Evolution of clonal populations approaching a fitness peak

Supplemental Information

Here we show the predictions of Fisher geometrical model with a static optimum for different parameter sets from those presented in the main text. Figures A1 and A2 show the effect of population size N and number of traits under selection n (indicated in different colors), for two different values of σ^2, which leads to different values for the mean effect of mutations.

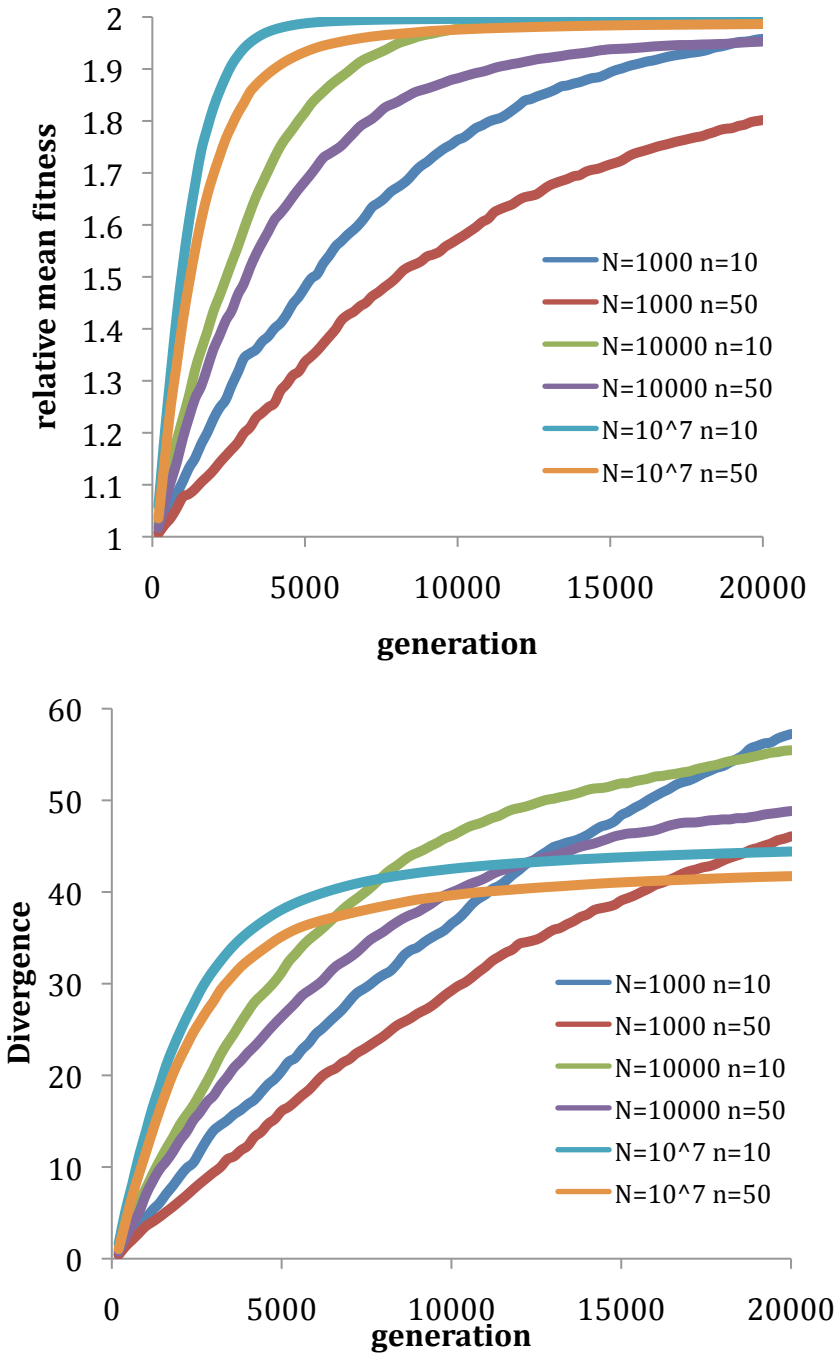


Figure A1) Dynamics of fitness increase and rate of molecular evolution with

phenotypic complexity (*n*) for different effective population sizes *N*. Divergence represents the number of mutations accumulated along time. *U*=0.001 which is the order of the genomic mutation rate for DNA based microbes. σ^2=0.0001 leading to a mean effect of deleterious mutations at the optimum of 0.001 or 0.005 depending on *n*.

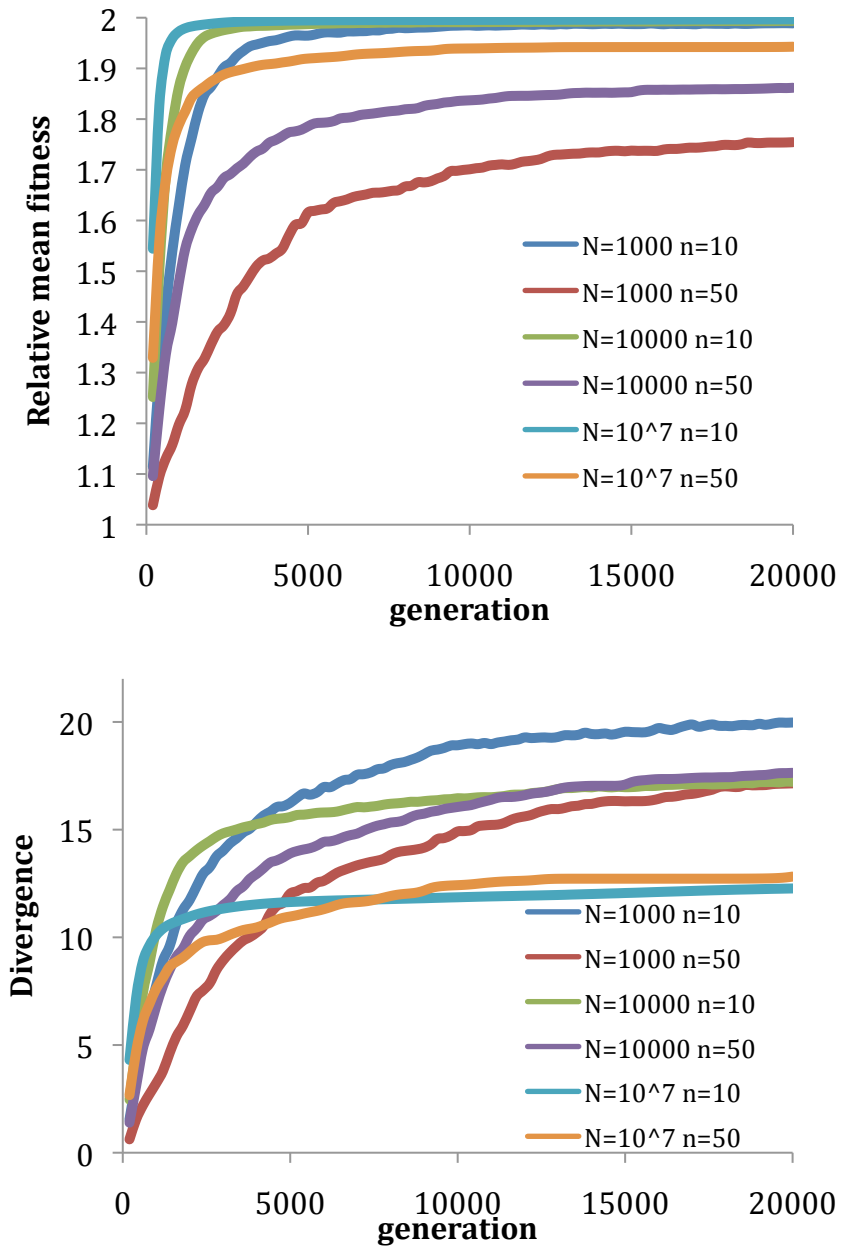
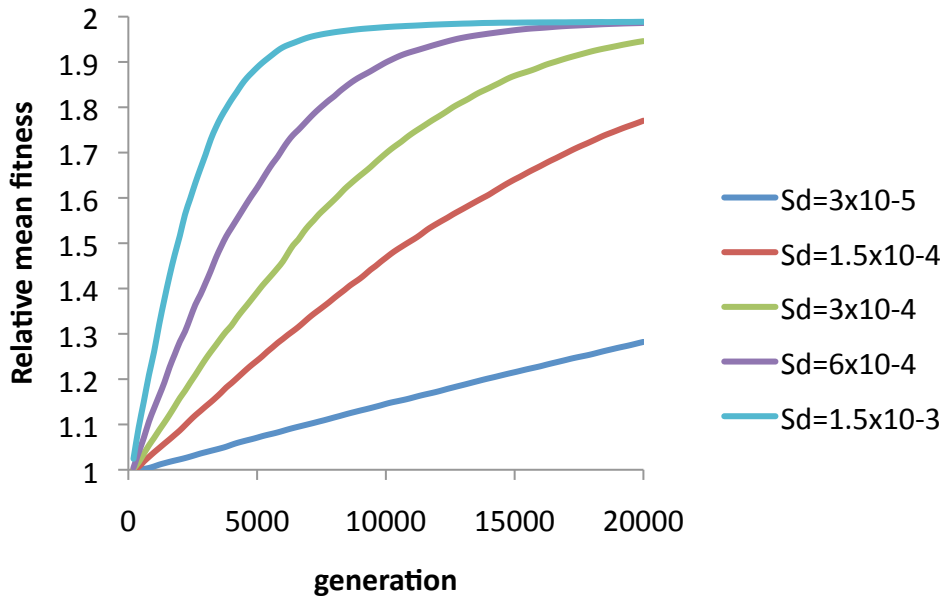


Figure A2) The same as A1 but with σ^2=0.001 leading to a mean effect of deleterious mutations at the optimum of 0.01 or 0.05 depending on *n*.



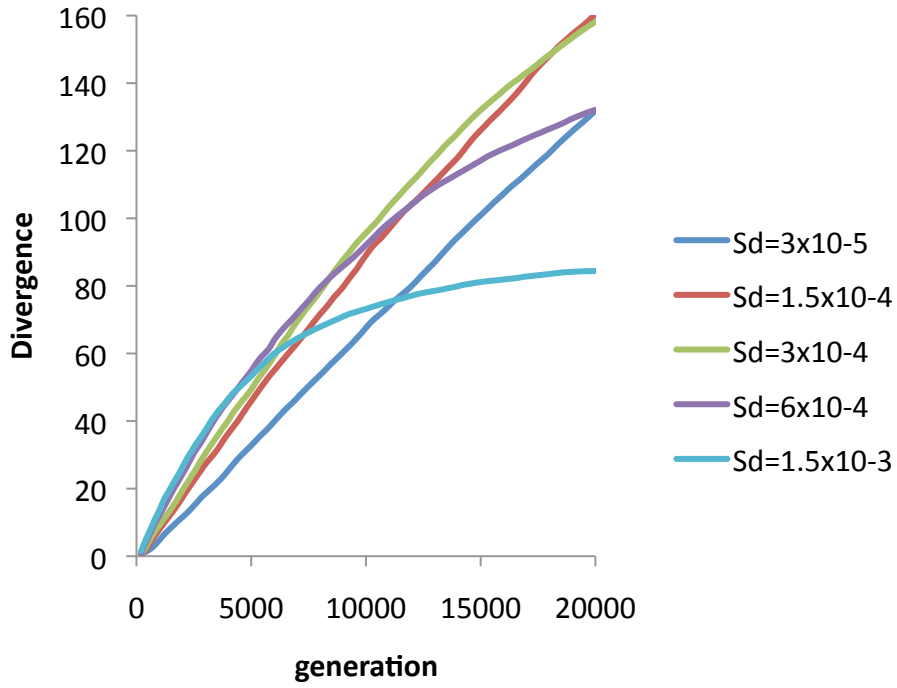
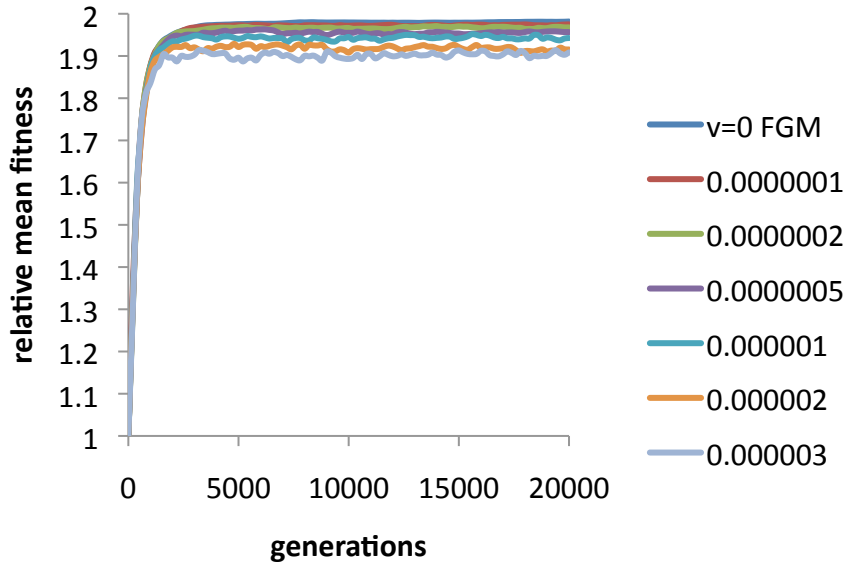


Figure A3) The effect of mutations in the dynamics of fitness and rate of mutation accumulation. Parameters are N=10^5 U=0.003, n=30 and W_0=0.5. Various mean effects at the peak (various σ^2), where Sd= $E(s_d)_{w=1} = \sigma^2/n$ are indicated in the figure. For all parameters values, deleterious mutations are never effective neutral (N*$E(s_d)$>1).

Figure A3 shows that when $E(s_d)_{w=1}$ is very small, mean fitness increases very slowly, at a constant rate, and this is accompanied by a constant rate of mutation

accumulation, at least during the 20000 generations period simulated. We note that for the curves where $E(s_d)_{w=1}=-3x10^{-5}$, in the initial genotype founder of the population (which has fitness 0.5 and $E(s_d)_{w=0.5}=-1.3x10^{-3}$) the fraction of effectively neutral mutations is 0.5%. This implies a rate of accumulation of these mutations of about $0.003*0.5\% = 1.5x10^{-5}$. This is a much lower rate than the one observed in the simulations, which is 0.0067, suggesting that the majority of the mutations accumulated are beneficial.

Here we show the predictions of Fisher geometrical model with a shaking optimum for different parameter sets from those presented in the main text.



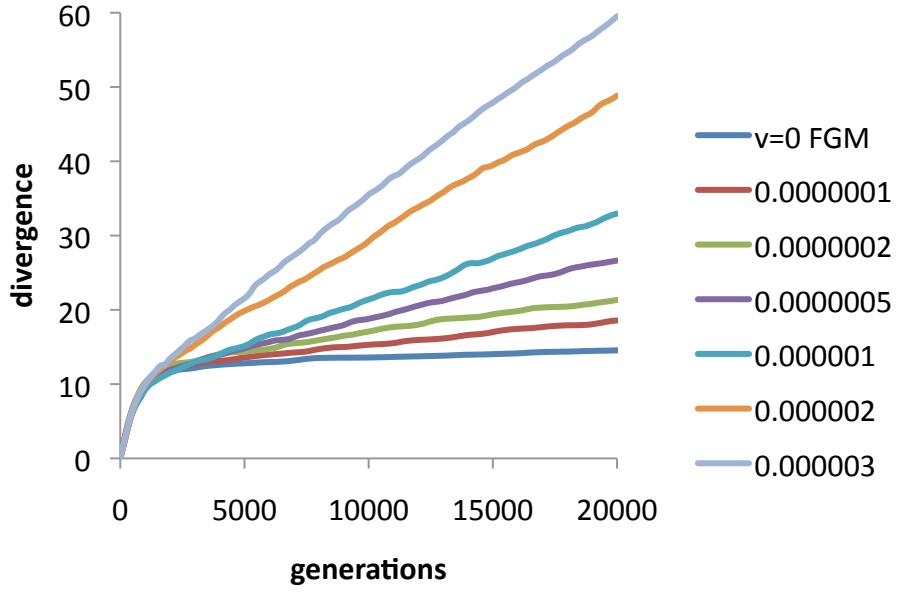


Figure A4) Dynamics of increase in fitness and number of mutations under a model with a shaking peak. N=10^5 σ^2=0.001, n=20, U=0.001, W_0=0.5 and the value of v is indicated in the figure.

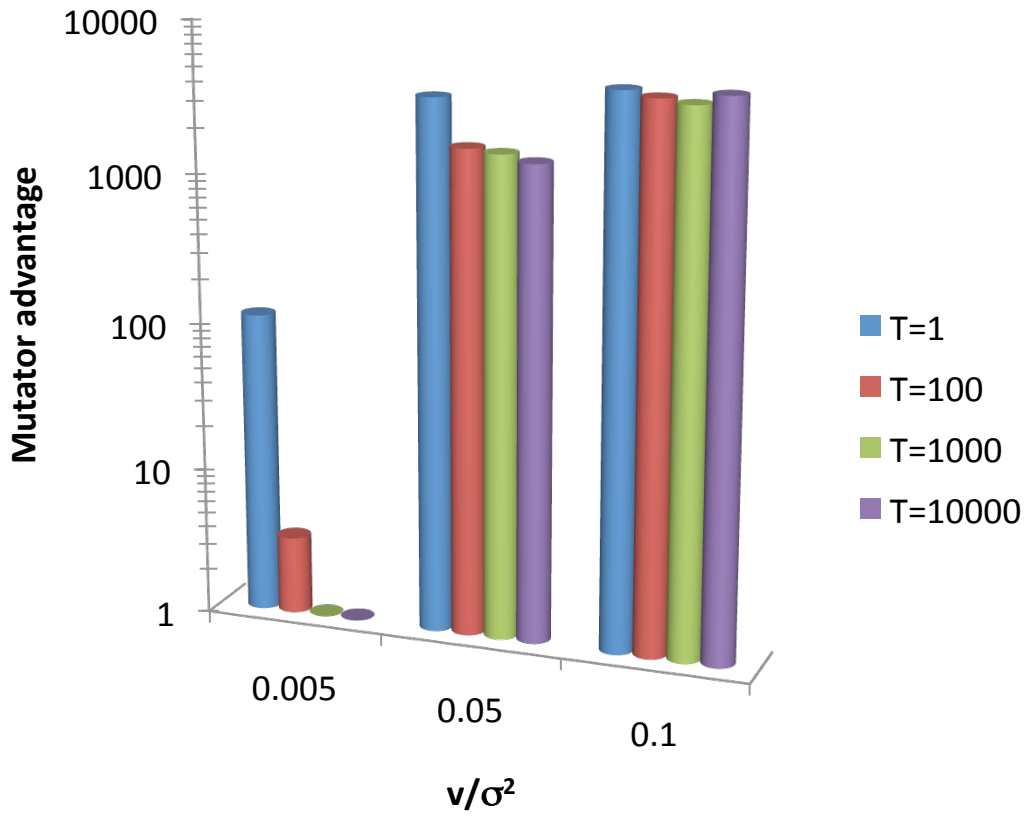


Fig A5) Advantage of mutator in large populations. The parameters values are the same as in Figure 3) of the main text except that N=10^6.

Figure A5 shows that in larger populations the advantage of mutator alleles is higher than in smaller populations, all else being equal.