Chapter 7 cont.

III) Selection and Quantitative Traits

A) Definition and Background:

Most phenotypic traits are not single gene traits, but are actually multiple gene products working together.

1) Metric Characters – phenotypic characters that vary in a continuously way (i.e., 1.021, 1.0212, etc.)(e.g., weight, height, length, etc)

2) Meristic Characters – phenotypic characters that vary discretely (i.e., 1, 2, 3, etc.)(e.g., number of hairs, number of whorls, etc.)

3) Quantitative Traits – continuously varying characteristics with polygenetic inheritance.

4) Heritability – the fraction of observed or measured variation in a trait that is due to genes.

5) Measure of Variance – the degree to which the population as a whole deviates from the mean

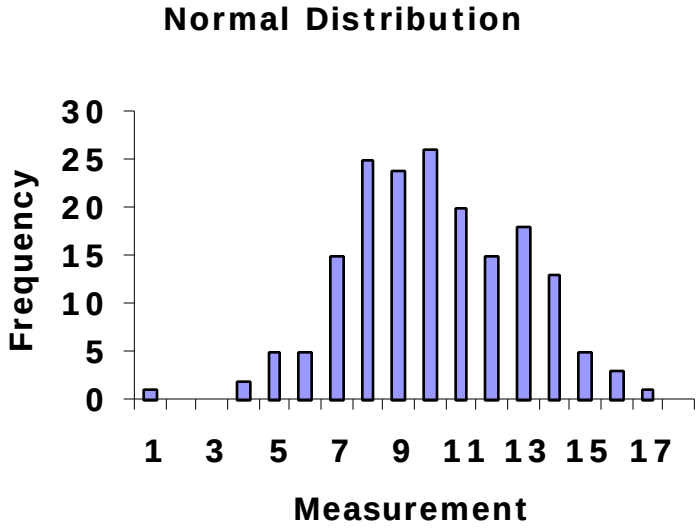
$$V = \frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \ldots}{n - 1}$$

where n is the number of individuals

or:

$$V = \frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2$$

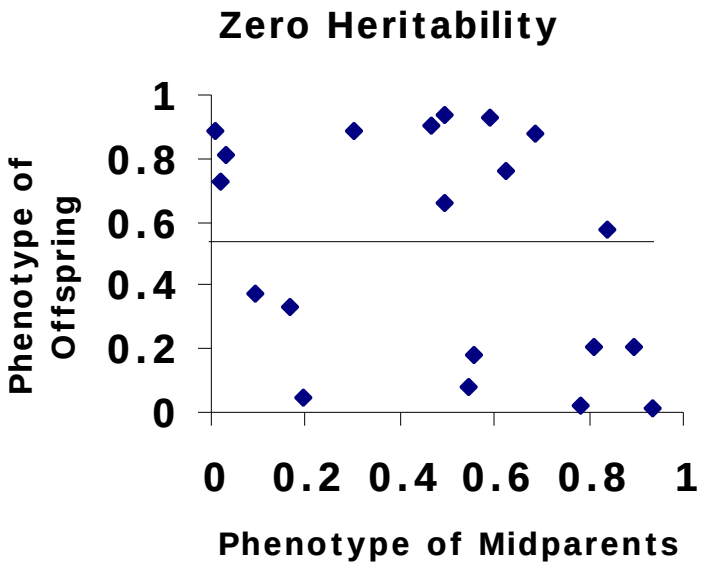
6) Phenotypic variation – (V_P) total observed or measured variation in a trait.

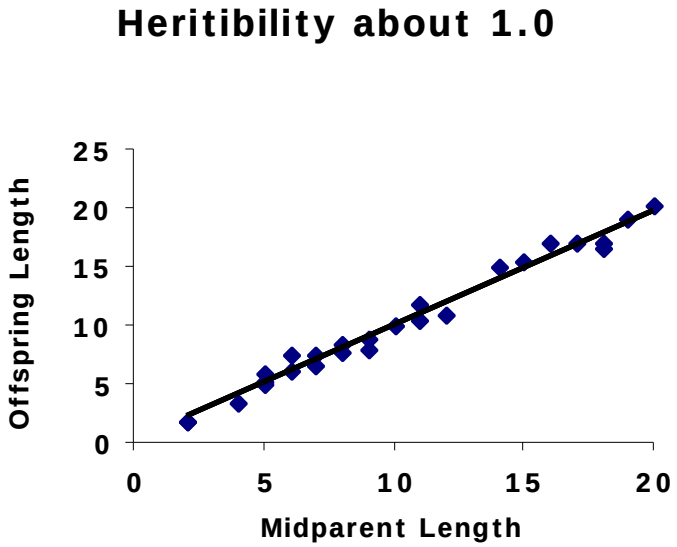


7) Environmental variation (V_E) is the amount of variation due to the environment. AA in good environment is big but in bad environment is small.

8) Heritability – is the fraction of the phenotypic that is due to genetic variation (V_G).

$$\text{Heritability} = \frac{V_G}{V_P} = \frac{V_G}{V_G + V_E}$$



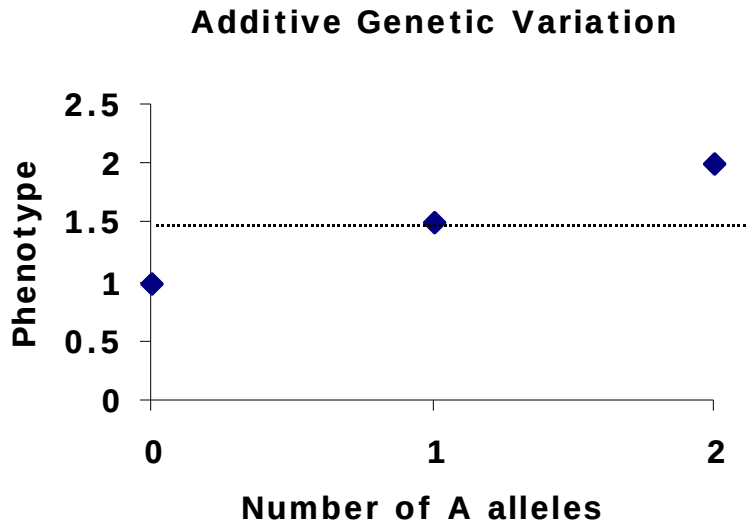


9) Narrow Sense Heritability – h^2 the fraction of the phenotypic variation that is due to additive genetic variation (V_A) and not dominance variation (V_D)

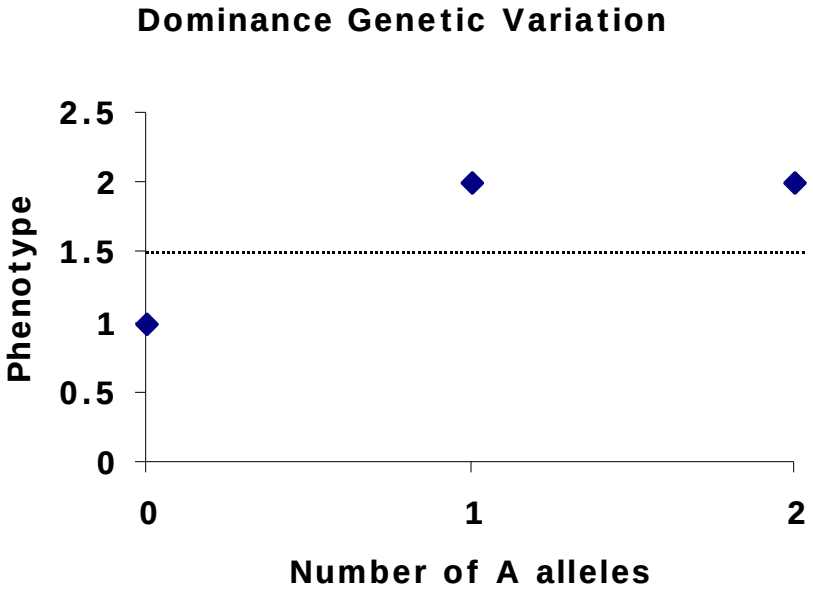
$$V_G = V_A + V_D$$

$$h^2 = \frac{V_A}{V_P} = \frac{V_A}{V_A + V_D + V_E}$$

Assuming that one A allele changes the phenotype by 0.5 units and there is no dominance



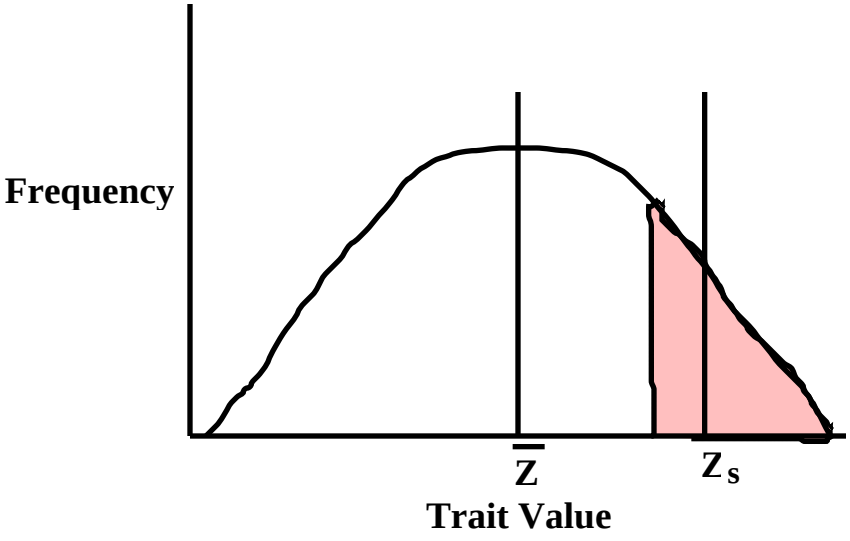
Assuming that there is complete dominance

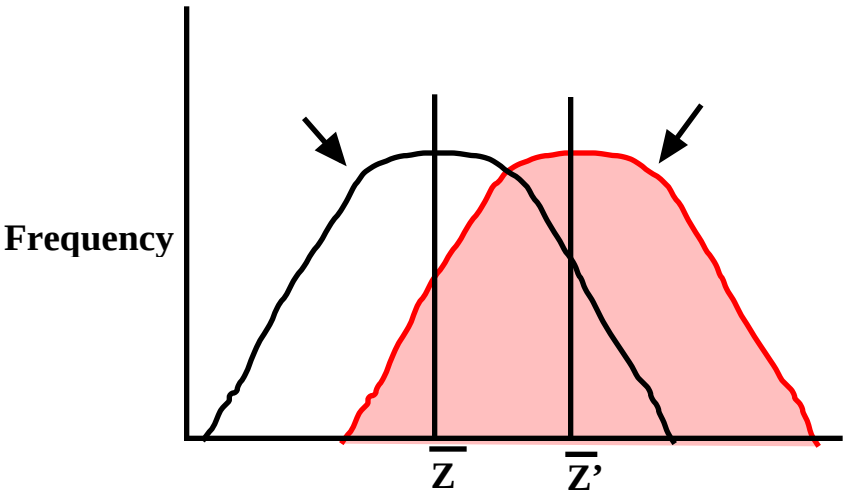


B) Response to Selection – the response to selection must be a combination of the degree to which the character is heritable and the strength of selection

$$R = h^2 S \quad \text{or} \quad h^2 = \frac{R}{S}$$

In Truncating Selection:





$$S = \overline{Z} - Z_s \qquad R = \overline{Z} - \overline{Z}' \qquad h^2 = \frac{\overline{Z} - \overline{Z}'}{\overline{Z} - Z_s}$$