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A kin-selection model on persistence of altruism

Persistence of altruism has been an engaging research area. In all types of altruism behaviors, cooperative breeding has captured a lot of attention. Using kin selection as a tool, we construct a comprehensive model to study the persistence condition of altruism. In our model, we classify individuals in the population of a species into four types, according to their role at the time we look at the population, i.e., floaters, helpers, solitary breeders, and breeders with a helper. We assume: i) the population is hermaphrodite, ii) breeders either have no helper or one helper each time, iii) the life cycle has the order – birth, helper death, dispersal, adult death. We assume ‘helping gene’ can have control over the following phenotypes: helpers’ level of helping (helper can also react differently, when it is born to two types of breeders), the effect of their helping on the improvement of survival rate and fecundity rate of breeders with a helper, the decreasing of helpers’ own survival rate. We examine the rate of change of inclusive fitness with the genotype, and obtain conditions for persistence of altruism. We compare the conditions for different scenarios: i) helpers improve newborns’ survival rate only, ii) helpers improve breeders’ survival rate, as well as newborns’ survival rate, iii) helpers improve breeders’ fecundity through male function, in addition to the improvement of fecundity through natal female function.