Variable selfing rates: should they matter during adaptation?

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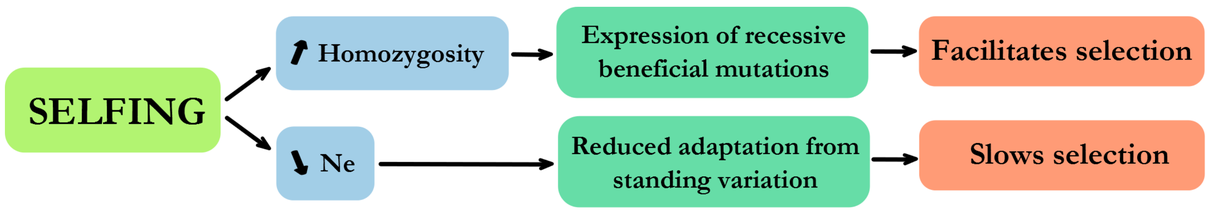
INTRODUCTION

1. Influence of selfing rate on adaptation



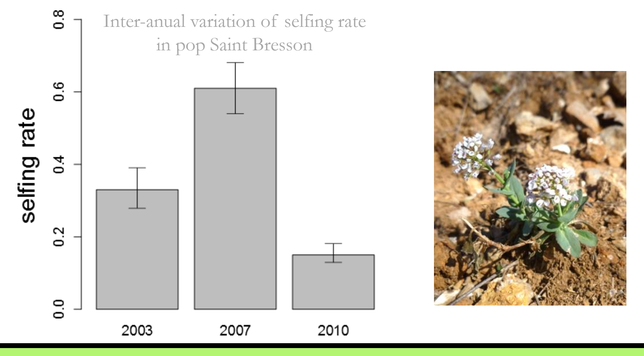
According to Glémin & Ronfort, 2013 (1):

- New mutation: higher probability to fix **recessive** mutation in **selfers**, and **dominant** mutations **in outcrossers**; adaptation time mostly quicker in selfers.
- Fixation from standing variation: adaptation **less likely in selfers** than outcrossers **under most conditions**

2. Temporal variation of selfing rates in natural populations

Noccaea caerulescens

- Colonization of soils contaminated with Zc, Cd and Pb.
- Mixed mating system, **year-to-year variation**



3. Main Question

Does temporal variation of selfing rates affect adaptation?

ANALYTICAL PREDICTIONS

Selfing rate σ variation → Inbreeding coefficient F variation → Apparent selection coefficient s variation:

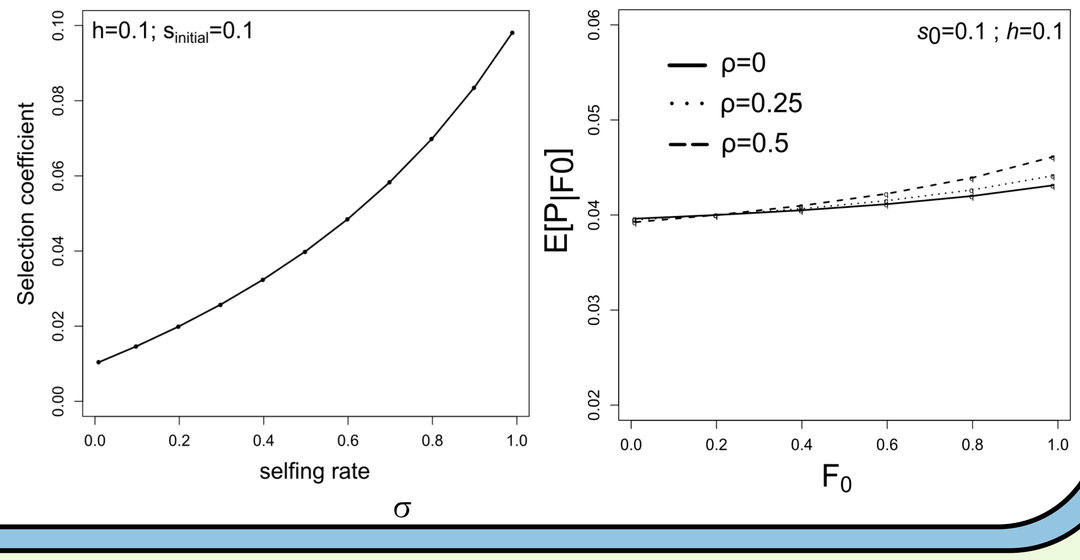
For a given sequence of $F_0, F_1, \ldots, F_k$: $s(F_t)=F_t s + (1 - F_t)hs$

Adapted from Peischl & Kirkpatrick, 2012 (2):

Probability of fixation: $E[P_{fix}|F_0] = 2s(\bar{F})(1 + \frac{s(F_o) - s(\bar{F})}{1 - (1 - s(\bar{F}))\rho})$

with ρ correlation between F_t and F_{t+1}

- P_{fix} depends on **initial selfing rate**, **mean selfing rate** and **autocorrelation**
- If recessive beneficial mutation: P_{fix} increases with F_0 and increases with ϱ if $F_0 > \overline{F}$



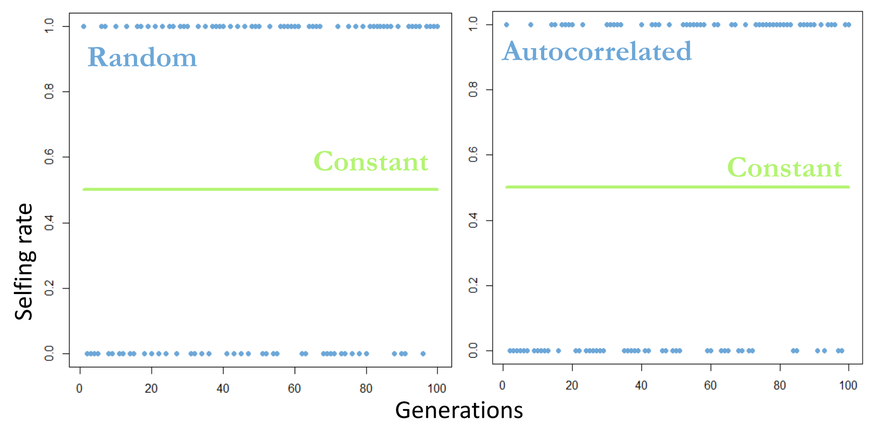
SIMULATIONS

Inclusion of **temporal variation** of selfing rate in the model of Glémin & Ronfort, 2013, a **Wright-Fisher model with selfing rate variation**

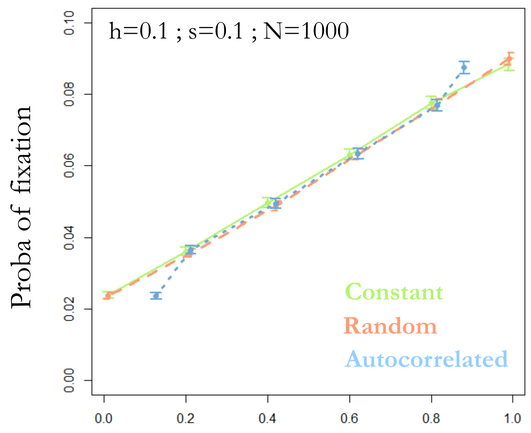
Different patterns of variation with the same mean:

- **Constant** mixed mating
- **Random** temporal variation
- **Auto-correlated** temporal variation

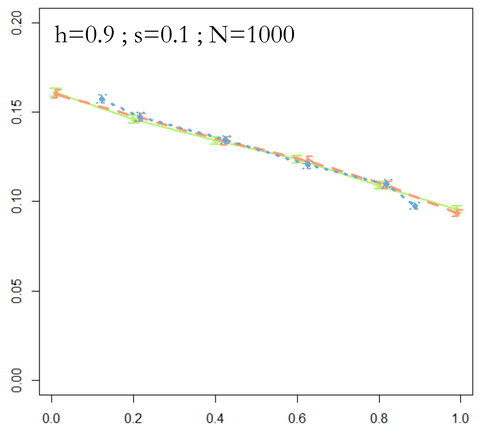
Aim: follow the fate of one mutation: probability of fixation and time to fixation



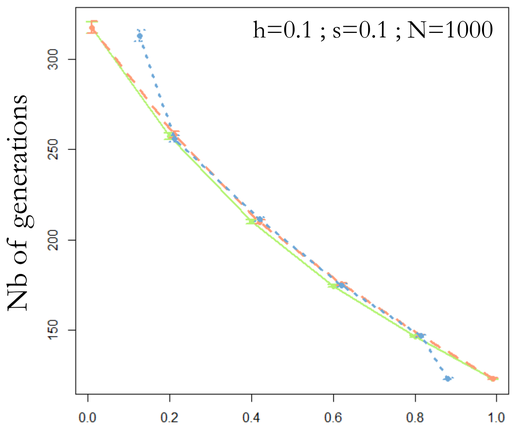
Probability of fixation of a single recessive beneficial allele



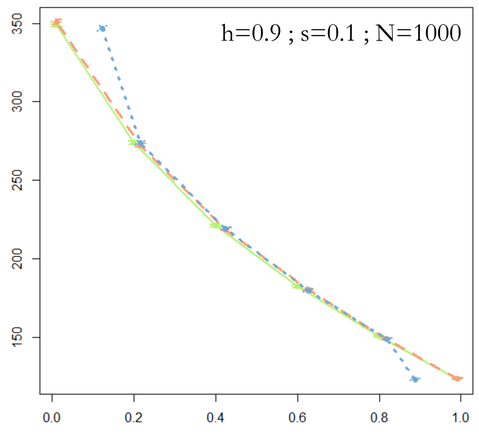
Probability of fixation of a single dominant beneficial allele



Time to fixation of a single recessive beneficial mutation



Time to fixation of a single dominant beneficial mutation



TAKE HOME MESSAGE

- Probability of fixation: depends on initial selfing rate and mean selfing rate. Also depends of the autocorrelation for a given initial selfing rate.
- Expectation over all possible initial selfing rates: no effect of autocorelation

(1) Glémin & Ronfort. 2013. Adaptation and maladaptation in selfing and outcrossing species: new mutations versus standing variation. Evolution 67 (1), 225-240. and references therein
(2) Peischl & Kirkpatrick.2012. Establishment of new mutations in changing environments. Genetics 191(3):895-906.