Evolution of plasticity and character displacement in a fluctuating environment

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Résumé

Species that compete for the same resource may undergo ecological character displacement (CD), whereby the phenotype of each species evolves to deviate from its optimum in the absence of competition. As most environments are not static, interspecific competition is likely to occur in environments that fluctuate over time, and the traits mediating the competition may also exhibit phenotypic plasticity in response to this fluctuating environment. We use a quantitative genetic model to study theoretically how a randomly fluctuating environment and evolution of plasticity influence CD in two competing species. We show that environmental fluctuations make the conditions for CD more stringent, requiring stronger competitive selection relative to stabilizing selection. This occurs because the expected population size is lower in a fluctuating environment, reducing the intensity of density-dependent competition. Evolving plasticity can restore CD by buffering the impact of environmental fluctuations through phenotypic tracking, depending on environmental predictability. Somewhat paradoxically, competition that leads to divergent CD at the phenotypic level selects for convergent CD in plasticity, because this limits the load caused by fluctuations in phenotypic divergence. Our results shed light on how competition, and interspecific interactions more generally, influence evolution of the fundamental niche in a fluctuating environment.

Mots-Clés: Competition, Character displacement, fluctuating environment

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