

Supplementary material

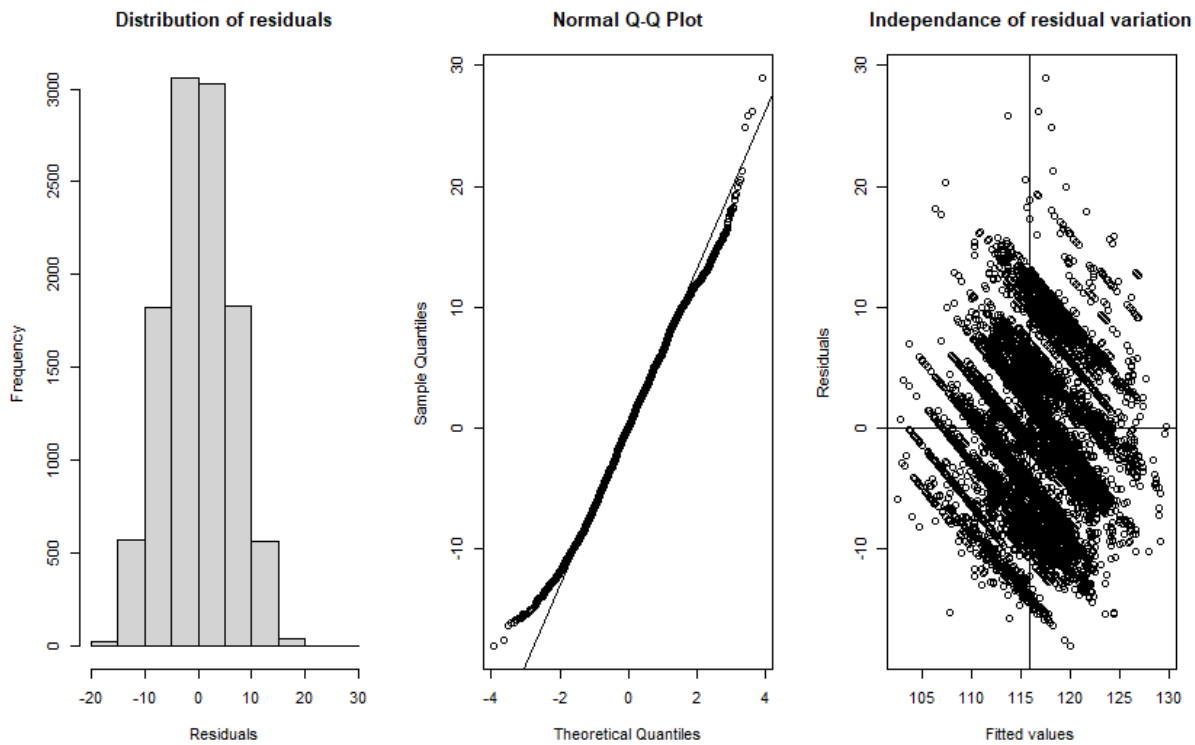


Figure S1. Analysis of residual variation of the random effect model. Left panel: distribution of residuals. Central panel: quantile-quantile plot of the residuals confirming no strong deviation from normality. Right panel: the residuals do not exhibit correlation with the fitted values of the model (Pearson's $r = 0.054$).

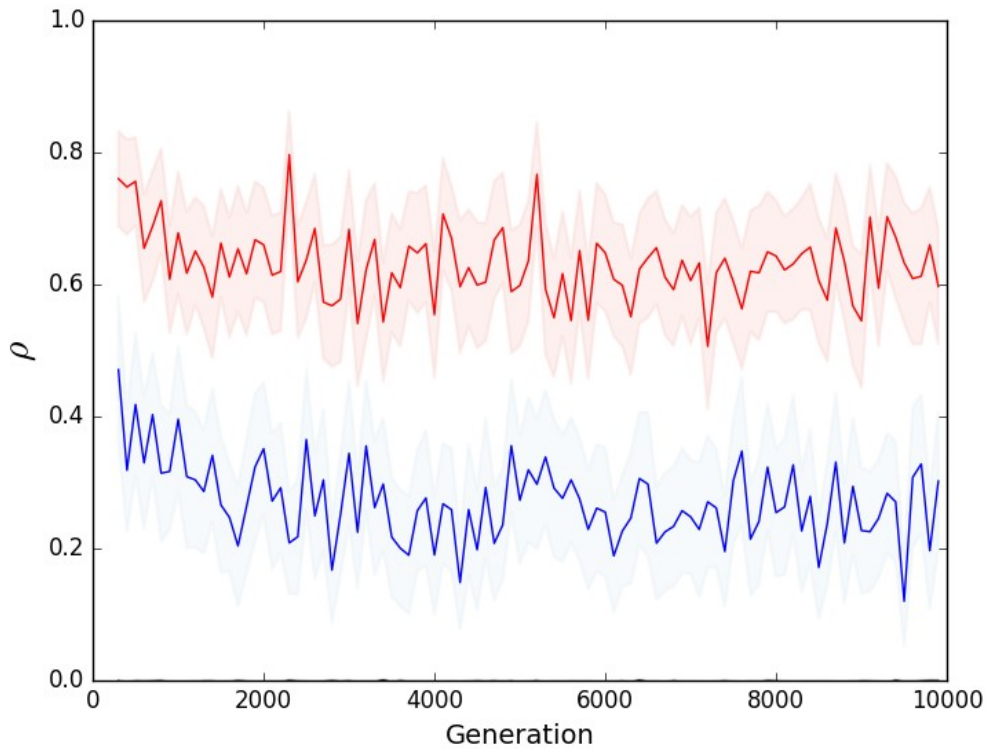


Figure S2. Levels of phenotypic correlation between mates monitored, *a posteriori*, in the simulations. Red and blue lines correspond to the values obtained under strong ($\rho=0.62$), and low assortative mating ($\rho=0.27$), respectively. Black line (almost coinciding with x-axis) corresponds to the value monitored under random mating ($\rho=0$). Each graph was constructed from the mean of 50 independent simulation replicates of the reference scenario (moderate intensity of selection $\omega^2=50$, $S_{zopt}=0.7$, $S_E=0.5$, three founding population of 500 individuals, see table 1 for more information). The colored areas correspond to the 95% confidence interval around that mean.

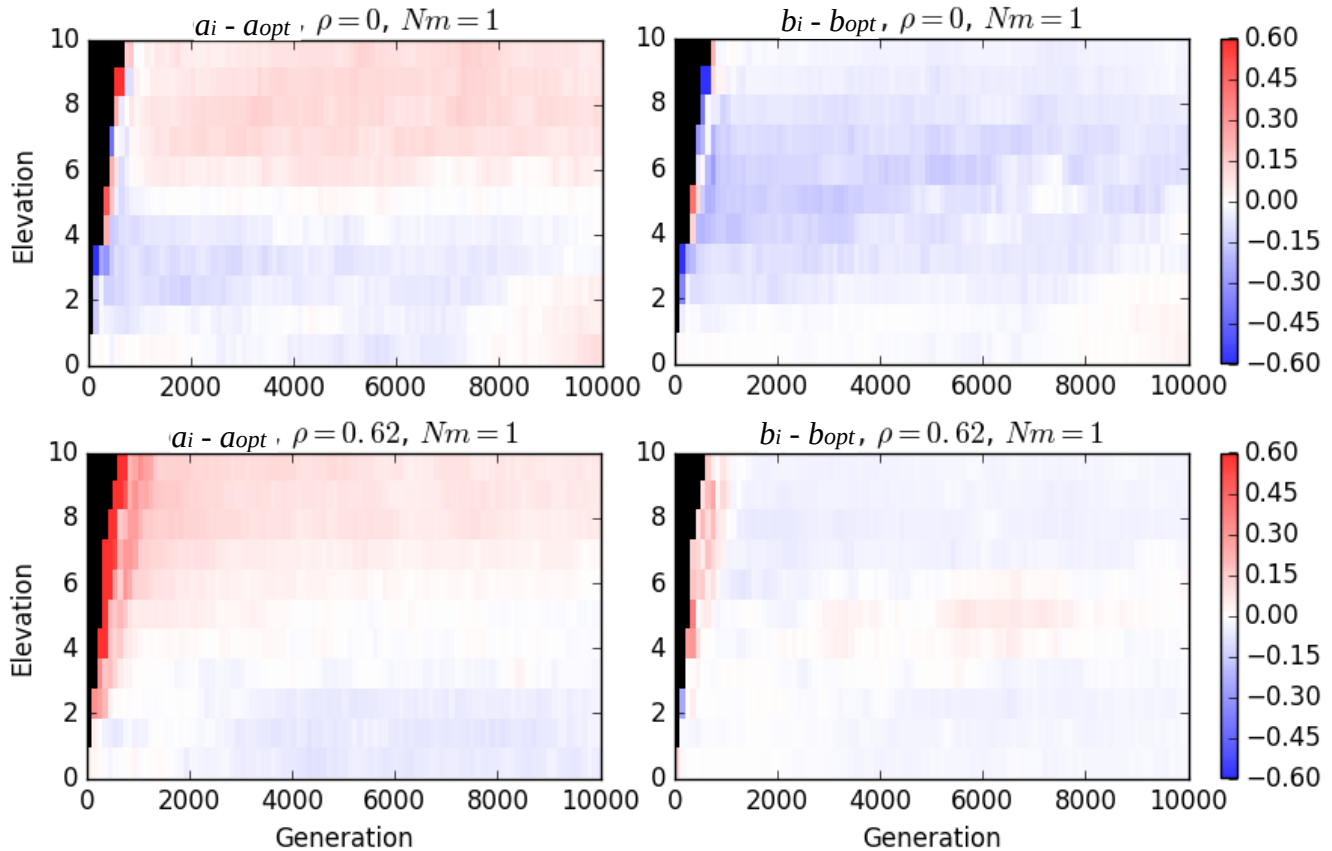


Figure S3. Optimality of the mean additive values for the intercept (a) and the slope (b) of reaction norms at each elevation level i over generations, stepping stone migration model, $Nm = 1$. a_{opt} and b_{opt} designate the optimal intercept and slope of reaction norms, respectively. Upper panel: random mating ($\rho = 0$), lower panel: strong assortative mating ($\rho = 0.62$). The lighter the color, the closer the mean intercept (left column)/slope(right column) value to the optimal intercept/slope. Black area corresponds to elevation levels with no individuals. The intensity of stabilizing selection was moderate ($\omega^2 = 50$). The slopes of the environmental gradients (S_E) and the optimal phenotypes ($S_{Z_{opt}}$) were 0.5 and 0.7, respectively. The values were averaged over 50 independent replicated simulations

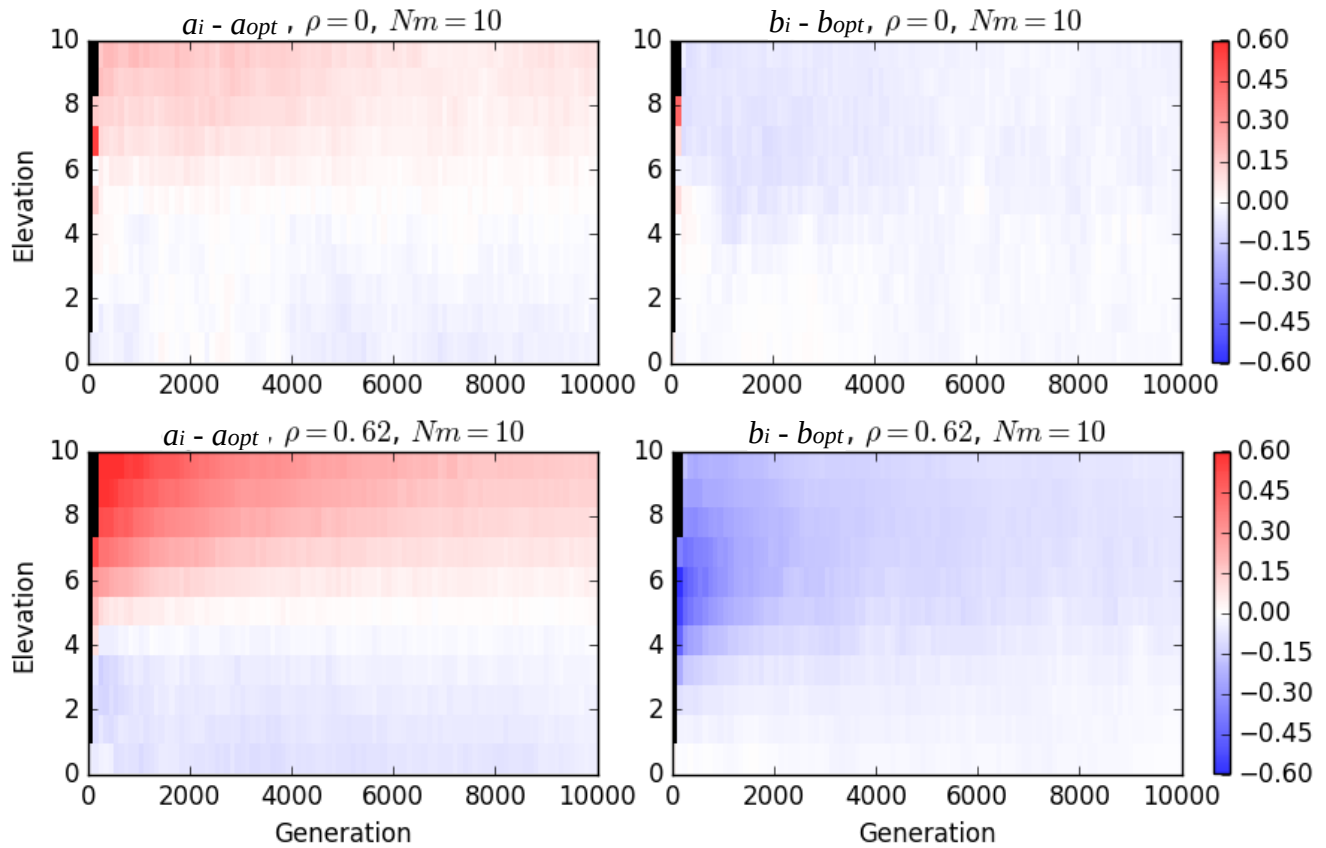


Figure S4. Optimality of the mean additive values for the intercept (a) and the slope (b) of reaction norms at each elevation level i over generations, stepping stone migration model, $Nm = 10$. a_{opt} and b_{opt} designate the optimal intercept and slope of reaction norms, respectively. Upper panel: random mating ($\rho = 0$), lower panel: strong assortative mating ($\rho = 0.62$). The lighter the color, the closer the mean intercept (left column)/slope(right column) value to the optimal intercept/slope. Black area corresponds to elevation levels with no individuals. The intensity of stabilizing selection was moderate ($\omega^2 = 50$). The slopes of the environmental gradients (S_E) and the optimal phenotypes (S_{Zopt}) were 0.5 and 0.7, respectively. The values were averaged over 50 independent replicated simulations

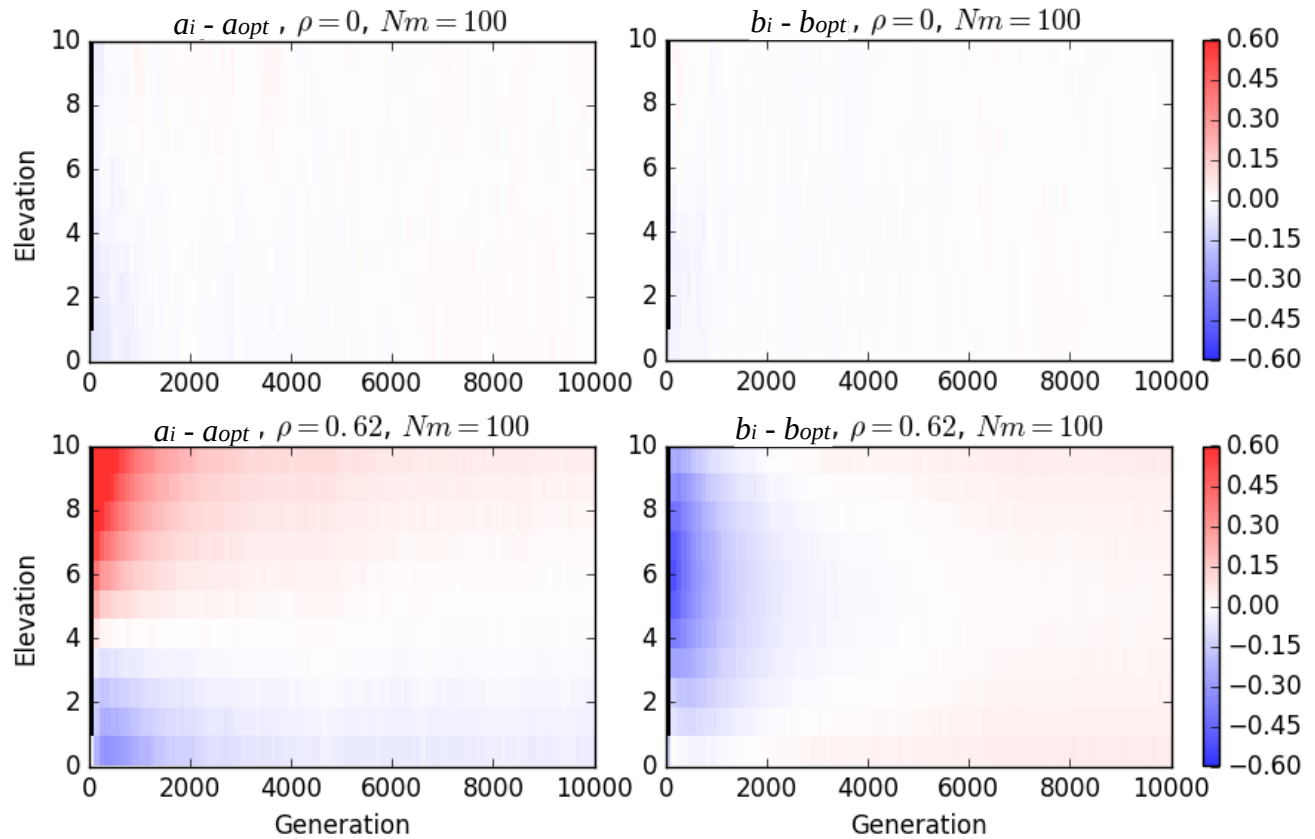


Figure S5. Optimality of the mean additive values for the intercept (a) and the slope (b) of reaction norms at each elevation level i over generations, stepping stone migration model, $Nm = 100$. a_{opt} and b_{opt} designate the optimal intercept and slope of reaction norms, respectively. Upper panel: random mating ($\rho = 0$), lower panel: strong assortative mating ($\rho = 0.62$). The lighter the color, the closer the mean intercept (left column)/slope(right column) value to the optimal intercept/slope. Black area corresponds to elevation levels with no individuals. The intensity of stabilizing selection was moderate ($\omega^2 = 50$). The slopes of the environmental gradients (S_E) and the optimal phenotypes (S_{Zopt}) were 0.5 and 0.7, respectively. The values were averaged over 50 independent replicated simulations

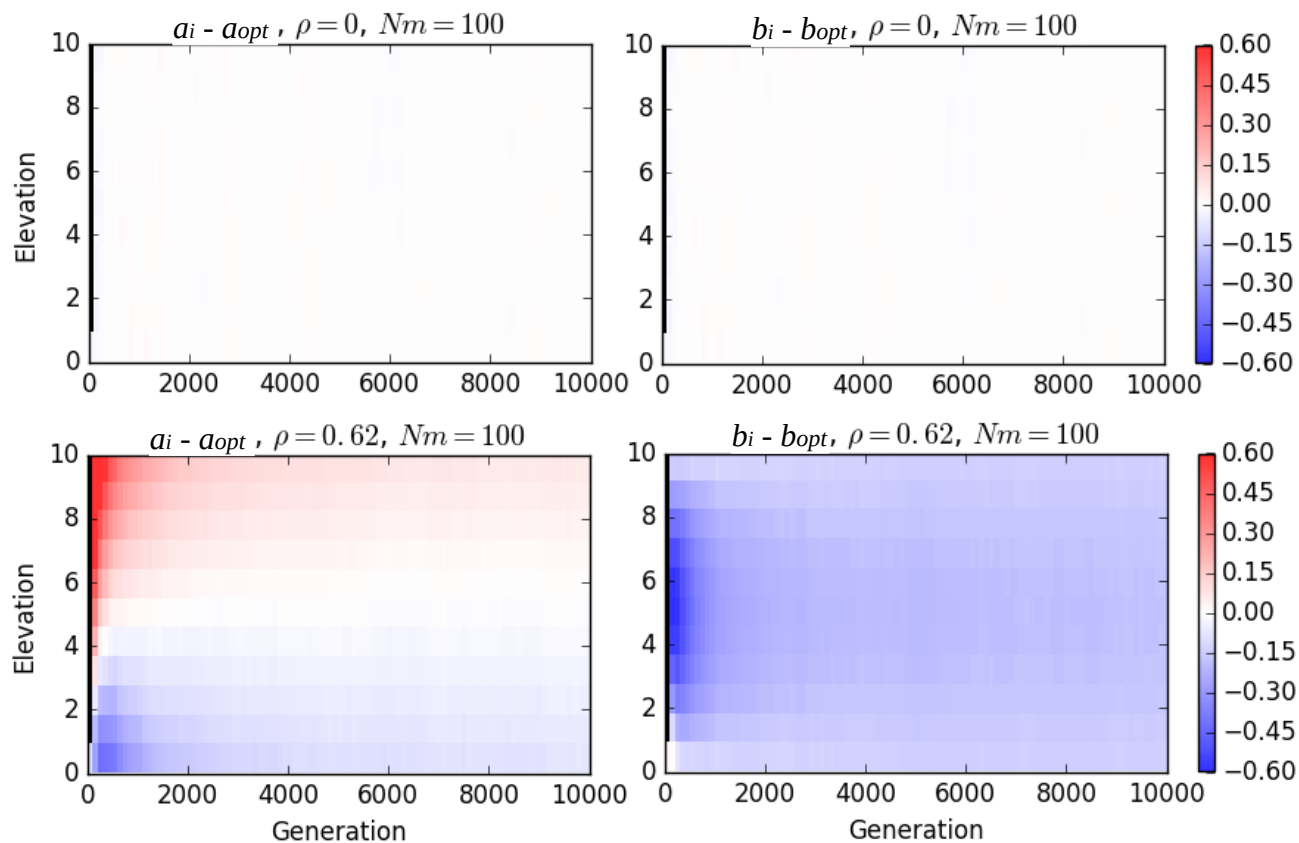


Figure S6. Optimality of the mean additive values for the intercept (a) and the slope (b) of reaction norms at each elevation level i over generations, island migration model, $Nm = 100$. a_{opt} and b_{opt} designate the optimal intercept and slope of reaction norms, respectively. Upper panel: random mating ($\rho = 0$), lower panel: strong assortative mating ($\rho = 0.62$). The lighter the color, the closer the mean intercept (left column)/slope(right column) value to the optimal intercept/slope. Black area corresponds to elevation levels with no individuals. The intensity of stabilizing selection was moderate ($\omega^2 = 50$). The slopes of the environmental gradients (S_E) and the optimal phenotypes ($S_{Z_{opt}}$) were 0.5 and 0.7, respectively. The values were averaged over 50 independent replicated simulations

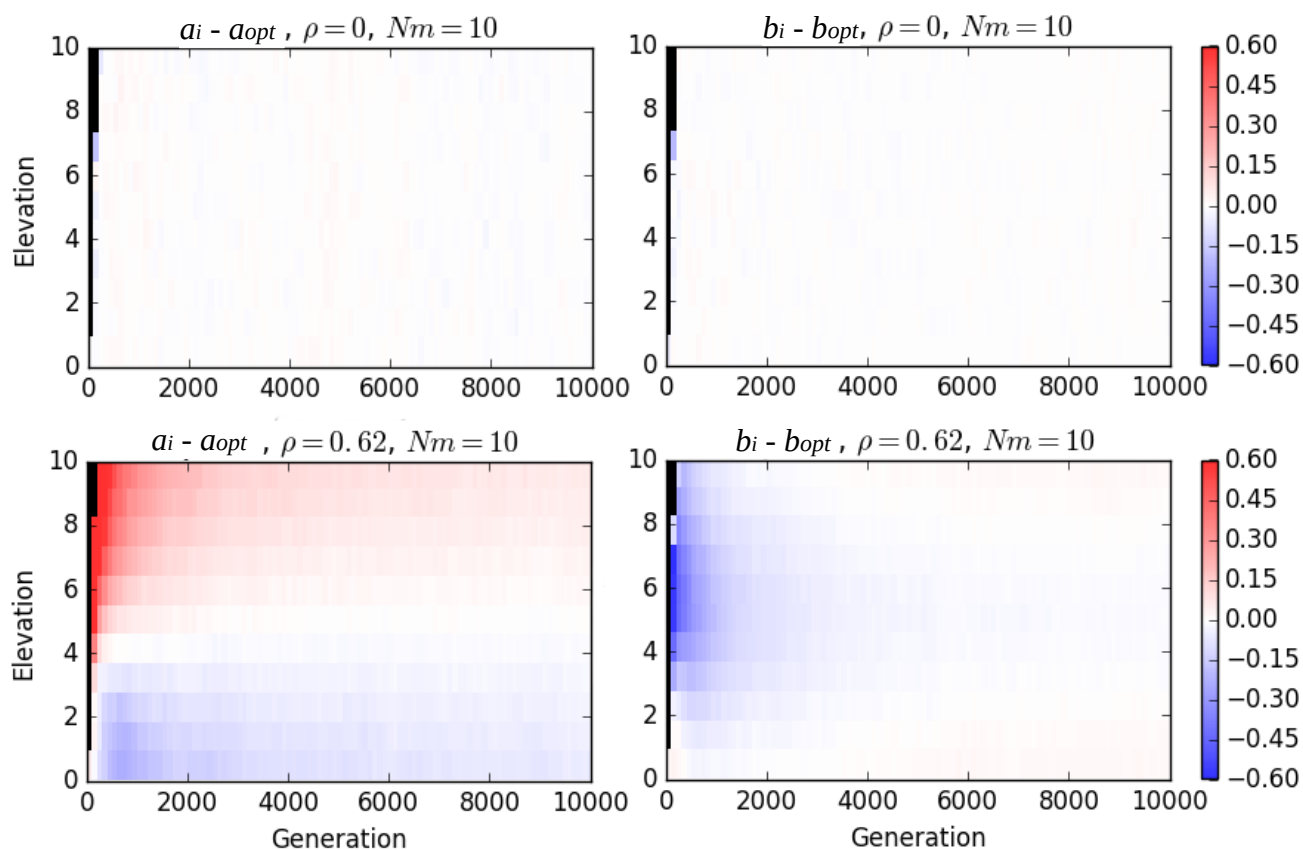


Figure S7. Optimality of the mean additive values for the intercept (a) and the slope (b) of reaction norms at each elevation level i over generations, island migration model, $Nm = 10$. Upper panel: random mating ($\rho=0$), lower panel: strong assortative mating ($\rho=0.62$). a_{opt} and b_{opt} designate the optimal intercept and slope of reaction norms, respectively. The lighter the color, the closer the mean intercept (left column)/slope(right column) value to the optimal intercept/slope. Black area corresponds to elevation levels with no individuals. The intensity of stabilizing selection was moderate ($\omega^2 = 50$). The slopes of the environmental gradients (S_E) and the optimal phenotypes ($S_{Z_{opt}}$) were 0.5 and 0.7, respectively. The values were averaged over 50 independent replicated simulations

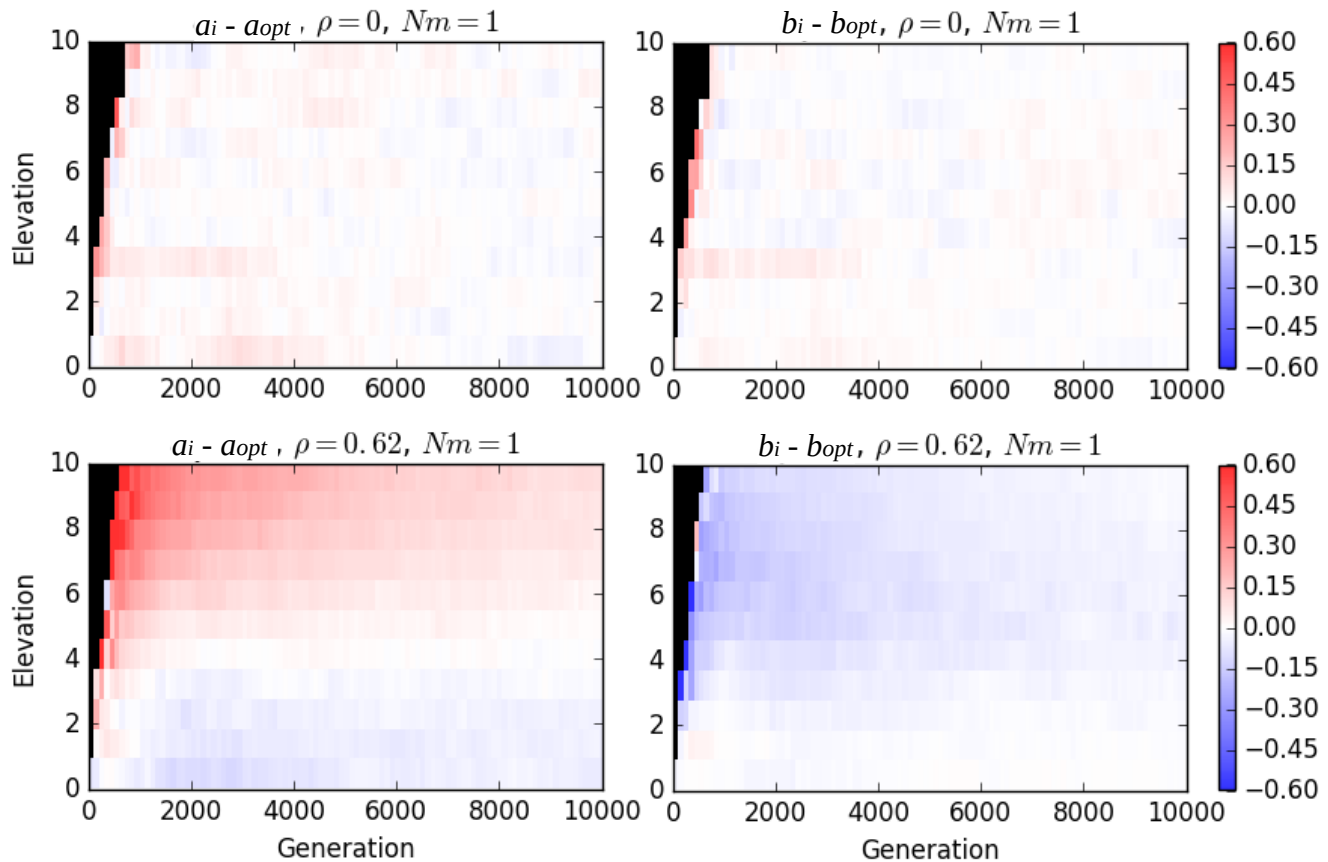


Figure S8. Optimality of the mean additive values for the intercept (a) and the slope (b) of reaction norms at each elevation level i over generations, island migration model, $Nm = 1$. Upper panel: random mating ($\rho = 0$), lower panel: strong assortative mating ($\rho = 0.62$). a_{opt} and b_{opt} designate the optimal intercept and slope of reaction norms, respectively. The lighter the color, the closer the mean intercept (left column)/slope (right column) value to the optimal intercept/slope. Black area corresponds to elevation levels with no individuals. The intensity of stabilizing selection was moderate ($\omega^2 = 50$). The slopes of the environmental gradients (S_E) and the optimal phenotypes ($S_{Z_{opt}}$) were 0.5 and 0.7, respectively. The values were averaged over 50 independent replicated simulations

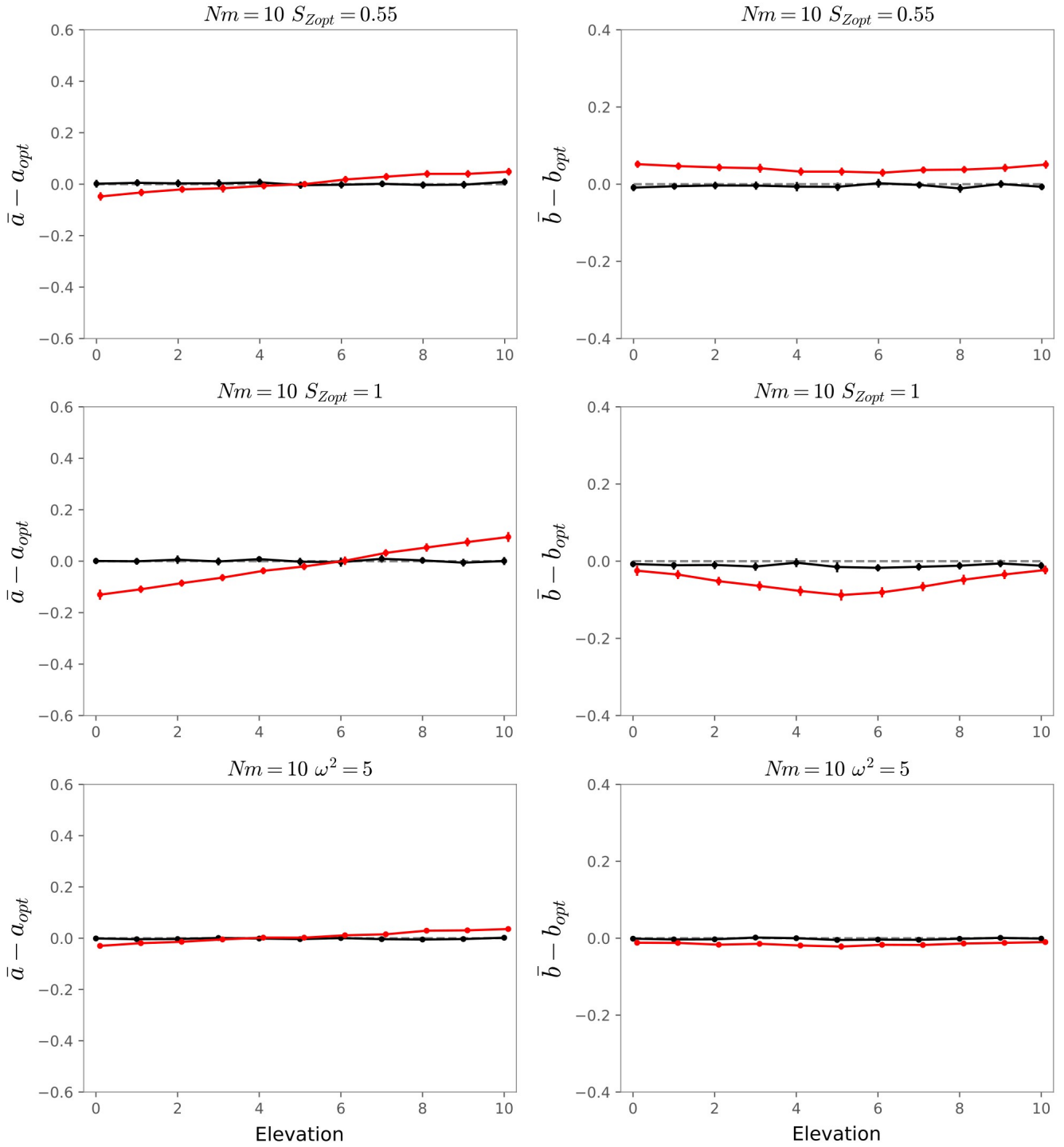


Figure S9. Mean additive values for the intercept (\bar{a}) and the slope (\bar{b}) of reaction norms in the presence of extensive gene flow ($Nm = 10$) connecting all populations (island migration model), and varying intensity of diverging ($s_{Zopt} = 0.55$, $s_{Zopt} = 1$) and stabilizing selection ($\omega^2 = 5$). Red lines correspond to the values obtained under strong assortative mating ($\rho=0.62$). Black lines are the mean values resulting from random mating ($\rho=0$). The intensity of stabilizing selection was moderate ($\omega^2 = 50$). The slopes of the environmental gradients (S_E) and the optimal phenotypes (S_{Zopt}) were 0.5 and 0.7, respectively. Each point is the mean of 50 independent simulation replicates. Error bars are the 95% confidence interval of the values averaged.

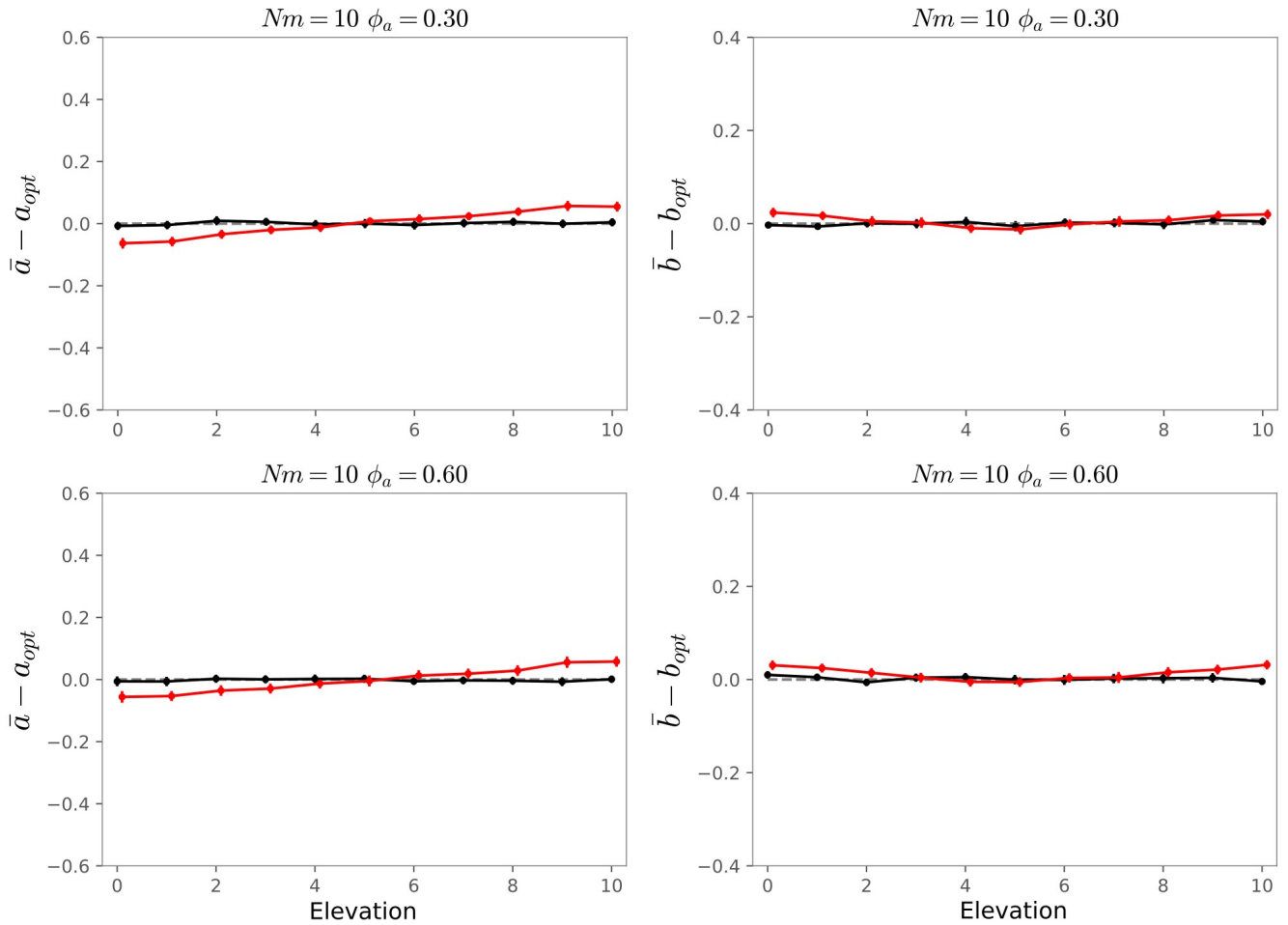


Figure S10. Mean additive values for the intercept (\bar{a}) and the slope (\bar{b}) of reaction norms in the presence of extensive gene flow ($Nm = 10$) connecting all populations (island migration model), and varying contribution of variance at environmentally insensitive loci (a loci) to phenotypic variance ($\phi_a = 0.30$ with $\phi_{bE} = 0.60$, or $\phi_a = 0.60$ with $\phi_{bE} = 0.30$). Red lines correspond to the values obtained under strong assortative mating ($\rho = 0.62$). Black lines are the mean values resulting from random mating ($\rho = 0$). The intensity of stabilizing selection was moderate ($\omega^2 = 50$). The slopes of the environmental gradients (S_E) and the optimal phenotypes (S_{Zopt}) were 0.5 and 0.7, respectively. Each point is the mean of 50 independent simulation replicates. Error bars are the 95% confidence interval of the values averaged.

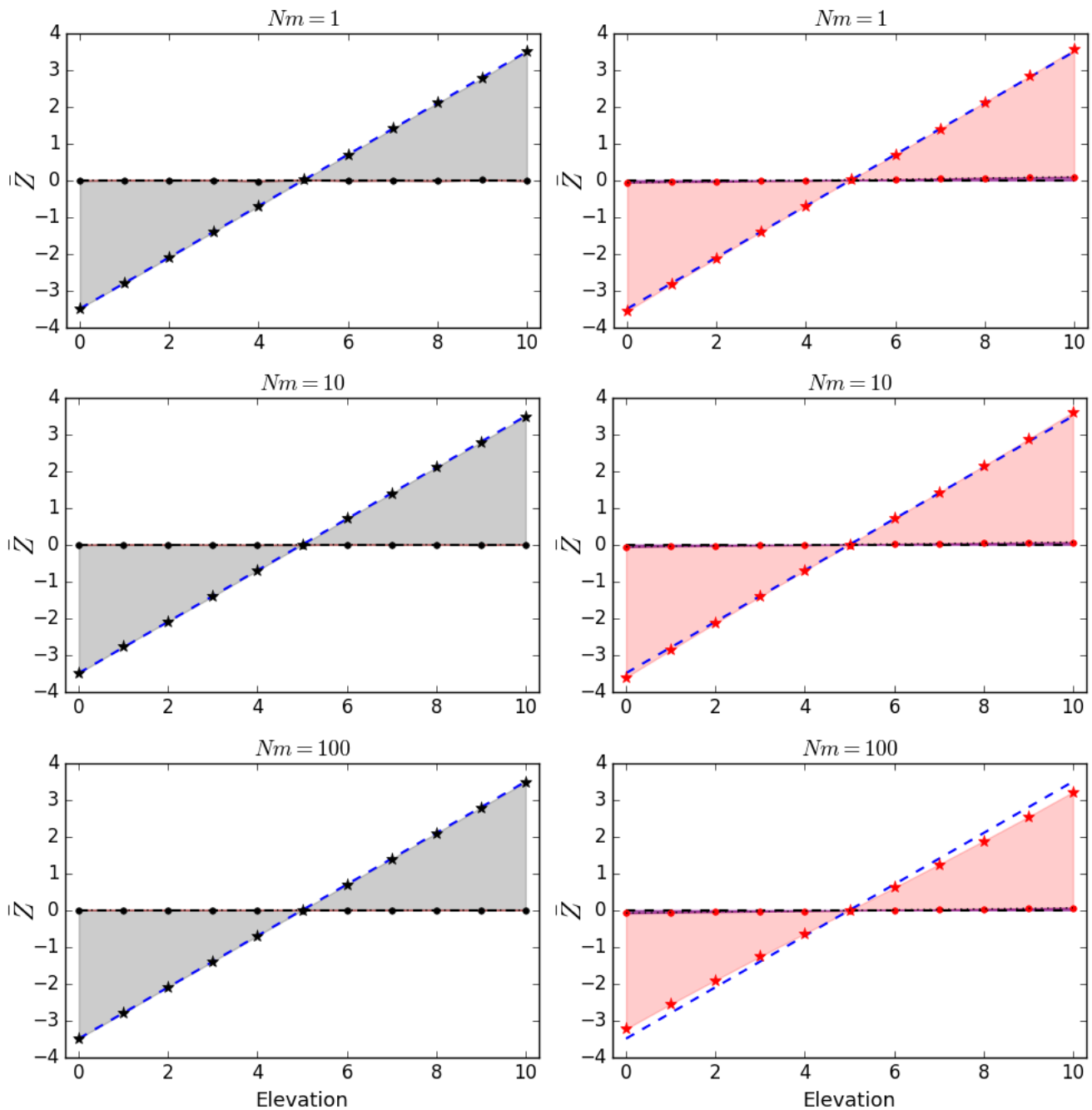


Figure S11. Contribution, under the island migration model, of the differentiation at the intercept (a loci) on the phenotypic differentiation Z across the environmental gradient under random ($\rho = 0$, black) and strong assortative mating ($\rho = 0.62$, red). Stars correspond to the mean phenotypic value expressed at each elevation level. Blue dashed lines represent the variation in the optimal phenotypic values. The intensity of stabilizing selection was moderate ($\omega^2 = 50$). The slopes of the environmental gradients (S_E) and the optimal phenotypes (S_{Zopt}) were 0.5 and 0.7, respectively. Dots are the mean intercept values at each elevation, the dotted lines being the linear regressions through these values. Dark shaded areas (almost invisible here) represent the proportion of phenotypic differentiation (light shaded area) along the gradient due to genetic differentiation for the intercept of reaction norm (a loci).

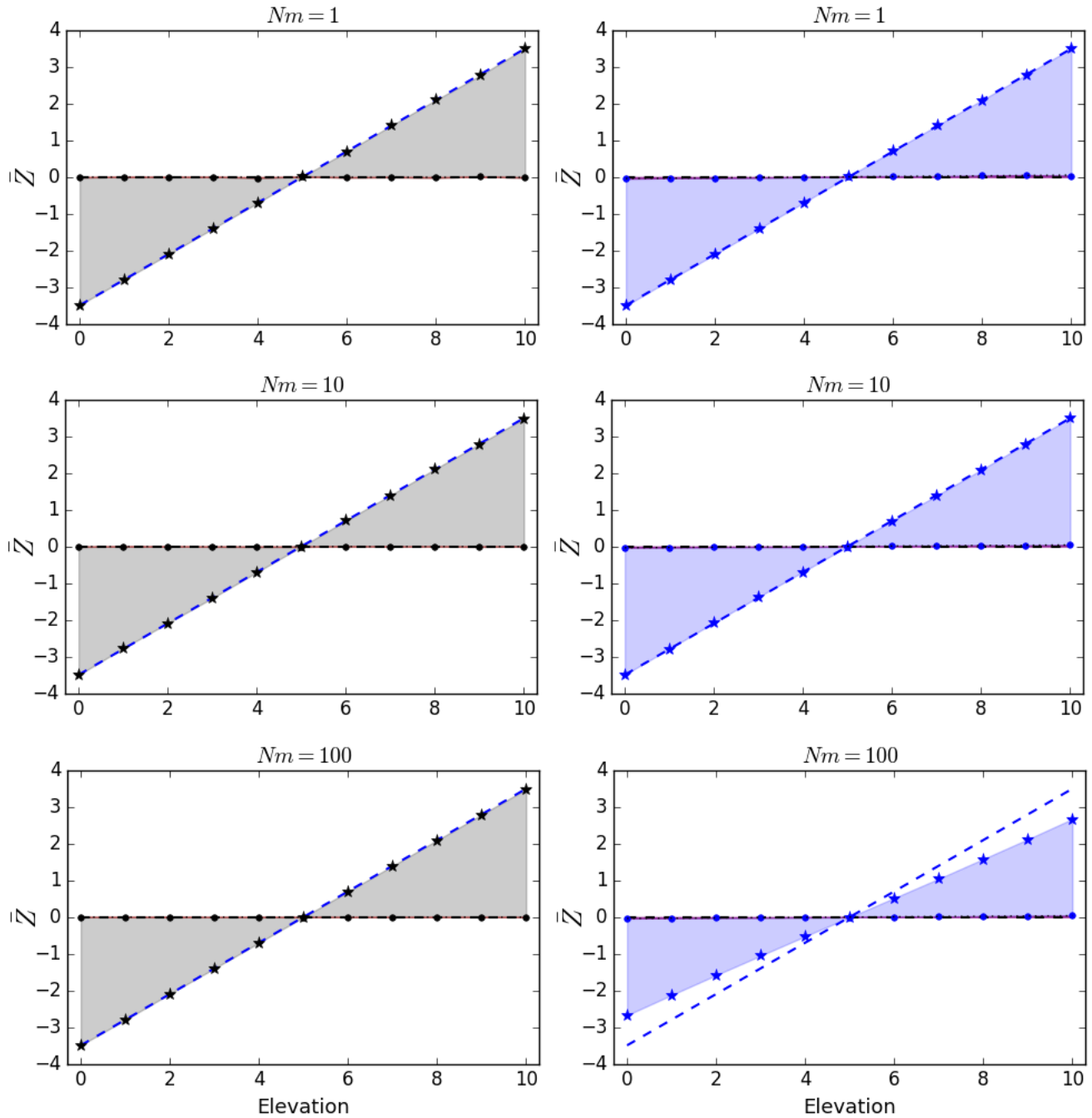
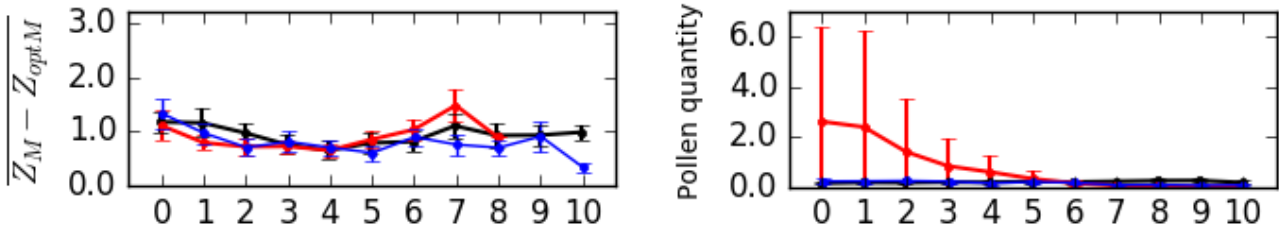
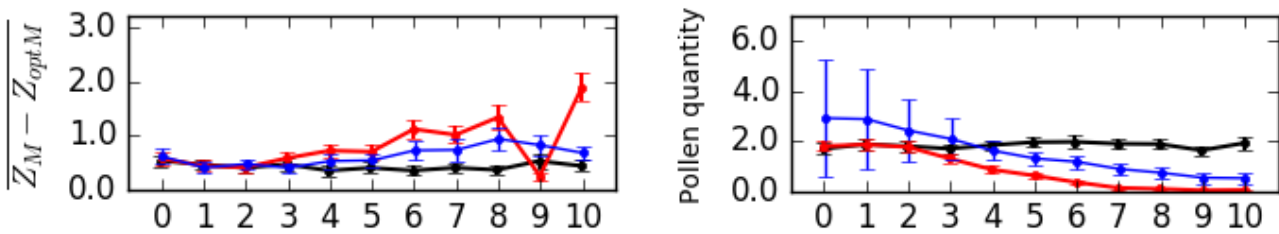


Figure S12. Contribution, under the island migration model, of the differentiation at the intercept (a loci) on the phenotypic differentiation Z across the environmental gradient under random ($\rho = 0$, black) and moderate assortative mating ($\rho = 0.27$, blue). Stars correspond to the mean phenotypic value expressed at each elevation level. Blue dashed lines represents the variation in the optimal phenotypic values. The intensity of stabilizing selection was moderate ($\omega^2 = 50$). The slopes of the environmental gradients (S_E) and the optimal phenotypes (S_{Zopt}) were 0.5 and 0.7, respectively. Dots are the mean intercept values at each elevation, the dotted lines being the linear regressions through these values. Shaded areas (not visible here) represent the proportion of phenotypic differentiation (light shaded area) along the gradient due to genetic differentiation for the intercept of reaction norm (a loci).

Island $Nm = 1$



Island $Nm = 10$



Island $Nm = 100$

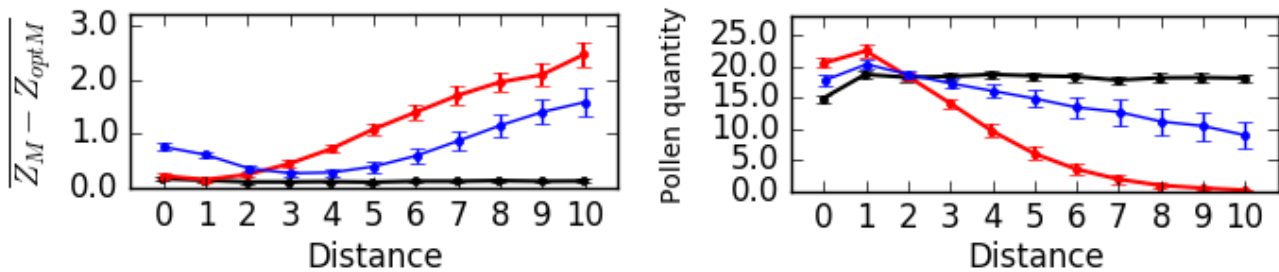


Figure S13. Effect of distance between mates on: maladaptation of male parent genotypes in their population ($Z_M - Z_{opt.M}$), and quantity of effective pollen received. Red and blue lines correspond to the mean values obtained under strong ($\rho = 0.62$) and moderate assortative mating ($\rho = 0.27$). Black lines are the mean values resulting from random mating ($\rho = 0$). The distance (x-axis) corresponds here to the difference in elevation between the mates. All the values were averaged from the pollen received by the three central populations 1, 2, 3 of the lowest elevation 0 at generation 10 000. Only matings involving individuals from distinct populations were accounted for. Pollen dispersed according to the island migration model. Each graph was built from the mean of 50 independent simulation replicates of the corresponding dispersal scenario. The intensity of stabilizing selection was moderate ($\omega^2 = 50$). The slopes of the environmental gradients (S_E) and the optimal phenotypes (S_{Zopt}) were 0.5 and 0.7, respectively. Each bar corresponds to the 95% confidence interval around that mean.

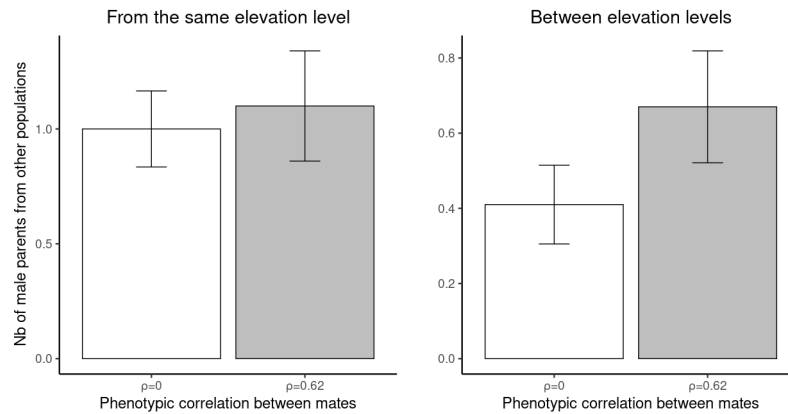


Figure S14. Mean number of male parents originating from other populations, either from the same elevation level (left) or from another elevation level (right), under random ($\rho = 0$, white bars) or strong assortative mating ($\rho = 0.62$, gray bars). Here a small fraction of pollen ($Nm = 1$), was dispersed according to the stepping stone migration. Incoming pollen flow was monitored at generation 10 000 and averaged for the three central populations of elevation 0, the lowest elevation level of the landscape. These populations received pollen from the other populations of elevation 0 (same elevation level) and elevation 1 (between elevation levels). Hence, all the efficient pollen originating from another elevation level was produced by individual of elevation 1. All the values were then averaged over the 50 independent replicates simulated for each scenario. The error bars are 95% confidence intervals of the means computed.