Pollination with a Proboscis: Trait-Based Variation in Mosquito-Flower Interactions

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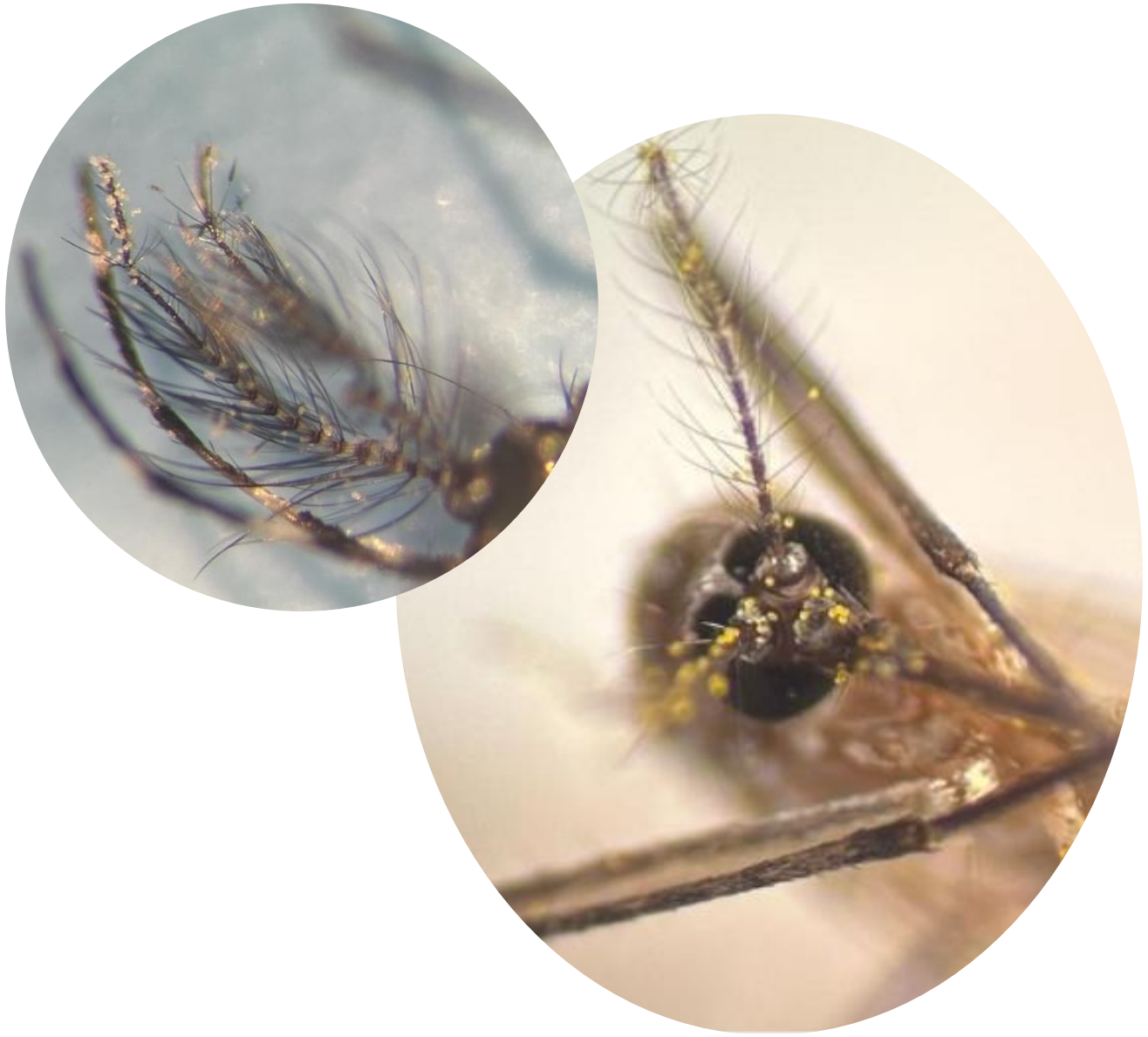
Outline

Background
Why mosquito-flower interactions matter

Experimental Design
How I tested these interactions

Results
What mosquitoes did, and what happened to the plants

Next Steps
Where these questions take me next



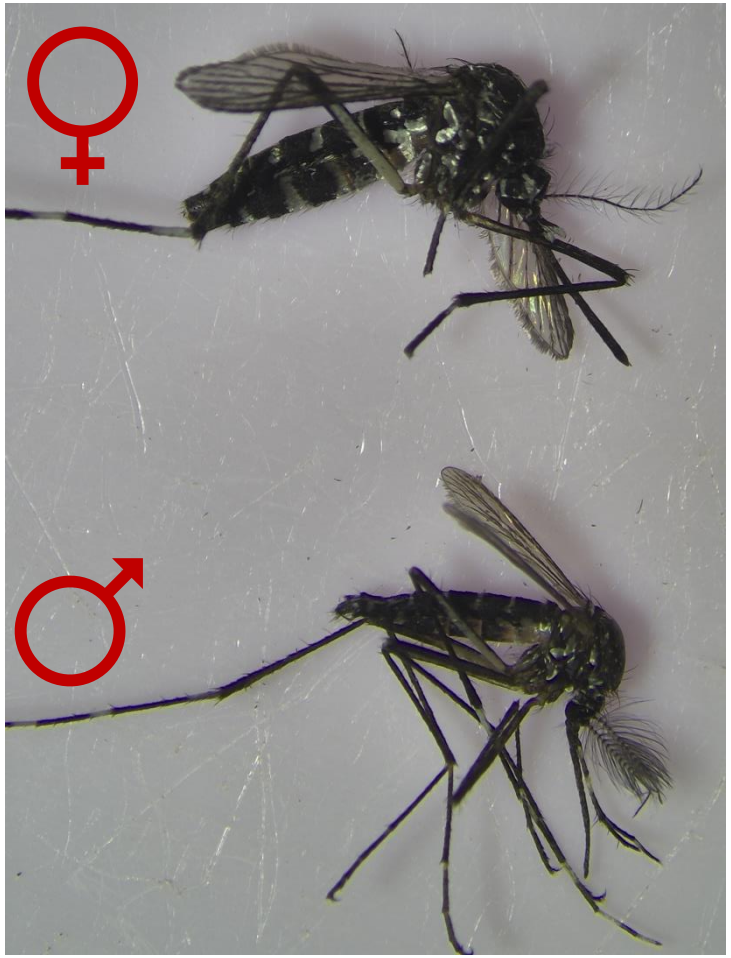
Why should we care about mosquito-flower interactions?

- **Mosquitoes are important targets for control**, but effective control requires understanding their ecology and resource use-knowledge that can inform control strategies such as **attractive toxic sugar baits.**

- **Mosquitoes visit flowers for nectar.**

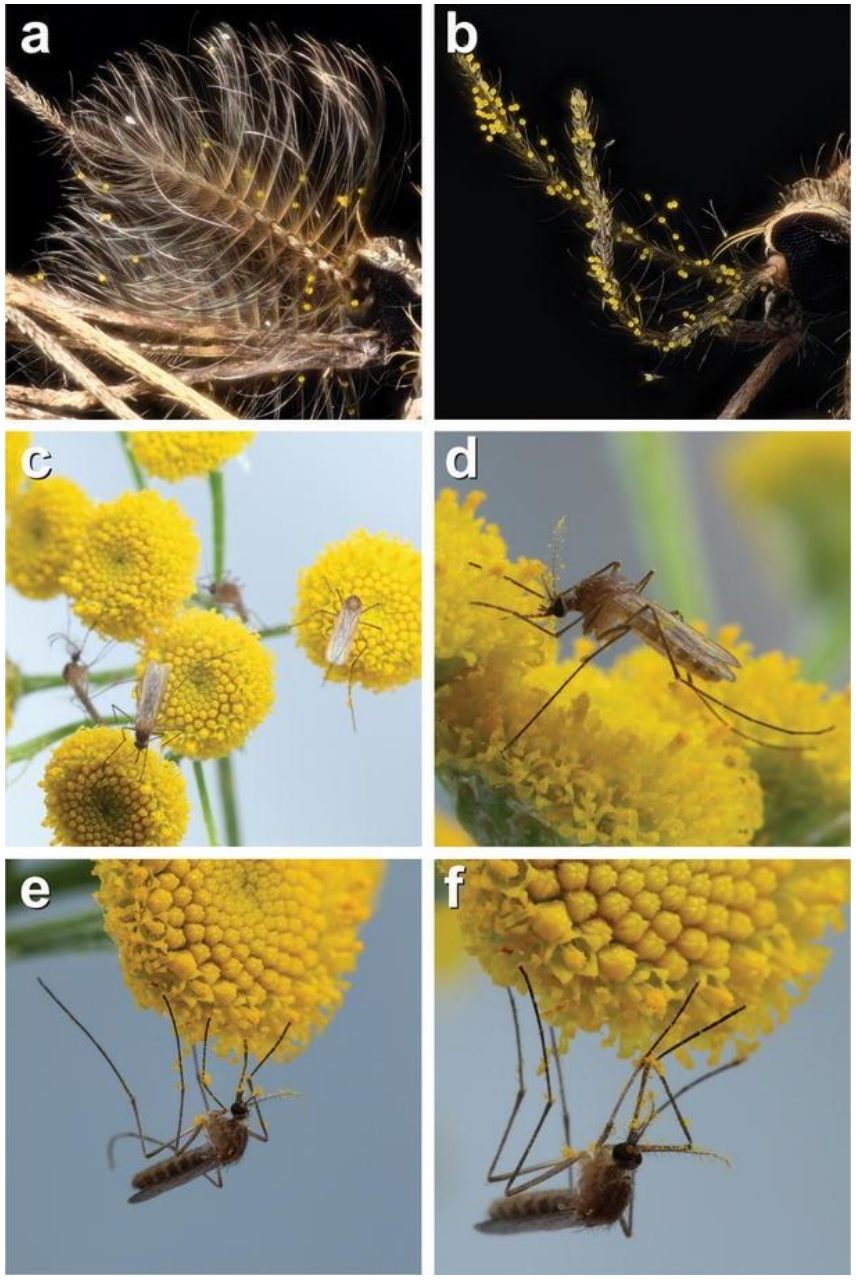
- While both sexes rely on plant sugars, only female mosquitoes take bloodmeals.

- Differing traits may influence floral interactions.



Previous Studies

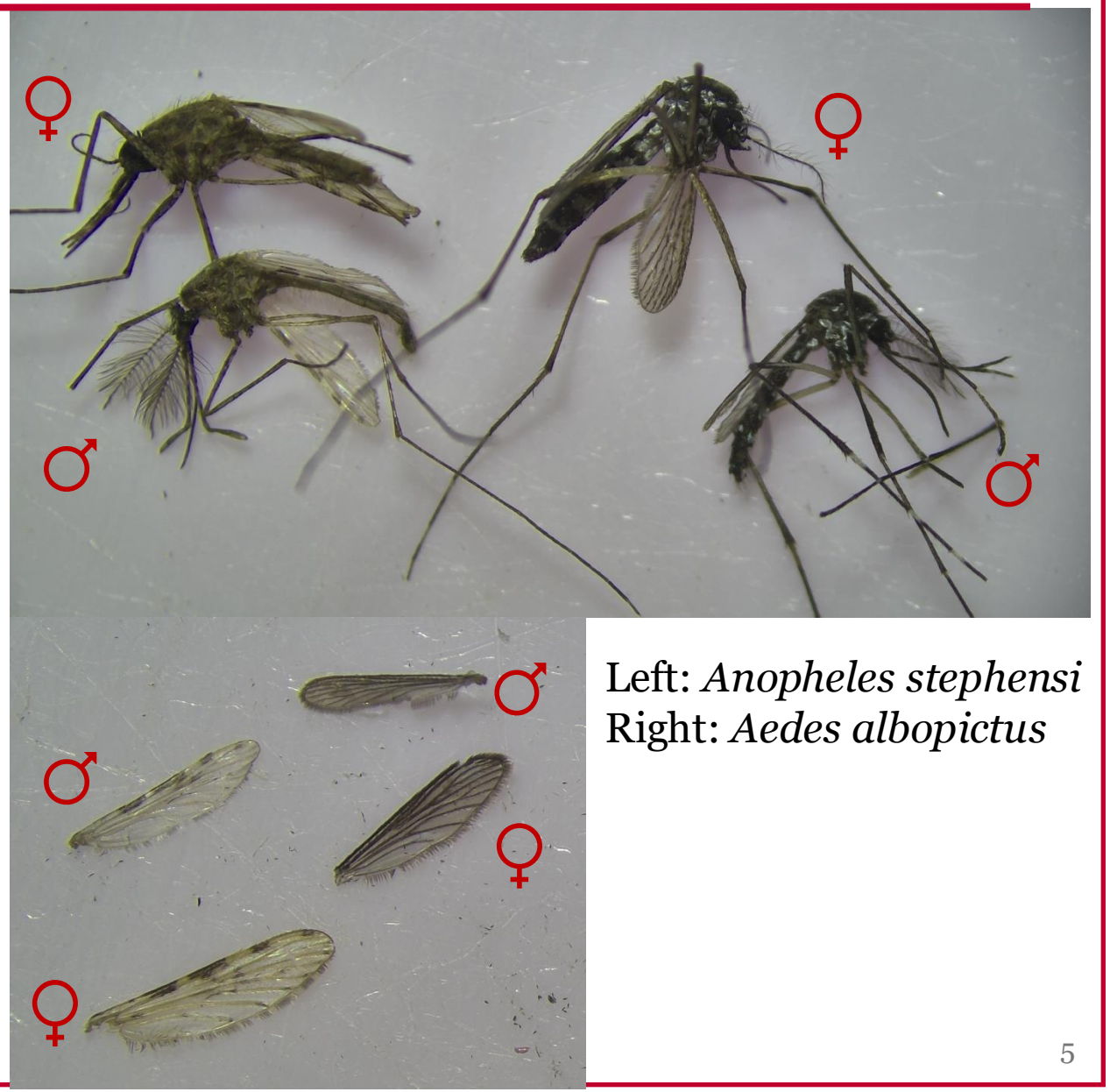
- Mosquitoes are well-studied as disease vectors, but not for their broader ecological roles.
- Previous research (e.g., *Platanthera obtusata* and *Tanacetum vulgare)* demonstrate that **mosquitoes act as legitimate pollinators and respond to distinct floral cues**.
- These response cues may vary by sex and species, **yet their ecological and behavioral impacts are unclear.**
- Understanding these patterns could ultimately inform more targeted mosquito control.



Peach & Gries, 2016

How might mosquito traits affect pollen transport?

- Size differences may directly influence pollen load and placement
  - Larger body surface area → Increased pollen retention
  - Longer legs/wings → Increased floral contact
  - Body part differences → Variation in pollen placement



Left: *Anopheles stephensi*
Right: *Aedes albopictus*

Research Questions

1. How do **sex differences** in mosquito morphology influence **pollen acquisition and transport**?

2. How does **pollination efficiency** vary between **mosquito species** visiting the same plant?

3. How do **sexes and mosquito species** differ in their responses to **floral odor**?



Image credit: Lawrence Reeves

Study Species

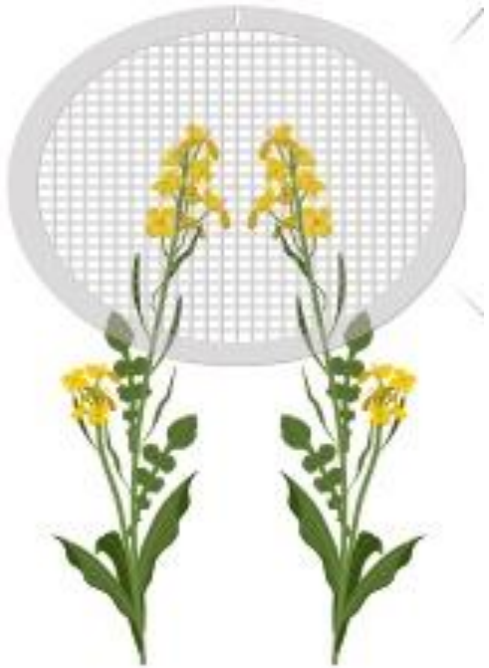


Aedes albopictus (Tiger mosquito)



Solidago canadensis (Canada goldenrod)

Pollination Assays



Paired goldenrod inflorescences

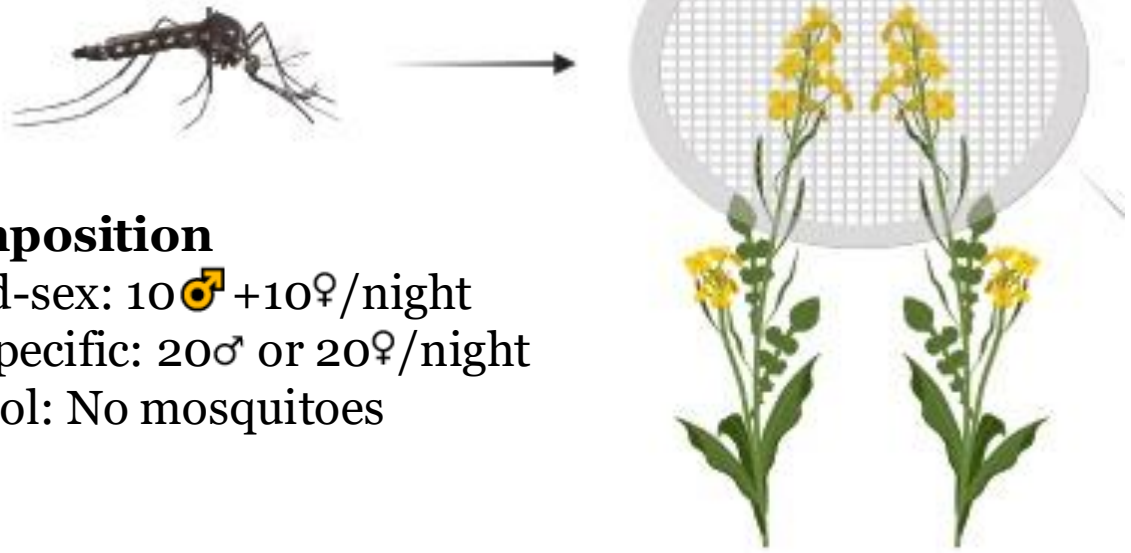
- Paired plants in 30 cm x 20 cm bags
- 16 h overnight exposure | 4 PM–8 AM
- 26°C | 80% RH

Created in https://BioRender.com

Pollination Assays

***Aedes albopictus* exposure**

- 20 mosquitoes per night
- 3 nights per plant pair
- 60 mosquitoes total per plant pair



Sex composition

- Mixed-sex: 10♂+10♀/night
- Sex-specific: 20♂ or 20♀/night
- Control: No mosquitoes

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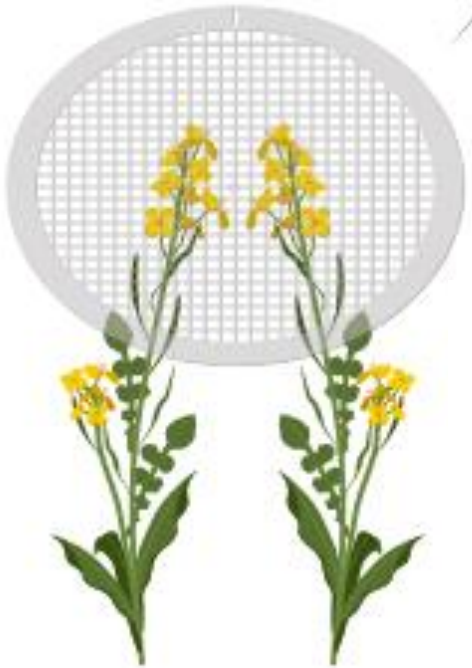
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Did mosquitoes pick up pollen?
- Presence/absence
- Pollen load
- Body location

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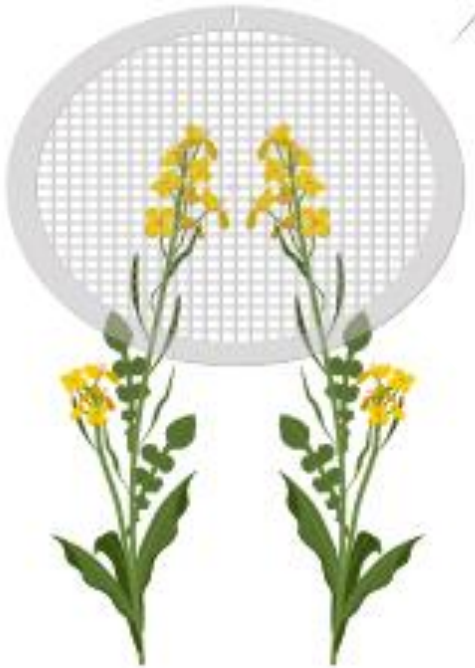
Graphics made with BioRender

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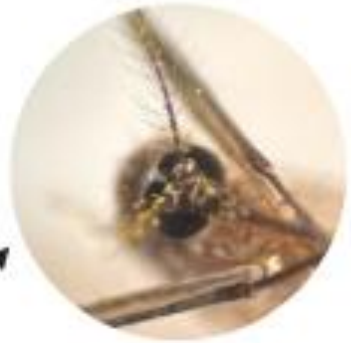
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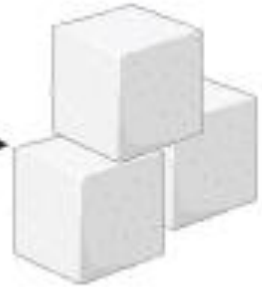
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Did mosquitoes feed from flowers?
- Fructose detection (cold anthrone assay)

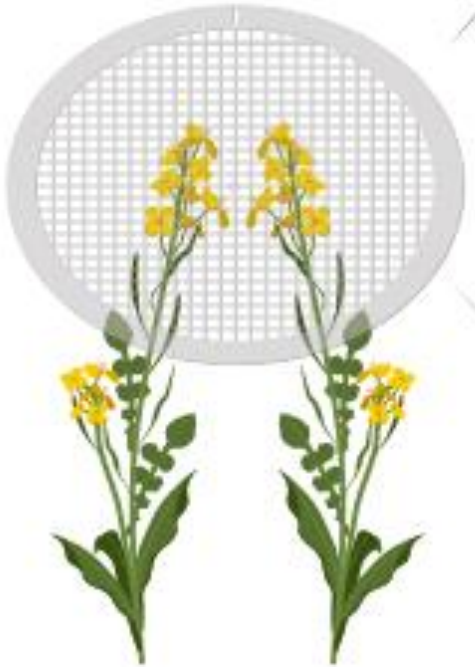
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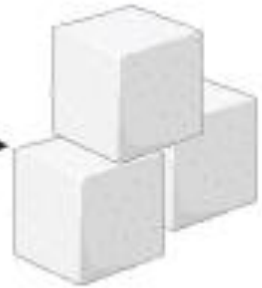
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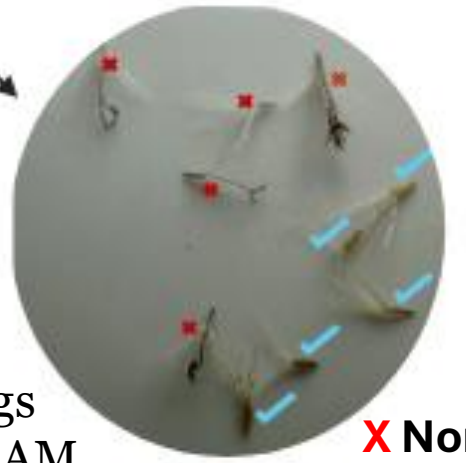
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Did flowers produce seeds?
- Seed set + viability

X Nonviable ✓Viable

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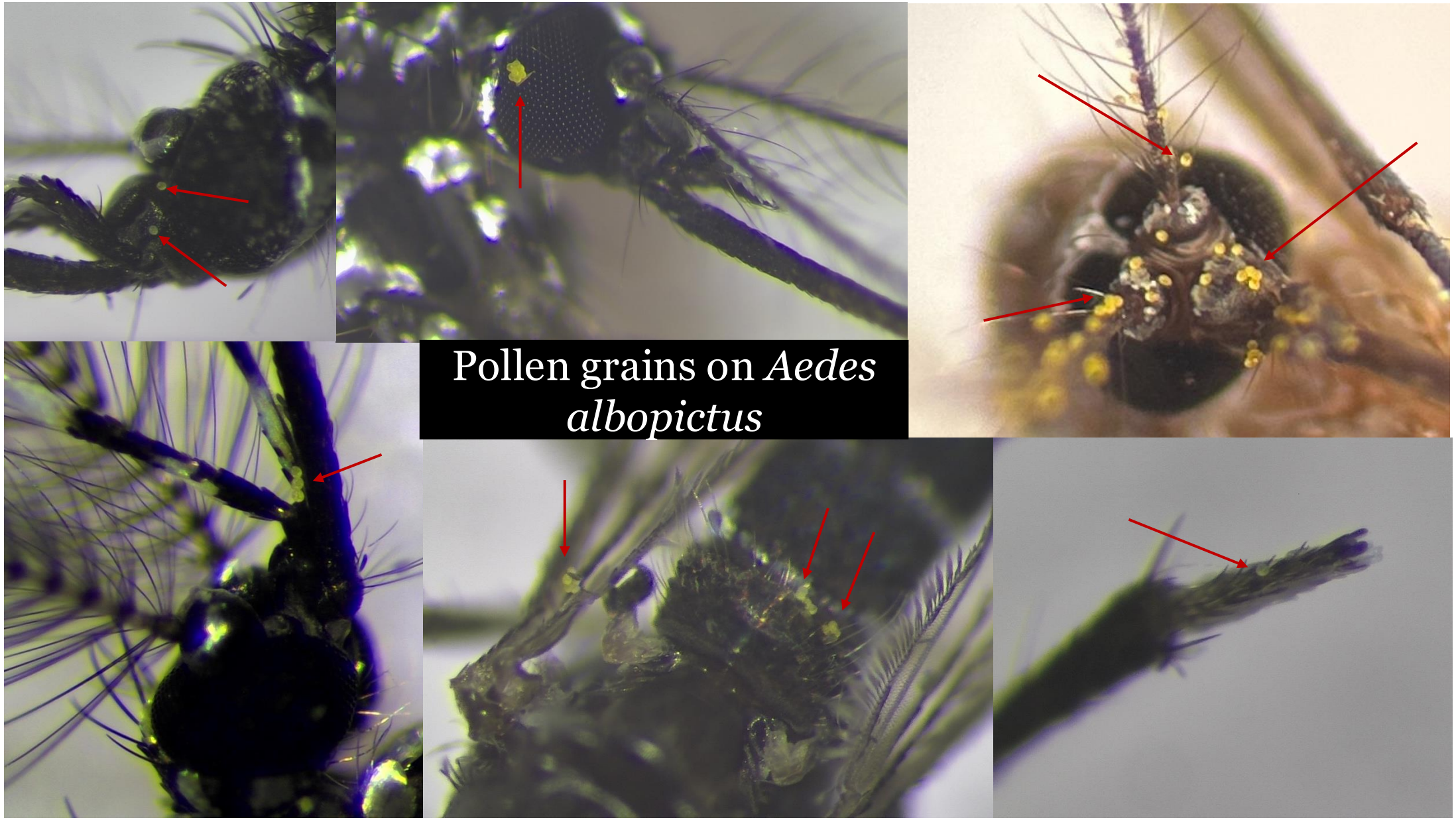
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Diggin’ for Gold(enrod)



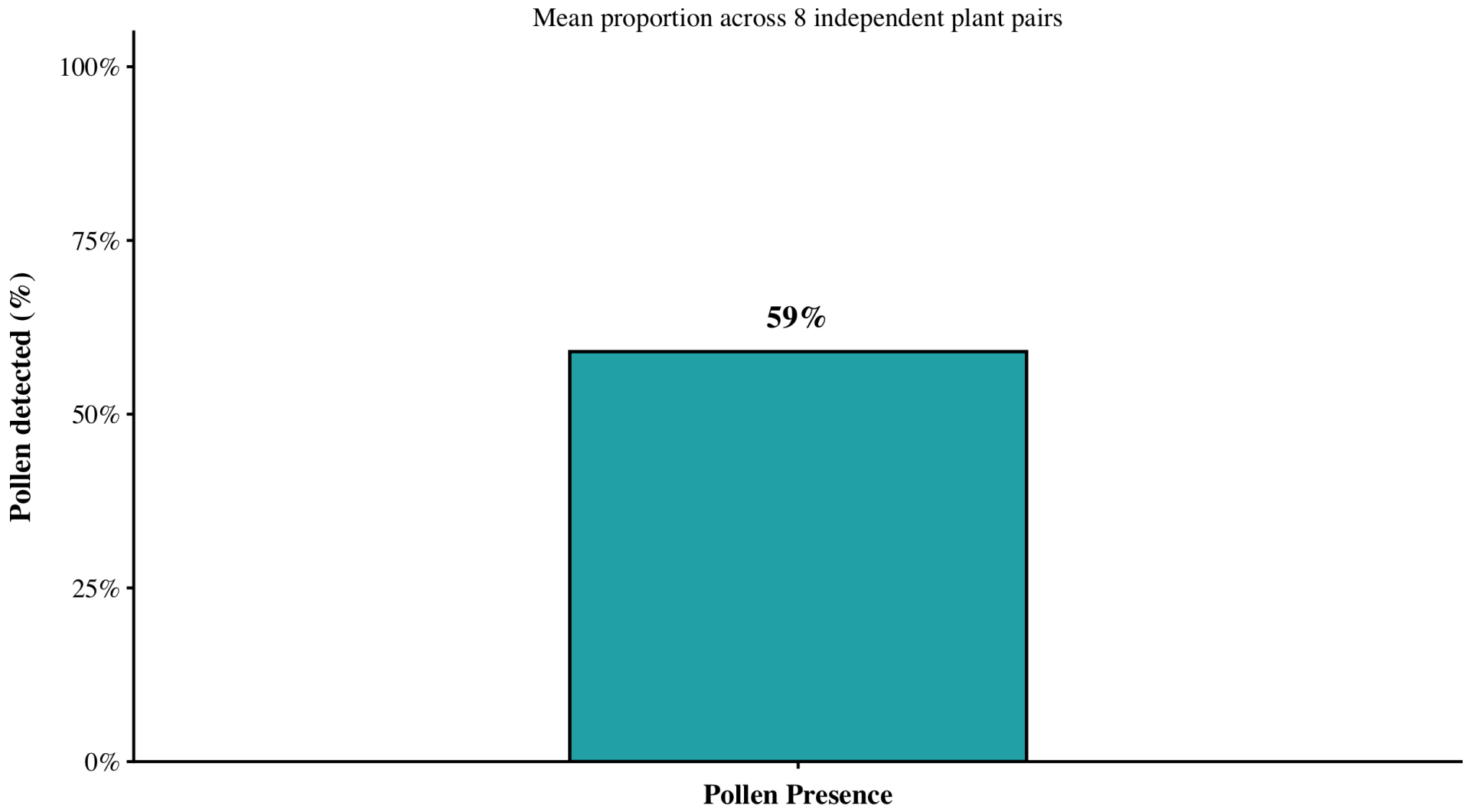


Aedes albopictus probing goldenrod (8x speed)



Pollen grains on *Aedes albopictus*

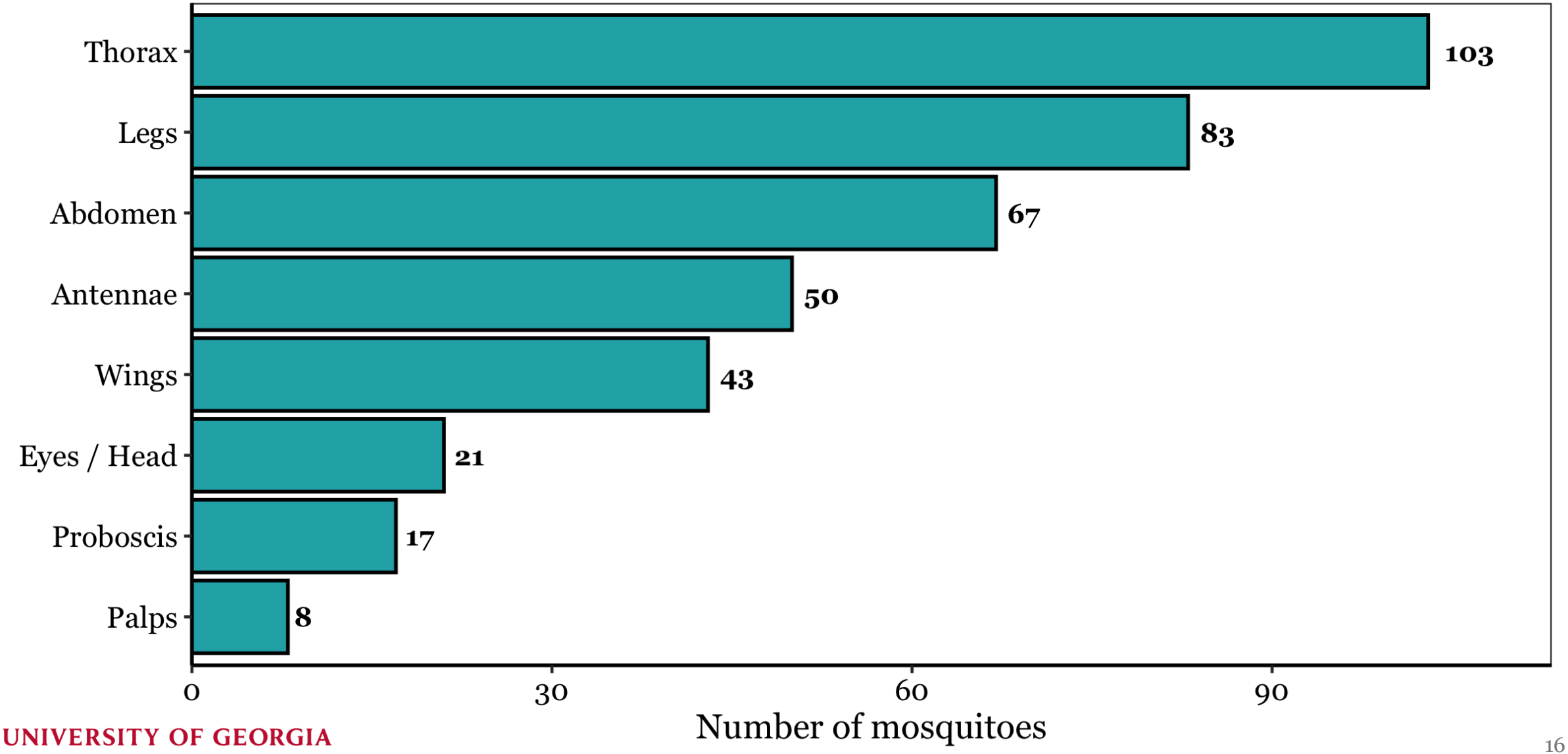
Mosquitoes Acquire Pollen From Goldenrod



On average, 59% of recovered mosquitoes carried ≥1 pollen grain after overnight exposure.

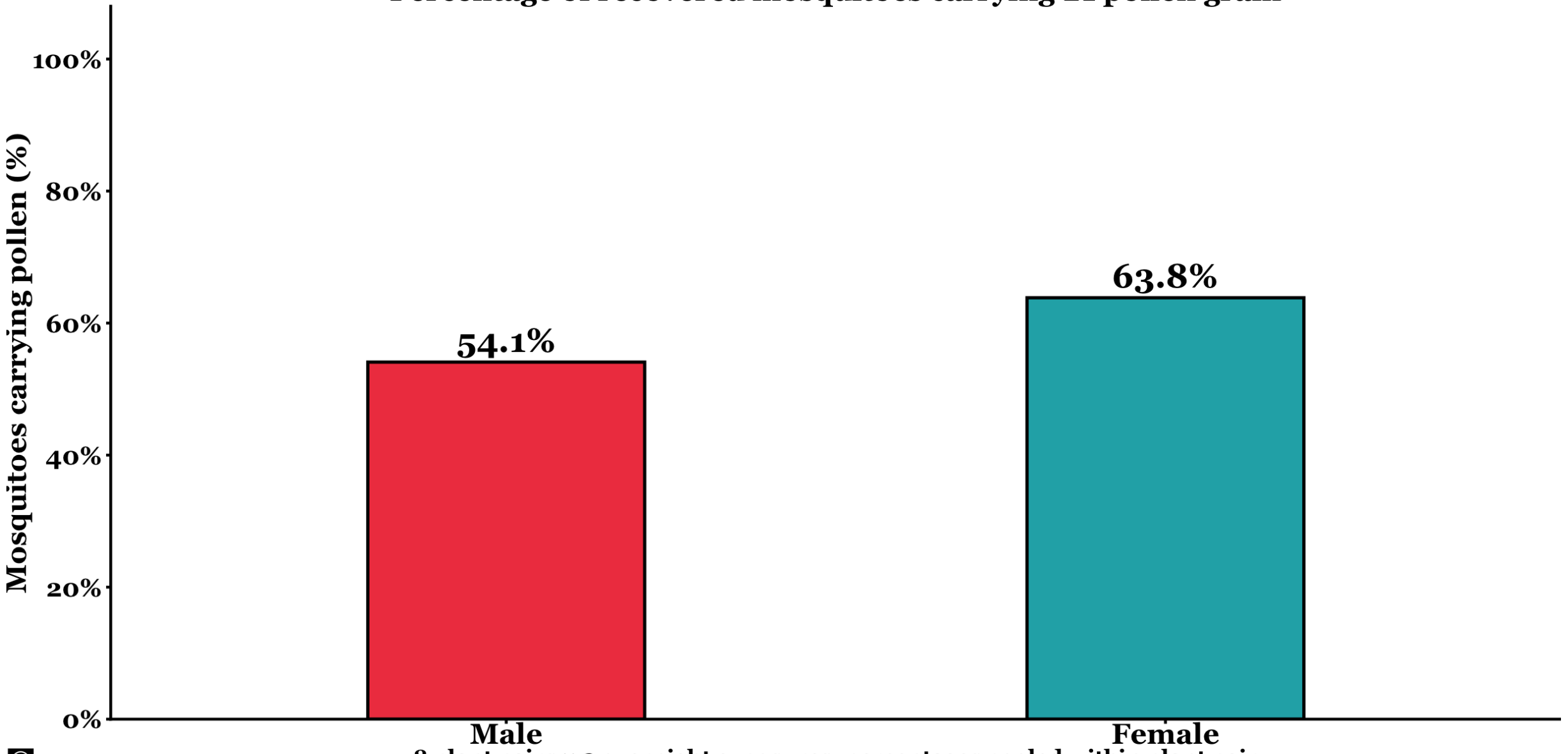
Where Did Mosquitoes Carry Pollen?

Number of recovered mosquitoes with pollen detected on each body part



Sex Differences in Pollen Acquisition

Percentage of recovered mosquitoes carrying ≥1 pollen grain



8 plant pairs × 3 overnight exposures; percentages pooled within plant pair

Paired Wilcoxon signed-rank test (n = 8): p = 0.01415

How did we detect recent floral sugar feeding?

Homogenize individual mosquito
in cold anthrone reagent



Individual mosquito from overnight floral exposure
sugar-starved ≥12 hrs before exposure



Wait 1 hour, observe for color change

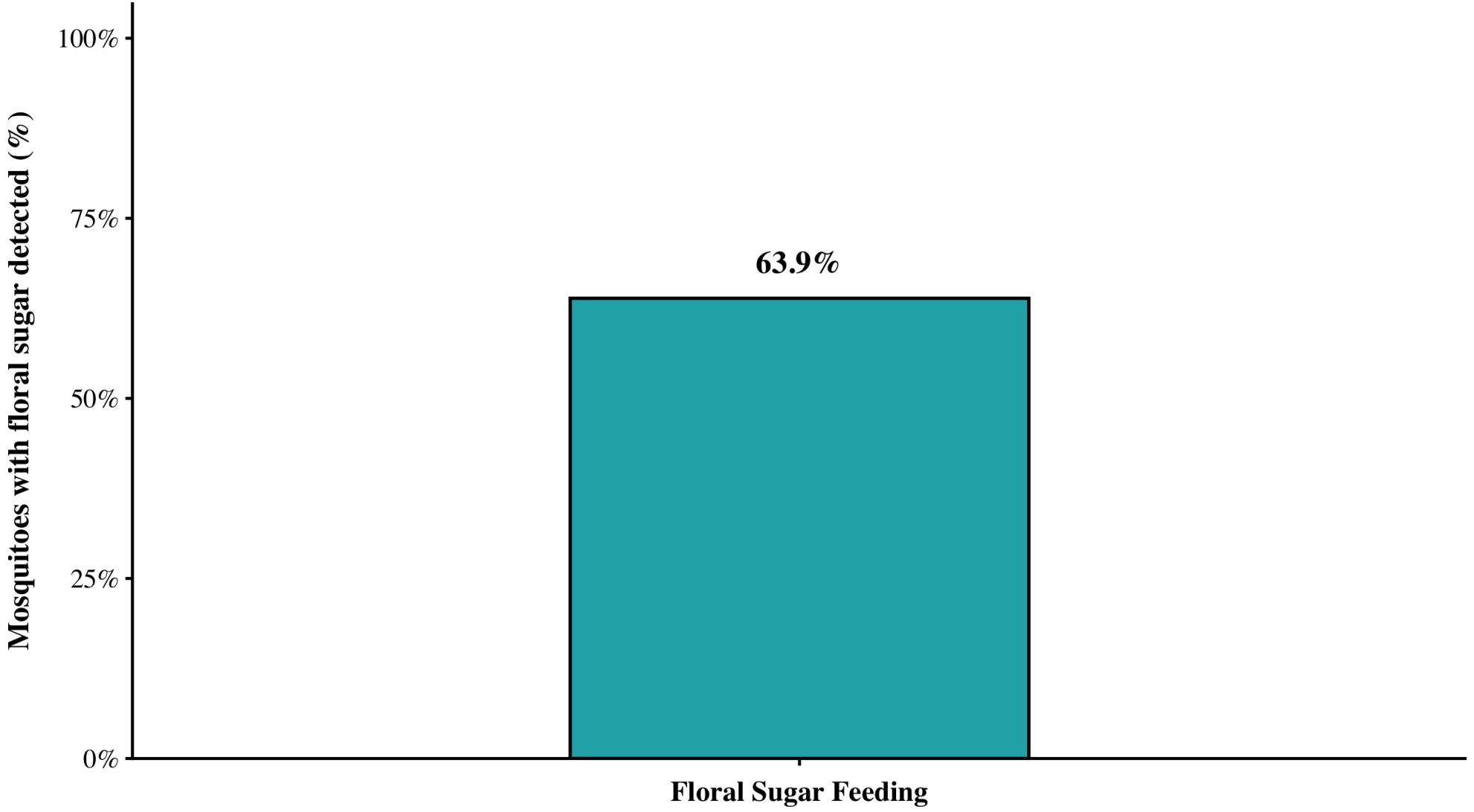


Fructose detected

Fructose not detected

Graphics made with BioRender

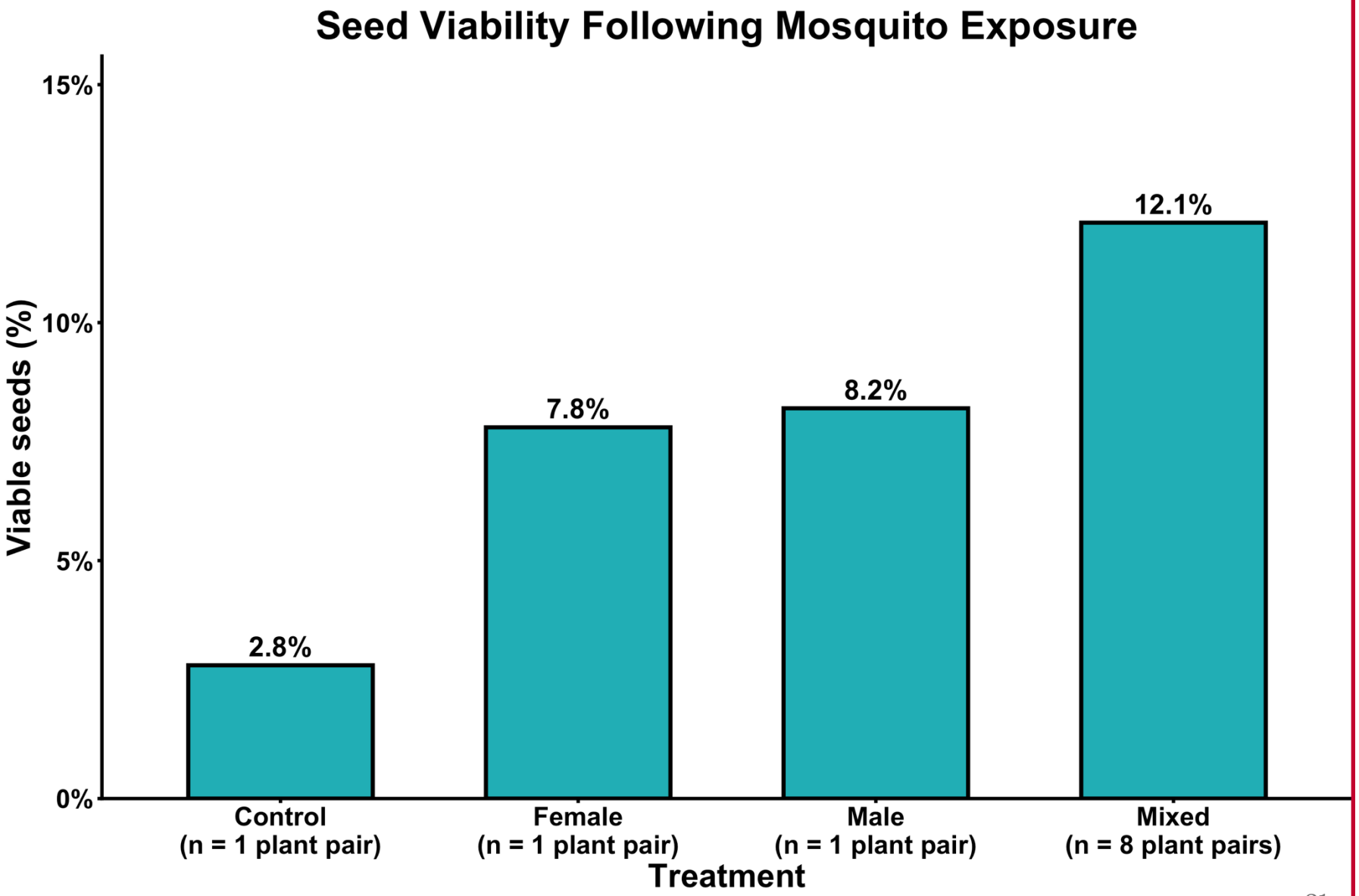
Mosquitoes Feed on Goldenrod



On average, ~64% of recovered mosquitoes tested positive for recent plant-derived sugar-feeding.

Seed Production

- Mosquito-exposed plants showed greater seed viability than controls.
- Mixed-sex exposure showed the highest seed production.
- Sex-specific treatments are preliminary because only one replicate was available for each treatment.



What did we learn toward our research questions?

Aim 1
How do sex differences in mosquito morphology influence pollen acquisition and transport?
→ **Females showed higher pollen-acquisition proportions than males within mixed-sex bags.**



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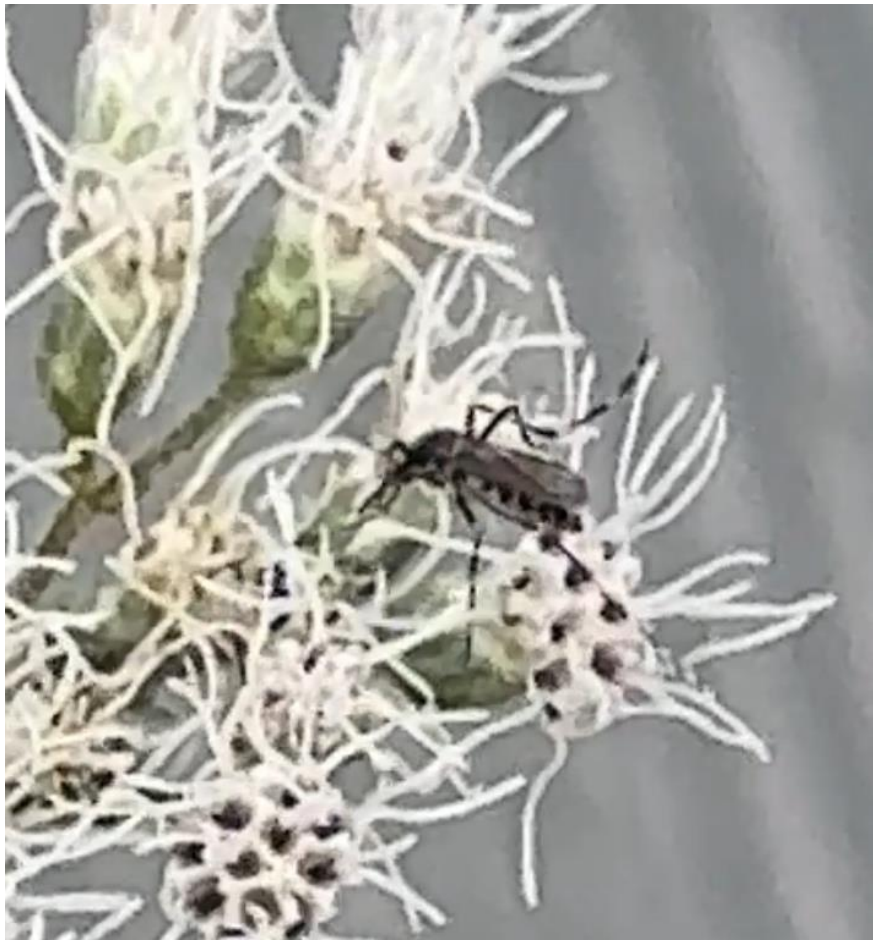
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Aim 3
How do sexes and mosquito species differ in their responses to floral odor?
→ **Ongoing work will test responses to floral odor.**

Where do we go from here?

- **Replicate** pollination experiments across mosquito species and host plants.
- **Test whether patterns observed in goldenrod extend to other plants.**
- **Identify mosquito visitors to flowers in the field.**
- **Identify key floral scent compounds** influencing sex- and species-specific responses.
- **Ultimately apply this knowledge toward more targeted mosquito control.**



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- Committee Members
  - Dr. Lewis Bartlett
  - Dr. Doug Paton







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