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Pollination with a Proboscis: Sex Differences in Mosquito-Flower Interactions

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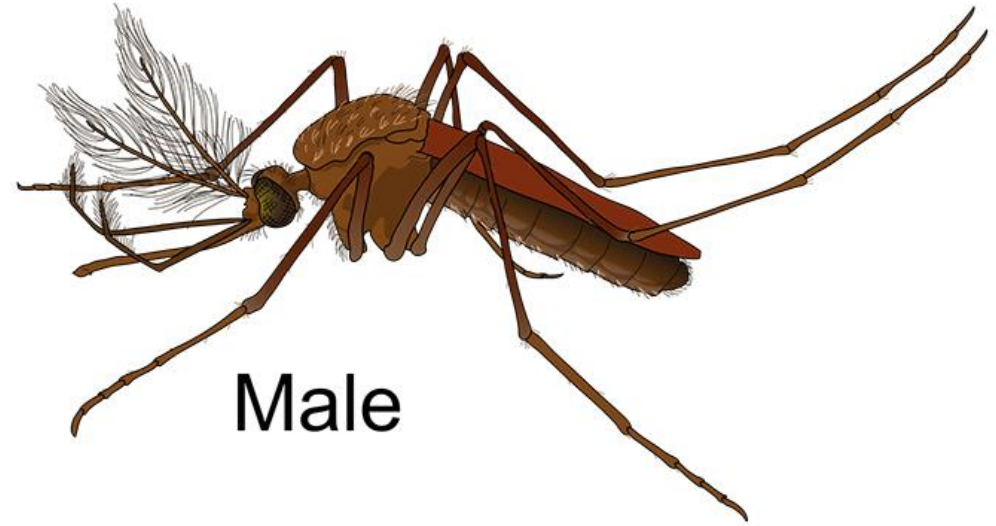
Outline

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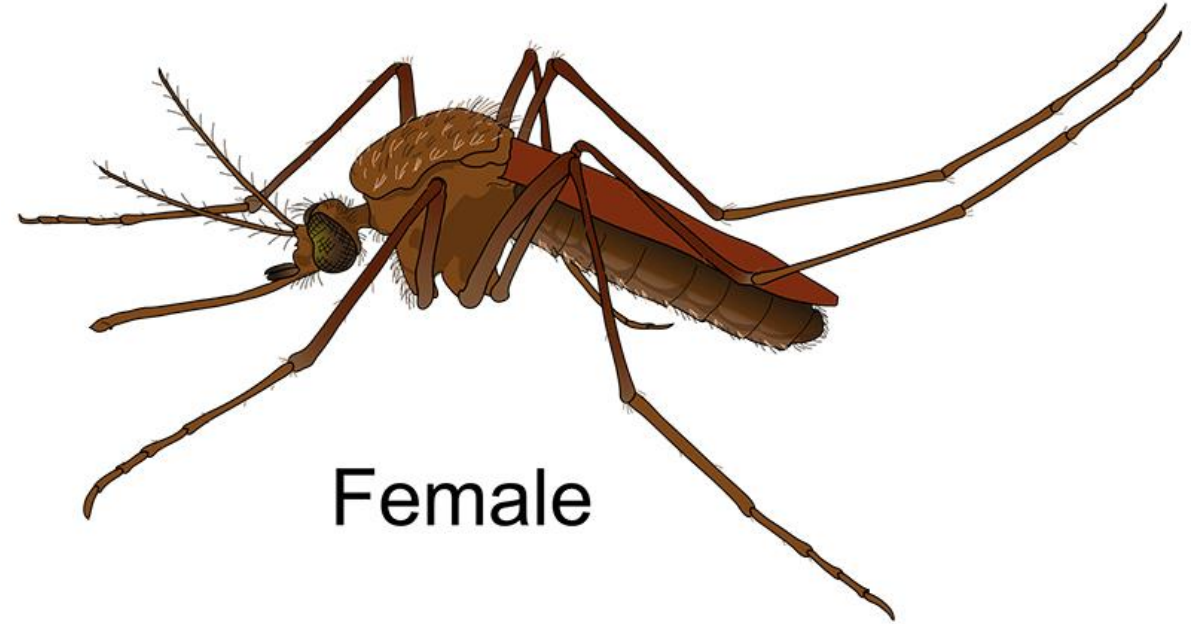


Background

- Mosquitoes visit flowers for nectar feeding.
- Males feed only on nectar.
- Females feed on both nectar and blood.
- Differences among sex and species may affect pollination efficiency.
- Plumose antennae in males are used for hearing but could also aid in floral detection.



Male



Female

Knowledge Gap & Rationale

- Mosquitoes are well-studied as disease vectors, but not for their broader ecological roles.
- Previous research such as those with *Platanthera obtusata* and *Tanacetum vulgare* show that **mosquitoes act as legitimate pollinators and respond to distinct floral cues**.
- These cues may vary by sex and species, but their ecological and behavioral impacts are unclear.
- Understanding these patterns could enable species-specific control by targeting unique floral host-seeking behaviors or inform the use of surgical control approaches like genetic techniques.



Image credit: Jeff Riffell

Research Hypotheses

1. Male mosquitoes transfer significantly more pollen than females due to morphological and feeding differences.
2. Pollination efficiency varies significantly between mosquito species visiting the same plant.
3. Attraction to floral odor differs between sexes and among mosquito species, indicating variation in olfactory responses to natural floral cues.



Image credit: Lawrence Reeves



Study Species

Solidago spp.
(Goldenrod)



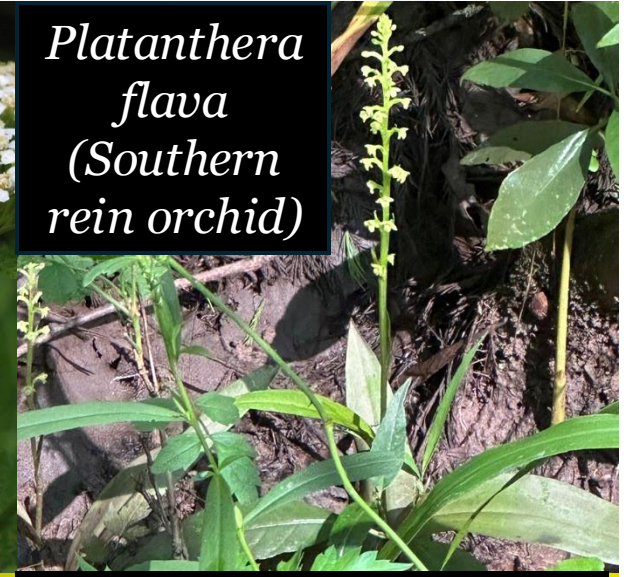
Eupatorium
serotinum
(Late Boneset)



Achillea
millefolium
(Yarrow)



Platanthera
flava
(Southern
rein orchid)



Anopheles sp.



Aedes sp.



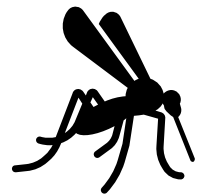
Culex sp.



Pollination Assays

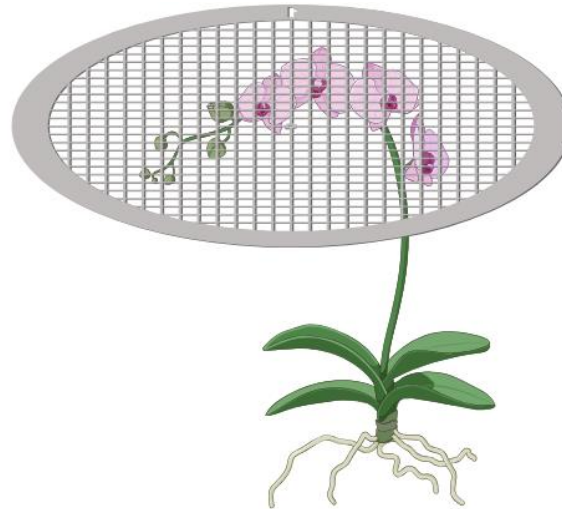
Hypotheses:

1. Males transfer significantly more pollen than females due to morphological and feeding differences.
2. Pollination efficiency varies significantly between species visiting the same plant.



Groups:

- Male/Female
- *Aedes/Anopheles/Culex*
- 40 individuals



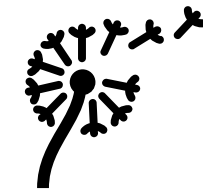
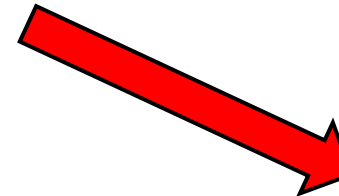
Mosquito exposure to flowers
(bagged inflorescence)



Environment:
27C, 80% rH

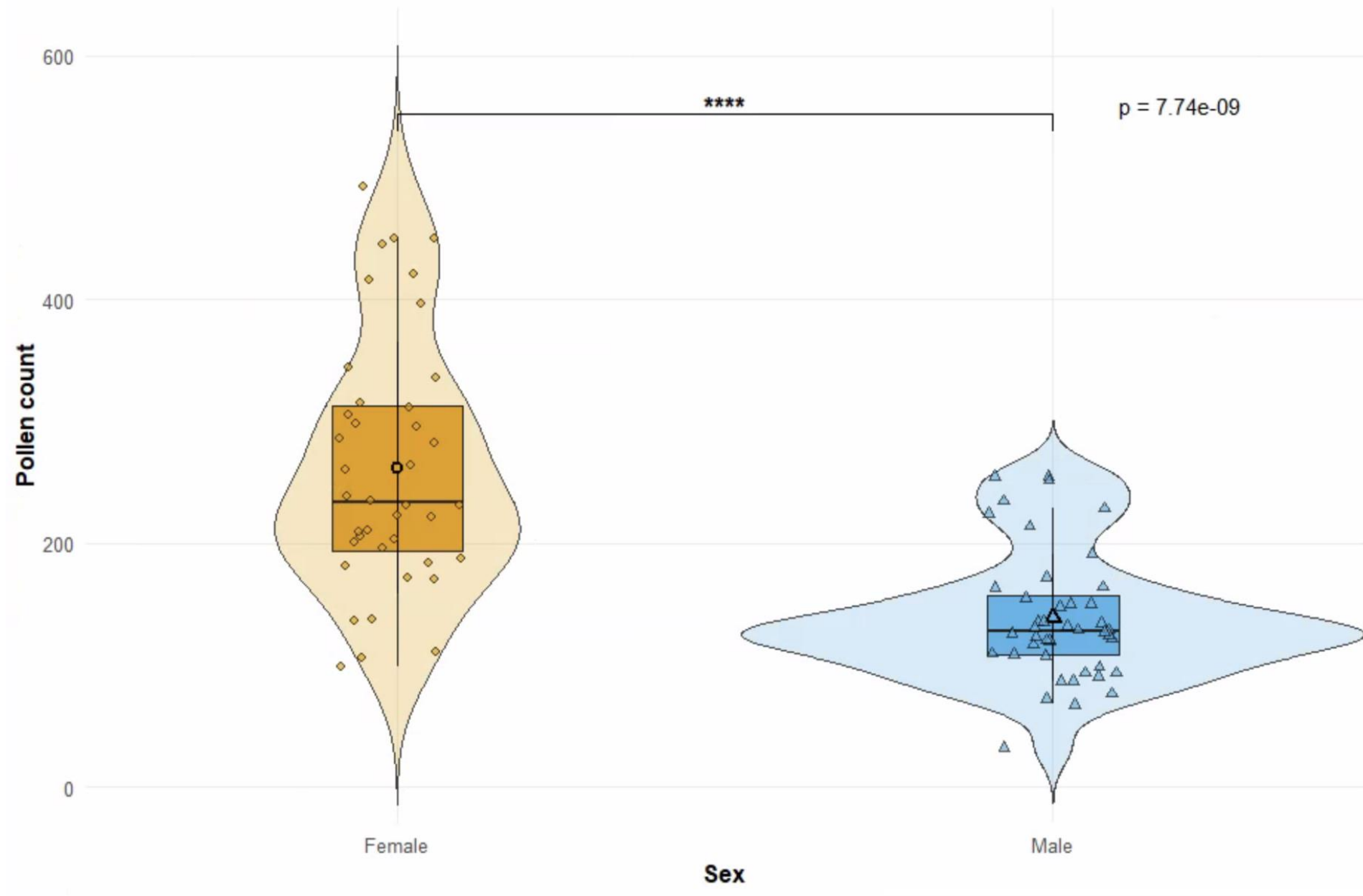


Pollen load
(after exposure)

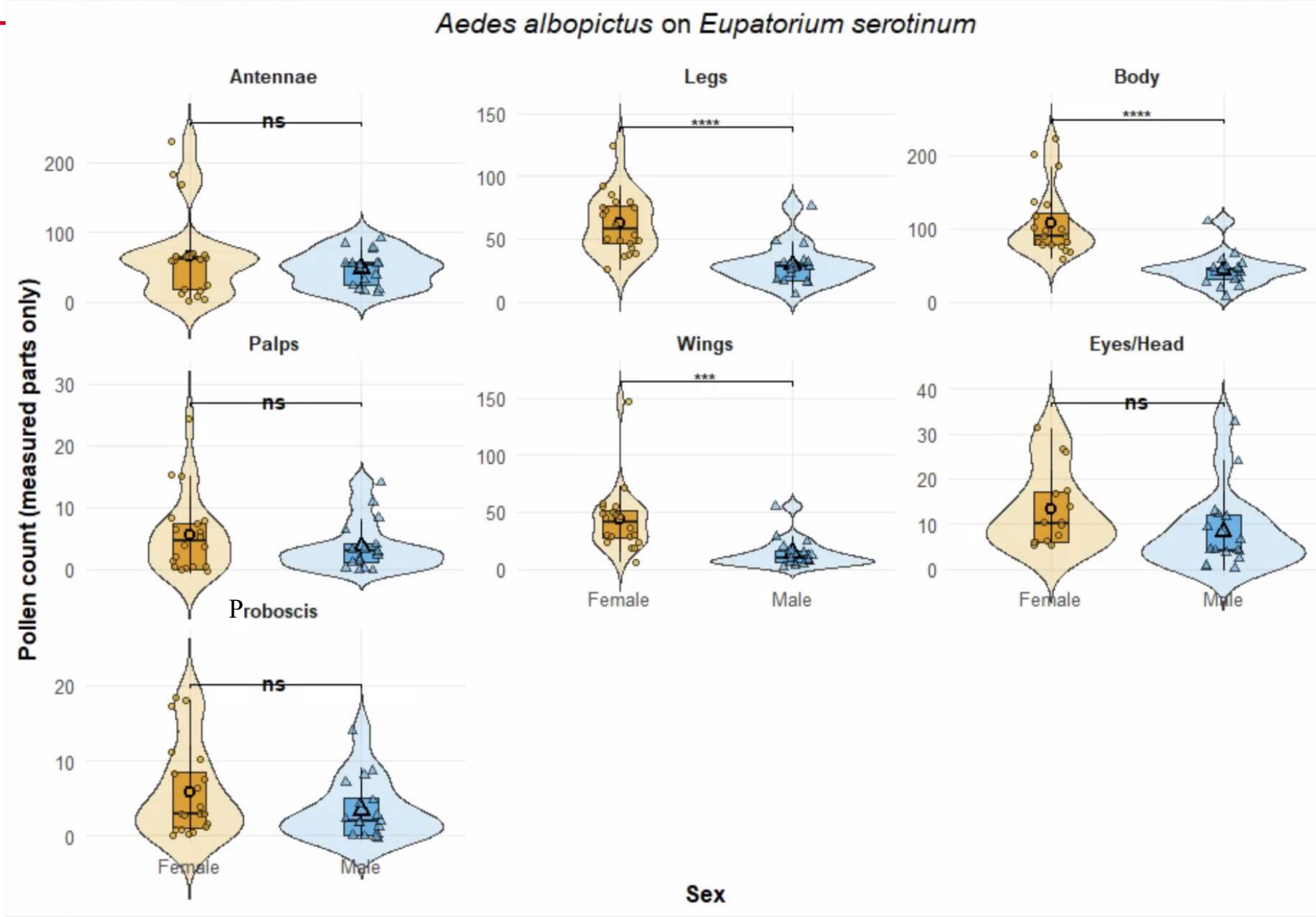


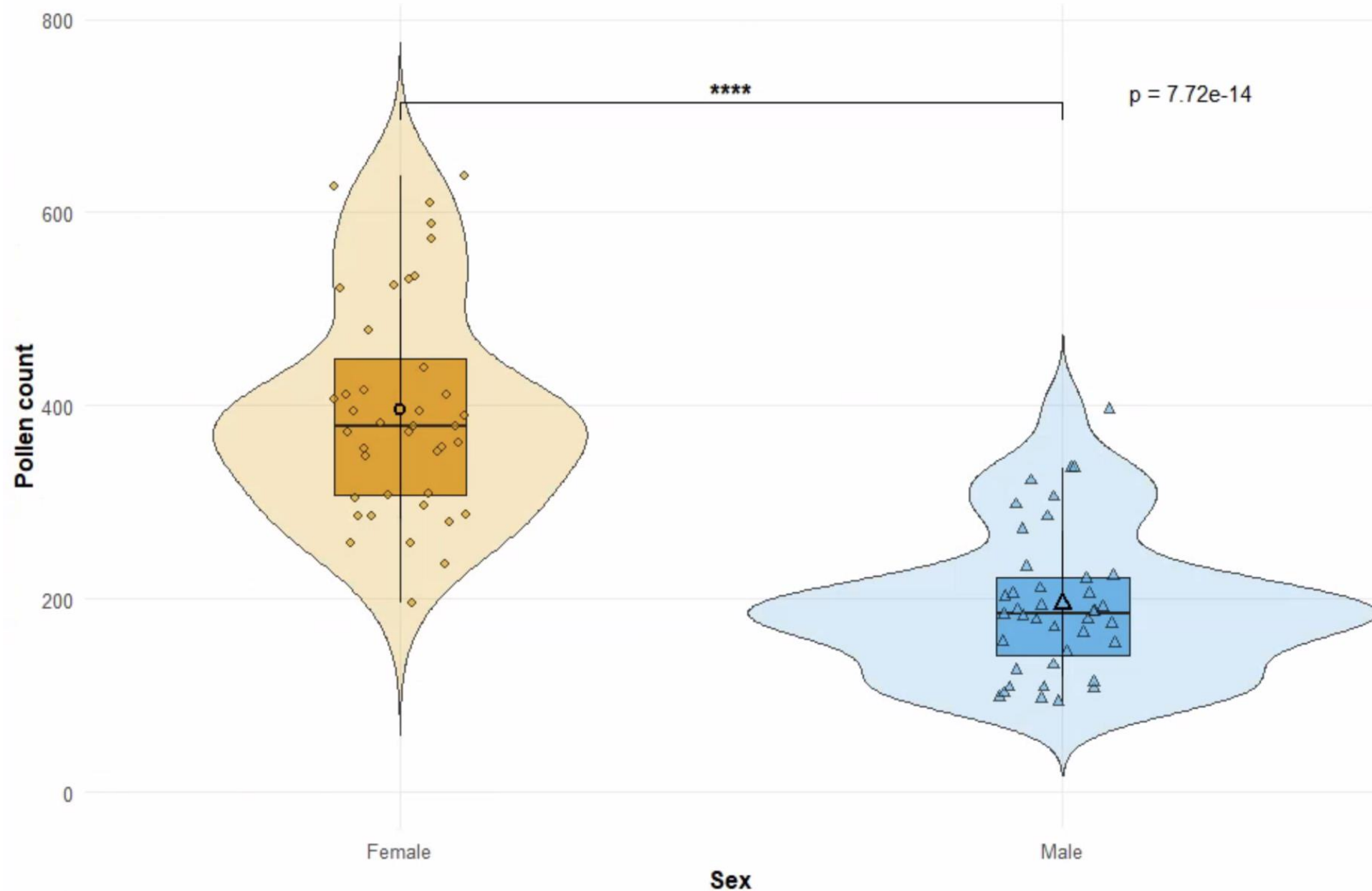
Seed set
(after exposure)

- Females (n=40)=
 259.88 ± 107.00
- Males (n=44)=
 139.14 ± 52.65
- **Females are carrying significantly more pollen than males.**
- Test used: Welch's two-sample t-test.



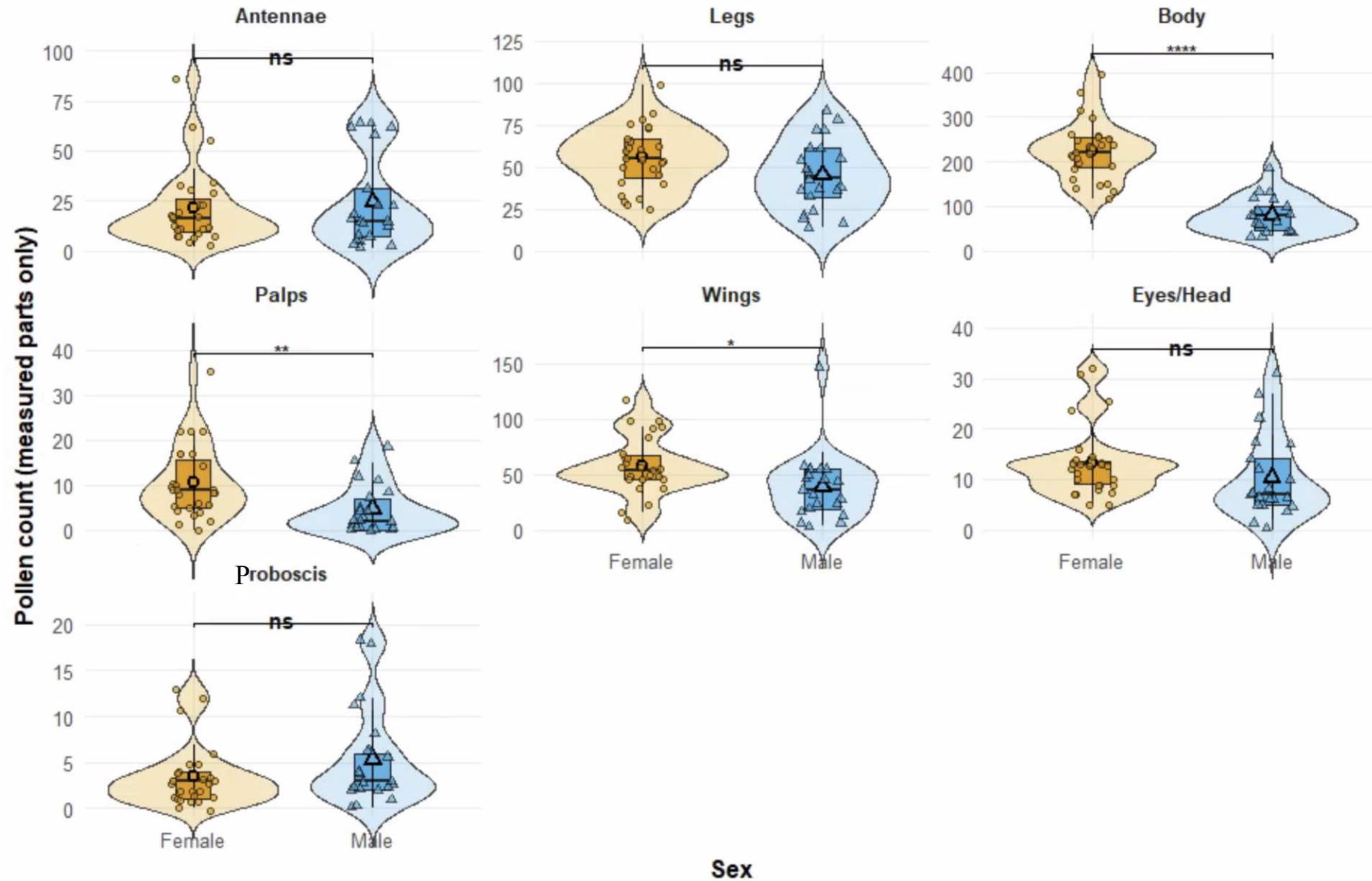
- Female *Aedes albopictus* are carrying significantly more pollen on their wings, legs, and body.



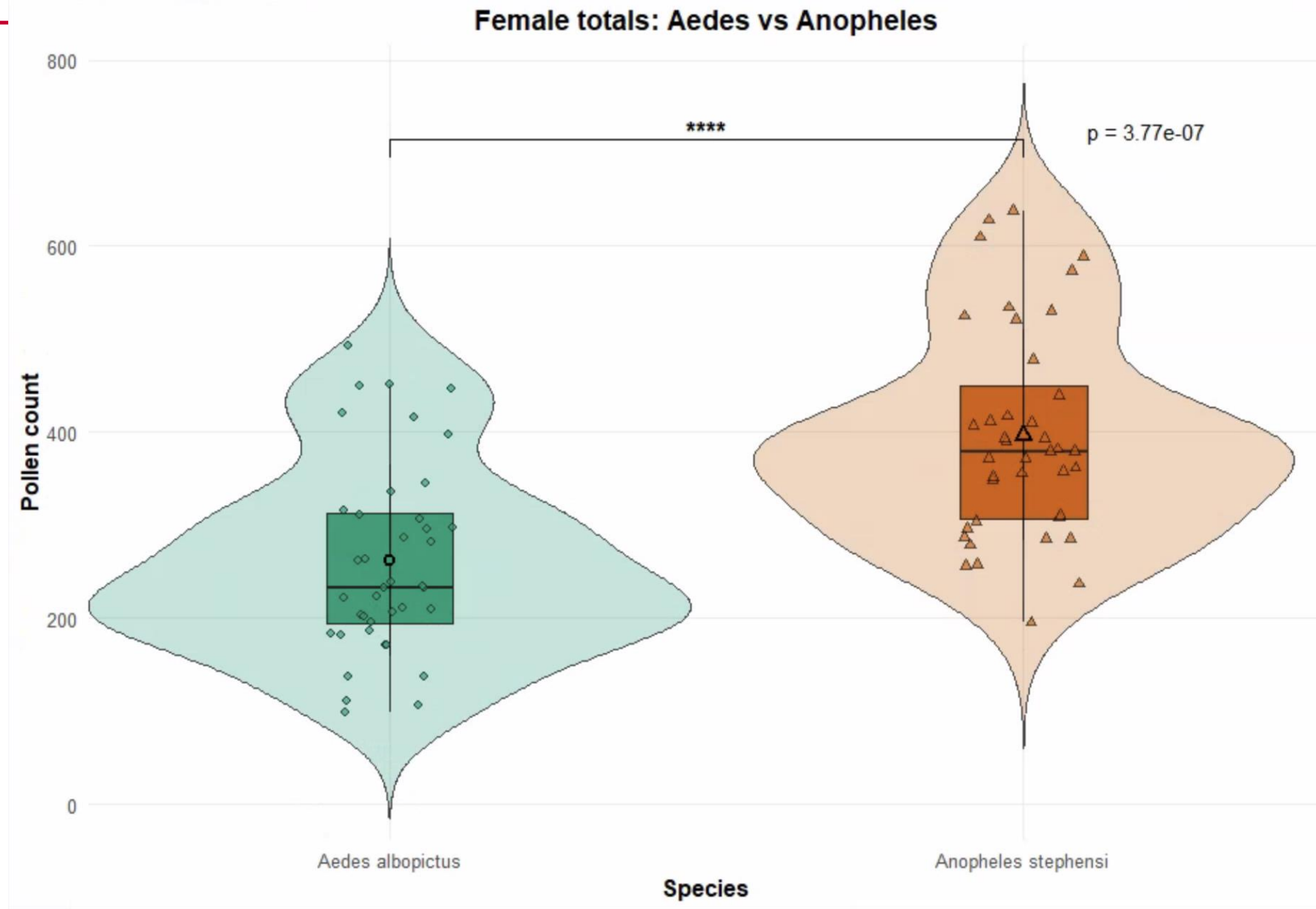


- Females (n=40)=
 396.53 ± 108.35
- Males (n=40)=
 194.73 ± 74.47
- **Females are carrying significantly more pollen than males.**
- Test used: Welch's two-sample t-test.

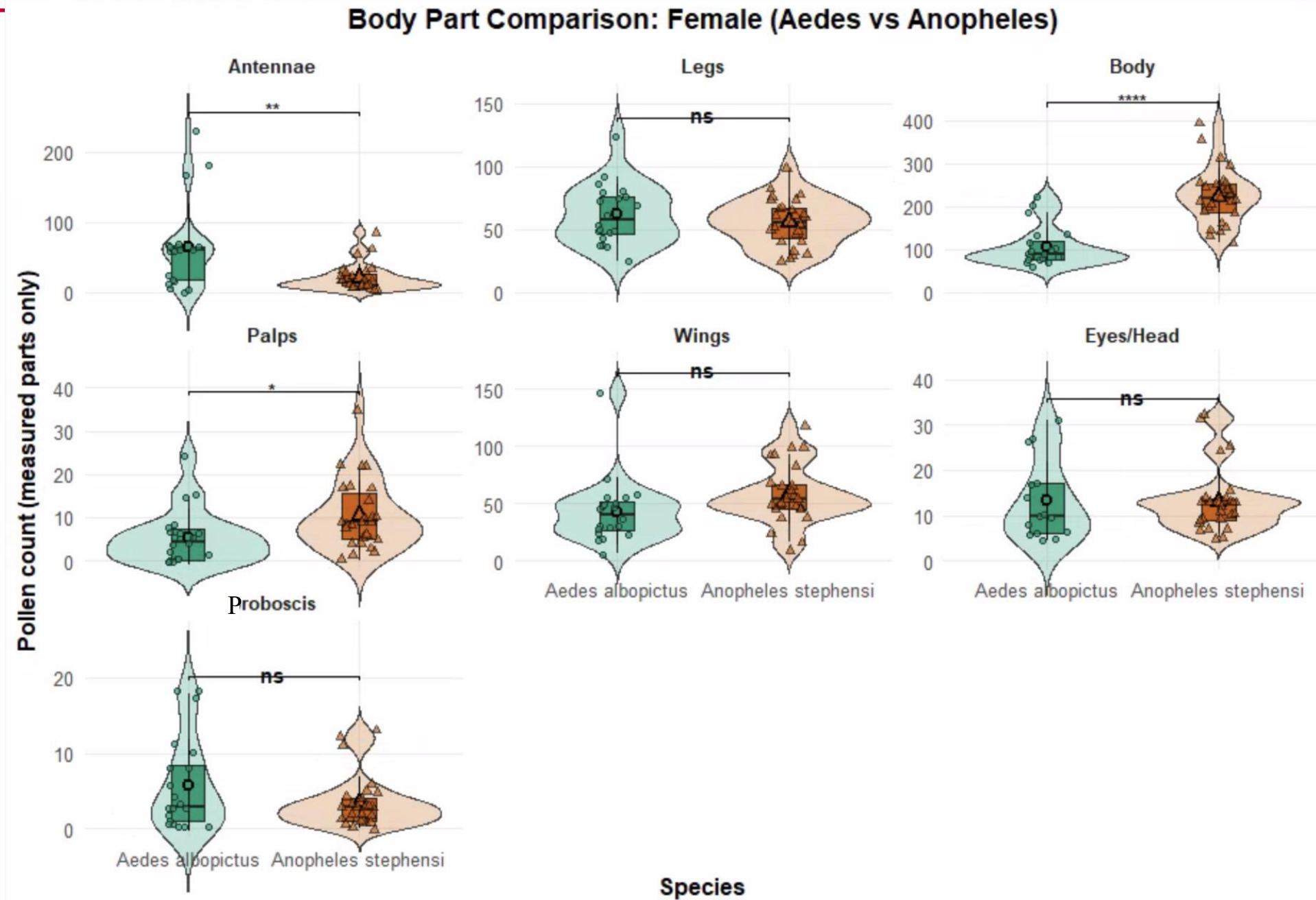
- Female *Anopheles stephensi* are carrying significantly more pollen on their palps, body, and wings.



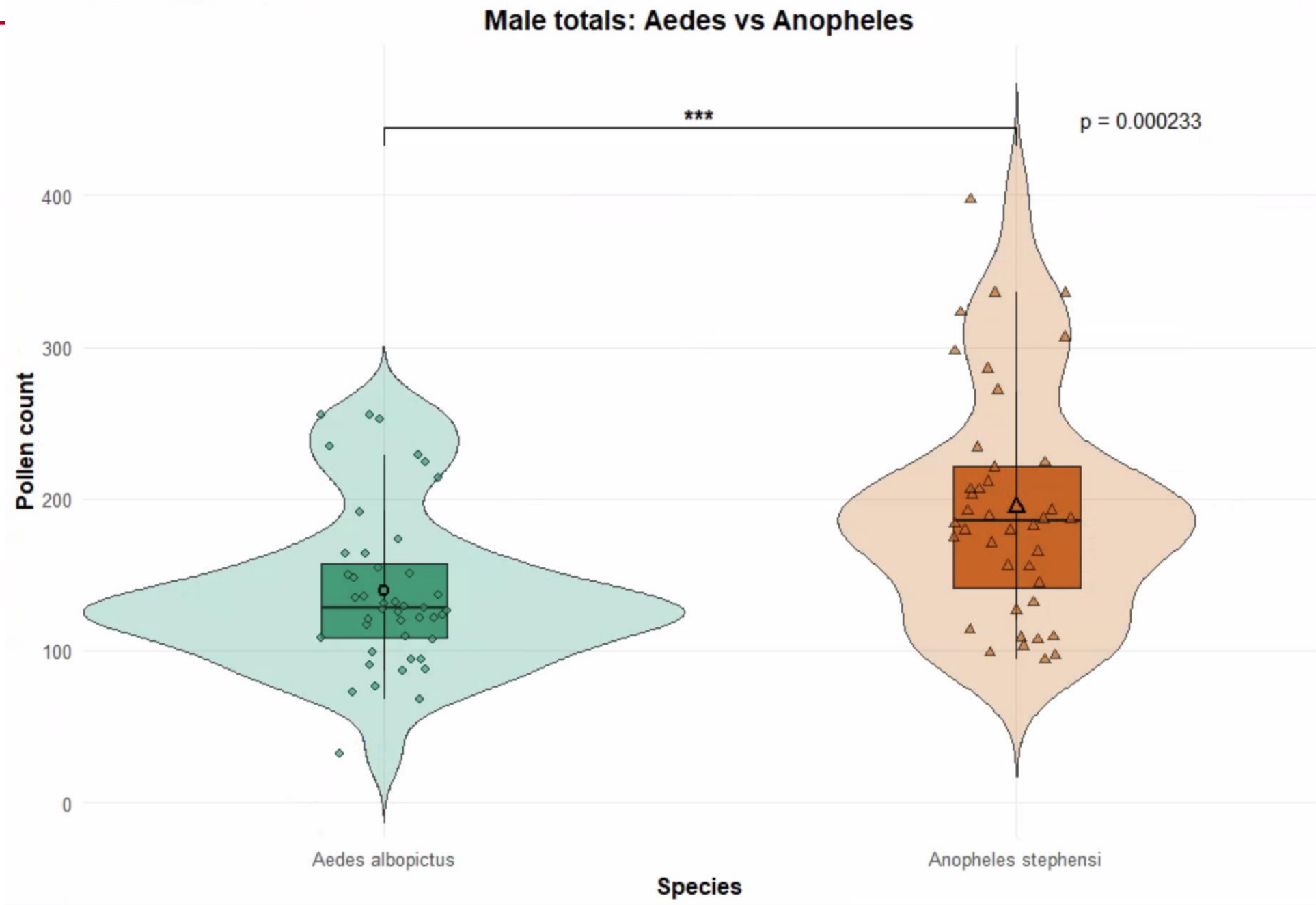
- Female *Anopheles stephensi* are carrying significantly more pollen overall than *Aedes albopictus* females.



- Female *Anopheles stephensi* are carrying significantly more pollen on their body and palps.
- Female *Aedes albopictus* are carrying significantly more pollen on their antennae.

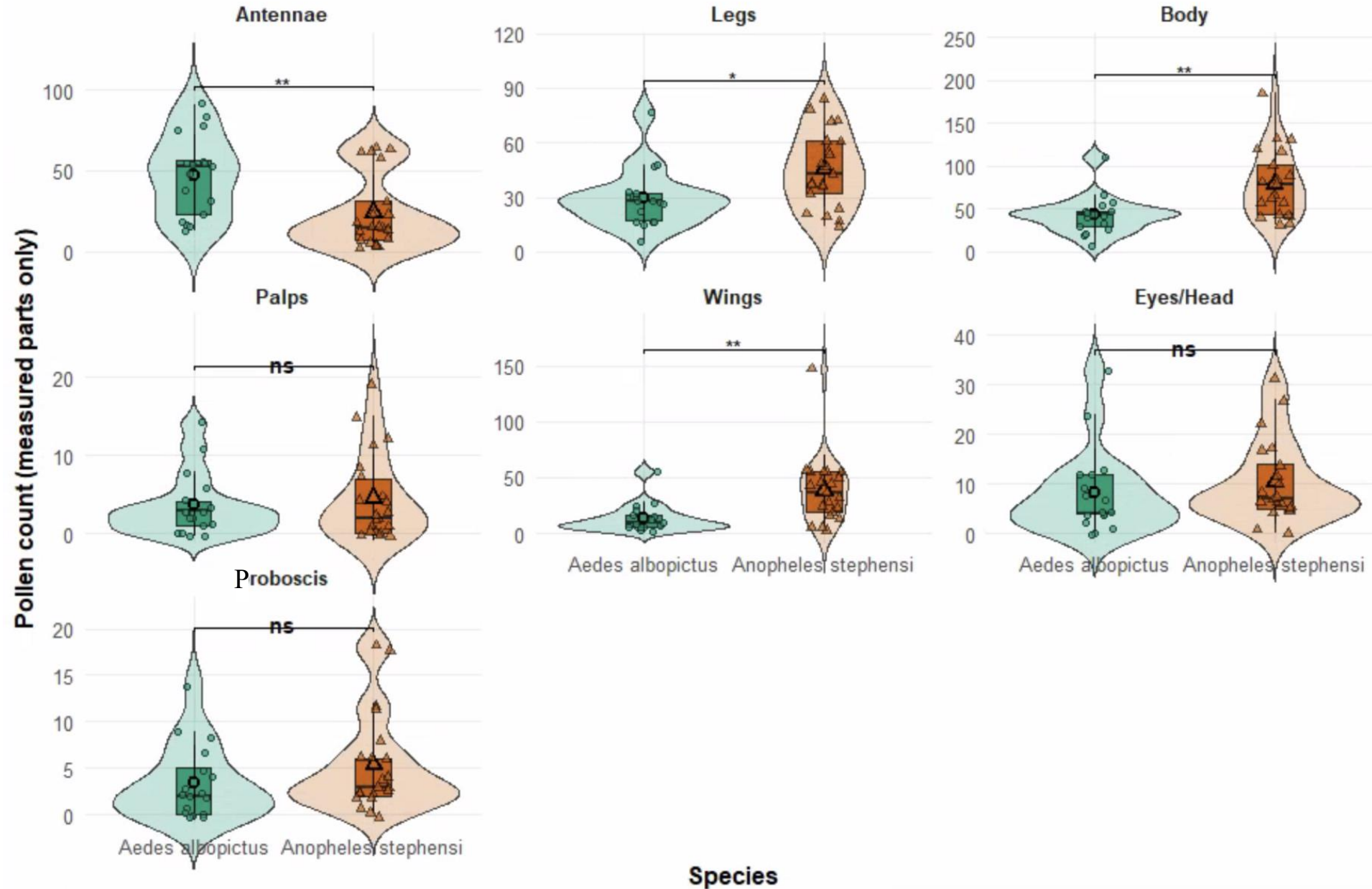


- Male *Anopheles stephensi* are carrying significantly more pollen overall than *Aedes albopictus* males.



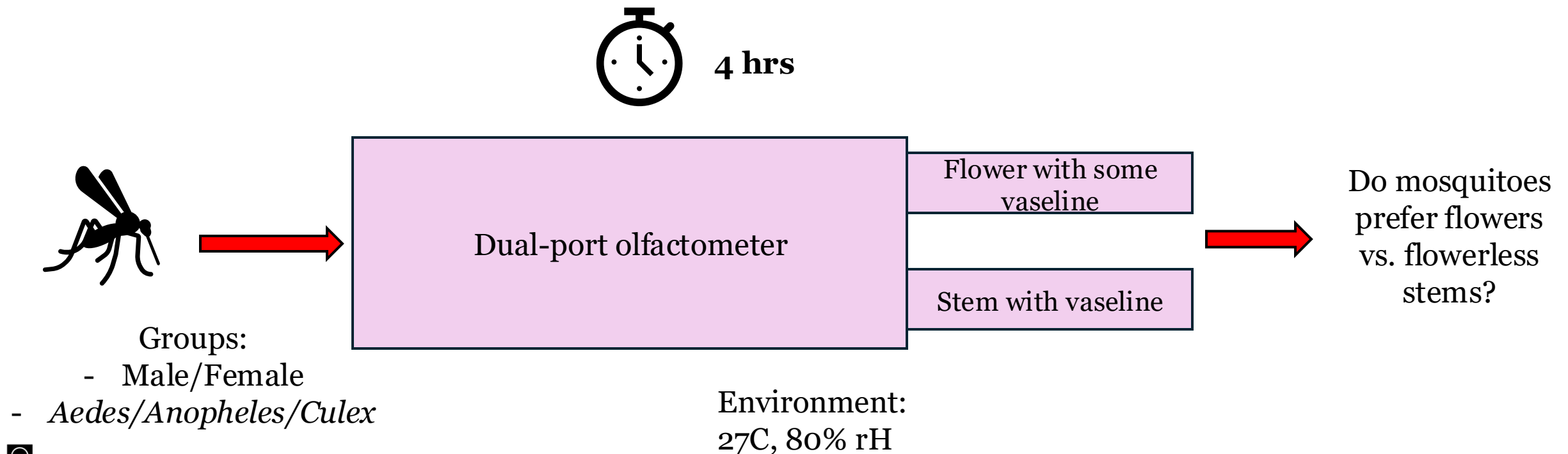
Body Part Comparison: Male (Aedes vs Anopheles)

- Male *Anopheles stephensi* are carrying significantly more pollen on their wings, legs, and body.
- Male *Aedes albopictus* are carrying significantly more pollen on their antennae.



Odor-Based Assays

- **Aim: Identify preference for flowers.**
- Assess choice by mosquito travel into either arm of the dual-port olfactometer.
- Hypothesis: Attraction to floral odor differs between sexes and among mosquito species, indicating variation in olfactory responses to natural floral cues.

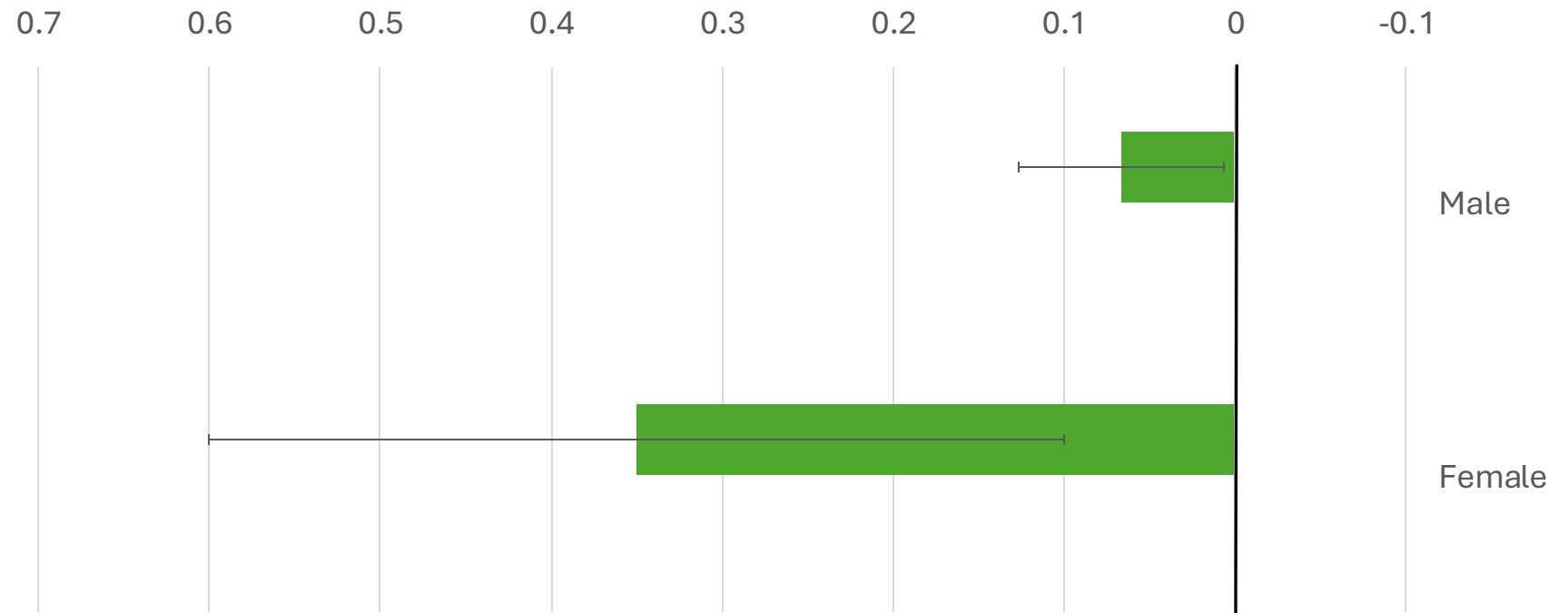


Odor-Based Assays

Anopheles stephensi response to *Eupatorium hyssopifolium*

Mean Proportion of Mosquitoes Responding

- For females, there were 2 replicates.
- For males, there were 3 replicates.
- 10 insects were used per replicate.



Next Steps

- Test attraction across additional mosquito species and host plants.
- Identify key floral scent compounds influencing sex- and species-specific responses.
- Apply findings to develop targeted, species-specific control strategies.



Image credit: Entomological society of America

Anticipated Outcomes & Significance

- Sex and species differences shape mosquito-flower interactions and pollination efficiency.
- Findings can inform ecologically grounded mosquito control, especially for invasive or vector species.
- In the long term, behavioral findings can complement genetic tools for control to make future approaches more precise.
- Attraction to specific floral odors may be harnessed for targeted mosquito control.



Image credit: Skyler Nichols

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Thank You



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