

Paper: “The ecological stage changes benefits of mate choice and drives preference divergence”

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Summary: Reproductive isolation drives evolution by creating a barrier that allows for the accumulation of dividing traits within a population that ultimately leads to speciation. The paper examines ecological dependent sexual selection, coined the ecological stage, in three-spine stickleback that results in reproductive isolation. The author seeks to understand the relationship between ecological conditions and mating preferences. The author hypothesizes that males and females interact in a preferred ecological context, in which mating interactions varies depending on distinct environmental conditions. The authors predicted that females would choose a mate based an indicator trait which is dependent on ecological conditions. The authors collected adult limnetic and benthic three-spine sticklebacks from Paxton Lake in British Columbia. For control, the authors used a maternal half-sibling, split-clutch design to have a base for maternal genetics, however, allowed for genetic variability in the fathers. For the first generation, a female’s clutch was extracted and split in half, in which each half was fertilized by either a low or high color male of the female’s species. The fertilized eggs clutches were hatched producing an initial 21 benthic adults and 25 limnetic adults. At 16 weeks, the offspring of each family were split and designated a diet treatment natural to the species. Food amounts were scaled to the number of fish in the tank, however, contrasting environments were set for each family split. Additionally, natural temperatures and controlled light was set for each split with temperatures being at 16°C and the light controlled in a 14-hour light and 10-hour dark cycle. The experiment ran for many generations in which biweekly counts adjusted the volume of water available to the fish. The experiment was aimed in determining whether color is a condition-dependent indicator that allowed for the offspring to survive to maturity. The authors found results that showed a strong correlation on survival through maternal ($p < 0.0001$) and paternal ($p < 0.0001$) lines, which supports that father color was an indicator trait. Depending on the condition-dependent trait expressed by their mates, the results show higher viability of survival of males to maturity that displayed the specific indicator trait. Different ecological condition, in this case diet, which are adapted by the limnetic and benthic also played a role in the outcome of fitness. For the limnetic that favored high color fathers, diet was a major support as the probability of survival was greater with the native plankton diet than the alternative macroinvertebrate diet. On the other hand, the benthics’ fitness was not reliant on either diet or fathers’ color variability, but rather size. With the data showing differences in conditions attributing to certain preferred traits of mating, we could draw that survivability is ecologically dependent in which sexual selection favors traits that the habitat supports such as color variability. In conclusion, selection can occur depending on the environment, which could result in ecological speciation.

Critique: My critique on this experiment would be to sample other animal species found at different habitats and to compare if the results shown in the experiment could be mimicked.

Multiple different species exhibiting the same results could further support the ecological hypothesis, that indicator traits are supported by environmental factors such as diet. Additionally, further research should be used to expand the experiment over several generations in seeing if the accumulation of traits between the barriers can result in speciation.