Investigating the relationship between floral color and co-occurrence in Eastern North American wildflowers

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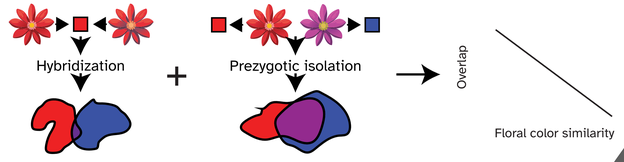
Background

Floral color differentiation and co-occurrence are expected to display complex patterns of correlation. For close relatives, past studies have found this in sister species:



However, the generalizability of this pattern across other clades and outside of sister species relationships remains untested. To investigate, we asked:

Q1: what is the relationship between floral color similarity and co-occurrence for close relatives? And,

Q2: how does that relationship change across larger phylogenetic scales?

Methods

For 899 species of common Eastern North American wildflowers, we collected data from open-source and community science databases on:

- range
- phylogeny
- phenology
- floral color

Color dissimilarity = Euclidean distance in HSL
Color similarity = max dissimilarity - dissimilarity
Overlap = Szymkiewicz-Simpson coefficient

Q1: Analyzed close relatives w/ multi. regression:

overlap ~ color similarity + genetic distance

Q2: Analyzed all species pairs w/ a partial Mantel test and phylogenetic generalized linear mixed model:

overlap ~ color similarity + genetic distance + (1 | species1) + (1 | species2)

Discussion

Q1: Close relatives co-occur more when they are less similar in floral color (divergent floral color).

- Floral color may be an important means of generating prezygotic isolation and allowing close relatives to coexist.
- This mechanism may contribute to the generation of such wide ranges of floral color diversity.

Q2: There is no evident relationship between floral color similarity and co-occurrence across all species pairs for common Eastern North American wildflowers.

Future work should seek to evaluate these patterns using color as perceived by pollinators. Future work may also examine the relative importance of color for prezygotic isolation, identify other mechanisms facilitating/preventing wildflower co-occurrence, and use study areas with greater floral diversity (e.g., the tropics).

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Results

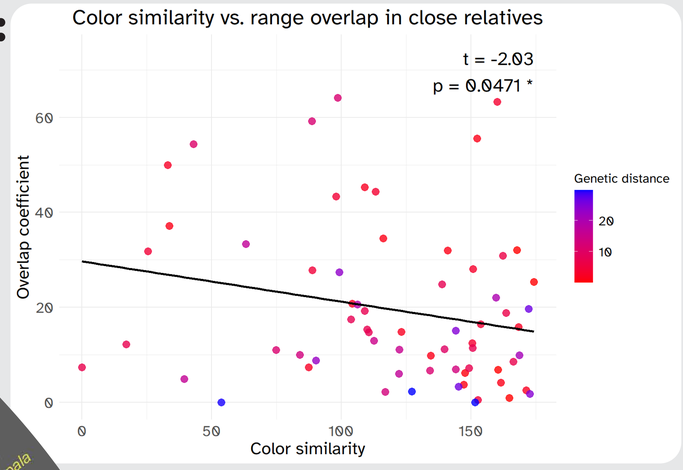
Do flowers of a color bloom together?

We investigated the relationship between floral color and co-occurrence for 899 common Eastern North American wildflowers to get the answer:

No.

In close relatives, flowers bloom with relatives of different colors; across larger phylogenetic scales, the relationship breaks down.

Q1:



Multiple regression reveals a significant negative correlation between color similarity and amount of co-occurrence (overlap) in close relatives.

Genetic distance is also negatively correlated with amount of co-occurrence in close relatives (t=-2.515, p=0.0145*).

But, does this generate a similar emergent pattern across all species?

No, partial Mantel tests and PGLMMs show no significant correlation between genetic distance or color similarity across all species.

Q2: