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Intraspecific competition – combining population genetics, game theory and adaptive dynamics

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Availability of solid mathematical tools is a necessary to understand the complex impact that modern life has on biodiversity and speciation. In the recent years sympatric speciation (i.e., speciation without geographically restricting gene flow) has emerged as a central topic of interest in theoretical ecology, and frequency-dependent intraspecific competition became popular as a possible prerequisite. It creates disruptive selection, which — followed by a mechanism removing unfit heterozygotes — might initiate incipient sympatric. Here we will present a mathematical approach to study intraspecific competition based on population genetics, evolutionary game theory and adaptive dynamics.

Various models of intraspecific competition are used in the theoretical literature, which are approximately equivalent for sufficiently weak selection. Here, we will argue, that the model of Christiansen and Loeschcke (1980, Theo. Pop. Biol. 18), or more generally the Wildcard model (Matessi and Schneider, 2009, Theo. Pop. Biol. 76), has the most convenient analytical properties. In particular, a global Lyapunov function exists for the model, a property that renders the study of long-term evolution promising. Namely, an underlying maximization principle exists that might justify an adaptive dynamics approach, which neglects explicit short-term dynamics, even in complex genetic setups.

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