



Updates on sunflower Pollinator Research

Understanding Interactions of Plant
Phenotype, Environment, and
Pollinator Identity

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Sunflower Pollinators

- Bees increase yield in sunflower hybrids $\approx 40\%$ ^{1,2}
- Larger florets reduce visits from native bees (ND)
- Differences in value, behavior of native bees versus honey bees

¹Du Toit AP. 1990. The importance of certain insects as pollinators of sunflower

²Mallinger, 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 - 2019

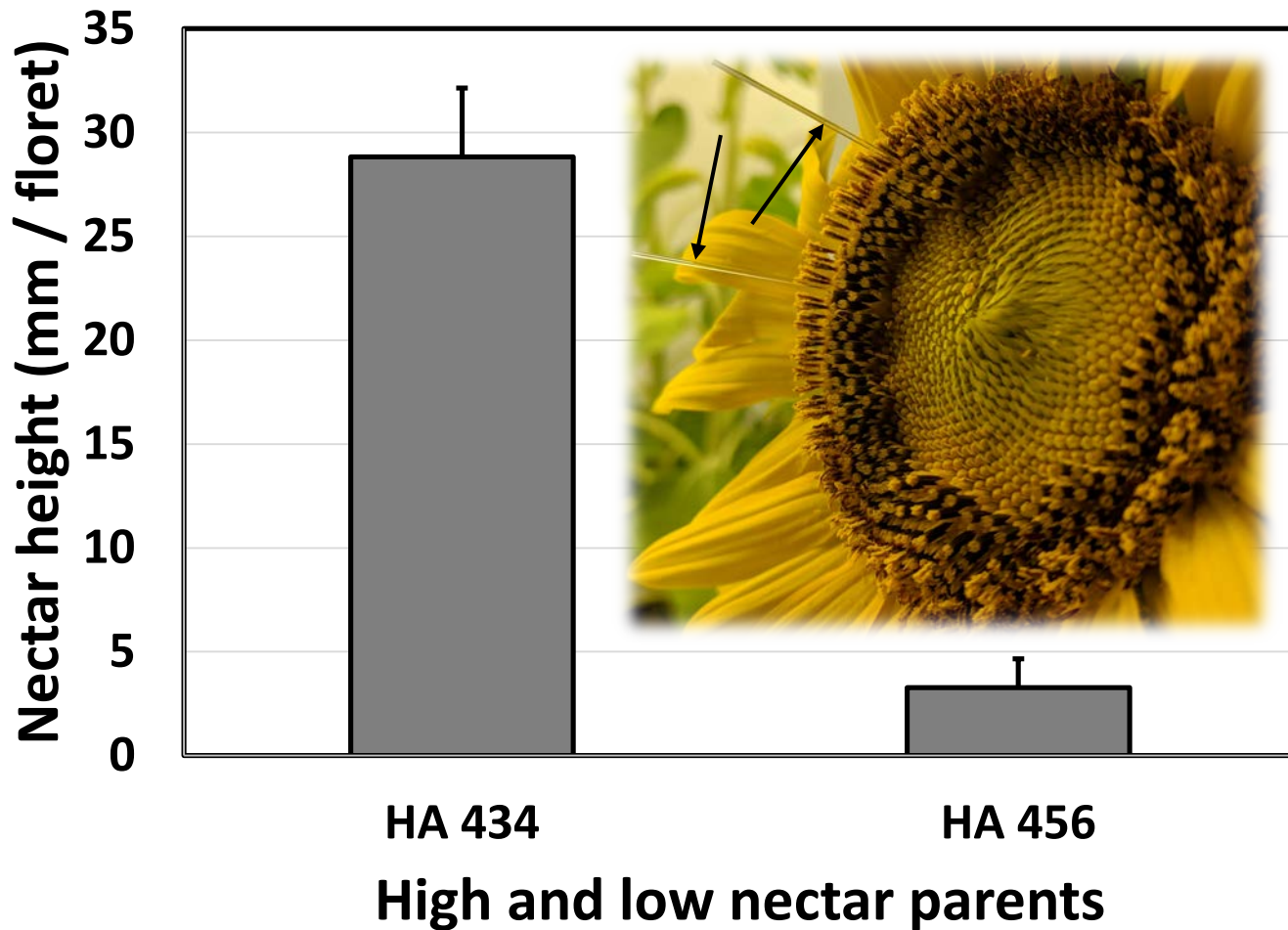
- Phenotype high-low nectar population for mapping
- Evaluate floret size effects on native bee populations (ND)
- Evaluate floret size effects on honey bee foraging (AZ)



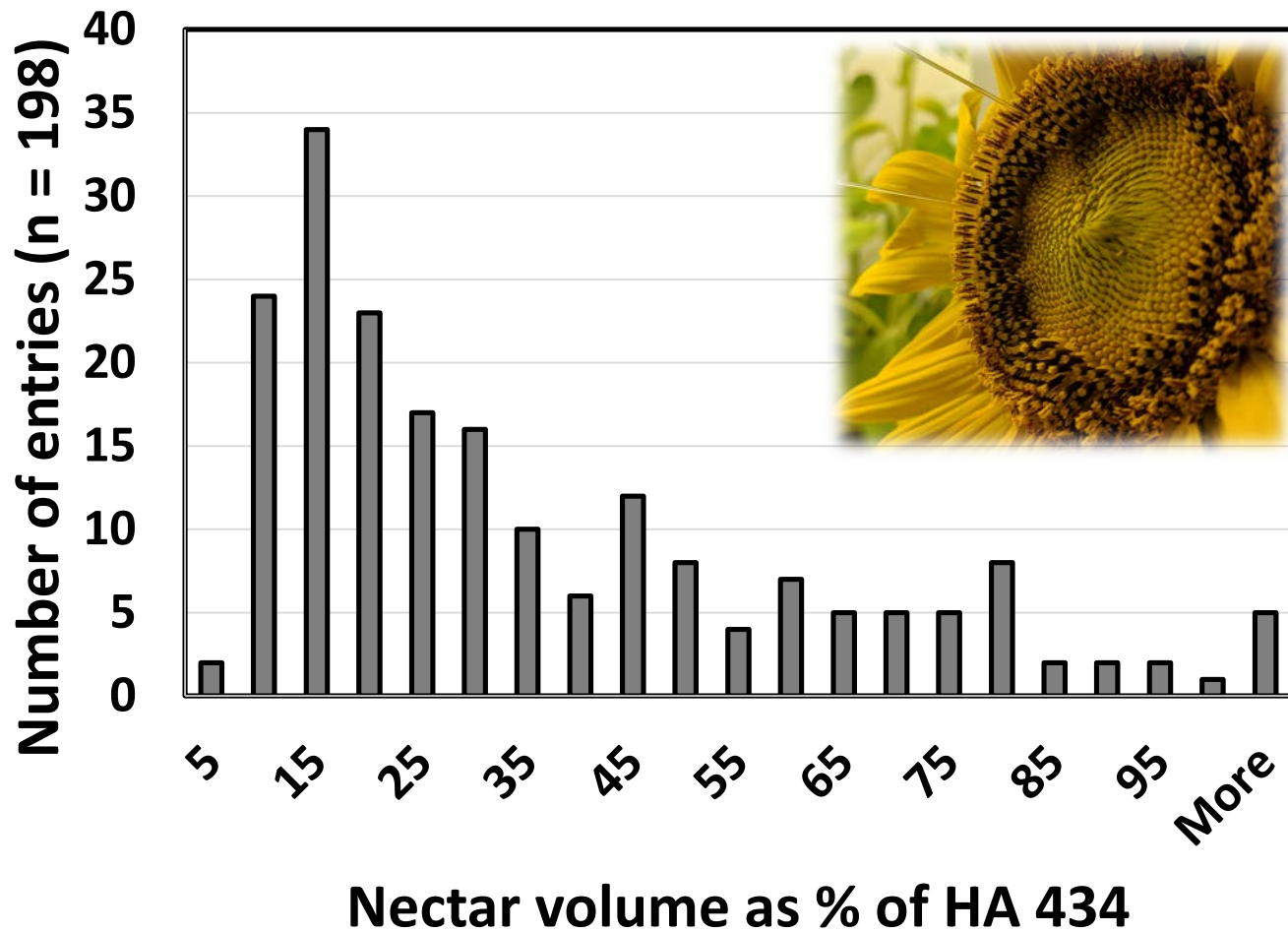
Nectar Phenotyping

- Crossed high (HA 434) and low (HA 456) nectar volume parental lines
- Measured F_6 nectar quantity and sugar content in growth chamber
- Split into 6 runs with parental lines repeated each time (+ field validation)

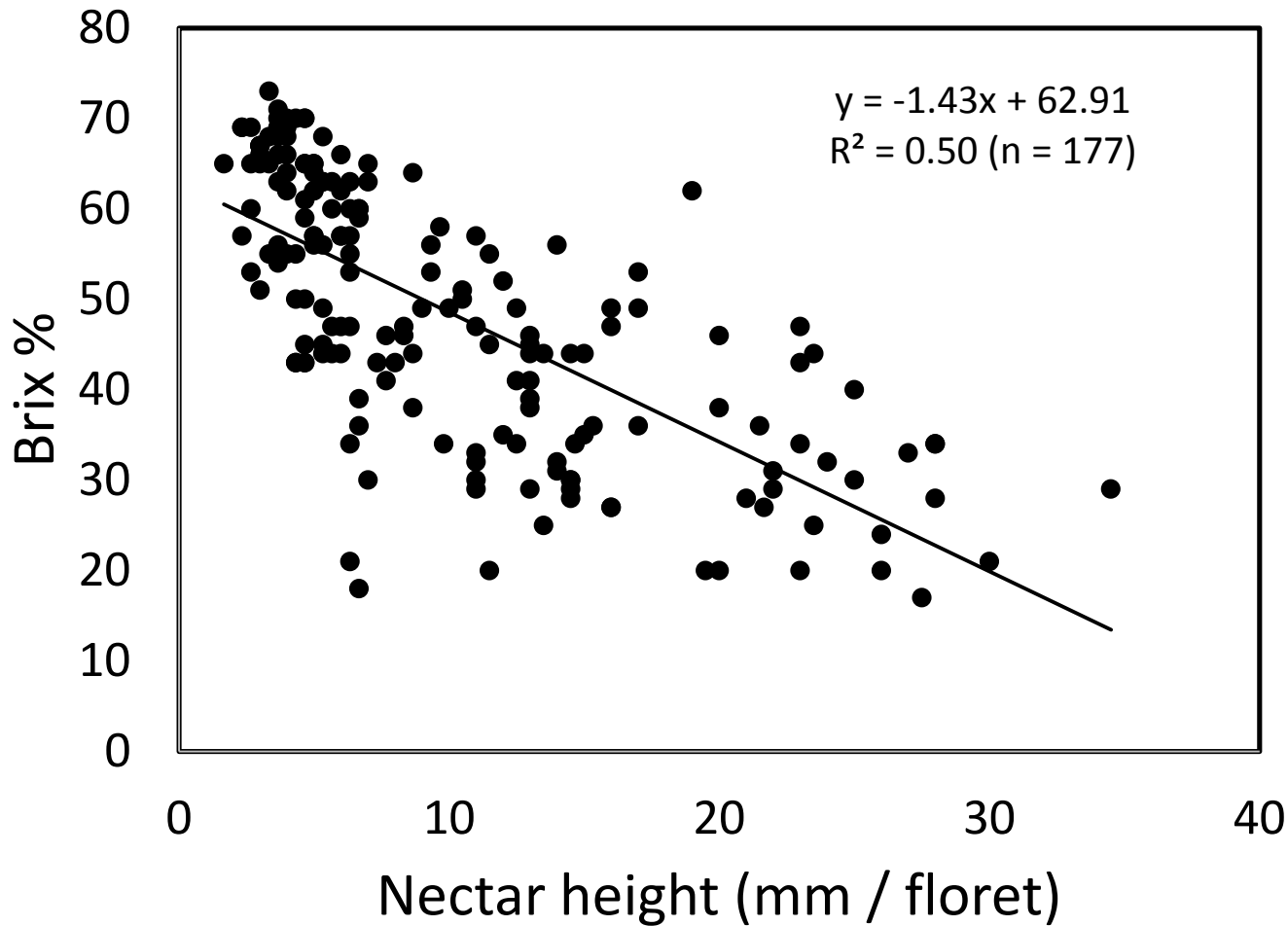
Parental line
nectar
production in
growth
chamber



Nectar volume
of F_6 plants in
growth
chambers



Relationship of
sugar content
to nectar
volume





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)

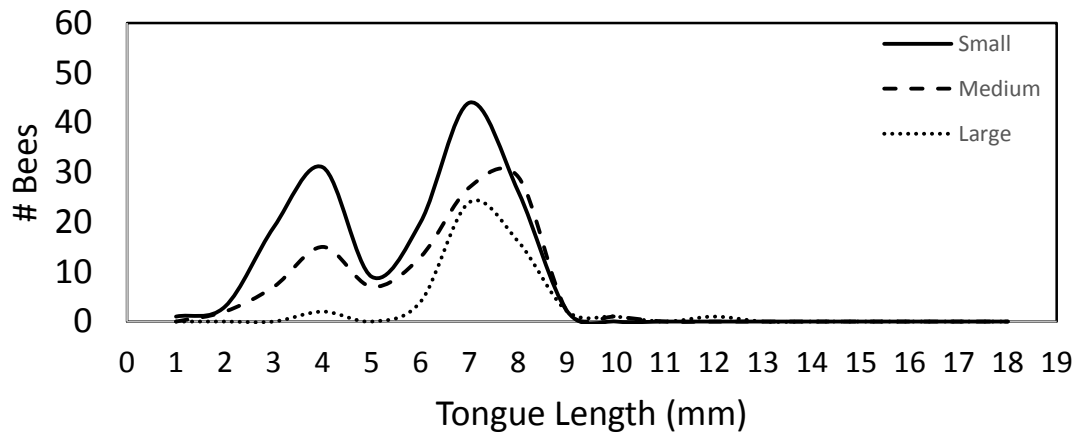


Wild Bee Populations

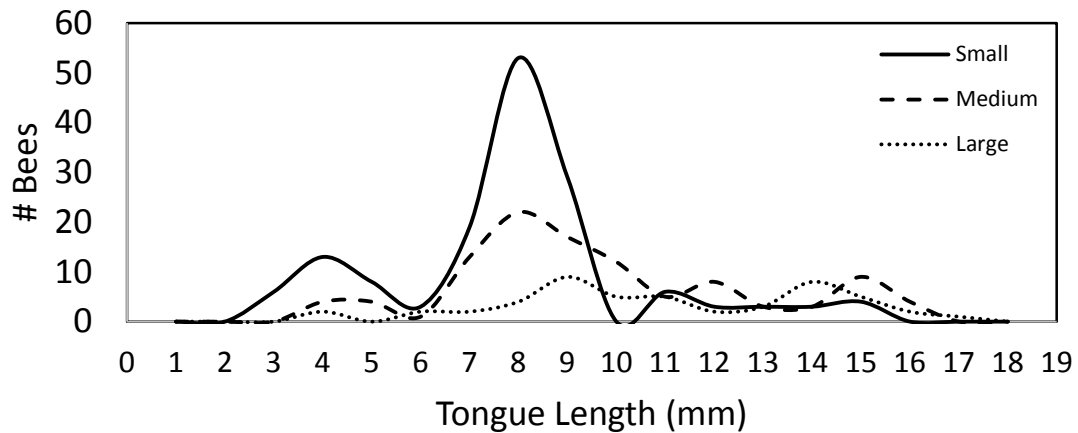
- Shorter florets = greater number of bee visits
- Does floret size influence size and species of bees?
 - Extremes may physically exclude certain species
 - Florets closer to wild types may have different, more diverse bees

Wild Bees-Casselton, ND





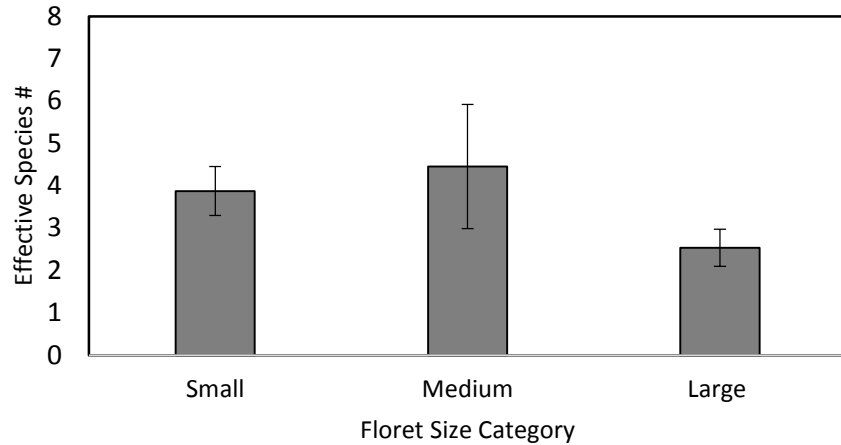
Early
Planting



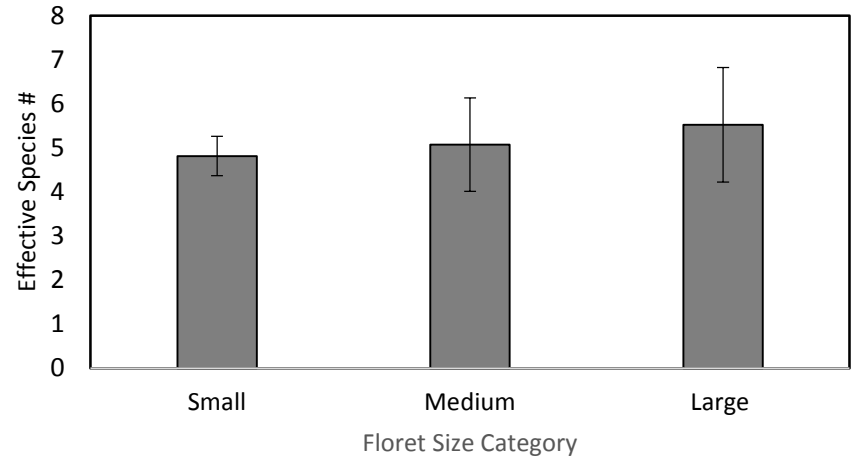
Late
Planting

2019-Diversity

Early



Late



Small

Medium

Large



Early
Planting



Late
Planting



Summary

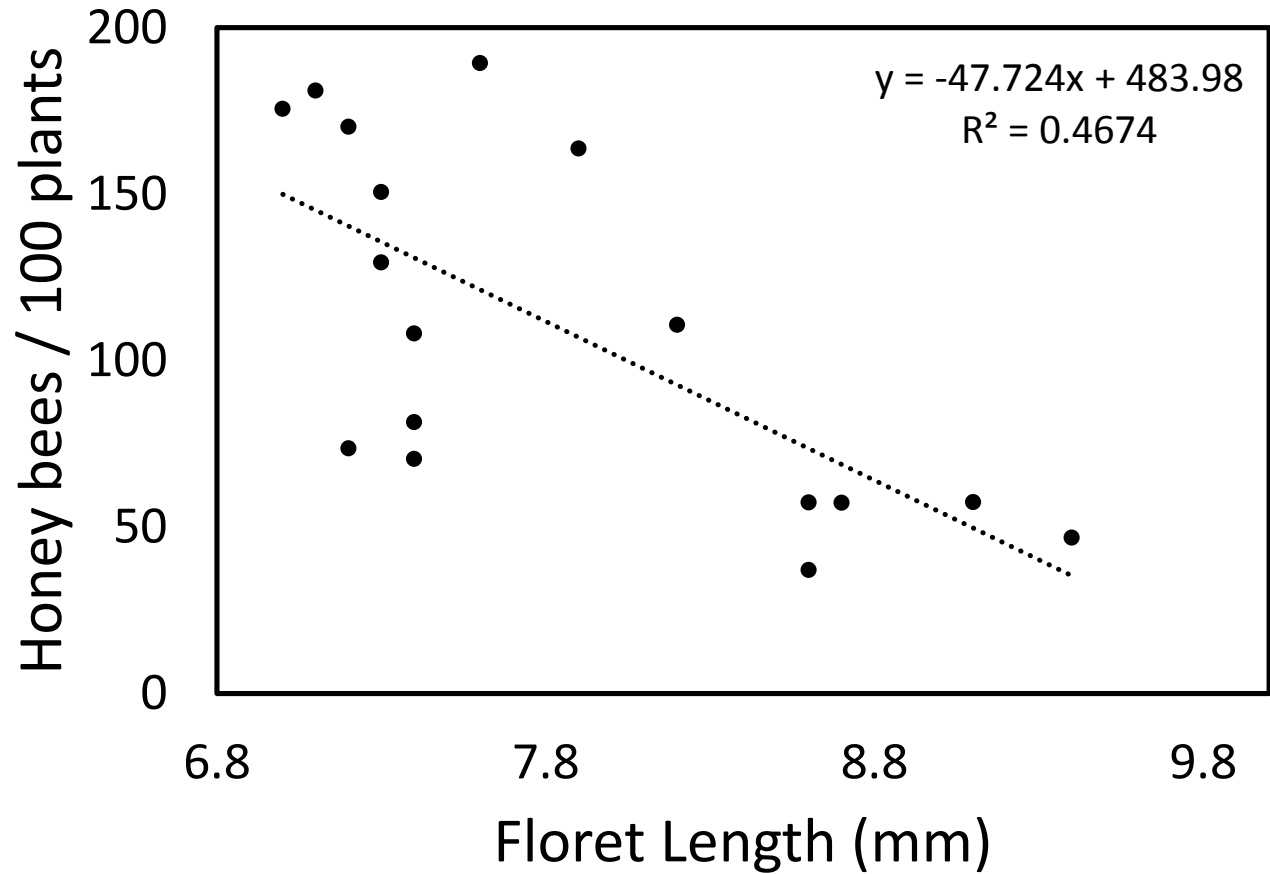
- Bees somewhat flexible foragers (some small bees on large florets)
- Diversity of bees similar between floret categories
- Species makeup varied between floret categories later in season



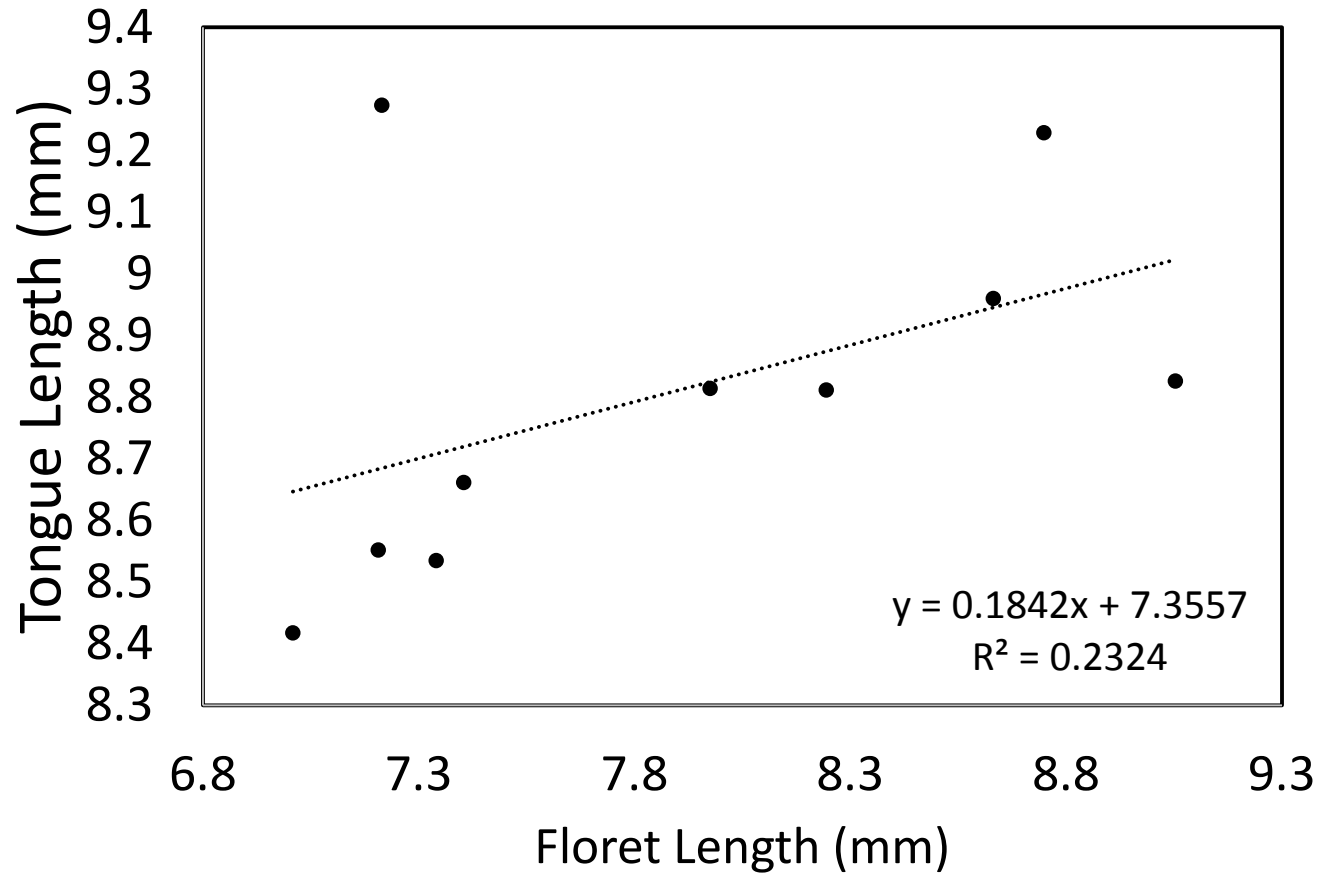
Honey bees-Tucson, AZ

- Video: honeybees foraging on sunflower

Honey bee
walking counts



Honey bee
tongue length





Summary

- Honey bee visitation decreases with increasing floret size
- Relationship of nectar quantity to bee visitation likely confounded by pollen foraging



Current Status

- Nectar volume mapping seems possible
- Progress on understanding factors governing bee and sunflower interactions
- CMS lines will be used to better understand honey bee behavior (improving hybrid seed production)

Acknowledgements

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