

Supplementary material 4. Estimates of selection and mutation parameters for CUB using a model with potential X-A differences in mutational bias

θ_X	κ_X	γ_X	θ_A	κ_A	γ_A	g	τ_X	$\ln L$
0.0027	4.17	1.75	0.0043	3.23	1.33	2.66	0.0725	-2365177.880

Let N_{eX} and N_{eA} be the effective population sizes of X and A before the change in population size, respectively. The scaled parameters are defined as follows: $\theta_X = 4 \times N_{eX} \times u_X$, $\theta_A = 4 \times N_{eA} \times u_A$, $\gamma_X = 4 \times N_{eX} \times s_X$ and $\gamma_A = 4 \times N_{eA} \times s_A$. Mutational biases are modelled by κ_X and κ_A ; $\kappa > 1$ means that mutation is biased towards unpreferred codons (mostly AT-ending). The extant population size for X or A can be obtained by multiplying g and N_{eX} or N_{eA} , respectively. Let t be the number of generations since the change in population size. We define τ_X as $t/(2gN_{eX})$. Similarly, $\tau_A = t/(2gN_{eA}) = \lambda \times \tau_X$, where $\lambda = N_{eX}/N_{eA}$. Therefore, the model only has one free time parameter. To reduce computational complexity, which increases rapidly with the number of free parameters, the maximum likelihood search was carried out in a restricted case with $\lambda = 0.75$, which should be reasonable in light of the results presented in the main text.