Genetic diversity

Quantitative traits

Molecular traits

Measuring genetic diversity

In a uniform environment or common garden, differences between populations reflect genetic differences!

What is genetic diversity?

math or intuition

G
Measuring genetic diversity
What is genetic diversity?
intuition

G-height, $Q_{ST}$ - high variation among pops

G-color, $Q_{ST}$ - low, variation within pops

Measuring genetic diversity
Common gardens enable estimation of heritability

"broad-sense heritability" $h = G / P$
$0 < h < 1$

With pedigrees you can partition variance
$G = A + D + I$
$A$= additive, $D$ = dominance, $I$ = interaction

"narrow-sense heritability" $h^2 = A / P$
Measuring diversity in molecular markers

Genetic diversity
What is genetic diversity?

- History of protein variation
  - 1966 electrophoresis in Drosophila & humans
  - many proteins = many loci
  - \( P = \) proportion polymorphic loci (in population) ~30%
  - \( H = \) proportion heterozygous loci (in individual) ~10%
  - \( A = \) average number of alleles per locus
  - "Great Obsession" Why is there so much variation?
  - Variation is cryptic

DNA variation
proportion polymorphic nucleotides ~1% within genes

Measuring genetic diversity
Molecular traits, no environment!

- Allele frequencies
- Gene pool model*

Measuring genetic diversity
How to measure genetic diversity in discrete traits (molecular markers)

Handout: Rogers & Montalvo Table 4.1

Measuring genetic diversity
Population genetic structure
Measuring genetic diversity

Population/spatial genetic structure
- Individual gene locus
- Genome (ploidy)
- Individual
- Within population
- Among population
- Isolation by distance

Genetic diversity

“molecular measures of genetic diversity have only a very limited ability to predict quantitative genetic variability. When information about a population’s short-term evolutionary potential or estimates of local adaptation and population divergence are required, quantitative genetic variation should be measured directly.”


Genetic diversity

Is genetic diversity good or bad?

More genetic diversity can favor persistence.
- Short-term--hybrid vigor, genetic rescue
- Long-term--increase adaptive potential

Genetic diversity

Is genetic diversity good or bad?

More genetic diversity can favor extinction.
- Short-term--lethal mutation, local maladaptation
- Long-term--Outbreeding depression (disruption of coadapted gene complexes)

Genetic diversity

Five processes that affect the distribution and amount of variation in populations:
1. Mutation
2. Natural selection
3. Migration
4. Random genetic drift
5. Non-random mating