Variability in response

Jinliang Yang
Nov. 5th, 2018

Announcements

- **Exam II**: Nov. 12th, (M) 7:30am
- **Office hour**:
  - Friday 3-5pm
  - Keim Hall 363
- HW key posted on Canvas

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Classes this week

- Finish Chapter 11 and 12
- For Ch12: empirical results and interpretation
    - Illinois long-term selection experiment for oil and protein in corn: **> 100 generations since 1896**
    - E coli long-term selection by Richard Lenski **> 50,000 generations since 1988**

Breeder's equation

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- R: response
- i: selection intensity
- h^2: heritability
- σ_P: standard deviation of the phenotypic value
- L: generation interval

Improvement of response

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- selection during the off-season in plants
- **genomic selection**

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- maximizing the repeatability of trait evaluation.
- sound measurement methods and proper experimental design

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  - **Be cautious**: increase the inbreeding coefficient and hence loss of alleles through genetic drift.
  - **Increase i is likely not the most efficient path!** i.e. p from 10% to 5% => i from 1.755 to 2.063.

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- increase the population size from which selections are made

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4. Increase additive genetic variance

$$h^2 = \frac{\sigma_A^2}{\sigma_P^2}; \qquad h = \frac{\sigma_A}{\sigma_P}$$

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- The breeding population needs to contain adequate additive genetic variation for the trait of interest.
- If no difference in breeding values exist between individuals within the population, genetic gain through selection is not possible.

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Response selection of two chicken populations.

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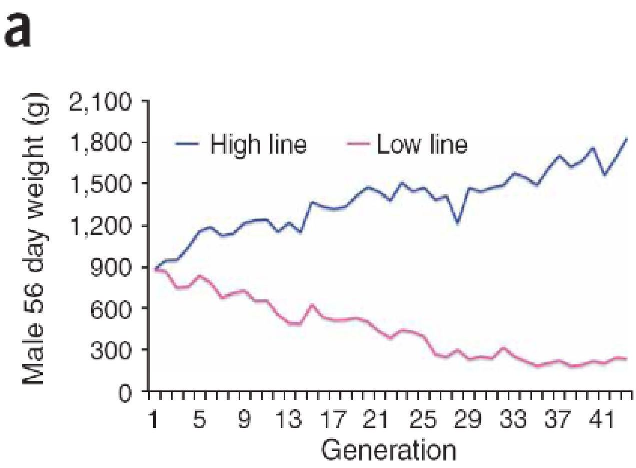

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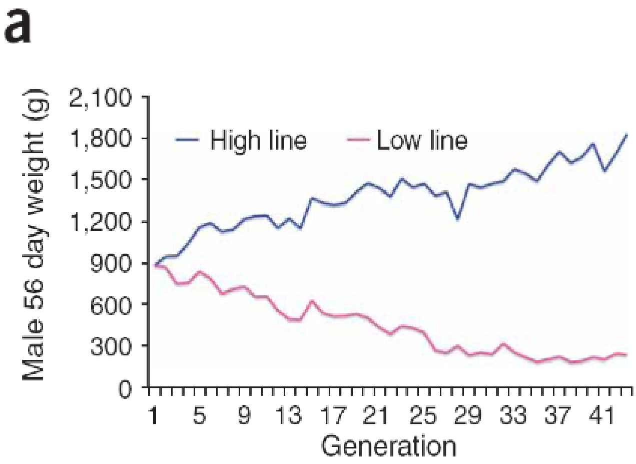

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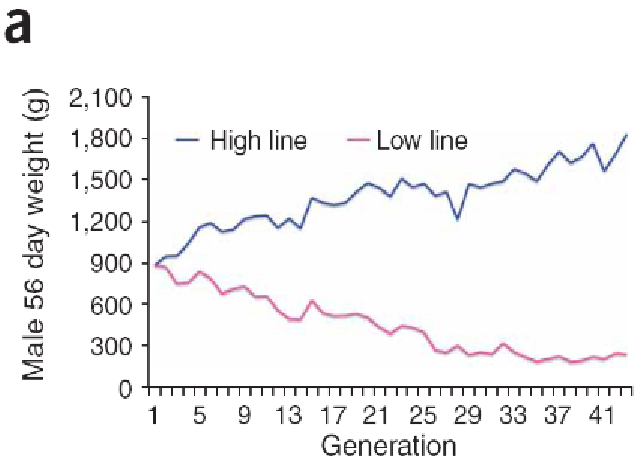

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2. Sampling error in estimating the generation mean
3. Differences in selection differential
4. Environmental factors

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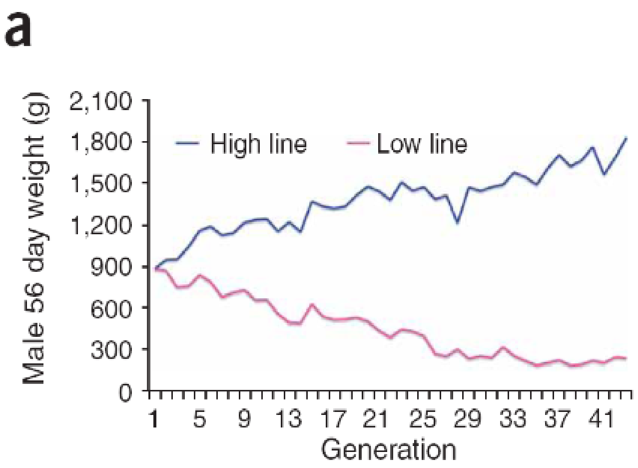

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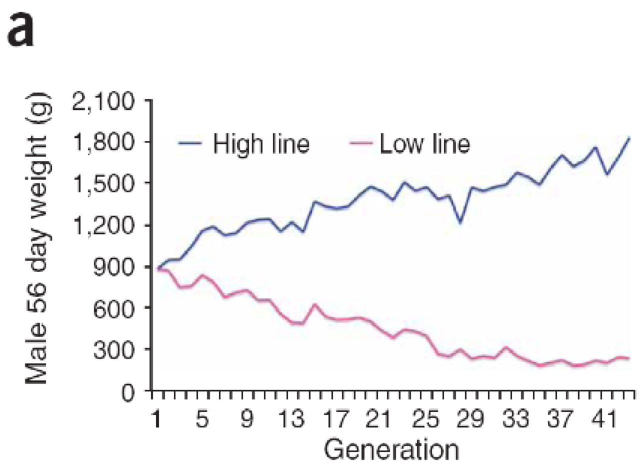

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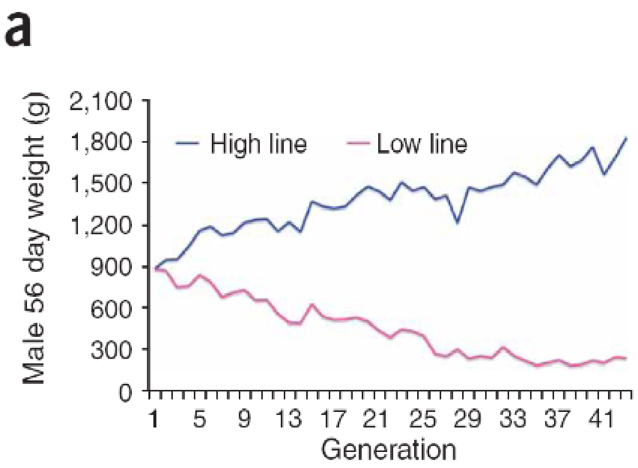

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How to separate these effects?

1. Maintain an unselected control population
2. Practice divergent selection
3. Or carry out replicated, parallel selection programs

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```r
S <- c(5, 6, 5, 6, 6, 10)
R <- c(3, 2, 1, 3, 2, 3)
df <- data.frame(s=cumsum(S), r=cums

library(ggplot2)
ggplot(df, aes(x=s, y=r)) +
  geom_point(color='red', size = 4)
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Be cautious:

1. Reduces response to selection after first generation fro high heritability traits (**Bulmer effect**)
2. Systematic changes in environment or inbreeding depression will affect response.
3. Random drift affect response.