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The UGA Black Fly Colony and Program Updates

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Colony History and Work



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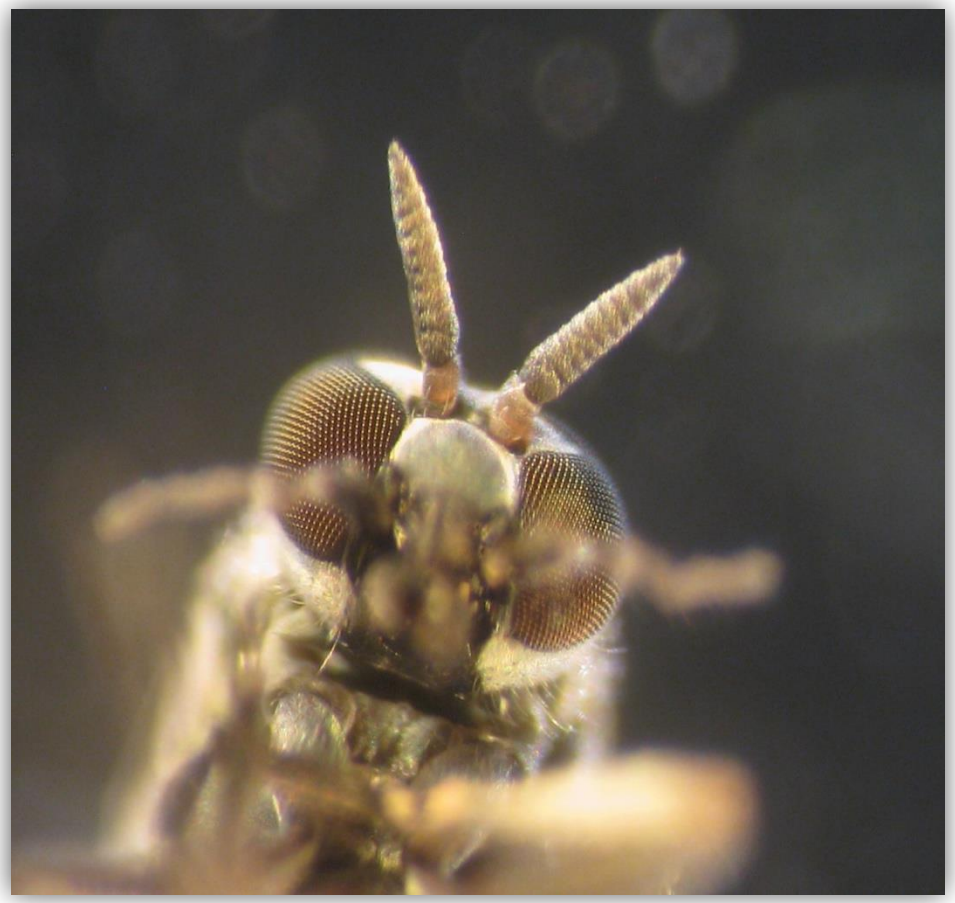
- Established 1981, Cornell University
- 1988 moved to University of Arizona
- 1991 moved to Clemson University
- 1999 moved to University of Georgia

- Species *Simulium vitattum*, transcontinental species
- Onchocerciasis focus (*S. damnosum* vector)
- Larvicidal, physiological, repellent, trap design studies + outreach

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Colony Basics

- Nine modified lobster tanks, ~300,000 larvae
- Fed high protein slurry every day
- Work 7 days a week, all year long (Christmas Exception)
- 3 full-time employees, 4 part-time



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COLONY RUNWAY, DAY 24






Freezer A
'I ran the Marathon in a few minutes'
Spark Holland
NOTICE
LABORATORY USE ONLY
NO FOOD OR DRINK ALLOWED
DO NOT REMOVE THIS SIGN
CAUTION
DO NOT STORE FLAMMABLE MATERIALS IN THIS BOX

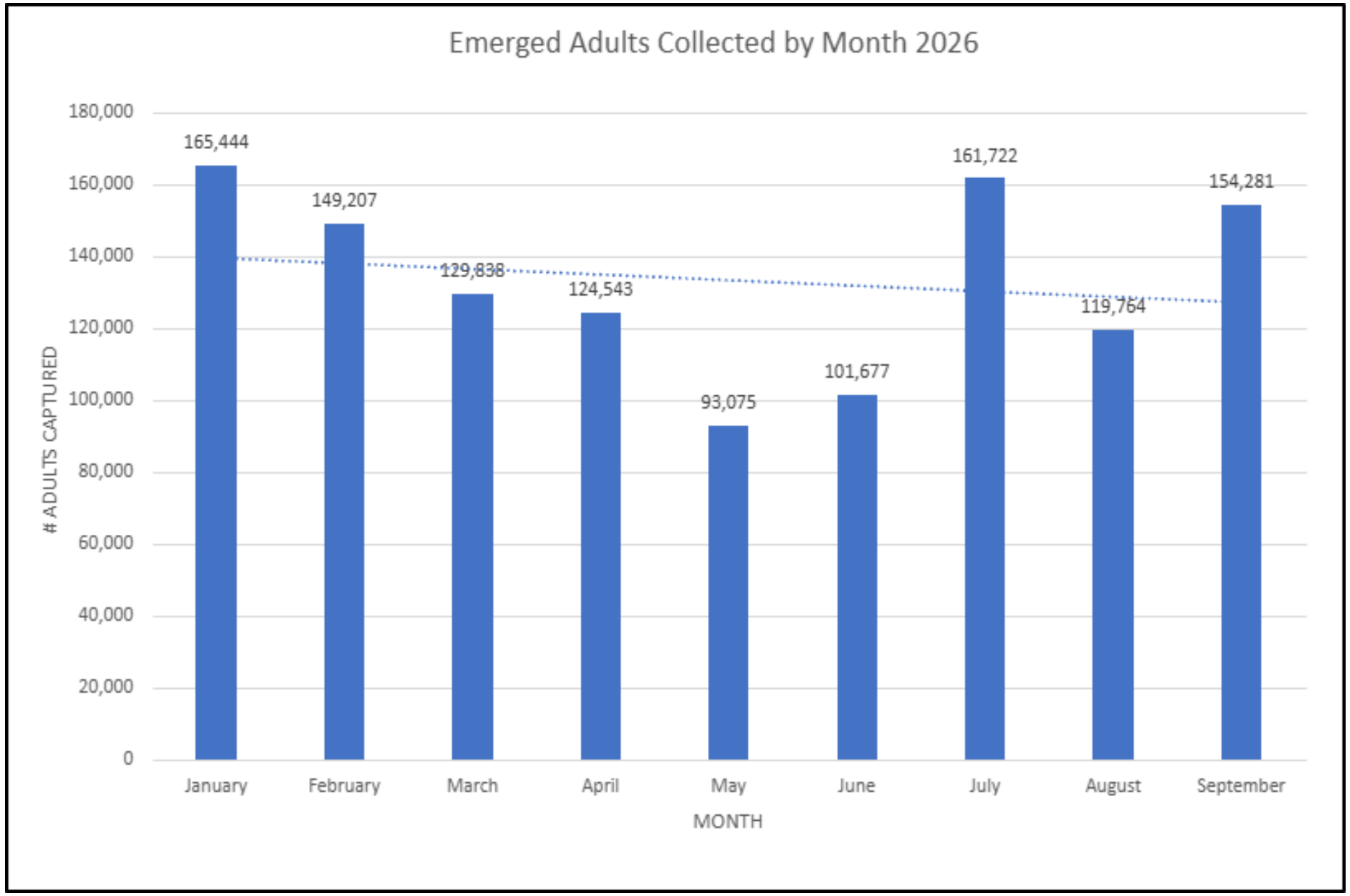

U.S.A. STANDARD TESTING SIEVE


Black Fly Colony Care
Monday
Tuesday
Wednesday
Thursd
Drain oldest tank or the tank with the least potential to produce adults.
• Remove substrate
• Remove catch screen being careful not to drop staples into tank
• Spray tank runway with copious amounts of H_2O
• Lightly scrub runway and lip
• Drain completely and vacuum lower and upper chambers of all water
• Fill tank with one gallon of bleach
• Run tank overnight
Set up oviposition Chambers as per protocol
Drain tank that is being cleaned.
• Scrub entire tank with Tilex and elbow grease
• Rinse profusely
• Drain and vacuum both upper and lower chambers
• Fill tank with water and 2 gallons of Clorox
• Turn on pump as soon as water levels allow. (This exposes pump interior to concentrated bleach solution)
• Run tank overnight.
• √ oviposition chamber
• Soak each eggsheet with 200mL of oviposition H_2O in am


1700 flies







AVERAGE	133,283
TOTAL	1,199,551

- Typically, 1.5 – 2 M adults collected per year

- Older tanks produce more adults

- September = 7 days a week

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What are we doing with all these flies?

- Internal projects
- External supplies for principal investigators



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Contract Information

- Biological supplier for BEI Resources, through the NIH
- Materials free
- Used in an array of projects
- Second contract awarded in 2025, continued in 2026

Entities Supplied to

BUSINESS

- Eurofins Agroscience Services LLC.
- Snell Scientifics
- Sierra Research Labs
- VecTech

UNIVERSITY

- Smith College
- Western Carolina U.
- Texas A&M
- Yale U.
- U. South Florida
- Dr. Vogel and Dr. Champagne (UGA)
- Graduate projects (UGA)
- BFRRC (UGA)
- U. of Toronto (CAN)
- U. of Calgary (CAN)
- U. of Greenwich (UK)

GOVERNMENTAL

- CDC
- USDA-ARS
- Walter Reed National Military Medical Center
- NIH-LMVR

Bellec Trap Design
Gates Foundation

- Representatives from the Gates Foundation and engineering company, Synapse, visited the Black Fly Lab in August

- Establish collaborative effort to improve Bellec trap designs used in Africa

- Increased detection of black flies carrying *Onchocera volvulus* [River Blindness causative agent]



What is a Bellec trap?



- Designed by Christian Bellec in the 1970s in West Africa
- Aluminum sheet coated with entomological glue is placed over or near rivers that support black fly populations. Placement may vary [over rapids, over calm water, on bank]
- Effort to catch gravid females as they search for optimal oviposition sites
- Less hazardous than the most prominent method…

Lamberton et al. 2015. Onchocerciasis Transmission in Ghana: Persistence under Different Control Strategies and the Role of the Simuliid Vectors. PLOS Neg. Trop. Dis. https://doi.org/10.1371/journal.pntd.0003688

Surakat et al. 2026. Adult blackfly (*Simulium damnosum* s.l.) collection methods: overview and research needs. Int. Health. I38-i45.

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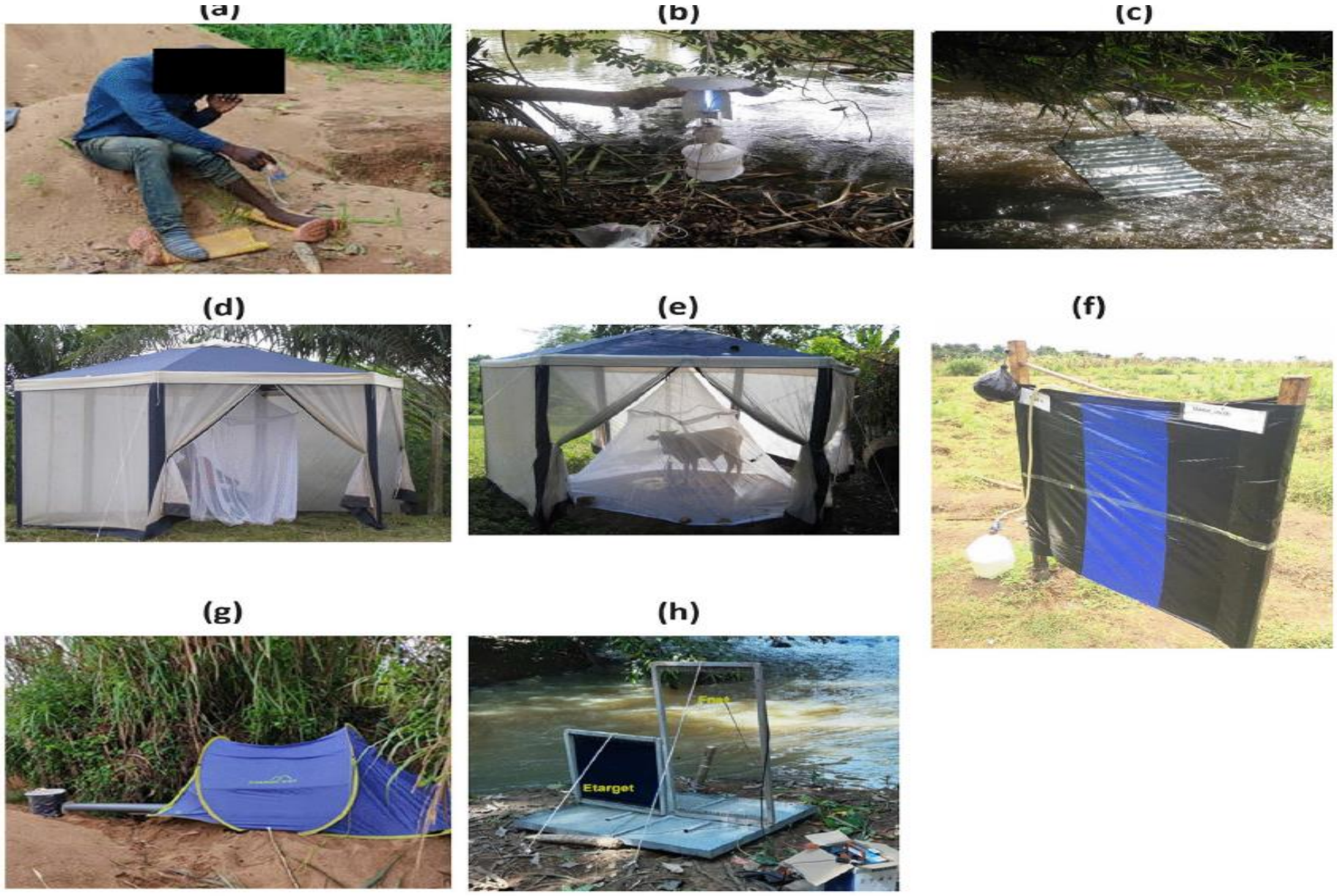


Fig 1. Different blackfly trapping methods. **(a)** the standard Human Landing Catch [18]; **(b)** Monk's Wood (light) trap [13]; **(c)** Bellec trap situated above rapids [13]; **(d)** human-baited tent [13]; **(e)** cow-baited tent [13]; **(f)** Esperanza Window Trap [22]; **(g)** Host Decoy Trap [18]; **(h)** electric net [19]. The images have been reproduced in accordance with their respective licences (see Acknowledgements).

Kyomuhangi I, Mustafa A, Hawkes F. 2026. A systematic review comparing the performance of alternative blackfly (Simulium) trapping methods against the standard human landing catch (HLC) for onchocerciasis surveillance. PLOS Neg. Trop. Dis. https://doi.org/10.1371/journal.pntd.0003688



How do we help?

Miniature tank, painted a uniform color

Cut sheets of thin aluminum, paint different colors and coat with Tanglefoot (entomological glue)

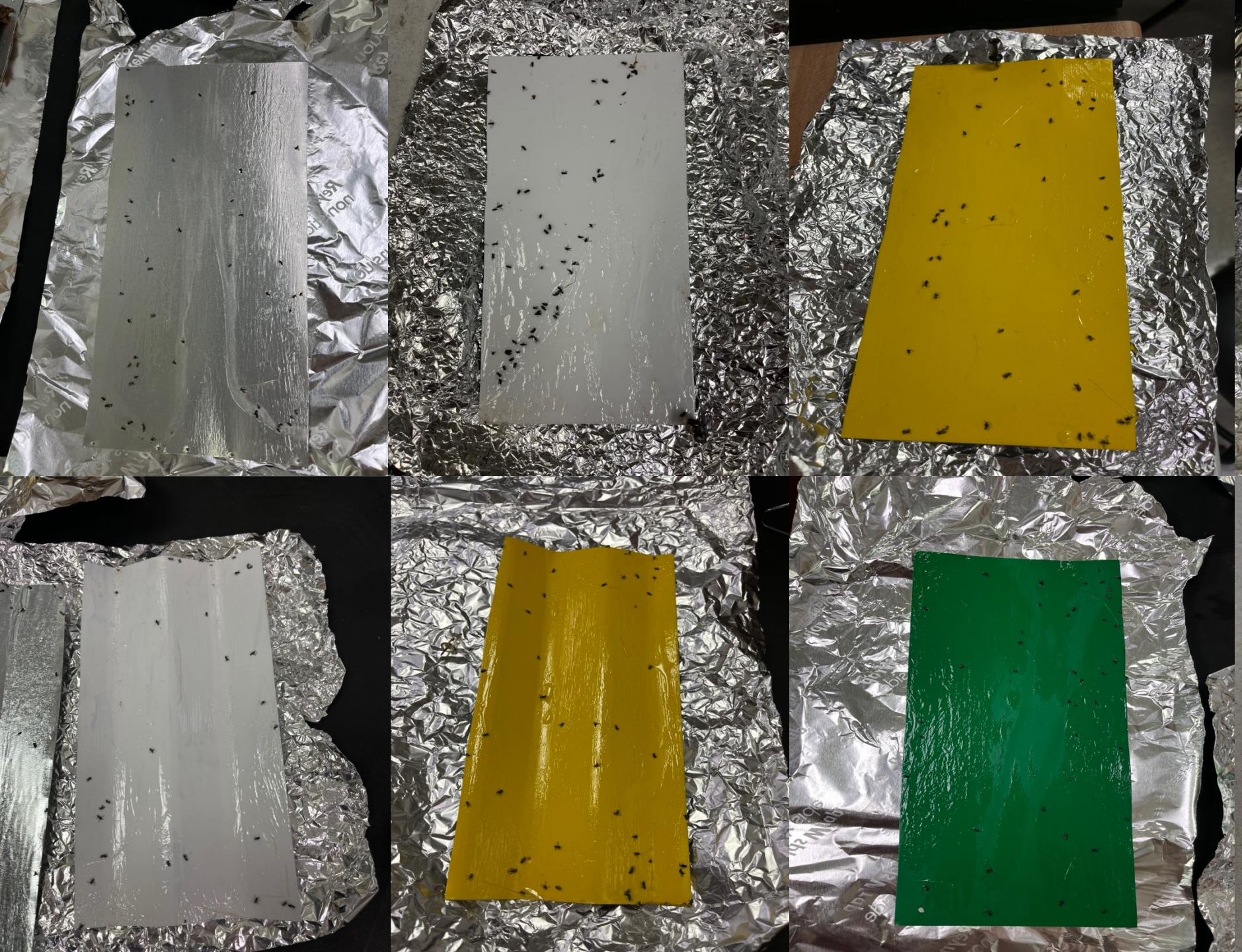
Pin to the runway and cover with a clear hood

Release gravid females into the hood for 24 hours

Determine catches

Pilot studies!

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Next Steps

- Synapse will provide testing materials [metal sheets, adhesives, solvents]
- Flies will be removed from sheets using solvents and RT-qPCR will be ran to determine downstream interference
- Testing many combinations, wildling down to a few ideal choices for field use

Salivary Project
[Dr. Calvo, Dr. Valenzuela-Léon – NIH LMVR]

- Proteins in black fly saliva can modulate host immune response:
- Platelet aggregation
- Coagulation
- Vasoconstriction
- Cytokine production

- Find novel mechanisms through which black flies manipulate host immunity, potentially leading to new insights into disease transmission and immune evasion strategies



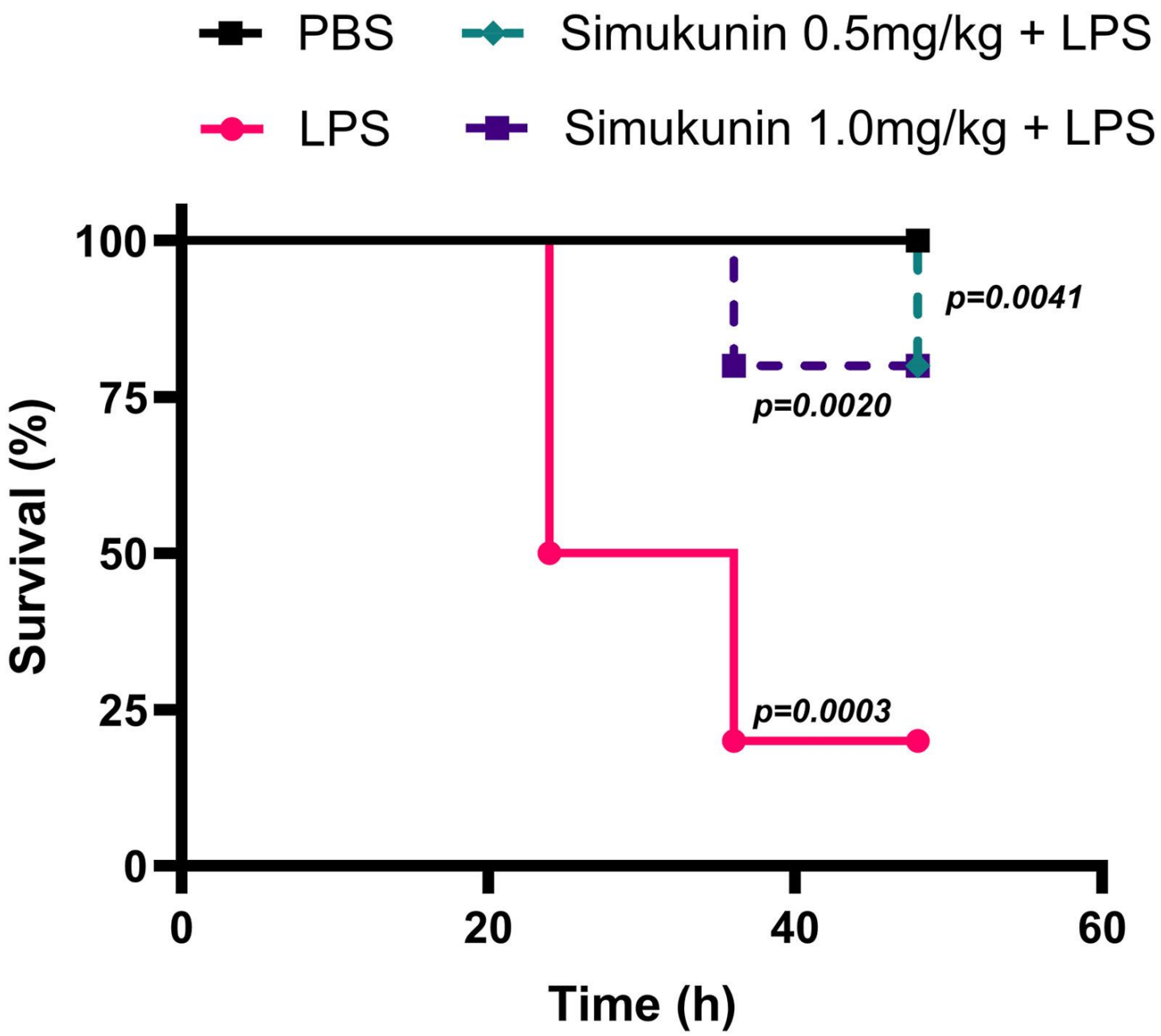


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Salivary Project
[Dr. Calvo, Dr. Valenzuela-Léon – NIH LMVR]

- Simukunin, a salivary protein in *Simulium vittatum*, was previously found to be an anti-coagulant
- Here, it is also found to inhibit the complement lectin pathway (LP) - one of three complement pathways in the immune system [classic, alternative, lectin]
- This inhibition halts an immune cascade traditionally causing cell lysis after pathogen introduction – assists vector borne diseases!
- Similar proteins have been found in mosquitoes and ticks

- Jung et al. 2026. The black fly salivary protein Simukunin inhibits complement activation through the lectin pathway protease MASP-2. J. Bio. Chem. 302(10): 113529.



Mice were inoculated with Simukunin 30 minutes before being challenged with a Lectin Pathway Sepsis [LPS]

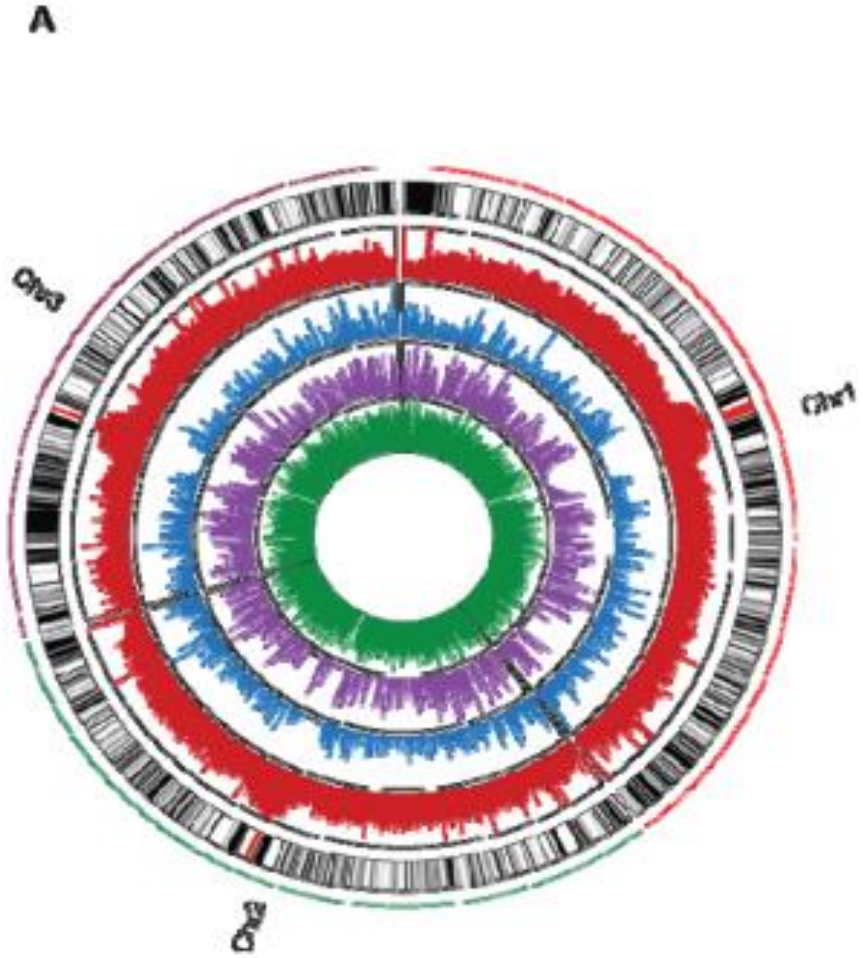
Monitored for 48 hours

Mice inoculated with Simukunin showed significant increases in survival **~75%** than those without **~25%**

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Genome Project
[Dr. Calvo, Dr. Valenzuela-Léon – NIH LMVR]

- The first chromosome-level genomic sequence for a black fly was determined
- 340.4Mbp
- *Drosophila melanogaster* = 143.7Mbp



Outer ring: GC content in 250kbp windows (25-40%, from white to black), with the centromeres labelled in red [gene-rich, high impact]

2nd Ring :repeat density in 250kbp windows (23-100%).

3rd Ring: shows the coding density in 250kbp windows (0-30%).

4th Ring: SNP density per 250kbp windows (0-1363).

Inner Ring: Mean TPM of genes across the genome, averaging the expression of all RNA sequencing samples used for functional annotation

Nishiduka et al. 2026. Chromosome-Level Genome of Simulium vittatum Links Black Fly Cytogenetics to Genome Organization and Evolution. bioRxiv. PREPRINT

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Genome Project
[Dr. Calvo, Dr. Valenzuela-Léon – NIH LMVR]

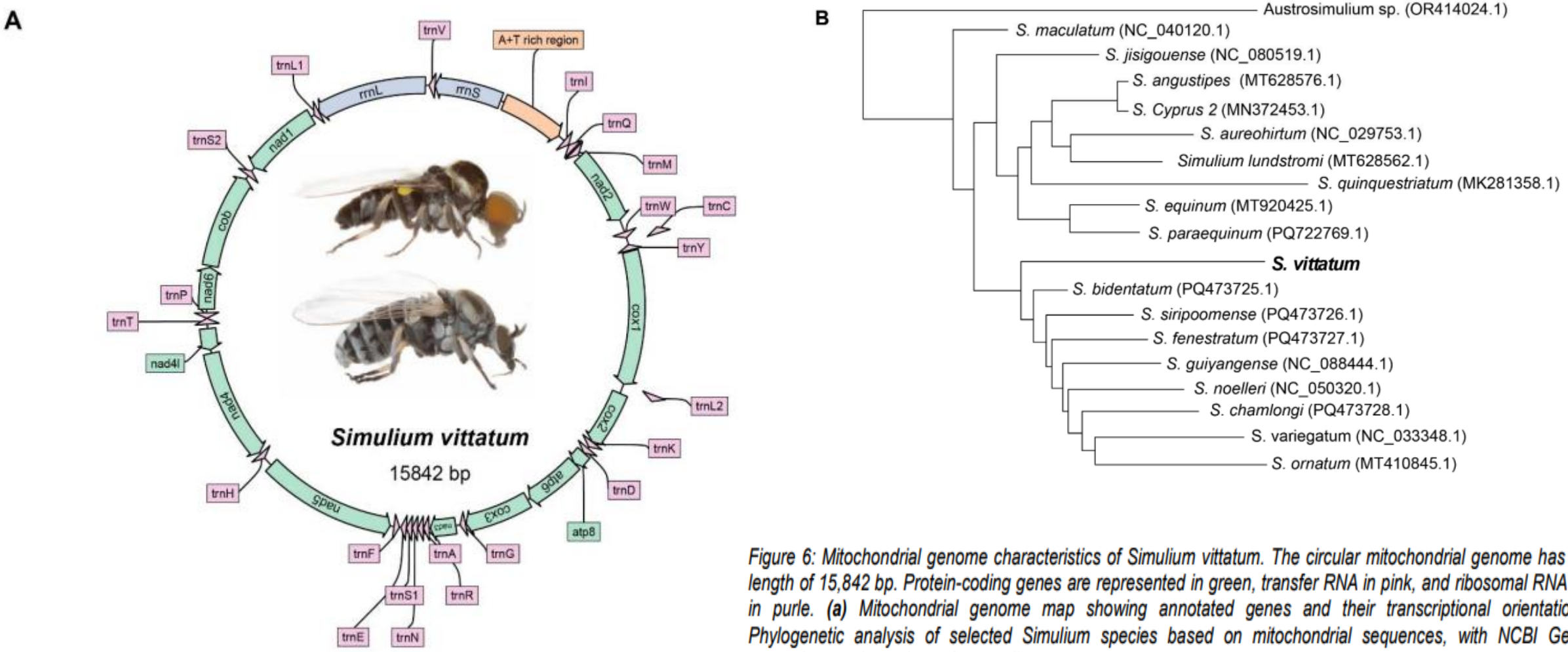


Figure 6: Mitochondrial genome characteristics of Simulium vittatum. The circular mitochondrial genome has a total length of 15,842 bp. Protein-coding genes are represented in green, transfer RNA in pink, and ribosomal RNA genes in purle. ***(a)*** *Mitochondrial genome map showing annotated genes and their transcriptional orientation.* ***(b)*** *Phylogenetic analysis of selected Simulium species based on mitochondrial sequences, with NCBI GenBank accession numbers shown in parentheses.*

Live Vector Resources

b|e|i RESOURCES

SUPPORTING INFECTIOUS DISEASE RESEARCH

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The BEI Resources Live Vector Catalog offers a growing array of arthropods that serve as vectors for the transmission of diseases such as **malaria, Lyme disease, trypanosomiasis, leishmaniasis** and **arboviruses.** Available live vectors include:

Phlebotomine sand flies



Triatomines

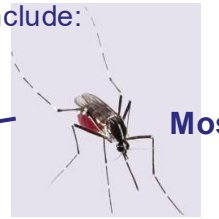


Black Flies



Additional reagents, such as antibodies, hybridomas, genomic libraries, nucleic acids and primers, are also available to support the advancement of vector research.

Mosquitoes



Ticks



Contributors to the program include the **CDC** (mosquitoes, ticks, reduviids), **WRAIR** (sand flies), **FR3** (soft-bodied ticks) and **UGA** (black flies)

For information and resources provided by these institutions and research groups, as well as protocols **for Aedes and Anopheles mosquitoes, ticks, sandfly and flea maintenance andresearch.**

www.BEIResources.org

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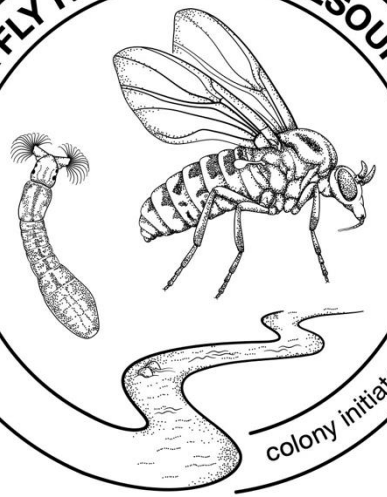
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GEORGIA Entomology

THANK YOU!

QUESTIONS?

UGA BLACK FLY RESEARCH & RESOURCE CENTER



colony initiated 1981

Gates Foundation

NIH

National Institutes of Health

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