

INTRODUCTION

What did Darwin observe?

1. Species have big reproductive potentials
2. Population number fairly constant
3. Therefore, high mortality rate
4. Each individual of a species a bit different from others
5. Much of inter-individual differences genetically determined

INFERENCE:

Mortality not equally likely among individuals, some better suited to successfully reproduce than others.

NATURAL SELECTION (and Artificial Selection)

Differential reproduction, or the differential contribution of genetic traits to next generation

SELECTION PRESSURE

Any feature of biotic or abiotic environment which results in natural selection

EVOLUTION

Any change in allelic frequencies in a gene pool

Hardy-Weinberg-Castle Model shows that evolution cannot occur if the following four conditions are met:

1. Large population (gene pool) of $\geq 10,000$ individuals
2. No immigration or emigration
3. No assortative mating, only random mate choice
4. No mutations

FITNESS

The number of successful offspring one leaves to the next generation

ADAPTATION

A trait (morphological, physiological, or behavioral) modified through natural selection

SPECIES

A group of individuals capable of interbreeding, but incapable of outbreeding with other such groups

[Dependent on reproductive isolating mechanisms]

SPECIATION

Acquisition of reproductive isolating mechanisms producing genetic discontinuities between populations (i.e., no gene flow)

What is artificial selection? Can it cause speciation? What is bioengineering? Can it cause speciation?

How does speciation occur?

Where:

Allopatric (spatially non-overlapping populations)

Sympatric (spatially overlapping populations)

Rate:

Gradual

Punctuated

Instantaneous

Mechanism:

RIM (reproductive isolating mechanisms)

Prezygotic

Geographical

Ethological

Ecological

seasonal, temporal, & habitat divergence

Mechanical

Immunological

sperm die in female tract or do not penetrate egg

Postzygotic

Hybrid mortality or < viability

Hybrid sterility

Hybrid < competitive with parental stock

Recent example of artificial selection

“RoundUp” – active ingredient is glyphosate-based herbicide. > 80% of soybean fields are sprayed (selection agent).

Morning glory is a common weed in agricultural fields (affected species).

32 lineages of morning glory plants growing in treated fields were found to be tolerant of RoundUp (as tested under lab conditions). Side effect of this selection is a 20-35% decrease in fecundity in herbicide-tolerant plants.