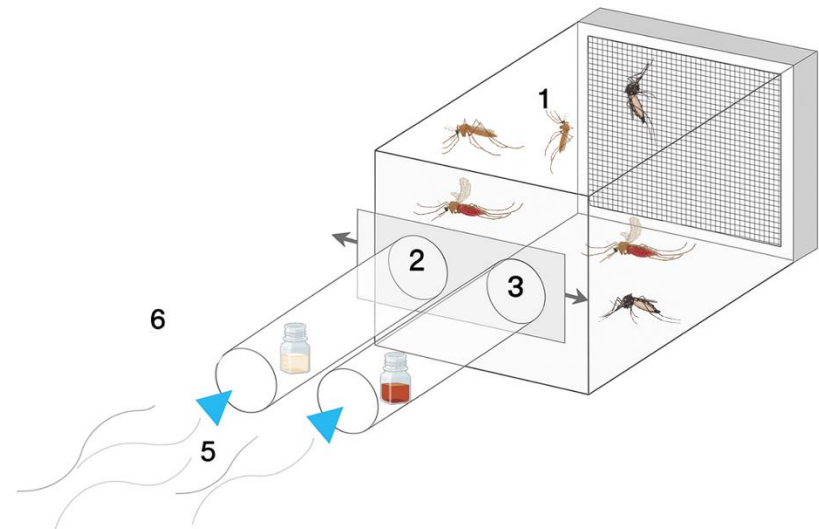


Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

Then what?



- Deploy and assess attraction in lab and field assays



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

Image adapted from Fikrig et al., 2023. doi:
[10.1038/s41598-022-26591-3](https://doi.org/10.1038/s41598-022-26591-3)

Conclusions



- Ornithophilic mosquitoes play a key role in pathogen transmission → **remain under-sampled by traditional traps**
- Whole-body odor blends appear to elicit greater overall attraction in field assays
- **A host-specific synthetic blend** could more accurately reflect bird-biting mosquito abundance → predict trend of arboviruses in environment



Acknowledgments

- The Dan Peach Lab
 - Mary Beard, Danica Shannon, & Skyler Nichols
- My committee members
 - Dr. Travis DeVault and Dr. Melinda Brindley



**UNIVERSITY OF
GEORGIA**

Savannah River
Ecology Laboratory



**U.S. DEPARTMENT OF
ENERGY**



**College of
Veterinary Medicine
UNIVERSITY OF GEORGIA**



Savannah River
Ecology Laboratory
UNIVERSITY OF GEORGIA

Questions, comments, & concerns welcome!

