

X-linked meiotic drive can boost population size and persistence

Carl Mackintosh, Andrew Pomiankowski, and Michael F Scott

Supplemental Information

Alternative form of density dependence

In the main text, we assumed that competition for resources among adults is a source of density dependent selection by reducing the survival or fecundity of adult females. The assumption is that the density dependence is generated by the population size (αN), but not by the birth rate (b). Here, we explore an alternative form of density dependence in which competition for resources can cause the population size to be depressed as population birth rate increases. For instance, if the density dependence is defined by

$$(1 - b\alpha N), \tag{S1}$$

then increasing the birth rate does not always increase population size (Figure S1). Without meiotic drive, the equilibrium population size is

$$\hat{N}|_{p=0} = \frac{b-2}{b^2\alpha}, \tag{S2}$$

which now includes a quadratic term in b not present in (Eq 8). Thus, when birth rates are very high, the equilibrium population size decreases because competition becomes more intense. For example, if competition is a function of the number of juveniles $J = bN$, then high birth rates both increase the number of juveniles, J , and increase the strength of competition among them.

As in our main results, we find that the intrinsic birth rate must be at least two for wild-type populations to persist whereas populations with drive can persist with a lower intrinsic birth rate (Figure S1). However, meiotic drive does not always increase population size in this scenario because increasing the effective birth rate by biasing the sex ratio towards females does not always lead to larger populations. Thus, some forms of density dependence could mean that increased birth rates do not increase population size, in which case the effect of meiotic drive on boosting the effective birth rate may change. However, we expect that increased birth rates will increase population size in most models of intraspecific competition.

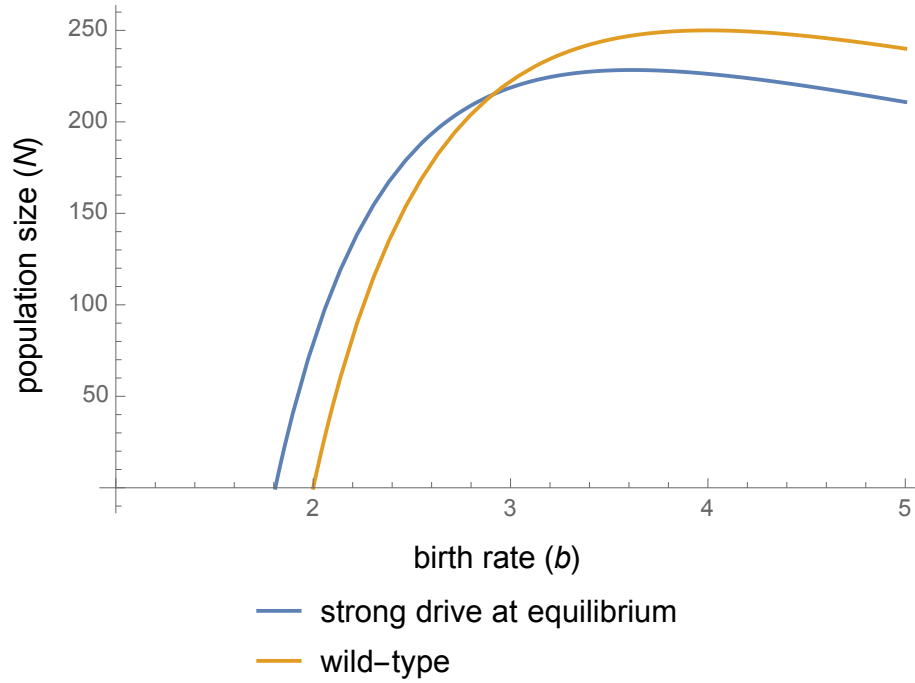


Figure S1: Equilibrium population size given density dependence is based on the the intrinsic birth rate (b). As before, meiotic drive allows the population to persist with lower birth rates ($b < 2$). But with higher values of the birth rate ($b > 3$), meiotic drive reduces population size. Parameter values: $s_m = 0$, $c = 1$, $h = 0.1$, $s_f = 0.8$, $\lambda_f = 1$, $\alpha = 10^{-3}$.