Examining the role of genetic compatibility in *Heliopsis helianthoides* pollen interference on *Echinacea angustifolia*

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Background

In interspecific pollen interference, heterospecific pollen prevents a flower from producing viable seeds, potentially posing complications for tallgrass prairie fragments.[1] Previous research demonstrated that pollen from *Heliopsis helianthoides* interferes with seed set in *Echinacea angustifolia* while causing most affected styles to prematurely shrivel without conspecific pollen. To clarify the role genetic compatibility plays in this interference, a hand-pollination experiment examined style shriveling in the context of unique maternal plant and pollen donor pairings. Pollen from *H. heliopsis* individuals was applied to several styles on *E. angustifolia* plants, with each floret receiving pollen from a single *H. heliopsis* plant. Florets were examined after 48 hours to determine the style shriveling rate of each pairing. The non-normal distribution of shriveling rates and the variation among crosses on the same maternal plant or with the same pollen donor supports a mechanism in which *E. angustifolia* falsely accepts *H. helianthoides* as a compatible pollen source.

Question

Does genetic compatibility between *Heliopsis helianthoides* sires and *Echinacea angustifolia* maternal plants contribute to their interspecies pollen interference interaction?

Methods

Bracts of anther-presenting florets on *Echinacea* heads were labelled with paint. *Echinacea* heads were covered with pollinator exclusion bags.

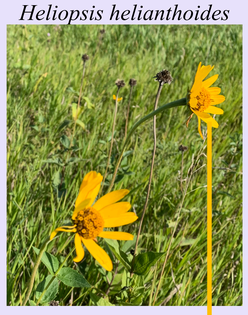
↓ *After 24 hours*

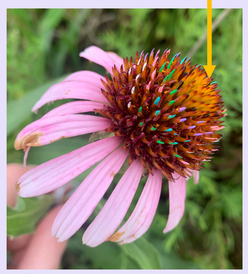
Pollen gathered from *Heliopsis* individuals was applied liberally to styles of at least 5 painted *Echinacea* florets. Each *Heliopsis* sire's pollen was applied to styles on 3 *Echinacea*, and each *Echinacea* plant received pollen from at least 3 *Heliopsis* sires.

↓ *After 24/48 hours*

Painted florets were examined for signs of style shriveling. Styles that had shriveled to the stigma crease on at least one arm were labeled as fully shriveled.

Heliopsis helianthoides





Echinacea angustifolia

Results

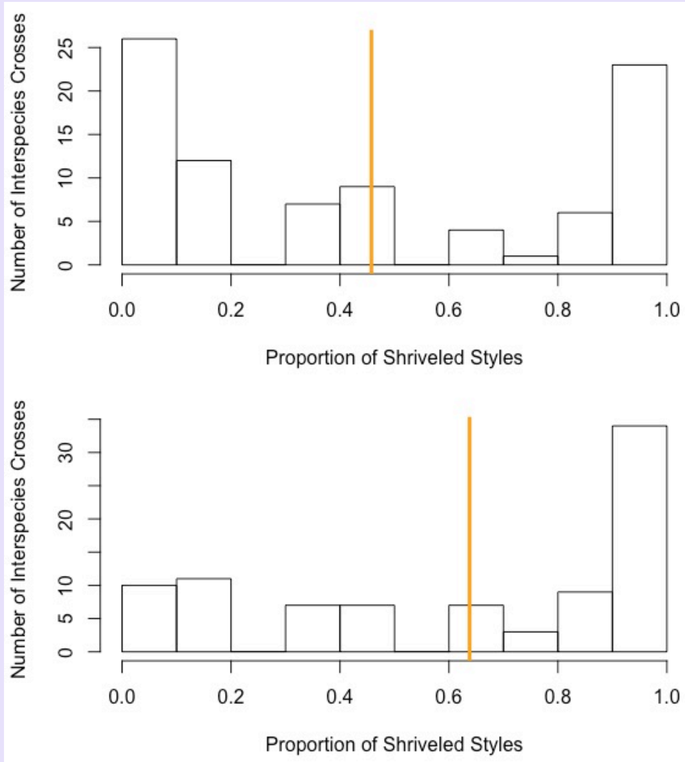


Figure 1. Distribution of style shriveling patterns on *E. angustifolia* florets, observed 24 and 48 hours after artificial interspecies pollen transfer from *H. helianthoides* pollen donor.

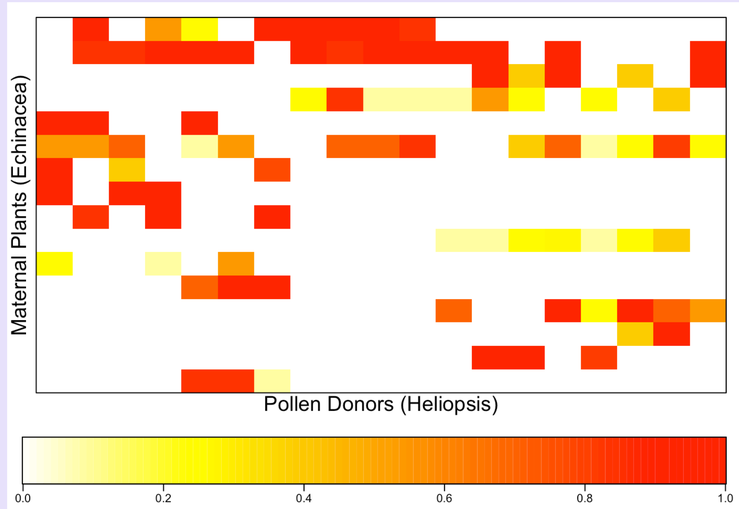


Figure 2. Degree of style shriveling 48 hours after artificial interspecies pollen transfer, resulting from unique pairings of *E. angustifolia* maternal plants and *H. helianthoides* pollen donors.

- Both 24 and 48 hours after artificial interspecies pollen transfer, the distribution of style shriveling resulting from the interspecies cross is non-normal
- Style shriveling patterns vary among crosses on the same maternal plant as well as among crosses that received the same donor's pollen

Discussion & Conclusion

- As shriveling patterns resulting from unique pairings do not reflect a normal distribution, reproductive interference of *Heliopsis* pollen on *Echinacea* florets is unlikely to result from a mechanism that is not affected by genetic variation in the maternal plant and/or pollen donor
- Style shriveling patterns vary among crosses on the same maternal plant and crosses from the same pollen donor, suggesting that both maternal and paternal genetic factors may contribute to the interference interaction
- A clogging mechanism for pollen interference in this system is unlikely to reflect this variation, especially among crosses with the same pollen donor, given the similarity of the two species' pollen grain structures
- An alternative explanation could involve *Echinacea*'s *S*-allele compatibility mechanism for preventing sib/kin-mating[2]

References

1. Kyogoku, D. 2015. Reproductive interference: ecological and evolutionary consequences of interspecific promiscuity. Population Ecology 57: 253-260.
2. Wagenius, S., E. Lonsdorf, and C. Neuhauser. 2007. Patch aging and the *S*-Allee effect: breeding system effects on the demographic response of plants to habitat fragmentation. The American Midland Naturalist Journal 169:383-397.

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