Native *Echinacea* more likely to accept pollen than non-native

Shona Sanford-Long, Middlebury College
ssanfordlong@middlebury.edu

Introduction

Minnesota was once home to vast expanses of prairie. However, increasing human development has broken the prairie into small patches, mostly relegated to roadside ditches and hills too steep for development. *Echinacea angustifolia*, commonly known as purple coneflower, is native to Minnesota prairies and one of many species that has suffered from habitat loss. While restoration efforts are increasing, some restoration projects have used *Echinacea pallida*, a non-native species that is genetically and morphologically similar to *E. angustifolia* (Kapteyn *et al*. 2002; McKeown 1999; personal observation). Goldsmith (unpublished) found that cross-pollination and hybridization were possible between *E. angustifolia* and *E. pallida*, but little is known about how well these species interbreed. In this experiment I begin to explore the potential impacts of *E. pallida* introduction by investigating the likelihood that neighboring *E. angustifolia* and *E. pallida* will accept pollen from the opposite species.

Methods

E. pallida population was located in a restoration plot at Hegg Lake Wildlife Management Area (HLWMA).
E. angustifolia plants were sampled from a native population within potential pollination distance of the *E. pallida* at HLWMA.
I performed intraspecific and interspecific crosses for each species, using style persistence as a measure of pollen acceptance rates (Wagenius 2004).
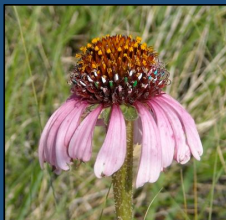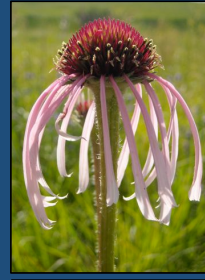

Bracts painted to differentiate pollen donors

Heads bagged to prevent contamination by pollinators

E. angustifolia

E. pallida

Results

• The proportion of compatible crosses was highest with maternal angustifolia*paternal pallida, and lowest with maternal pallida*paternal angustifolia.
• Intraspecific pallida crosses showed a lower proportion of compatibility than intraspecific angustifolia crosses.
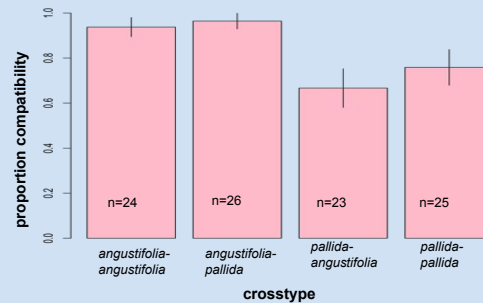• $p < 0.008$ according to a generalized linear model with a binomial response (n=98 crosses).

Figure 1. Proportion compatibility between species. Crosses were considered compatible when ≥6 styles were crossed and >80% of styles shriveled, or when 5 of 5 styles shriveled. Crosses were considered incompatible when ≥6 styles were crossed and <30% of styles shriveled, or when 0 of 5 styles shriveled. Crosstype is maternal-paternal.

Literature Cited

Kapteyn, J., B. Goldsbrough, and E. Simon. 2002. Genetic relationships and diversity of commercially relevant Echinacea species. *Tag Theoretical And Applied Genetics Theoretische Und Angewandte Genetik* 10(2-3):369-376.
McKeown, K. A. 1999. A review of the taxonomy of the genus Echinacea. Pp. 482-489. In J. Janick (ed.), Perspectives on new crops and new uses. AHASHS Press, Alexandria, VA.
Wagenius, S. 2004. Style persistence, pollen limitation, and seed set in the common prairie plant *Echinacea angustifolia* (Asteraceae). *International Journal of Plant Science*. 165(4): 595-603.

Conclusions

Based on compatibility rates, *E. angustifolia* was most likely to accept pollen from *E. pallida* and *E. pallida* was least likely to accept pollen from *E. angustifolia*. Assuming that style shriveling is proportional to seed set, these data suggest that if *E. pallida* is introduced into a population of *E. angustifolia*, *E. angustifolia* plants are likely to hybridize while *E. pallida* plants remain mostly pure.

Future Work

I plan to collect achenes from all crosses and analyze seed set to compare fertilization rates to compatibility rates.
I would like to study the morphological characteristics and survivorship of the hybrid offspring to learn more about the effects of crossing between *E. pallida* and *E. angustifolia*.

Heads almost ready to harvest

Attempting to quantify species characteristics (petal length and head color)

Acknowledgements