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Digest

Digest: Sexual selection may shape species' range limits

Olivia R. Sinclair[1] and Tabitha R. Taberer[1,2]

[1]Department of Biology, University of Oxford, Oxford, United Kingdom
[2]African Natural History Research Trust, Kingsland, United Kingdom

Corresponding author: Department of Biology, University of Oxford, 11a Mansfeld Road, Oxford, OX1 3SZ, United Kingdom. Email: olivia.sinclair@biology.ox.ac.uk
This article corresponds to Tschol, M., Reid, J. M., & Bocedi, G. (2024). Sexual selection and mate limitation shape evolution of species' range limits. *Evolution*. 78(5), 951–963. https://doi.org/10.1093/evolut/qpae031

Abstract

In a recent study, Tschol et al. (2024) present a model that investigates how 2 different forms of sexual selection, selection for traits that increase mate encounters and selection for traits that enhance one's ability to compete for mates, affect geographical range limits. The model demonstrates that range limits expand in response to selection on mate-encountering traits and contract when selection acts on reproductive competitiveness. When traits coevolve, range limits depend on the mating system. This study demonstrates the importance of accounting for sexual selection and intraspecific interactions when investigating eco-evolutionary dynamics of geographic range limits.

Understanding the eco-evolutionary dynamics that affect species' range limits is critical to ecology and evolutionary biology, although most research in this field focuses on interactions among species. In a new study, Tschol et al. (2024) investigate how two major components of intraspecific sexual selection, the ability to encounter mates and compete successfully for fertilization, affect a species' geographic range. Traits such as mobility, pheromone production, and mating calls (Kokko & Wong, 2007) can increase the likelihood of mate encounters, which further depend on the mating system and adult sex ratio of the species, which vary significantly across taxa (Bessa-Gomes et al., 2004; Shaw et al., 2018). Furthermore, the level of intrasexual competition during mate encounters may influence the development of ornamentation or weaponry, which, in turn, could reduce survival, ultimately affecting population density and the adult sex ratio in a feedback loop (Kokko & Brooks, 2003). In this study, Tschol et al. (2024) present a model that accounts for these complex dynamics, gaining a more holistic understanding of how sexual selection affects geographic range limits.

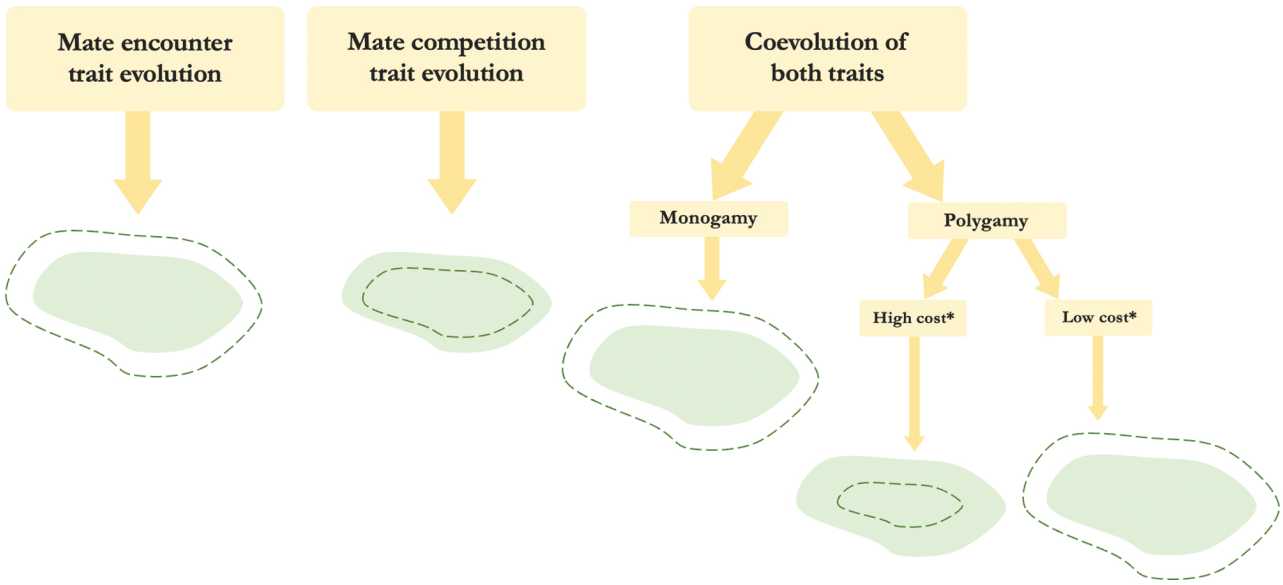

Figure 1. Summary of results found by Tschol et al. (2024), testing the effect of sexual selection traits on species' range limits. Solid patches represent range limits before trait evolution, and dashed lines represent range limits after trait evolution. *Cost of competition trait.

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To investigate and test this variable effect of sexual selection on range limits, Tschol et al. (2024) develop and run models based on populations structured along density gradients under three scenarios: (a) only the mate encounter trait evolves; (b) only the competition trait evolves; and (c) both traits evolve jointly. The models vary in the strength of selection on each trait, the strength of male competition, and dispersal ability. The authors account for the effects of different mating systems (polygyny and monogamy) and the survival costs of each trait on the probability of mate encounter.

Their findings reveal that the effects of sexual selection on range limits depend on the trait that selection acts upon, as well as the overall mating system. When the mate encounter trait is selected for, the range limits extend as males are better able to find mates at the edges. Conversely, when the competition trait is under sexual selection, range limits contract. This may be caused by the shift toward a female-biased sex ratio resulting from an increase in male mortality associated with stronger competitive ability (e.g., parasite or predation-related mortality). For example, the mating song of the male Pacific field cricket attracts both females and *Ormia ochracea*, a deadly parasitoid fly (Lehmann, 2003). When both mate finding and competition traits coevolve, their combined effect on the range limit depends on the mating system (monogamy vs. polygamy) and the cost of the competition trait (see Figure 1).

The results of Tschol et al. (2024) contribute to our understanding of global patterns of species' distributions. For instance, similar work could be applied to tropical species that experience high levels of sexual selection (such as freshwater fish; Fujimoto et al. (2015)) and have geographically small range sizes. A comparative study on birds by Cally et al. (2021) remains the only other study to investigate a direct link between sexual selection and range size, though no relationship was found. More theoretical and empirical research linking the causes and consequences of sexual selection and other sources of intraspecific selection to the spatial population dynamics across species' ranges is needed.

Conflict of interest: The authors declare no conflict of interest.

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