Selection for Variance in Offspring Number

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For two genotypes that have the same mean number of offspring but differ in the variance in offspring number, natural selection will favor the genotype with lower variance. The concept of fitness becomes cloudy under these conditions because the outcome of evolution is not deterministic. However, the effect of variance in offspring number on the fixation probability of mutant strategies has been calculated under several scenarios with the general conclusion that variance in offspring number reduces fitness but only in proportion to the inverse of the population size (Gillespie 1974, Proulx 2000). This relationship becomes more complicated under a metapopulation scenario where the "effective" population size depends on migration rate, population structure, and life cycle.

It is shown that in a life cycle where reproduction and migration (the Birth-Migration-Selection life cycle, or BMS) occur prior to soft selection within every deme, the fitness of a strategy depends on migration rate. When migration rates are near zero, the fitness of the strategy is determined by the size of individual demes, so that the strategy favored in small populations tends to be fixed. As migration rate increases and approaches panmixis between demes, the fitness of a reproductive strategy approaches what its value would be in a single, panmictic deme with a population size corresponding to the census size of the metapopulation. Interestingly, when the life cycle is characterized by having selection in each deme prior to migration (the Birth-Selection-Migration life cycle, or BSM) there is no effect of migration rate on the fitness of a reproductive strategy. These results are found to be qualitatively consistent with the individual-based simulation results in Shpak (2005).

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