Greenhouse Experiment Design

Crosses between individuals of the same subspecies within the population

Sympatric Crosses

Allopatric Crosses

Crosses between individuals of different subspecies

Introduction & Study System

Geographic isolation can occur in allopatry, sympathy, or parapaxy, and is often viewed as the primary cause leading to speciation. When partially isolated populations come into contact again after range expansion, natural selection could strengthen prezygotic isolation barriers and assortative mating and reduce hybrid fitness. This is a hypothesis known as reinforcement, which can be tested if the following conditions are met: 1) heterospecific matings occur in nature; 2) hybrids are selected against or have reduced fitness; 3) mate discrimination traits have variations that are heritable and can respond to selection; and 4) reproductive character displacement was directly selected to minimize hybridization and has not occurred as a by-product of divergent selection in response to the environment.

Evolution of postzygotic isolation between subspecies of \textit{Clarkia xantiana}

\textbf{Clarkia xantiana (Onagraceae)}

\textit{subspecies xantiana} \quad \textit{subspecies parviflora}

\textbf{Hypothesis}

Crosses between subspecies that occur in allopatry are more reproductively compatible than crosses between subspecies that occur in sympathy.

\textbf{Results}

Fruits produced from the crosses were collected and opened. The number of viable seeds, fertilized but aborted ovules, and unfertilized ovules were counted.

\textbf{Conclusion}

In this study, we revealed that similar incompatibility exists between allopatric populations of \textit{xantiana} and \textit{parviflora}. We found that the percentage of viable seeds produced was not significantly different between sympatric and allopatric crosses. In other words, allopatric crosses are not any more reproductively compatible than sympatric crosses.

We observed the pattern of asymmetric crossing, where crosses of \textit{xantiana} to \textit{parviflora} produced a significantly higher proportion of seeds than crosses of the reverse direction. Our results suggest that such asymmetry in reproductive isolation can be attributed to which of the subspecies is the pollen acceptor or donor. We observed that when \textit{xantiana} is the pollen acceptor, more than half of the ovules were not fertilized or did not develop successfully into seeds. But when \textit{parviflora} is the pollen acceptor, the success rate for seed development is a lot higher, perhaps slightly more so in sympatric crosses than in allopatric crosses (Figure 1).

The similar reproductive compatibility between \textit{xantiana} and \textit{parviflora} that occur in sympathy and allopatry is not inconsistent with the expectations of the reinforcement hypothesis. Our results suggest that cross-compatibility does not depend on geographic origin.

Field experiments currently in progress look beyond cross-compatibility to investigate the fitness of hybrids in the field.

Reference


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