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Successful genomic selection for timing of breeding in a wild songbird

Irene Verhagen, Phillip Gienapp, Veronika N. Laine, A. Christa Mateman, Kees van Oers & Marcel E. Visser

The physiological mechanisms underlying the seasonal timing of breeding in birds, a trait with major fitness consequences, are not well understood. For one thing, timing of breeding is a 'complex trait', in the sense that it is the result of a cascade of physiological events. There is clear variation in when females lay their first egg within a population, but it is unclear how they differ in their underlying physiology. A better understanding of this variation in timing of breeding, its physiology, and especially the genetic basis of variation, is important, because this determines the potential of timing of breeding to respond to selection, i.e. its 'evolutionary potential'.

Comparing individuals that have been selected to differ in their timing of breeding may prove to be a promising way to study these mechanisms. Using a model species in evolutionary ecology, the great tit (*Parus major*), we created selection lines for early and late breeding by selecting on their genotype instead of their phenotype. We studied whether artificial selection resulted in a divergence of the early and late selection lines, both on the genomic and phenotypic level. The results show increased genetic differentiation between the early and late line over three generations. In addition, the early line females laid on average ~6 days earlier compared to the late line. We also studied whether the endogenous free running period of the day/night clock under constant conditions (tau) and basal metabolic rate, which are potentially part of the mechanisms underlying seasonal timing, would respond to selection on timing of breeding (i.e. correlated selection), but they did not.

Great tit.

In conclusion, we successfully created selection lines for timing of breeding in a wild bird species. As such, we obtained a tool for future studies to investigate the physiological mechanisms underlying timing of breeding, and the genetic variation in these mechanisms, an essential component for evolutionary change in timing of reproduction.