



Identification of semiochemicals attractive to *Simulium vittatum* (IS-7)

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Background

- Black flies (Diptera: Simuliidae) - important pest insects
- Nuisance: economic impact (thousands to millions U\$)
 - Human recreational activities
 - Livestock industry
 - Population suppression programs (Public & Private)
- Vectors of pathogens for humans and animals
 - Viruses
 - Parasites
 - Impact on human and animal health



Background

- *Onchocerca* (Nematoda: Filarioidea)

In North America:

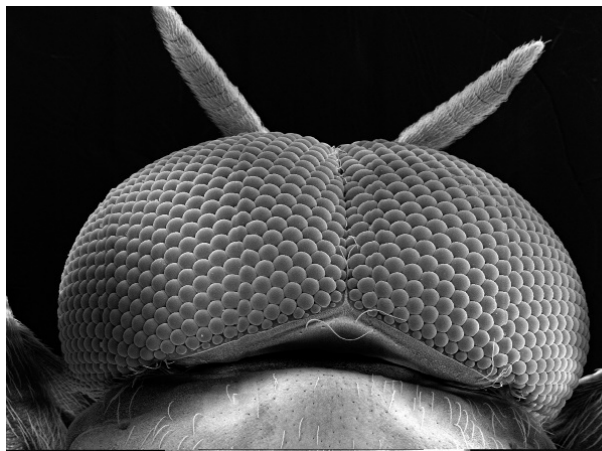
- Cattle: *O. gutturosa*, *O. lienalis*, *O. stilesi*
- Dogs, cats: *Onchocerca lupi* - Emerging zoonosis
 - *Simulium tribulatum* (Hassan et al., 2015)
 - Other species? (Adema, pers. comm.)
- Wild ungulates
 - *Onchocerca cervipedis* (Verocai et al. 2012)
 - Undescribed sp. in white-tailed deer (McFrederick et al. 2013)
 - *S. vittatum* complex may vector

Objective

- To identify volatile organic compounds that are attractive to host-seeking *S. vittatum* black flies

Future implementation in baited traps:

- Population suppression programs
- Research and surveillance of vector/pathogens



Methods

- Black fly Colony, UGA Dept. Entomology
- *Simulium vittatum* (IS-7) females
- Host-seeking (i.e., post-oviposition)

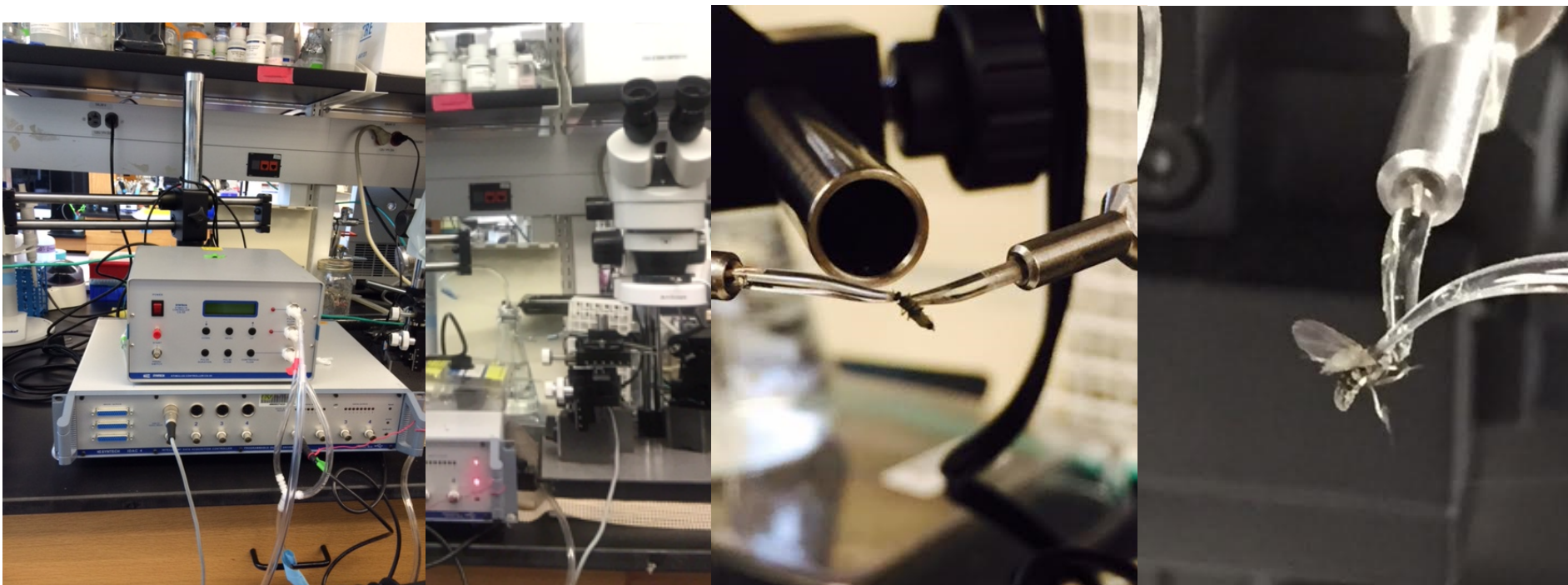


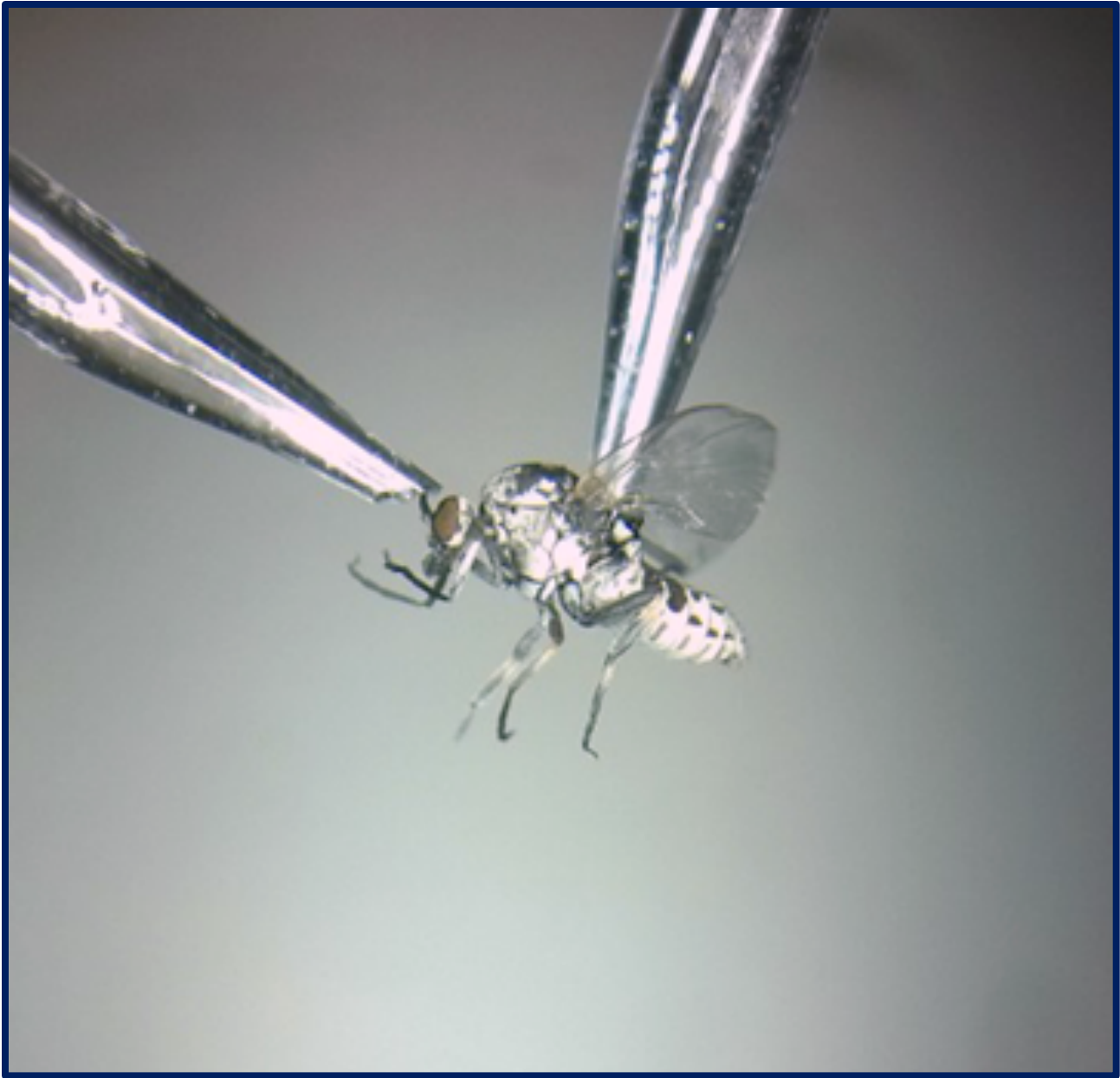
Methods

- **Selected 58 organic volatile compounds:**
 - **Different chemical classes**
 - **Carboxylic acids, Alcohols, Ketones, Aldehydes, Alkanes, etc.**
 - **Attractive to hematophagous dipterans**
 - **Potential mammal hosts: cattle, dogs, and humans**

Methods

- **Electroantennography (EAG)**
 - Measures electric response to stimuli
 - 11 groups of 5-7 compounds (6 reads/compound)
 - 1:100 dilution



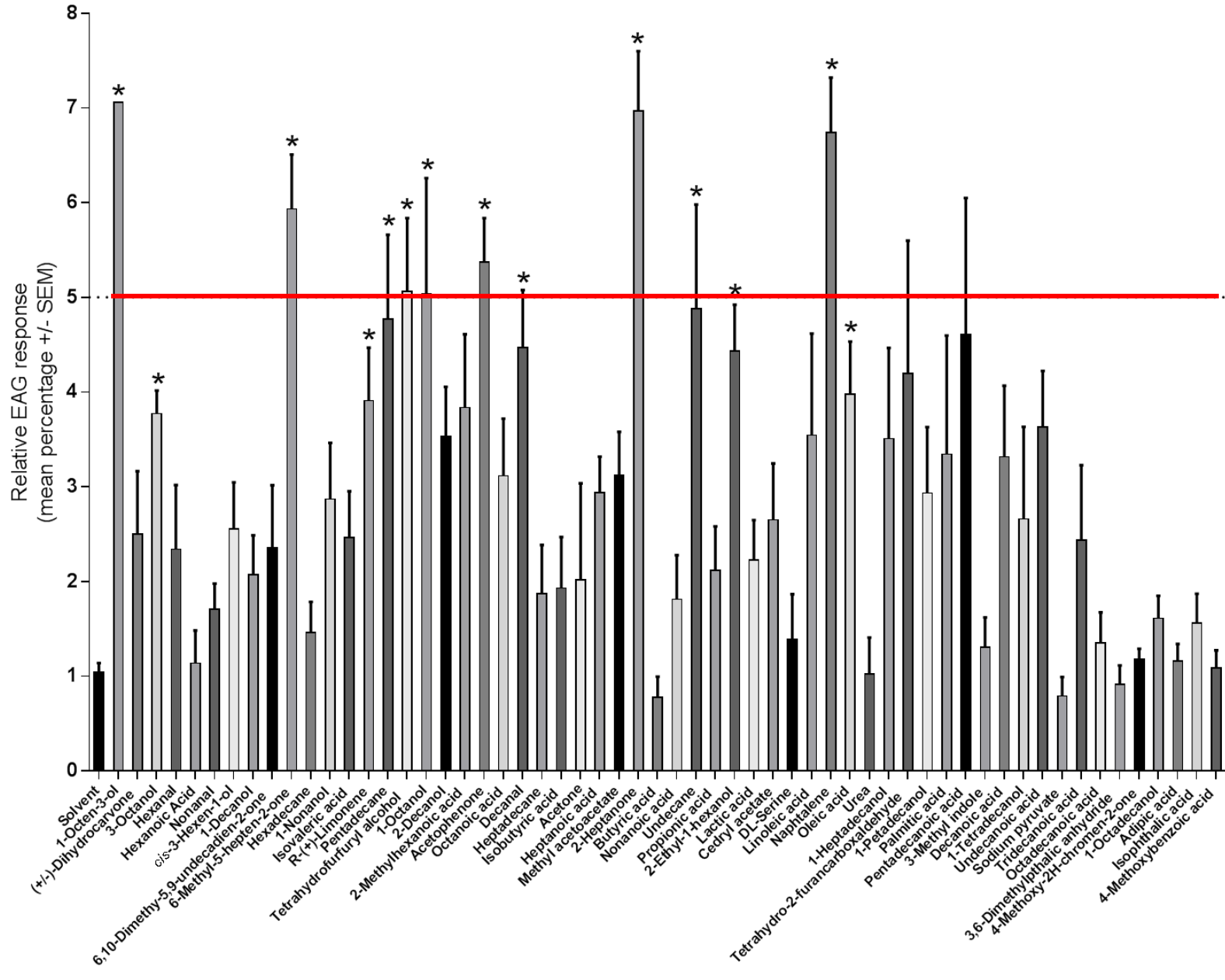


Methods - EAG

- Statistical analysis:
 - EAG responses normalized to 1-octen-3-ol
 - One-way ANOVA with multiple comparisons
 - Normalized EAG differed from solvent control ($\alpha=0.005$)



Results - EAG



Results - EAG

- Seven out 58 compounds:

- 1-Octen-3-ol

- 1-Octanol

- Tetrahydrofurfuryl alcohol

- 2-Heptanone

- 6-Methyl-5-hepten-2-one

- Acetophenone

- Naphthalene

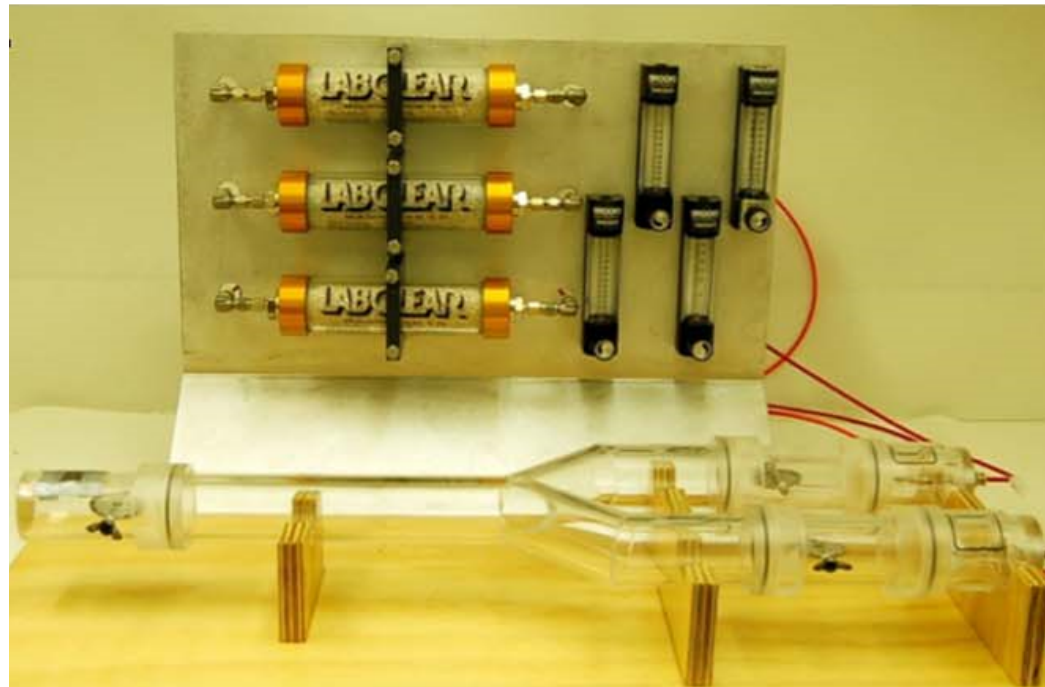
Alcohols

Ketones

Polycyclic aromatic
hydrocarbon

Methods

- Behavioral assay: Y-tube olfactometer (Young et al., 2015)
- 7 compounds (1:1000, 1:100, 1:10)
- 6 groups of 20 flies/dilution/compound (n=120)

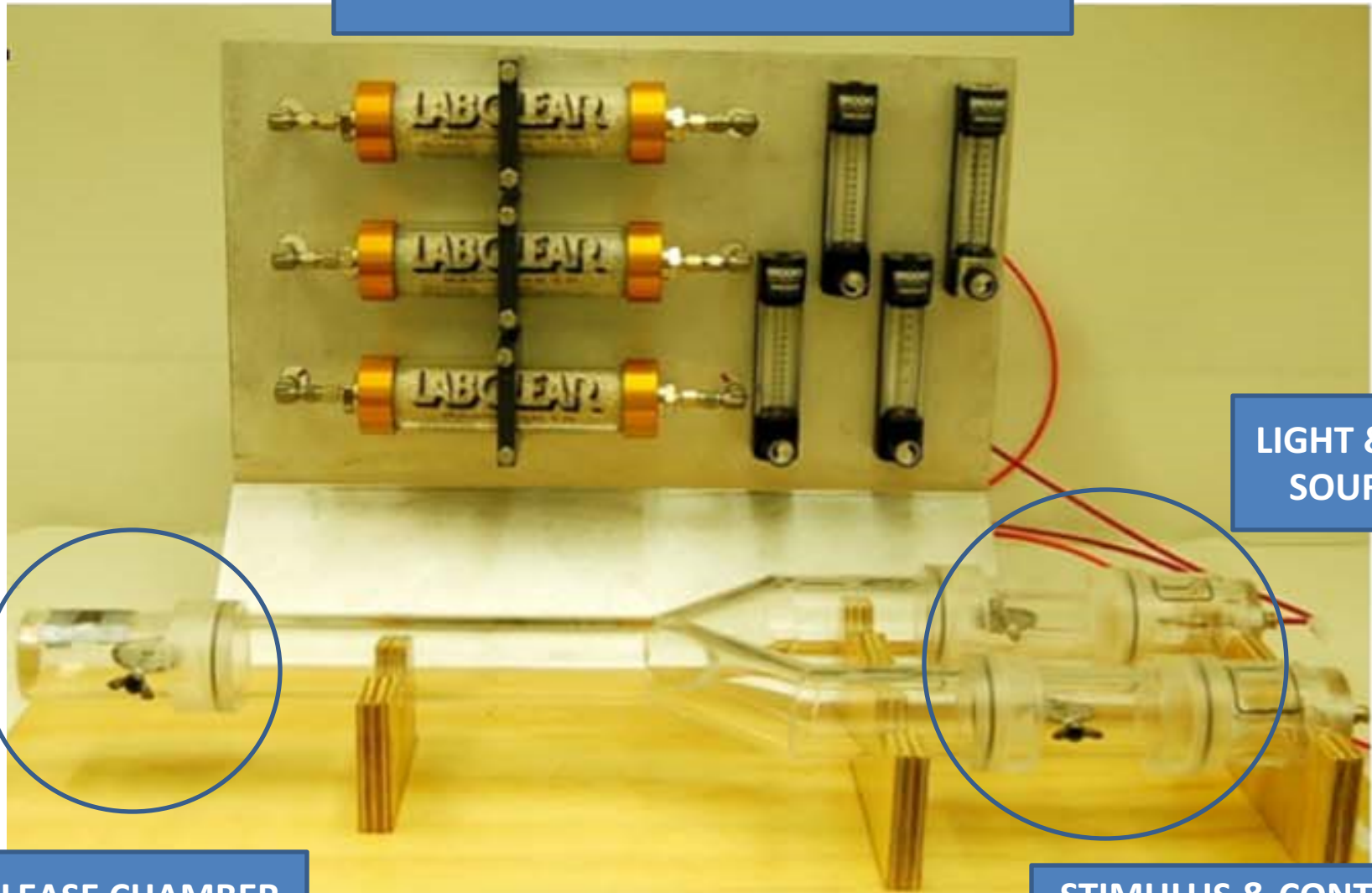


DARK ENVIROMENTAL ROOM

**LIGHT & AIR
SOURCE**

RELEASE CHAMBER

**STIMULUS & CONTROL
CHAMBERS**



Methods

- **Statistical analysis:**
 - **Compared proportions of attracted flies (stimuli vs. control)**
 - **Likelihood ratio test based on a multinomial probability model**
 - **Custom program written in FORTRAN 95**

Results – Y tube

- Attractive compounds:

1:1000

- 1-Octen-3-ol

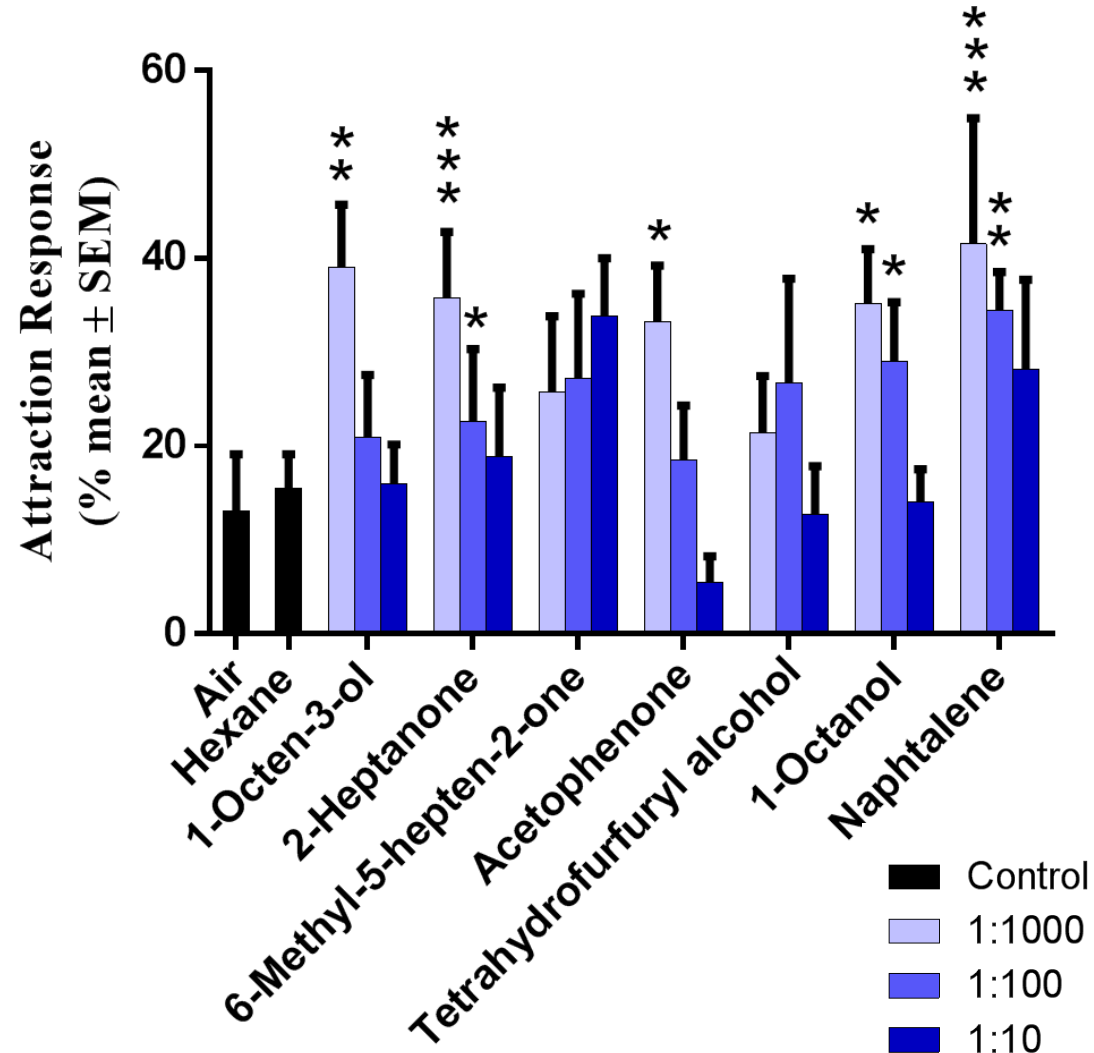
- Acetophenone

1:1000, 1:100

- 2-Heptanone

- 1-Octanol

- Naphthalene



Discussion

Few simuliids tested for attraction of compounds

Vectors of *O. volvulus* (river blindness)

- *S. vittatum*/*S. damnosum*/*S. ochraceum*
 - Acetophenone (cattle, dog, human) (Young et al., 2015)
- *S. vittatum*/*S. ochraceum*
 - 1-Octanol (cattle), 1-Octen-3-ol (cattle, human)
- *S. vittatum* – never tested on others
 - 2-Heptanone (cattle) – stable + horn flies (Birkett et al. 2004)
 - Naphthalene (cattle, dog, human)

Future directions

- Test compounds in the field
 - Encephalitis Virus Surveillance (EVS traps)
 - Esperanza Window traps (EWT)



Future directions

- After selecting most attractive compounds/blends
- Population suppression programs of nuisance flies
- Surveillance of black fly transmitted pathogens

Onchocerca lupi

Onchocerca spp.

Vesicular Stomatitis Virus (cattle)

& others...



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GATES *foundation*



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Thanks!

