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The genetic correlation between flower size and water use efficiency in monkeyflowers

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ABSTRACT

Question: Does water loss during drought stress represent an important physiological constraint on the evolution of flower size?

Organism: A genetically diverse population of *Mimulus guttatus* (yellow monkeyflower) originally sampled from an alpine meadow in Oregon, USA.

Methods: We grew plants of three different genotypic classes (small, medium, and large flowered) under both well-watered and drought-stress conditions and measured water use efficiency using stable carbon isotopes.

Results: There was no difference in water use efficiency among flower size genotypes under well-watered conditions, but the water use efficiency of small-flowered plants was substantially lower than that of medium or large genotypes under drought stress. Whether this paradoxical result is a direct effect of flower size or an indirect (i.e. pleiotropic) effect, the presence of a genetic correlation between floral and physiological traits indicates that selection of one does impact the other.

Keywords: carbon isotopes, drought, genetic correlations, *Mimulus guttatus*, water use efficiency.

INTRODUCTION

The diversity of floral morphologies in angiosperms, and the association between particular floral features and animal pollinators, provide textbook examples of adaptation and co-evolution (Faegri and Van der Pijl, 1979; Johnson, 2006). However, pollinators are only one of several selection pressures that act on floral traits. For example, the majority of angiosperms reproduce via self-fertilization at least occasionally. Selfing implies different optima for the size, number, and coordination of floral parts than outcrossing, and as a consequence, highly selfing species typically exhibit a distinct 'syndrome' of features (Ornduff, 1969). Floral traits may also be developmentally linked to other physiological, phenological, and

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