The role of sexual selection in shaping adaptive variation

The world is rapidly changing, with almost all habitats on earth likely facing some degree of environmental change. Much of this change is caused by increasing human activity, including, anthropogenic driven climate change. Understanding how species and populations may be influenced by and respond to increasing temperature is therefore an important goal which may have far reaching consequences. Populations may respond to changing environments in a number of different ways: they may migrate to more suitable habitats, if they cannot migrate due to geographical barriers or habitat fragmentation populations may adapt to the new environmental conditions, but if adaptation rates are not great enough to keep pace populations will go extinct. In this project, I plan to fill a gap in our knowledge regarding how populations adapt to increasing temperatures at both the phenotypic and genomic level. I plan to address the specific question of how the genetic variance shaped by sexual selection may influence the adaptive capacity of populations to thermal stress.

Sexual selection is an important and potent evolutionary force, and has driven the evolution of some of the most elaborate and extravagant traits that we observe in nature, from the dazzling plumage of birds, to the impressive horns observed in mammals and insects. These sexually selected traits, normally found in males, evolve because they increase an individuals' sexual attractiveness or combative ability. Recent research has shown that sexually selected traits, and outcome of sexual selection in general, reflect individuals' genetic quality and thus can shape the genetic variance that exists within populations. This occurs because strong sexual selection reduces the number of reproductively successful individuals and thus limits the amount of genetic variation passed to the next generation. Although less in quantity, the remaining genetic variation may, however, be of higher quality due to individuals burden with low quality genes failing to reproduce. As amount and nature of genetic variation in a population is probably one of the most important factors in determining a populations adaptive capacity, there is possibly a link between the effects of sexual selection on shaping genetic variation and adaptive capacity. However, currently direct tests of this are lacking and whether adaptation relies on genetic variation shaped by sexual selection remains largely unknown.

I plan to use long term experimental evolution populations to address these questions. The species I will be using is the bulb mite, *Rhizoglyphus robini*, a model organism for sexual selection research. These populations have been evolving for over 2 years (50+ generations) with differing intensities of sexual selection and previous research found that stronger sexual selection reduces genetic variance in the populations by eliminating weakly deleterious variance and decreasing the reproductive pool of males. Moreover, these populations have also been exposed to both high and low temperatures for an additional 2 years. I plan to check if sexual selection helped populations to adapt in increased temperature and resequence these populations in order to directly investigate the genetic variance that exists in populations both before and after temperatures changes. Thus providing important insights into what genes and variants are important to thermal adaptation, and more broadly draw a link to identifying which species in nature are likely more or less vulnerable to climate change.

The approaches used to address this question are novel and my results likely to provide important insight into our understanding of crucial evolutionary and ecological processes. If we wish to conserve biodiversity for future generations we need a better and more nuanced understanding of which species may be more vulnerable to climate change. This project will fill an important gap in our knowledge and I hope influence proactive management plans of vulnerable species.