

Pollinator efficiency on *Echinacea angustifolia*: which bees get an “A”?

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Introduction

Tallgrass prairie once spanned continuously from Canada to southern Texas, but it now is fragmented, covering less than 0.1 percent of its previous area (Sampson and Knopf, 1994). *Echinacea angustifolia* is a model species for restoration research because it is a long-lived forb native to tallgrass prairie. *E. angustifolia* populations are small and fragmented.

E. angustifolia is self-incompatible and relies on pollinators for reproduction. At least 26 native solitary bees, and several insect species from other orders, have been observed visiting the flowers of *E. angustifolia*. These visitors may carry pollen between the plants (Wagenius, 2010). The size, behavior, and pollen basket location varies among these pollinators, therefore they may vary in their pollination efficiency.

The purpose of this study is to investigate how effective the *E. angustifolia* pollinators are at causing receptive styles to shrivel.

Methods

Map of study site, Douglas County, Minnesota

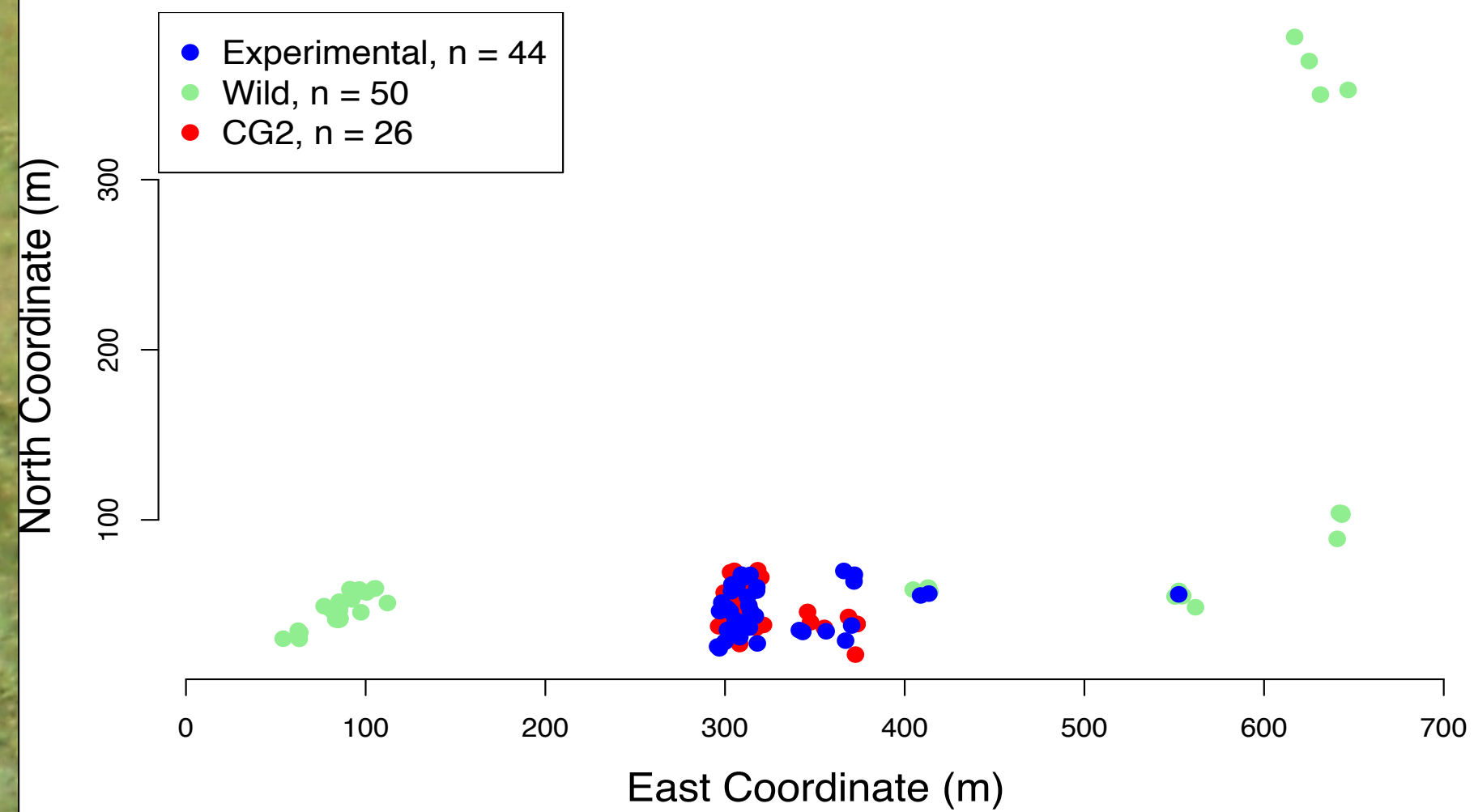


Figure 1. Map of the Hegg Lake study site in Douglas County, MN. The flowers used consisted of the experimental plot and wild populations in close proximity.

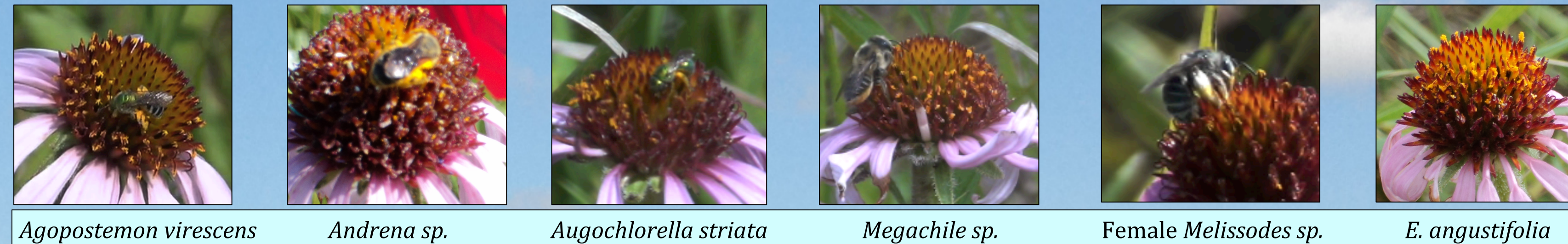
Style Persistence:

Pollination of *E. angustifolia* is assessed for each floret. If compatible pollen lands on the style, it will shrivel within 24 hours. If the style receives no pollen or the pollen is incompatible, the style will persist up to ten days.

Protocol:

- Day 1: Cover 1st day flowering plant with pollinator exclusion bag.
- Day 2: Wait for second row of styles to emerge.
- Day 3: Remove bag and observe and video record first pollinator visit. Count number of receptive styles and re-cover with exclusion bag.
- Day 4: Assess style shriveling and paint subtending bracts of shriveled styles.

A Selection of the Study Species



Results

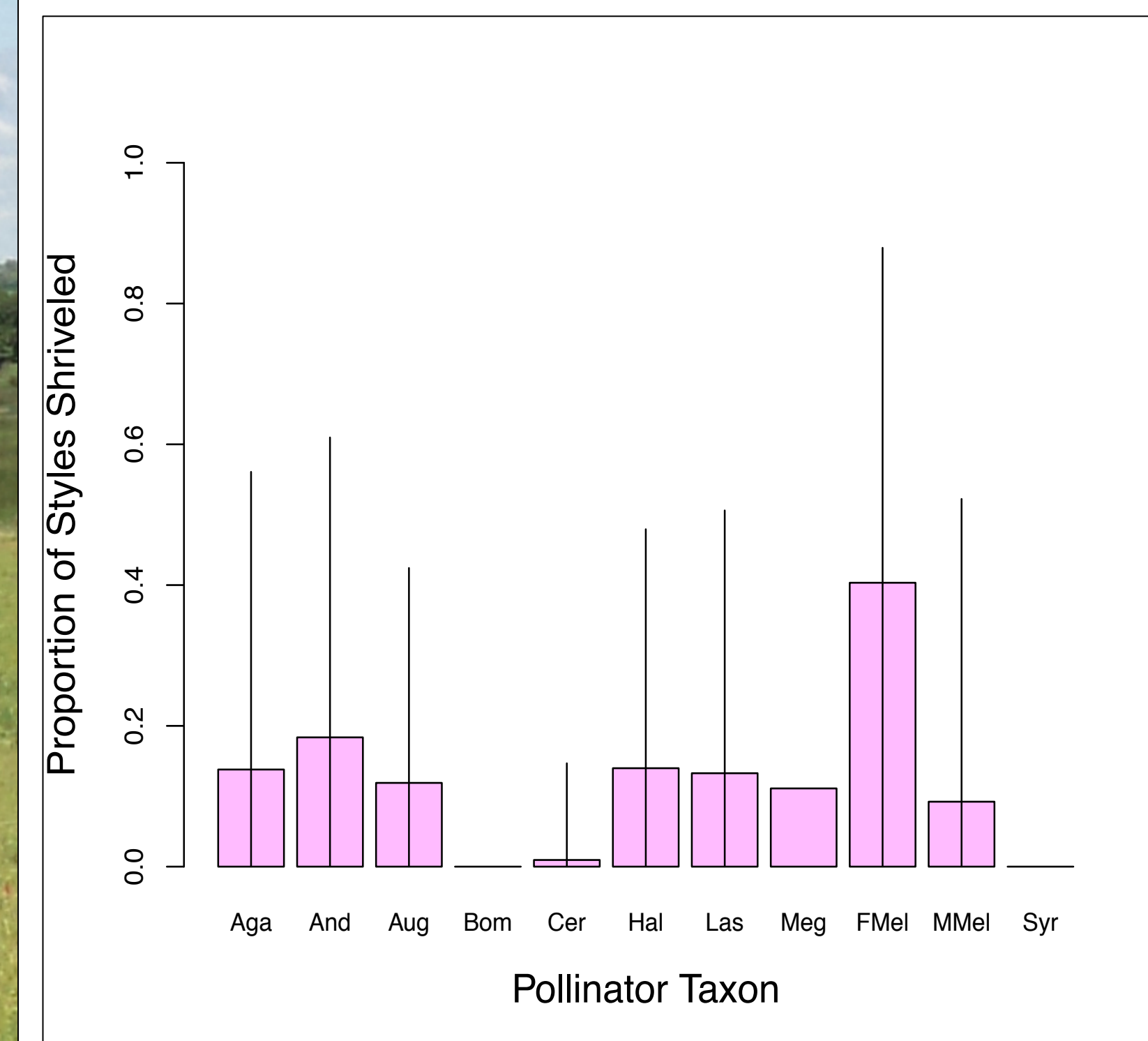


Figure 2: The efficiency of pollinators as shown by the pollinator taxon vs. the proportion of receptive styles shriveled.

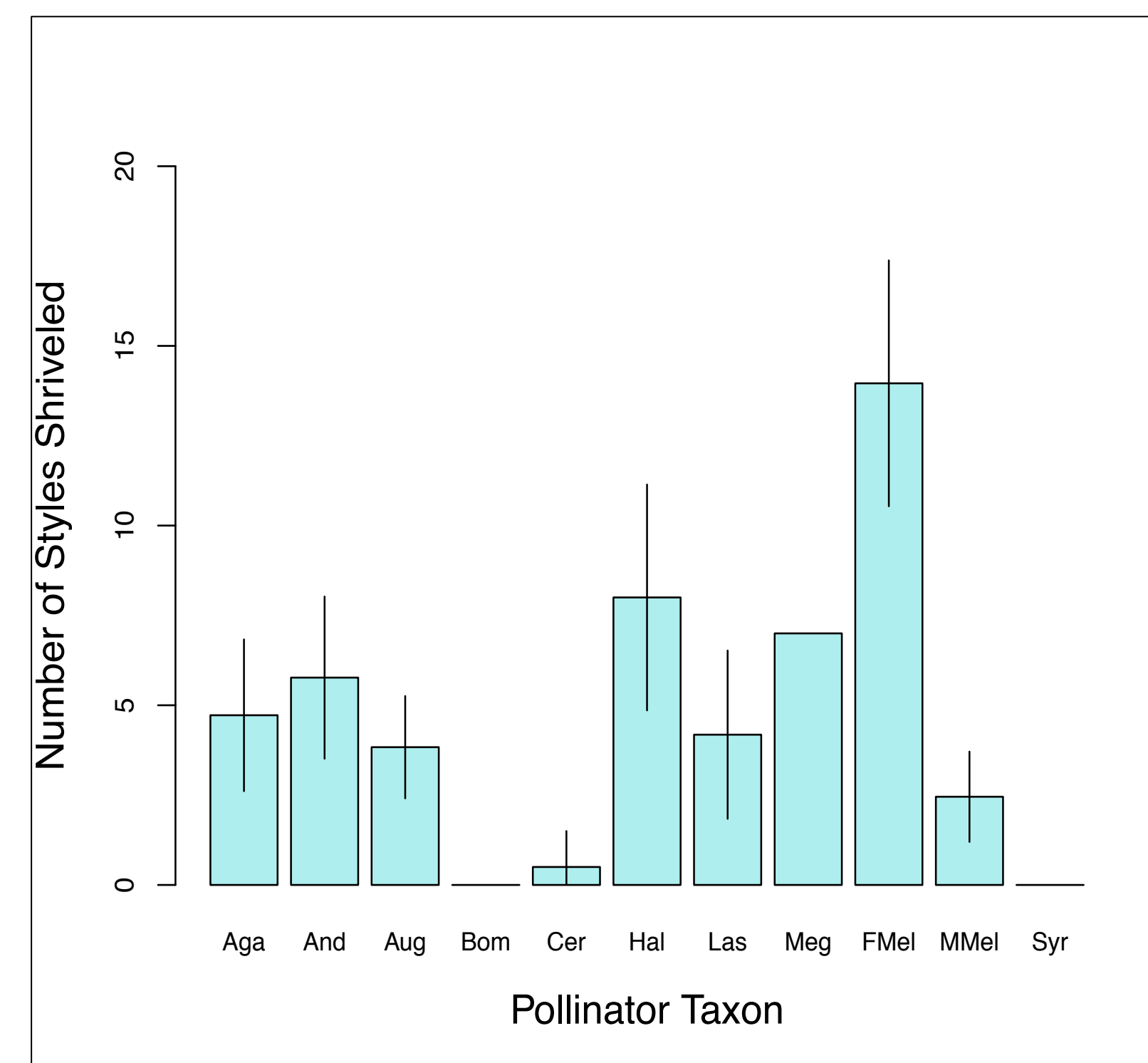


Figure 3: The average number of styles shriveled in one visit, as shown by the pollinator taxon vs. count of styles shriveled.

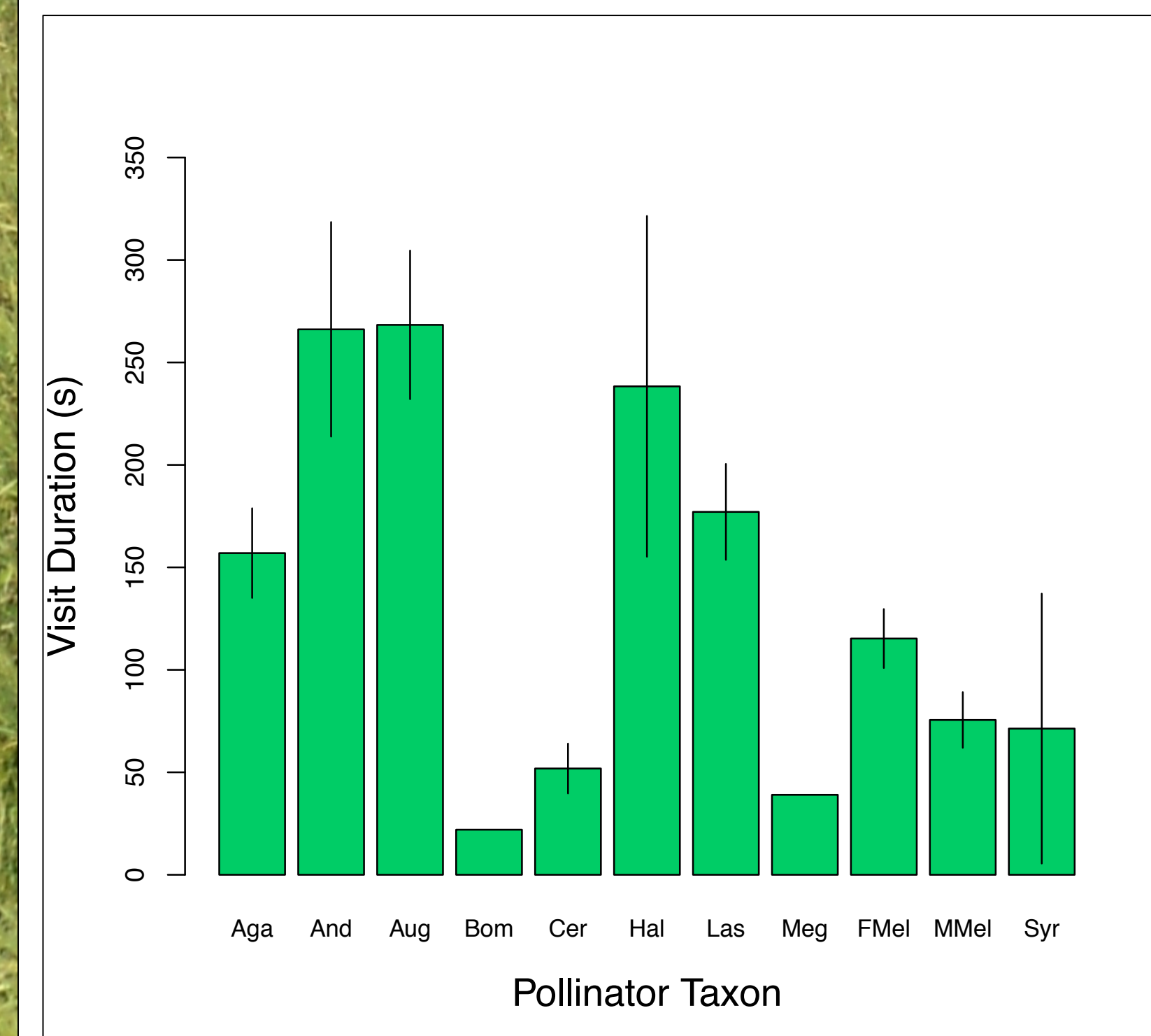


Figure 4: The average time the pollinator spent on the head of *E. angustifolia*.

Taxon	Abbreviation	Length (mm)	Number of Observations
<i>Agopostemon virescens</i>	Aga	11	18
<i>Andrena sp.</i>	And	7-15	13
<i>Augochlorella striata</i>	Aug	7	6
<i>Bombus</i>	Bom	11-16	1
<i>Ceratina calcarata</i>	Cer	6-8	2
<i>Halictus sp.</i>	Hal	7-11	3
<i>Lasioglossum sp.</i>	Las	8-10	22
<i>Megachile sp.</i>	Meg	13-14	1
Female <i>Melissodes sp.</i>	FMel	10-15	24
Male <i>Melissodes sp.</i>	MMel	10-15	11
<i>Syrphidae</i>	Syr	10-12	3

Table 1: The pollinator's taxa, the corresponding abbreviation (which appears in Figures 2-4), the length of the pollinator, and the number of observations in this study.

Discussion & Conclusion

- ~ Observed pollinators for approximately 45 hours.
- ~ The data was collected over three separate years: 2010, 2012, and 2013.
- ~ Within each taxa, the percent of styles shriveled varied greatly.
- ~ Female *Melissodes sp.* had both the highest efficiency and highest number of styles shriveled.
- ~ Female *Melissodes sp.* shriveled about four times more styles than the male *Melissodes sp.*
- ~ The *Halictus sp.* had the second highest count of styles shriveled, but tied for fourth for percent of styles shriveled.
- ~ The duration of the visit does not appear to be correlated to the number or proportion of styles shriveled.
- ~ Length of the pollinator does not appear to be correlated the number or proportion of styles shriveled.
- ~ More observations of *Megachile sp.* would be needed to see if pollen basket location plays a role in efficiency.
- ~ The seeds of 2013 pollinations will be paternity tested.

Literature Cited

- ~ Sampson and Knopf. 1994. Prairie Conservation In North America. *Bioscience*.
- ~ Wagenius, Stuart, and Stephanie Pimm Lyon. 2010. Reproduction of *Echinacea angustifolia* in fragmented prairie is pollen-limited but not pollinator-limited. *Ecology*. 91:733-742.

Acknowledgements

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