

2. Competition

All living things need natural resources, but it is not enough for every one. This means that individuals have to fight for them in order to survive.

This struggle for resources is called competition.

Resources: Foodwatermates.....land (habitat/territory).

Competition results in winners and losers. Winners obviously benefit from gaining resources.

Competition for resources between members of different species is called interspecific competition. Competition for resources between members of the same species is called intraspecific competition.

Competition and Evolution

- Individuals and species that are less competitive are at risk of dying out because they will struggle to gain resources.
- This means that competition is driving force behind natural selection and evolution. Individuals with genes that make them more competitive are more likely to survive and pass on those genes.
- How can a less competitive species avoid extinction?
- adopt new survival strategies (if they want to stay in the same habitat).
- move to an area where there is less competition.

Decline of the red squirrel

- The red squirrel is a native species of the British Isles, living in broadleaf woodlands.
- Red squirrels were once widespread throughout the British Isles but in the last 50-60 years, their numbers have dramatically declined and they are now absent from many areas.
- Small, isolated populations exist on the Isle of Wight, Wales and central England. They are still widespread in the North of England and Scotland.
- The destruction of red squirrels' natural habitat has contributed to their decline but the major reason is because of competition from the grey squirrel.
- The grey squirrel is not native to the British Isles but was introduced from North America towards the end of the 20th century. It is larger and more aggressive than the red squirrel.
- It is not clear exactly how grey squirrels have caused the decline of red squirrels but scientists think that greys are more successful in foraging for food than reds.

3. Population genetics

Chromosomes: the threadlike structures where DNA is contained.

- DNA: Deoxyribonucleic acid. All DNA is composed of the same 4 nucleotide (ATGC), differ in sequence.
- **Genes**: the working subunits of DNA of chromosome, carry genetic information that determine what the organism is like.
- Genes make up different DNA sequences, with specific length –determined by number of base pairs - called genotypes
- The region of the chromosome at which a particular gene is located is called its locus.
- In each organism, there is homologues chromosomes, one from Father and the other from mother.
- **Alleles** are *different forms of the same gene* which are located on the same part of the chromosome (locus).

Gene pool

- All of the alleles of all individuals in a population.
- Microevolution: evolutionary changes in the frequency of alleles in a population.
- Mechanism of microevolution:
 1. Mutations. Green genes mutated to brown genes.
 2. Migration (gene flow).
 3. Natural selection.

Polymorphism:

- occurrence of different allelic forms of a gene in a population (see mutation).
- Is the occurrence of two or more clearly different morphs or forms? Caused as a single base mutation of DNA.
- If there is only one allele for a gene in the population – every individual is homozygous for the trait – it is fixed in the population.
- All alleles of all genes possessed by all members of a population form a gene pool.

The Hardy-Weinberg Law

- The frequency of an allele in a population will remain constant over time, provided that the following conditions are met:
 - ✓ Population size is very large.
 - ✓ Random mating.
 - ✓ No mutation (no conditions acting on the population to change the allele frequency).
 - ✓ No gene input from external sources (or migration).

- ✓ No natural selection occurring (All genotypes must have equal probabilities of surviving and reproducing. No phenotype can have a selective advantage over another).
- ✓ This means.....evolution does not occur.

4. Mutation

Changes in the nucleotide sequence of DNA = is a change in gene sequence. Mutations are raw material of evolution.

There are many different types of mutations and causes for them. Some mutations are harmful, while others can be beneficial.

Genetic variation within a population increases by mutations and is absolutely necessary for natural selection to occur.

If all individuals are identical within a population then their fitness will all be the same.

No variation means no evolution and mutations are the ultimate source of variation.

Mutations create variation within the gene pool. The results of these mutations are new genetically altered organisms that increase the variation of living organisms.

Natural selection chooses the best mutations and maintains them and gets rid of the others with bad mutations.

This means that natural selection acts as a sieve for mutated living organisms.

Note that:

1. Most mutations are harmful.
 2. Some are useful.
- Mutations will result in:
 - Structural changes.
 - Functional changes.
 - Behavioral changes.

5. Variation It is the differences in the phenotypes.

As previously mentioned:

Mutations led to changes in alleles led to new traits led to multi-characters (polymorphism) or variation (range of differences) among individuals of a population.

Types of variation

- Interspecific: one species differs from another.
- Intraspecific: individuals of the same species differ from each other.

Variation Causes

1. Genetic (heredity) variation

- Change in structure and function of gene. Inherited from generation to another.
- Each tomato is different because it comes from a plant with *different alleles*, that code for different characteristics.

2. Environmental variation

- Two individuals of the same genotype may have different phenotype when under different condition of food, temp. light so.....
- These plants are genetically identical, the flower colour difference is due to the effects of soil pH.

• Sources of genetic variation

1. Mutation: inheritable changes in a gene or a chromosome

a) Gene mutation: (point mutation)

- Chromosome mutation (deletion, duplication, inversion, translocation).

2. Genetic recombination

a) Sexual reproduction:

Two individuals produce haploid gametes (egg or sperm) – that combine to form a diploid cell or zygote.

- Reassortment of genes provided by two parents in the offspring.
- Increases dramatically the variation within a population by creating new combinations of existing genes.

b) Asexual reproduction: less variation (only mutation)...

- Gene interactions: causing them to affect each other which could lead to new traits.