Condition-dependent sexual dimorphism in a dioecious plant

Josh Hough[*,†], Adriana Salcedo[†], and Spencer C.H. Barrett[†]

[*]*Department of Plant Sciences, University of California, Davis*
[†]*Department of Ecology and Evolutionary Biology, University of Toronto*

ABSTRACT

Theory predicts that sexual selection favoring the sex-specific exaggeration of traits will lead to the evolution of sexual dimorphism, with traits in one sex becoming more pronounced than homologous traits in the opposite sex. Such trait exaggeration may come at a cost, however, and highly sexually dimorphic traits are expected to evolve an increased sensitivity to variation in condition, with greater trait exaggeration occurring in higher condition individuals. Although both sexual dimorphism and condition-dependent trait expression have been widely documented, the extent to which these forms of plasticity co-vary is not well known, especially in flowering plants, where sexual selection and the occurrence of sexual dimorphism are probably less well developed than in many animal groups. Here, using a common garden experiment in which soil nutrients were manipulated, we investigate how variation in condition affects sexually dimorphic trait expression in the dioecious wind-pollinated annual plant *Rumex hastatulus*. We found evidence for significant sexual dimorphism in reproductive traits (e.g., flower number and reproductive mass), which were on average 20% more dimorphic and 80% more condition-dependent than vegetative traits (including leaf number and size, and total vegetative mass). As predicted by theory, our experiment also revealed that the strength of condition-dependence increased with the degree of sexual dimorphism, suggesting that traits that have evolved sexual dimorphism have also evolved condition dependent expression. However, in contrast to previous studies in animals, we found that both males and females exhibited similar responses to the manipulation of condition, suggesting that there are key differences between plants and animals in the expression of sexually dimorphic trait variation. We conclude that differences between males and females in both absolute and proportional allocation to reproduction are crucial for understanding how sexually dimorphic traits respond to variation in condition in plants.