Competition between males improves resilience against climate change

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Diamondback moth. Credit: Olei/Wikipedia/CC-BY-SA-2.5 and GNU FDL

Animal species with males who compete intensively for mates might be more resilient to the effects of climate change, according to research by Queen Mary University of London.

Moths exposed to increasing temperatures were found to produce more eggs and have better offspring survival when the population had more males competing for mating opportunities (three males for every female).

The study, published in the journal *Proceedings of the Royal Society B*, suggests that sexual selection can provide a buffer against climate change and increase adaptation rates within a changing environment. This could improve understanding of how changing environments might affect animal species in both natural and agricultural systems.

PhD student and lead author Jon Parrett from Queen Mary's School of Biological and Chemical Sciences said: "Climate change is altering environments all over the world in a variety of ways, with increases in temperature of several degrees being likely in many places. It is vitally important that we understand how animal populations will respond to these changing environments. Our study is the first to look at how sexual selection affects an animal population's ability to respond to gradual increases in temperature."

"We found that moths were more likely to succeed in stressful environments of increasing temperature when there were more males competing for mating opportunities. This is because males who were best adapted to the new environment were more likely to be mated with, and these successful fathers passed on their 'good genes' to their offspring, aiding survival in the new environment."

Several populations of the Indian meal moth Plodia interpunctella were established with either a male-biased sex ratio of three males for every female (strong competition) or a female-biased sex ratio of one male for every three females (weak competition). The team then gradually increased the temperature that they were reared at by 2°C every other generation.

As temperature increased beyond the normal range for these animals, populations showed declines in the number of eggs produced per female and also in the survival of offspring to adulthood.

The populations kept with a male-biased sex ratio, however, were more resilient to increasing temperatures. Production of offspring and survival rates were still affected, but significantly less than in the female-biased populations.

The team extended the study by comparing females who were allowed to choose their mates with females who were only given a single option of a male to mate with. They found that when females were allowed to be choosy they also laid more eggs and had better offspring survival in the face of increasing temperatures.

These positive effects of sexual selection may, however, be too small to protect populations and delay extinction when environmental changes are relatively rapid.

Co-author Dr Rob Knell from Queen Mary's School of Biological and Chemical Sciences said: "We used a laboratory system for this research, but our conclusions are likely to be applicable to many animal species. Intense competition for mates is a feature of many well-known animals: rutting stags, displaying peacocks, male birds of paradise and singing male crickets are all trying to win the mating game.

"Our results indicate that these competitive mating systems can play an important role in determining the response to new environments, whereas species where there is less competition for mates are likely to be less able to adapt to new conditions."

The authors caution that the study is only a laboratory demonstration of the effect and more research is needed to fully understand how these

effects might operate in natural systems.

More information: The effect of sexual selection on adaptation and extinction under increasing temperatures, *Proceedings of the Royal Society B*, rspb.royalsocietypublishing.or … .1098/rspb.2018.0303

Provided by Queen Mary, University of London

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