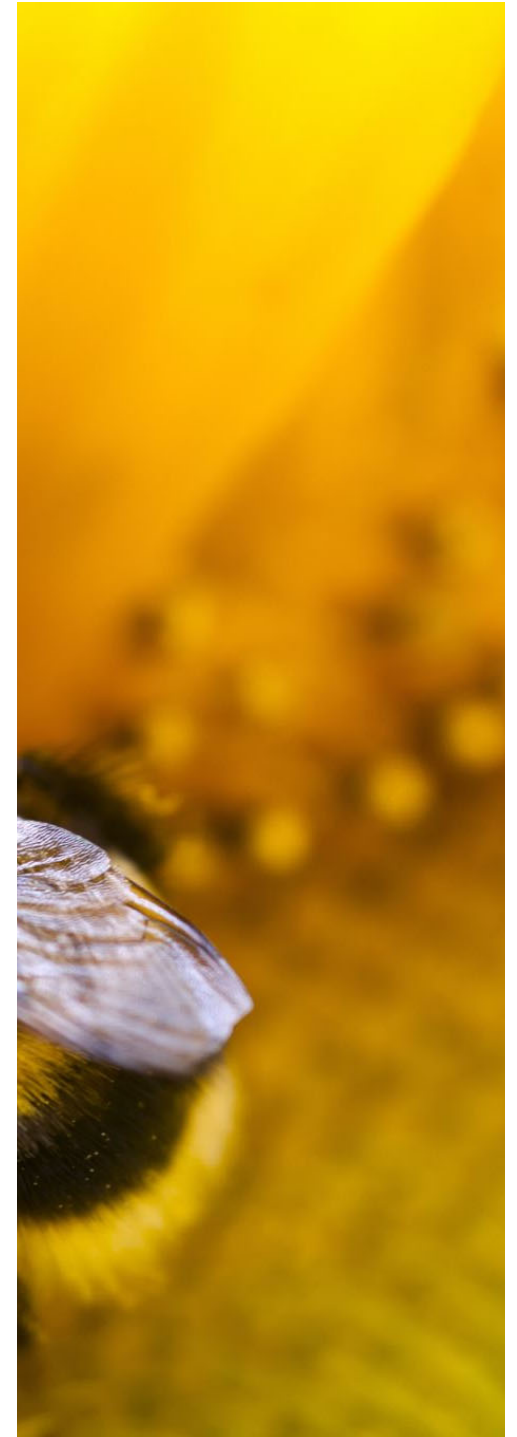


# Further Updates on Sunflower Pollination:

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Interactions of Plant  
Phenotype, Crop  
Environment, and  
Pollinator Identity

Beth Ferguson, Brent Hulke & Jarrad Prasifka  
USDA-ARS, ETSARC Fargo, ND



# Sunflower Pollinators

- Bees increase yield in sunflower hybrids  $\approx 40\%$ <sup>12</sup>
- Larger florets reduce visits from native bees (ND)
- Differences in value, behavior of native bees versus honeybees

Du Toit AP. 1990. The importance of certain insects as pollinators of sunflower

Mallinger, RE., J Bradshaw, AJ Varenhorst, and JR Prasifka. 2019. Native solitary bees provide economically significant pollination services to confection sunflowers (*Helianthus annuus* L.) (Asterales: Asteraceae) grown across northern Great Plains

# Pollinator Projects-2020

1

Examine additional inbred lines for genotype, environment and genotype x environment effects on nectar volume and composition  
*(new)*

2

Use phenotypic data to map gene(s) controlling nectar volume in cultivated sunflower  
*(continued)*

3

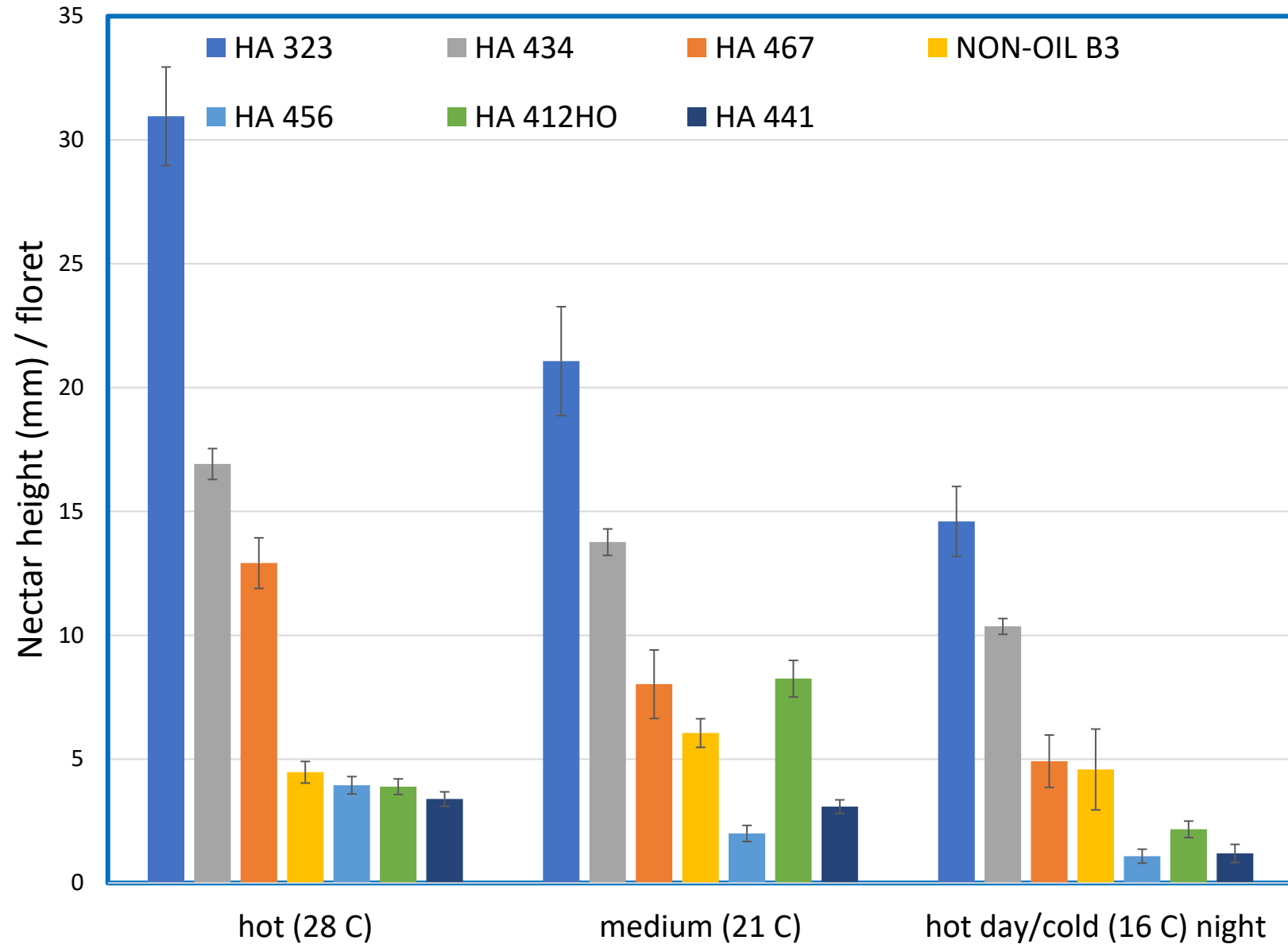
Continue field observations to model how nectar access, nectar volume, and other traits influence bee visitation to sunflowers  
*(continued)*

# Nectar x Floret

Line:  $p < 0.05$

Treatment:  $p < 0.05$

Line\*Treatment:  $p < 0.05$

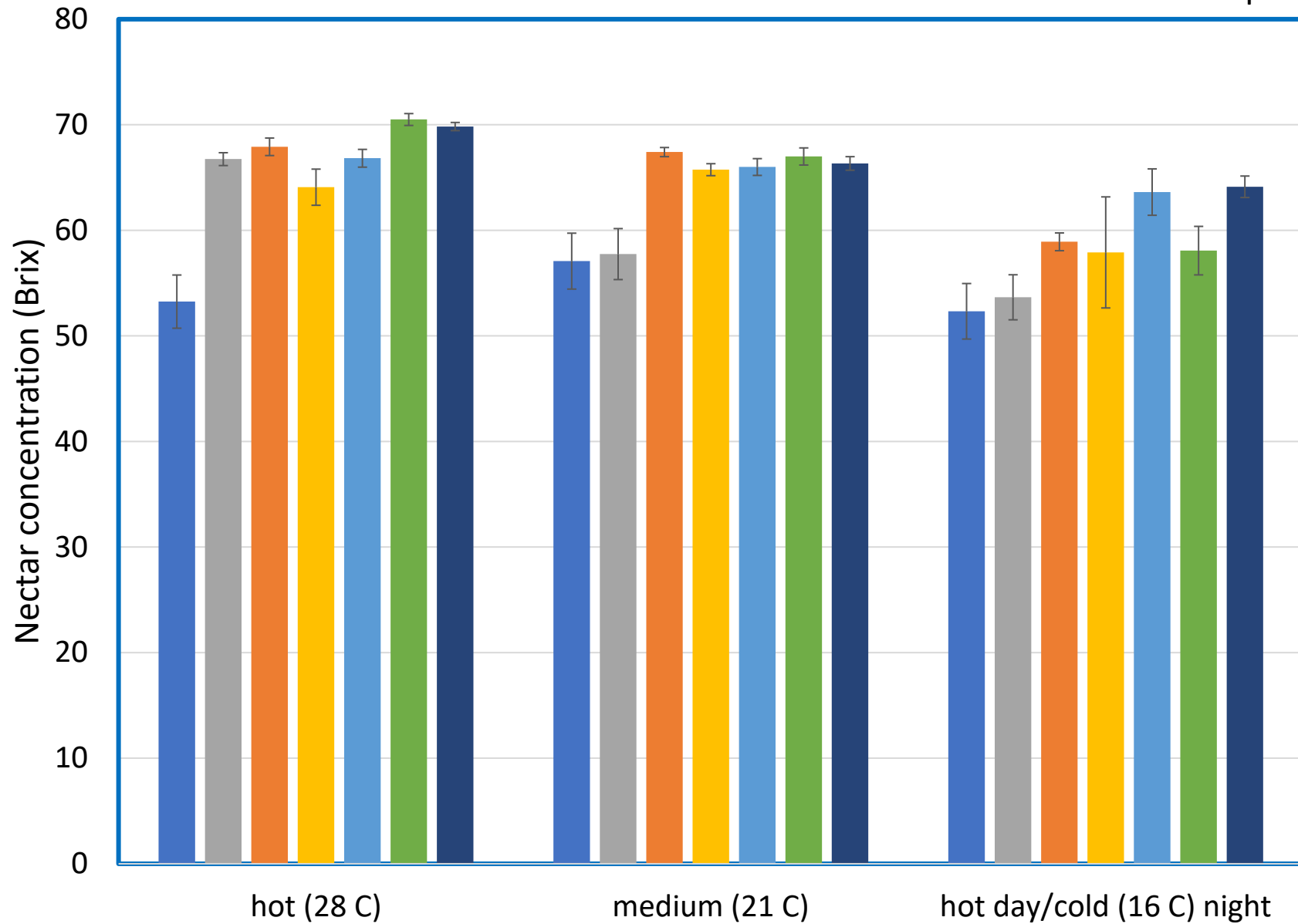


# Nectar Concentration

Line:  $p < 0.05$

Treatment:  $p < 0.05$

Line\*Treatment:  $p = 0.02$

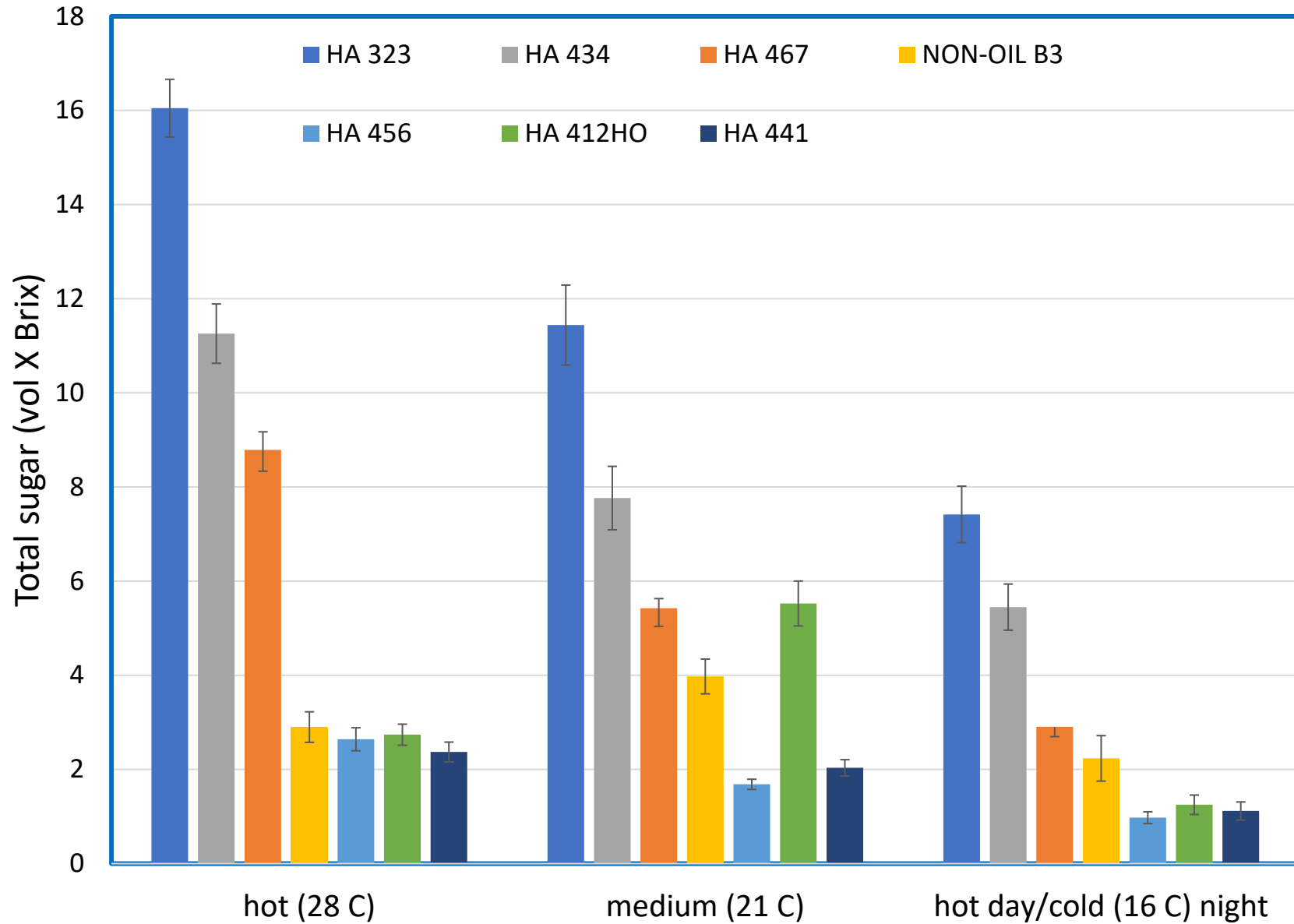


# Total Sugar

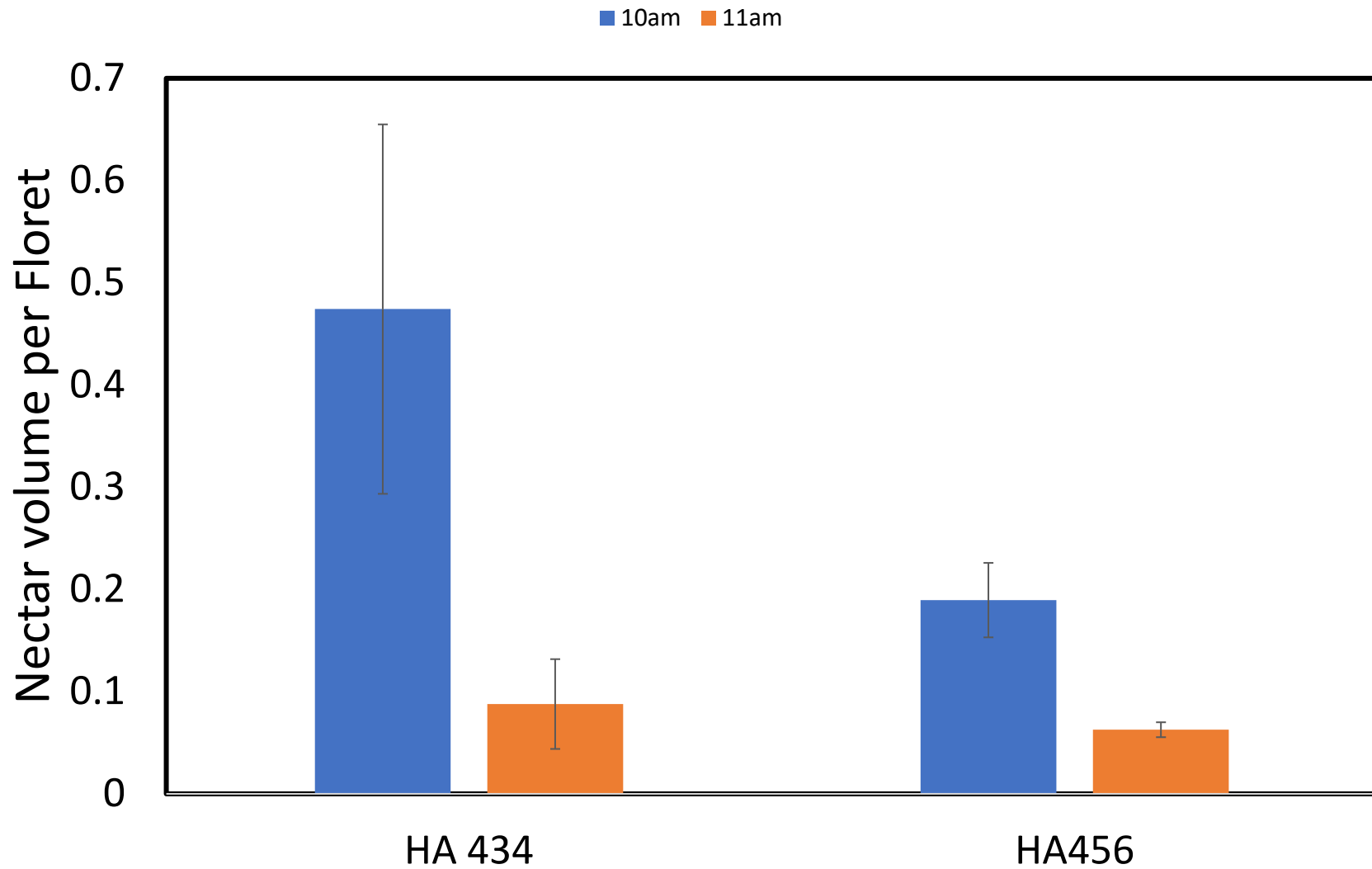
Line:  $p < 0.05$

Treatment:  $p < 0.05$

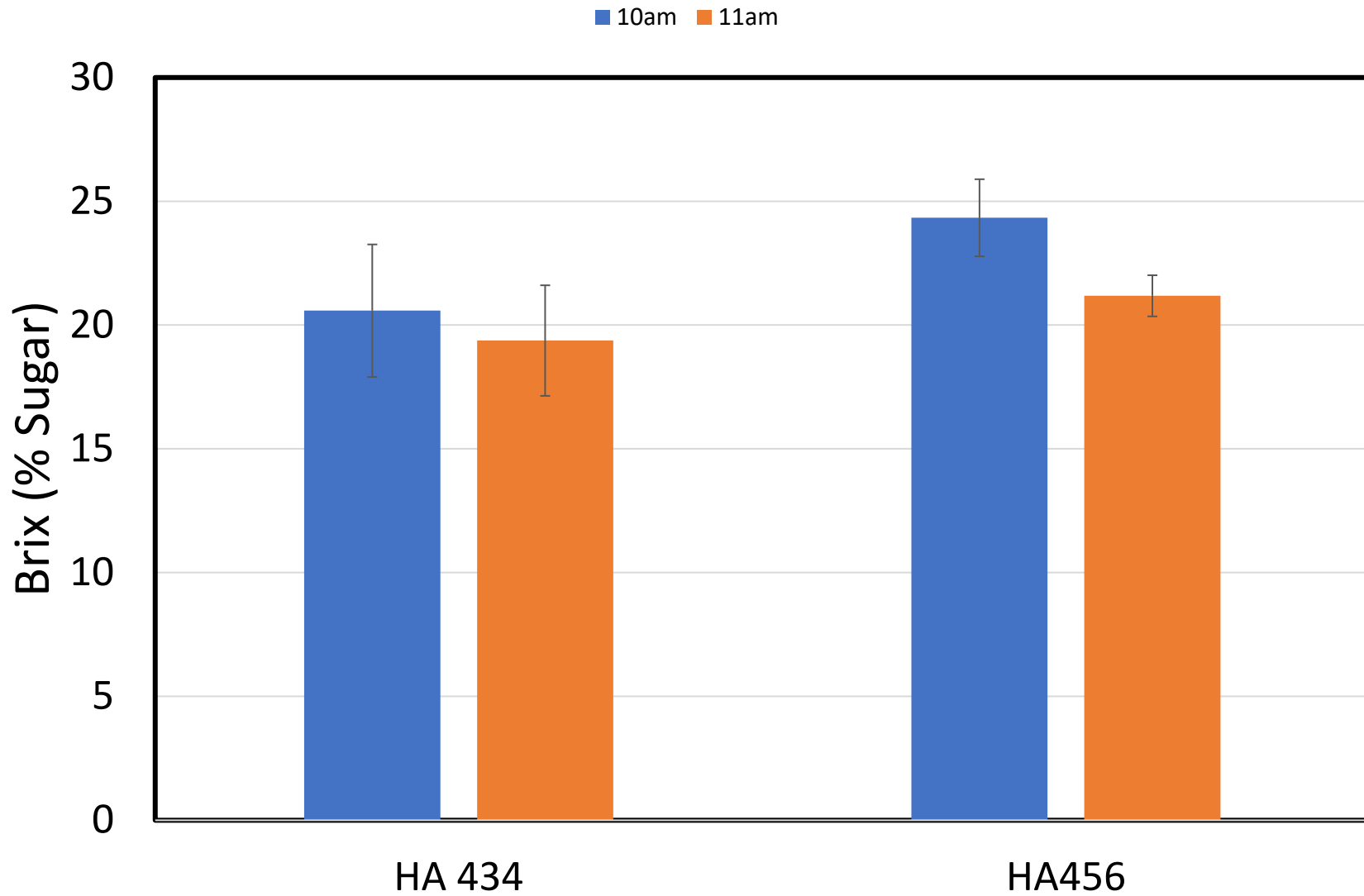
Line\*Treatment:  $p < 0.05$



# Change Over Time-Nectar Volume



# Change Over Time-Brix





# Objective 1 Summary

- Sunflowers produce less nectar under cooler temperatures
- Response appears consistent across lines
- Sugar content is unaffected by changing temperature

# Pollinator Projects-2020

1

Examine additional inbred lines for genotype, environment and genotype x environment effects on nectar volume and composition  
*(new)*

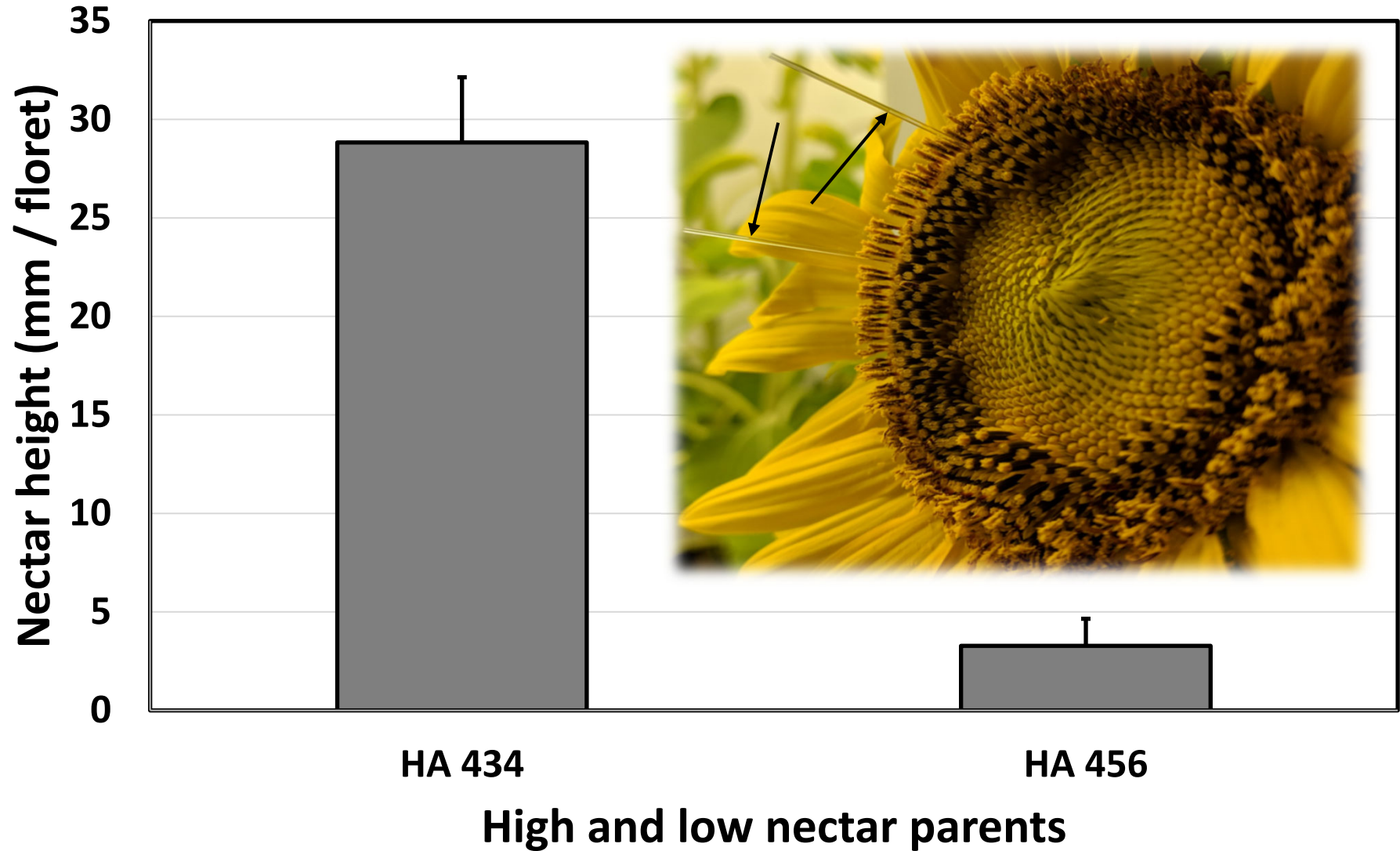
2

Use phenotypic data to map gene(s) controlling nectar volume in cultivated sunflower  
*(continued)*

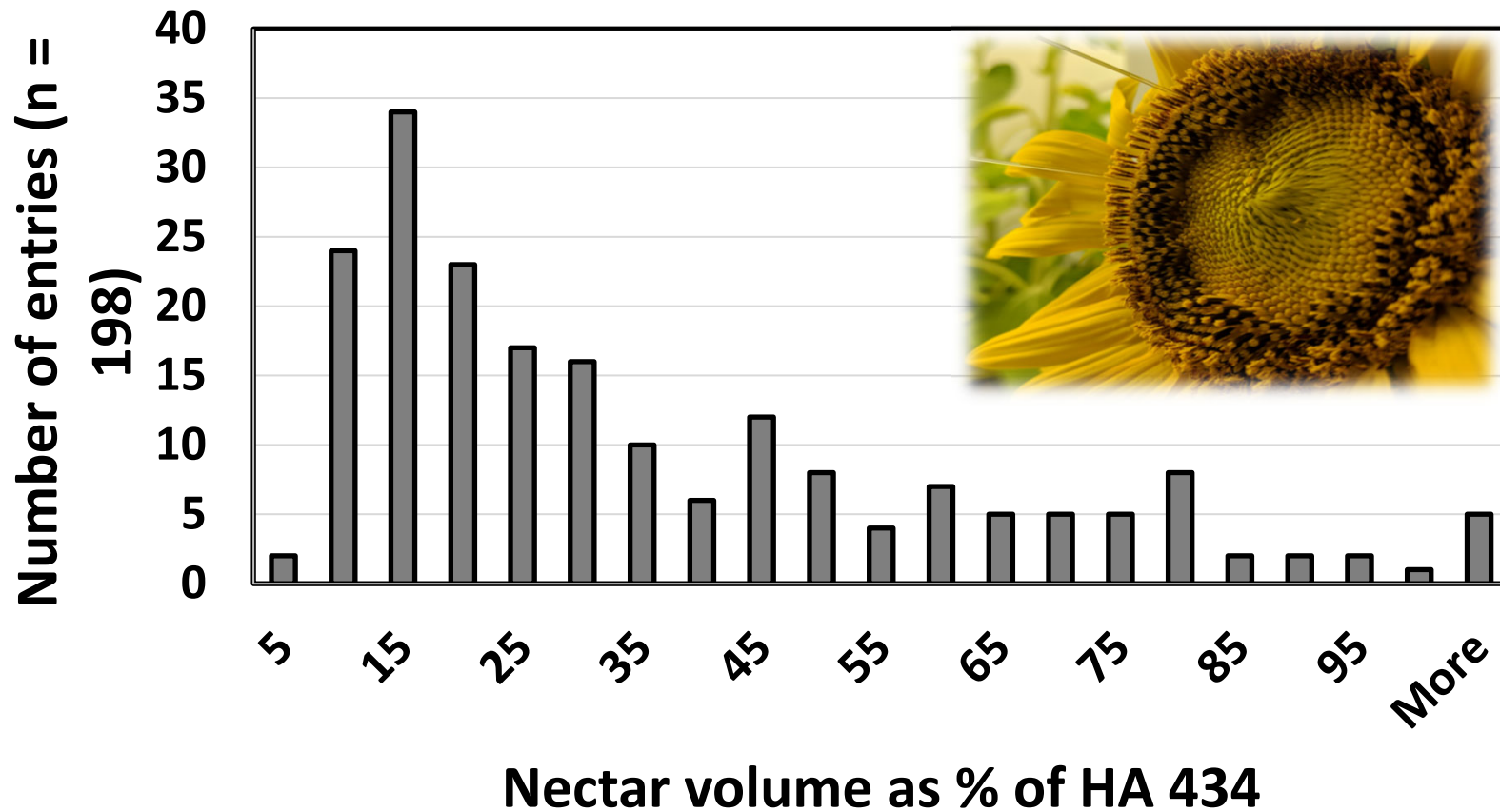
3

Continue field observations to model how nectar access, nectar volume, and other traits influence bee visitation to sunflowers  
*(continued)*

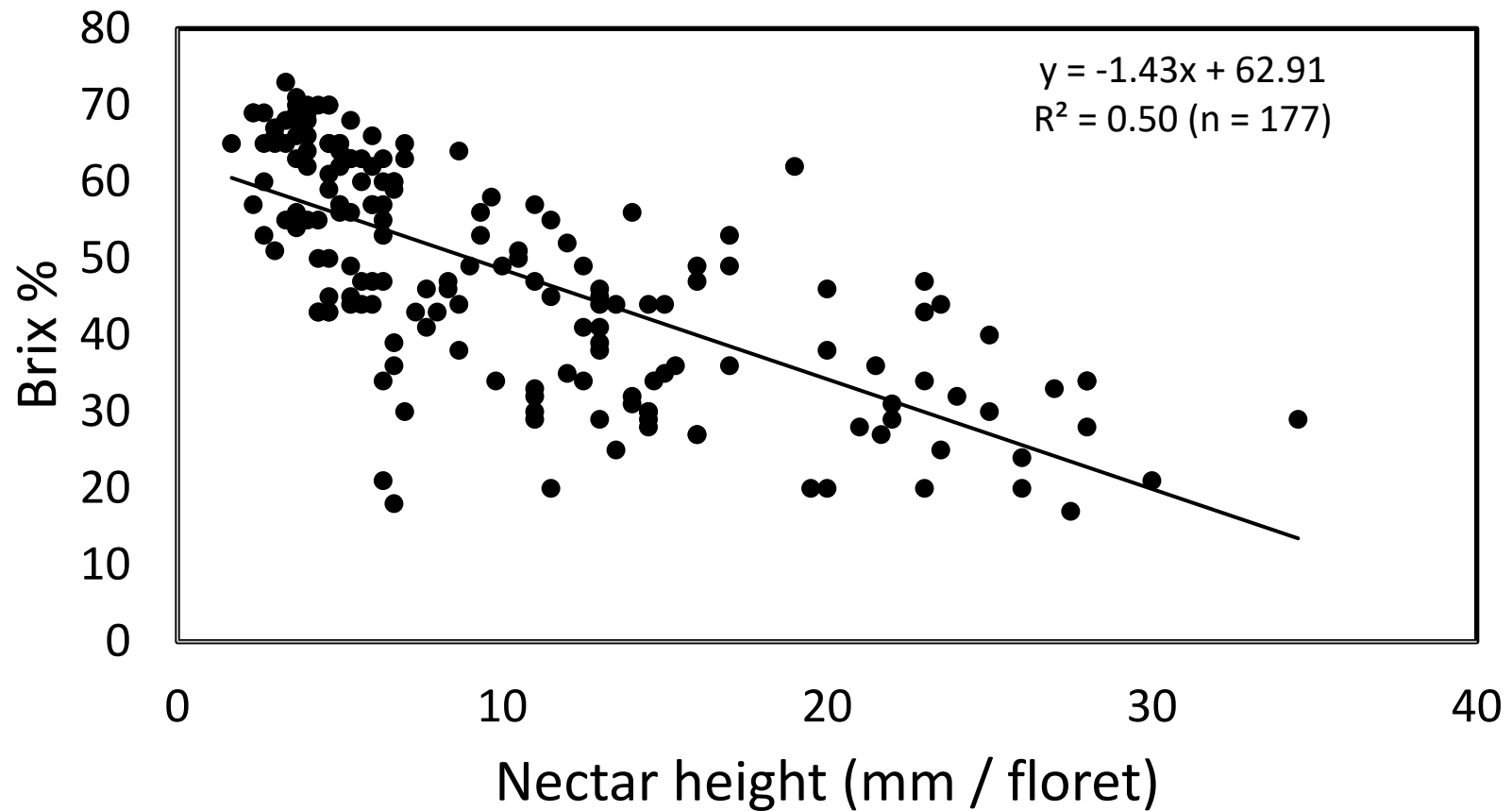
# Parental line nectar production in growth chamber



# Nectar volume of $F_6$ plants in growth chambers



# Relationship of sugar content to nectar volume



## Objective 2 Summary

- Nectar volume effectively phenotyped in chambers
- High & low volume  $F_6$  lines from chamber, showed similar pattern under field conditions (not shown)
- Increasing nectar volume dilutes sugar content (in this population)
- Progress delayed due to Covid limitations

# Pollinator Projects-2020

1

Examine additional inbred lines for genotype, environment and genotype x environment effects on nectar volume and composition  
*(new)*

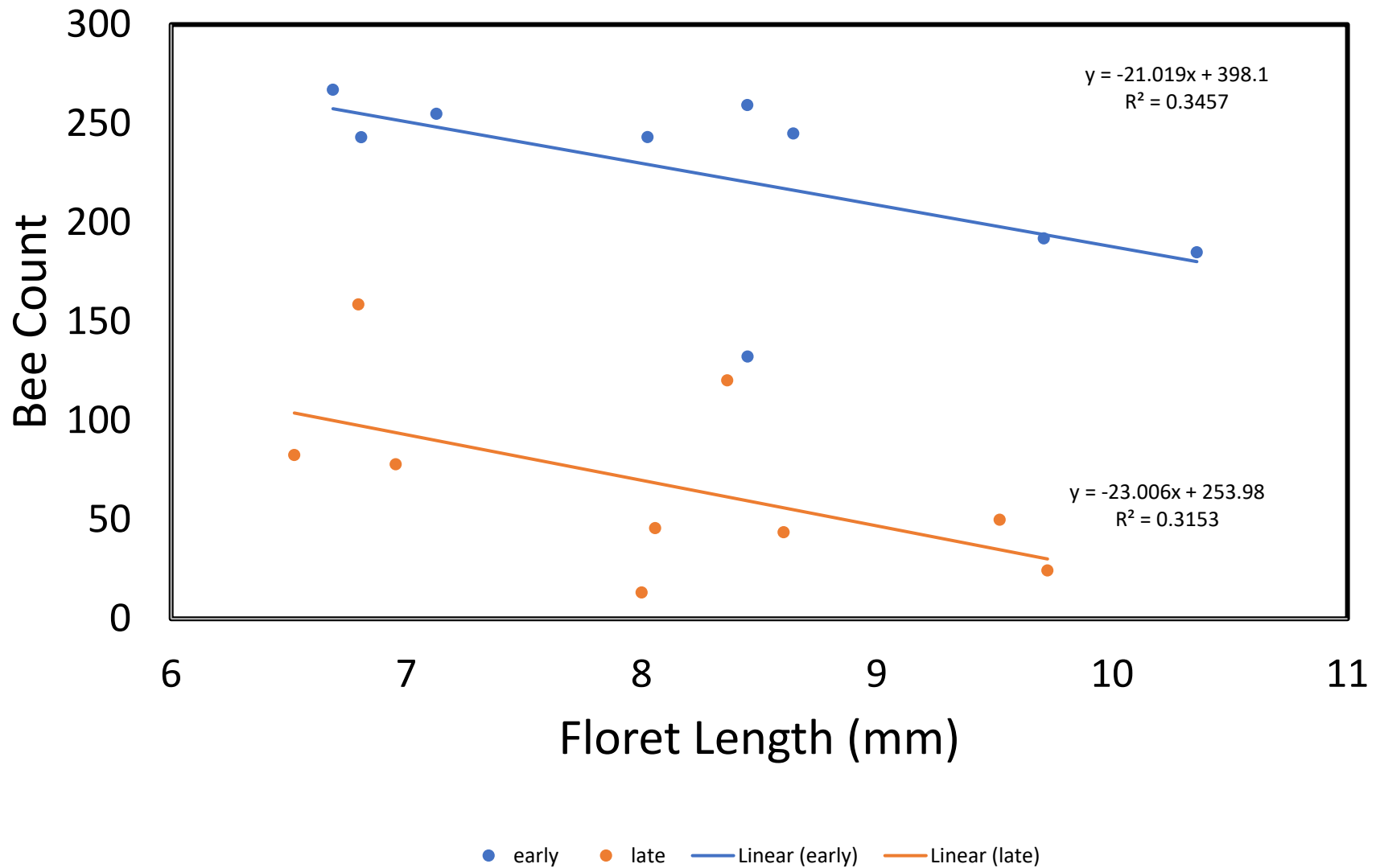
2

Use phenotypic data to map gene(s) controlling nectar volume in cultivated sunflower  
*(continued)*

3

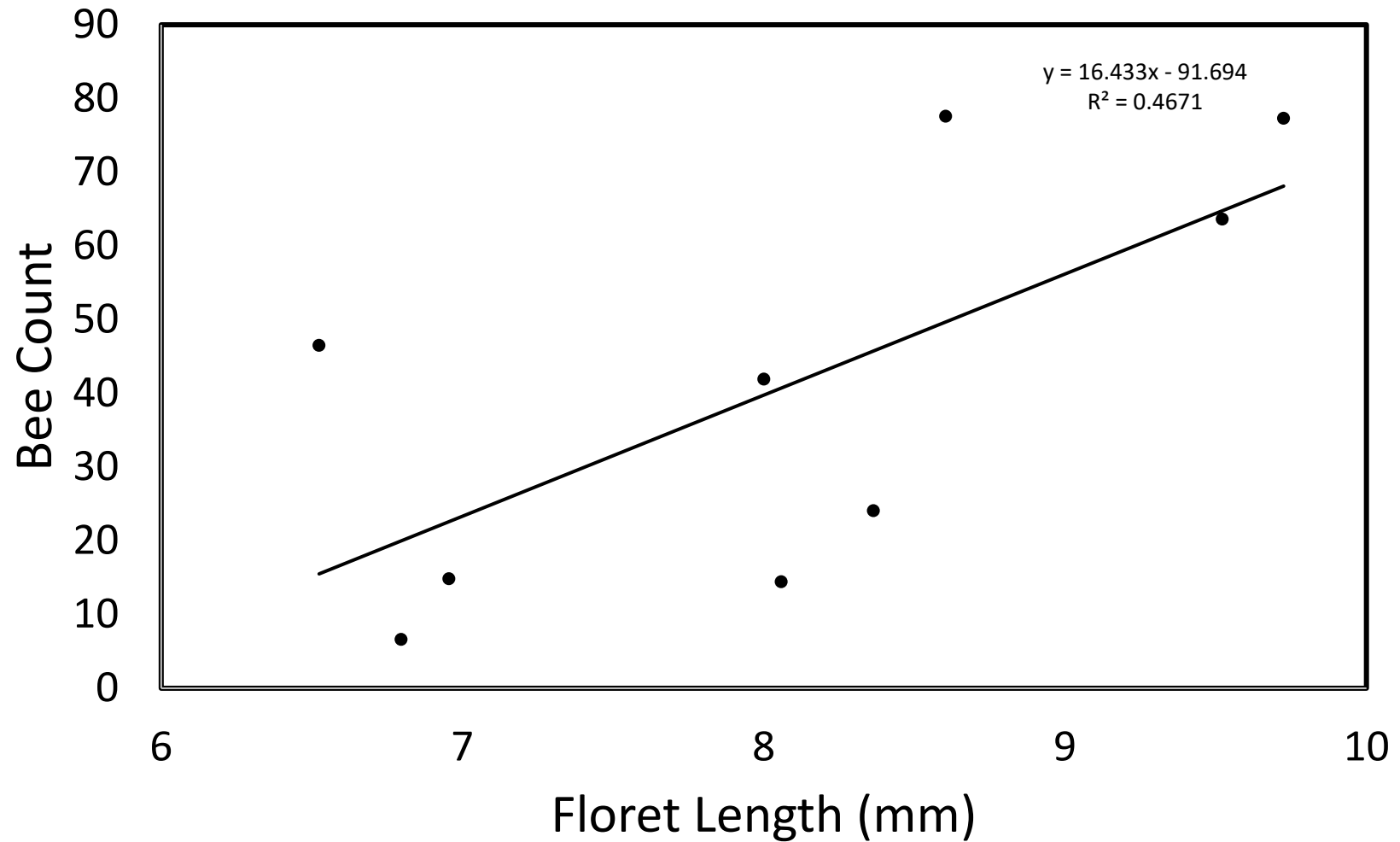
Continue field observations to model how nectar access, nectar volume, and other traits influence bee visitation to sunflowers  
*(continued)*

# Native Bee Response to Floret Length-ND 2019

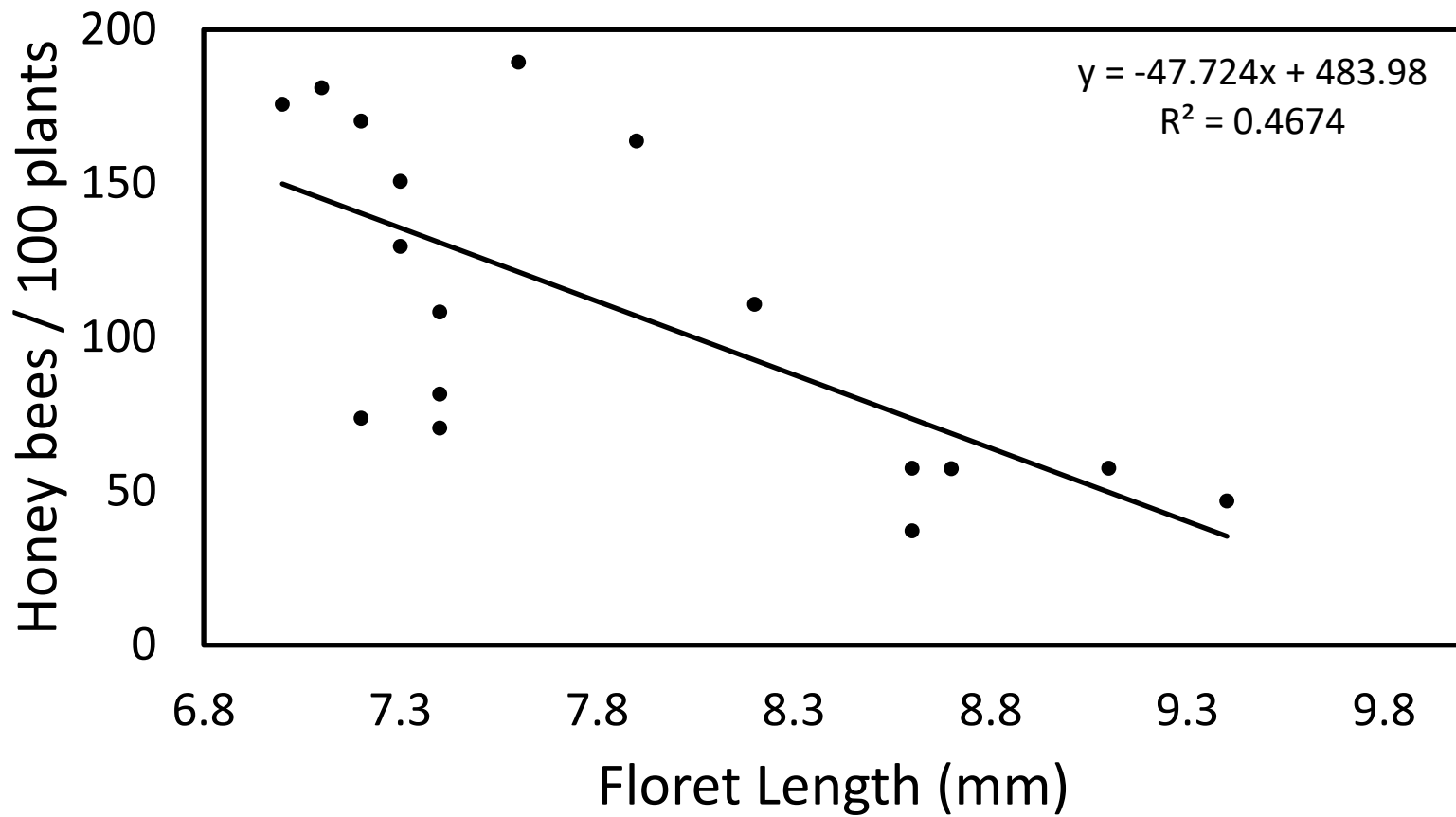




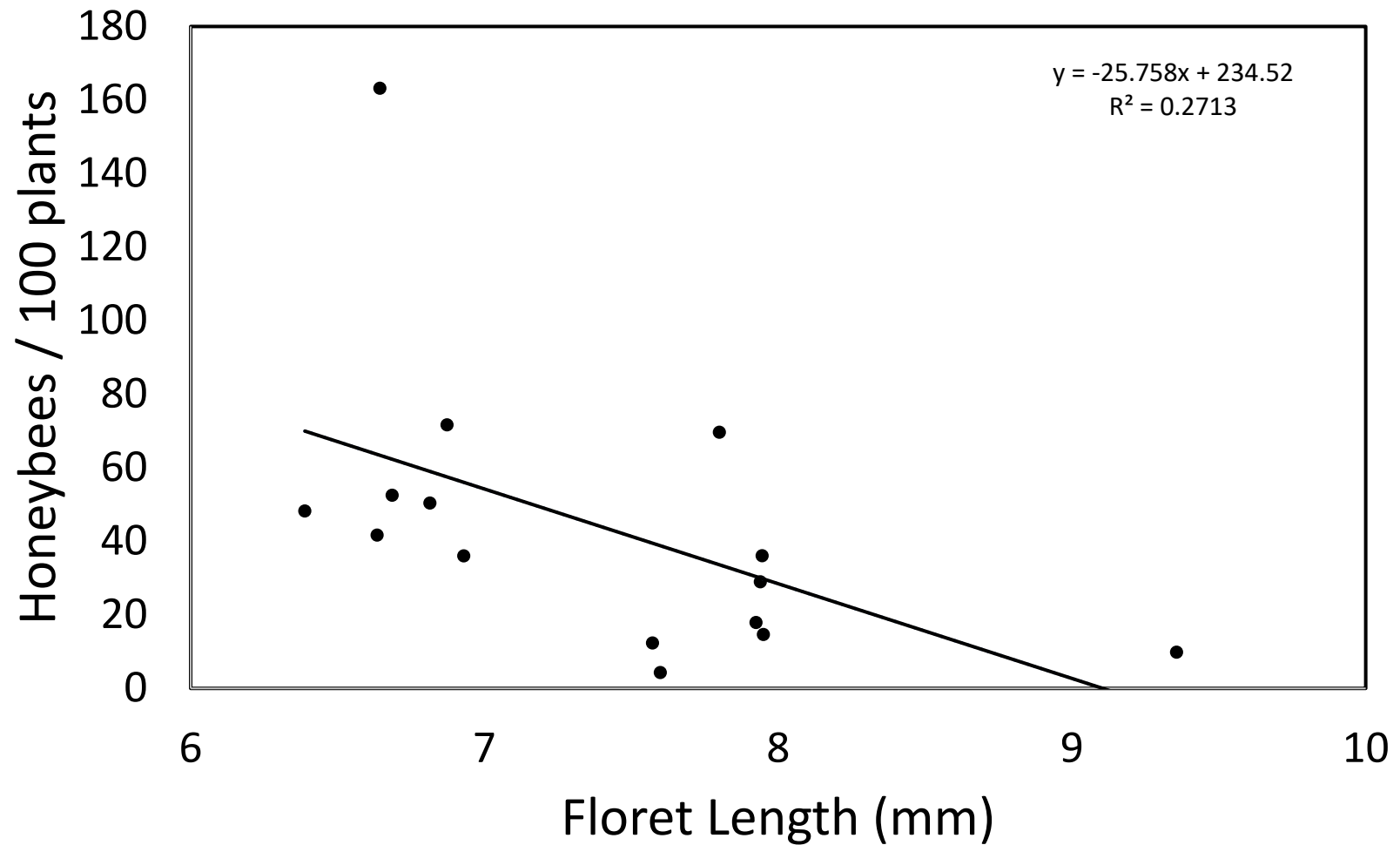
# Bumblebee Response to Floret Length-ND 2019



# Honeybee Response to Floret Length-AZ 2019



# Honeybee Response to Floret Length-AZ 2020



## Objective 3 Summary

- Native Bees respond negatively to increasing floret length except for bumblebees, which respond positively
- Similarly, honeybees decrease visitation as floret length increases
  - Low nectar volume in sampled plants may explain variation
  - Additional factors like sugar content and head area further explain visitation patterns

## Takeaways

- Continued progress on understanding factors governing bee and sunflower interactions
- Nectar volume mapping possible, genetic analysis delayed
- After removing pollen, bee relationship to floret length less clear and revealed additional factors

# Acknowledgements

- Lisa Brown
- Shawna Pantzke
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- Gloria DeGrandi-Hoffman

