Climate constrains range expansion of a population diverging under allochrony : the case of the pine processionary moth

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Abstract

Allochronic speciation occurs when populations sharing similar feeding regimes diverge because they mate at different times. Such speciation mode is fascinating because it allows uncovering the organisms' adaptations and/or geographic range shifts that arise from the new ecological constraints faced and forecasting the impact of global warming upon biodiversity. Here we address the question of potential divergence of the climatic niche of two sympatric populations of pine processionary moth *Thaumetopoea pityocampa* (PPM) that exhibit a shift in their phenology and are thus subjected to very contrasted ecological constraints. The larval development of a newly discovered PPM population, referred to as summer population (SP), occurs in the spring-summer instead of in the autumn-winter as for the other populations of this species. We carried out field sampling in coastal regions of Portugal where both populations are sympatric, and we performed species distribution and spread modeling to analyze the response of SP to environmental parameters and predict its current and future range. We show that the geographic region where both populations occur in sympatry, display unique climatic conditions, which enable the coexistence of populations with so different phenologies. Our results indicate that the phenological shift experienced by SP, led to new climatic constraints that impede this population to fill the realized niche of the typical populations. Given the narrow climatic tolerance and low dispersal capacity of the SP, our study indicates that this population will become endangered by global changes. We demonstrate that a climatic niche shift occurred during this divergence under allochrony.

Keywords: Thaumetopoea pityocampa, pine processionary moth, allochronic speciation, niche shift, species distribution modeling

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