# The sweet smell of success: floral scent affects pollinator attraction and seed fitness in *Hesperis matronalis* (Brassicaceae).

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## Introduction

- Floral scent is assumed to be a target of pollinator-mediated natural selection.
- Few studies have attempted to document relationships between floral scent and direct measures of plant fitness.
- Measuring scent-fitness relationships as well as pollinator behavior will allow us to better understand the assumed potential for natural selection on floral scent by pollinators.

**Plate 1**. Bee pollinator

**Study Species -** *Hesperis matronalis* (Brassicaceae)
- Biennial introduced to North America
- Flower color polymorphic (purple and white)
- Highly scented: 39 volatile compounds
- Two major volatile categories
  - Aromatics (15 compounds)
  - Terpenoids (24 compounds)
- Peak scent production at dusk
- Variety of daytime pollinators
  - Syrphid flies
  - Many different types of bees
  - Lepidopterans
- Visitation by rare crepuscular moths

**Plate 2.** *H. matronalis* color morphs

Using *H. matronalis* as a study system, we sought to answer three questions:

**Q1: How do diurnal floral visitors respond to scent augmentation?**

**Q2: Does scent emission influence seed fitness when plants are exposed to day vs. night pollinators?**

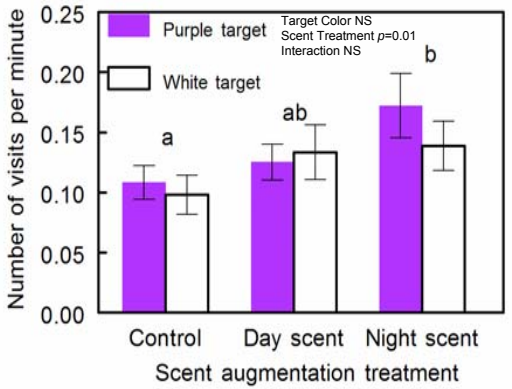
**Q3: Can variation in seed fitness in wild populations be explained by floral scent emission during day vs. night?**

**Q1 *Rationale*:** If floral scent is attractive to pollinators, then augmenting targets with additional scent extracts should increase pollinator visitation.

**Methods:**

- Scent treatments: Pentane floral extracts to produce three scent augmentation treatments in ten floral equivalents
  - Night = extracted @ peak emission (dusk)
  - Day = extracted @ off-peak emission (day)
  - Control = pentane only
- Emitters containing each scent treatment paired with matching color target of ten flowers
- Pollinator observation and ANOVA of pollinator visitation rates

**Plate 3**. Experimental scent-color targets




→ 60% more visitation to night-scent extracts

→ 16% more visitation to day-scent extracts

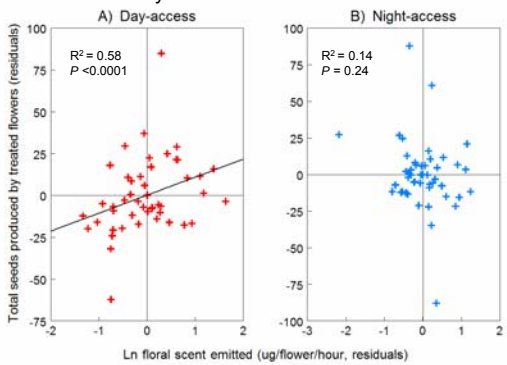
→ No effect of target color

**Q2 and Q3 *Rationale*:** If pollinators are attracted to scent, then plants with greater floral volatile emission will have greater seed fitness than those that are weakly scented; this relationship should be stronger for day-pollinator exposed plants, given the greater abundance of these insects seen in wild populations.

**Q2:** Floral scent and female fitness in limited pollinator access arrays

**Methods:**
- Potted plants (N = 98)
- Two treatment arrays:
  - Day-pollinator access (7am-7pm)
  - Night-pollinator access (7pm-7am)
- Dynamic headspace extraction:
  - Day (Day-access)
  - Dusk (Night-access)
- Gas chromatography-mass spectroscopy (GC-MS)
- Female fitness = seed production/plant
- Regression analysis by treatment:

Total seed production = $\alpha + \beta_1$(ln total day or dusk emission rate) + $\beta_2$(floral pigmentation ) + $\beta_3$(floral size) + $\beta_4$(flower production) + $\beta_5$ (inflorescence height)



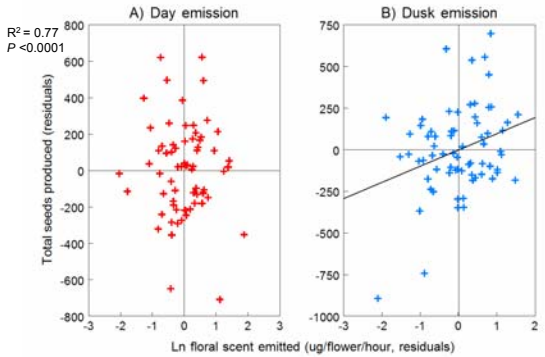

→ Day-access: significant positive scent-fitness relationship (total scent and terpenoids); flower production was also significant

→ Night-access: no significant relationship between any traits and fitness

**Q3:** Floral scent and female fitness in wild populations

**Methods:**
- 4 populations
  - 10 purple,10 white plants/population
- Dynamic headspace extraction:
  - Day
  - Dusk
- GC-MS
- Female fitness = seed production/plant
- Regression Analysis:

Total seed production = $\alpha + \beta_1$(ln total day emission rate) + $\beta_2$(ln total dusk emission rate) + $\beta_3$(flower production) + $\beta_4$(inflorescence height)




→ No relationship between day scent and fitness

→ Significant positive relationship between fitness and night scent (total and terpenoids). Flower production and inflorescence height also significant

## Conclusions

- Enhanced floral scent leads to increased pollinator visitation and seed fitness in *Hesperis matronalis.*
- Scent-fitness relationship may be driven in part by terpenoids at both day and night; matches known pollinator preferences.
- Variable pollination environments in arrays vs. wild populations?
- Presence/absence of both scent variables in model?

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