Population Genetics (CC-14, unit5)

By : Sriparna Ray
Zoology Department
Bidhan Chandra College,

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Introduction

1. Population genetics is the study of change in the frequencies of allele and genotype within a population.

2. Population geneticists study the genetic structure of populations, and how they change geographically and over time.

- Gene – a discrete unit of hereditary information consisting of a specific nucleotide sequence in DNA.
  - Alleles – alternative forms of a gene.
- Genotype – the genetic makeup of an individual.
- Phenotype – the physical traits of an organism.

Hardy Weinberg principle

States that ;

$(p+q)^2$ $p^2 + 2pq + q^2 = 1$

Under the certain condition,allelice frequences,remains constants from generation to generation.

If any one condition is not made, genetic equilibrium will be disturbed and the population may evolved.

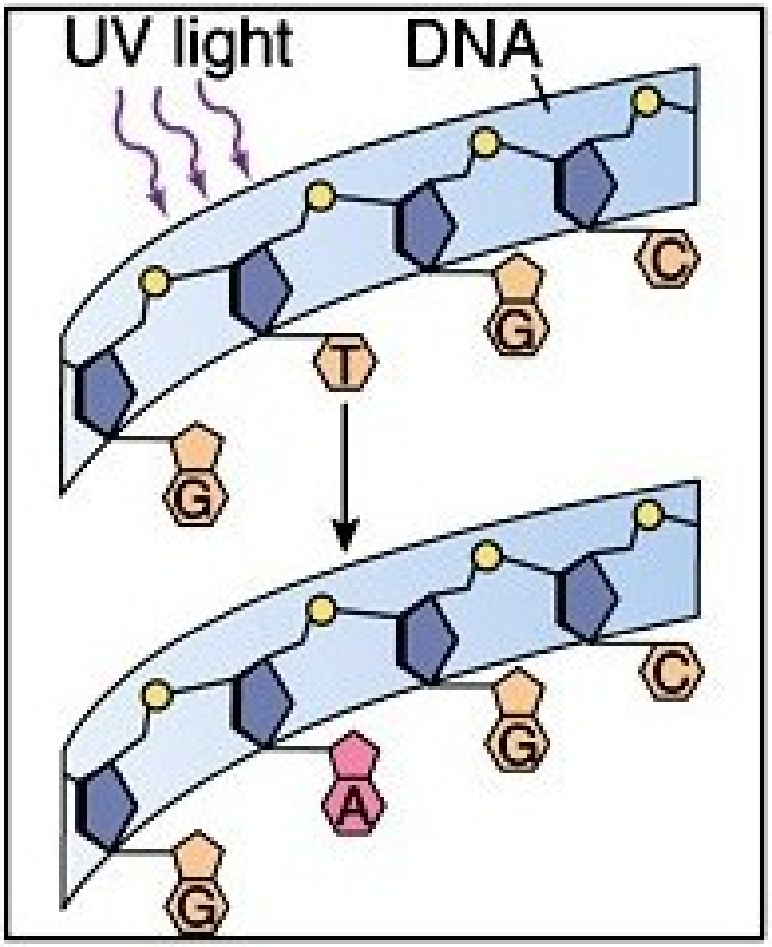
Why Allele Frequencies Change

- Five evolutionary forces can significantly alter the allele frequencies of a population

  - 1. Mutation
  - 2. Migration
  - 3. Genetic drift
  - 4. Nonrandom mating
  - 5. Selection

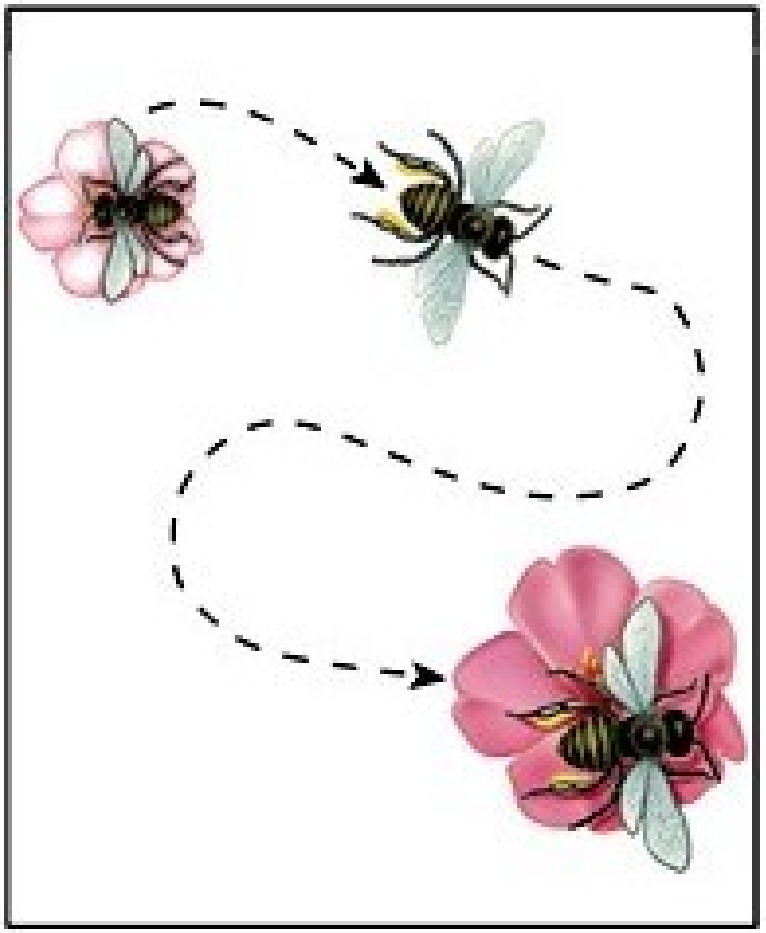
Mutation

- Errors in DNA replication
- The ultimate source of new variation



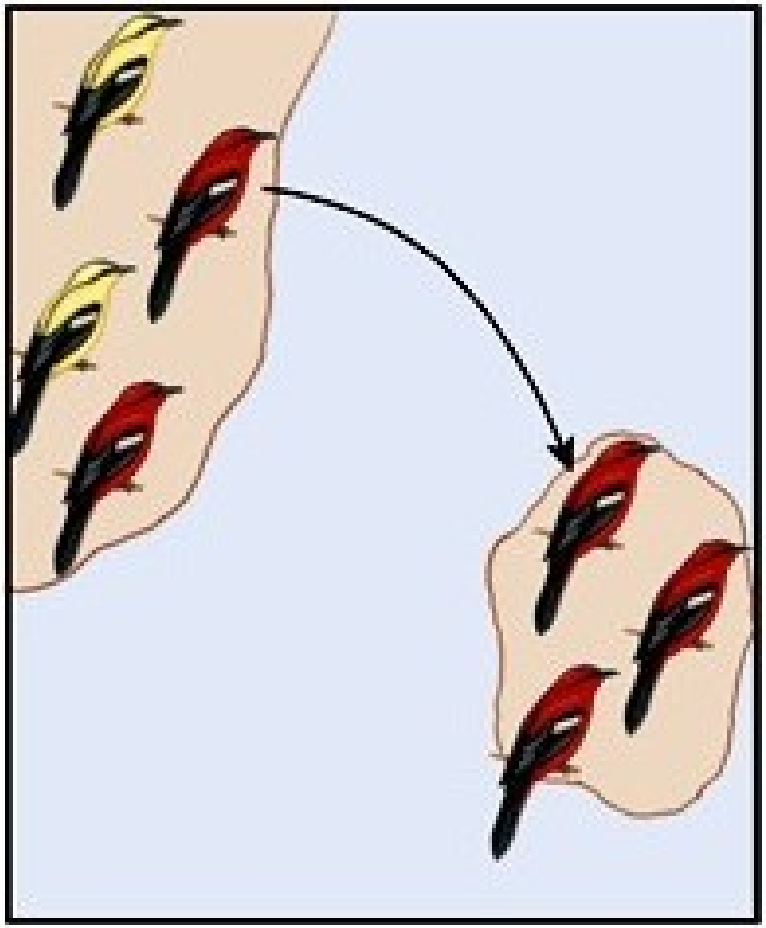
Migration

- Movement of individuals from one population to another
  - Immigration: movement into a population
  - Emigration: movement out of a population
- A very potent agent of change



Genetic Drift

- Random loss of alleles
  - More likely to occur in smaller population
- Founder effect
  - Small group of individuals establishes a population in a new location
- Bottleneck effect
  - A sudden decrease in population size to natural forces

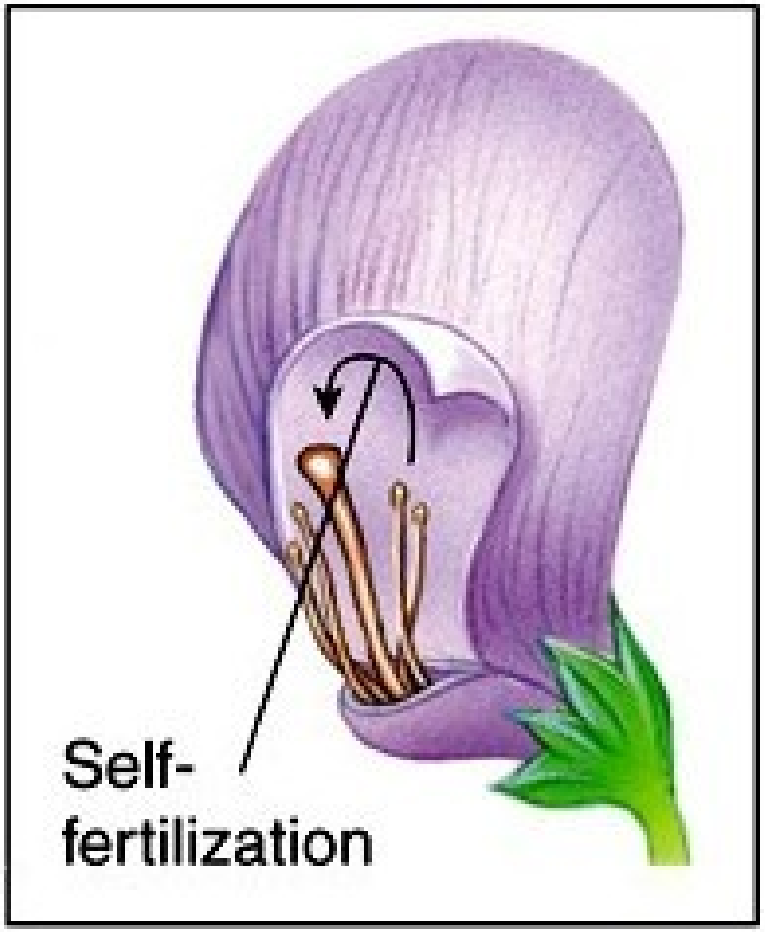


Nonrandom Mating

- Mating that occurs more or less frequently than expected by chance

- Inbreeding
  - Mating with relatives
  - Increases homozygosity

- Out breeding
  - Mating with non-relatives
  - Increases heterozygosity

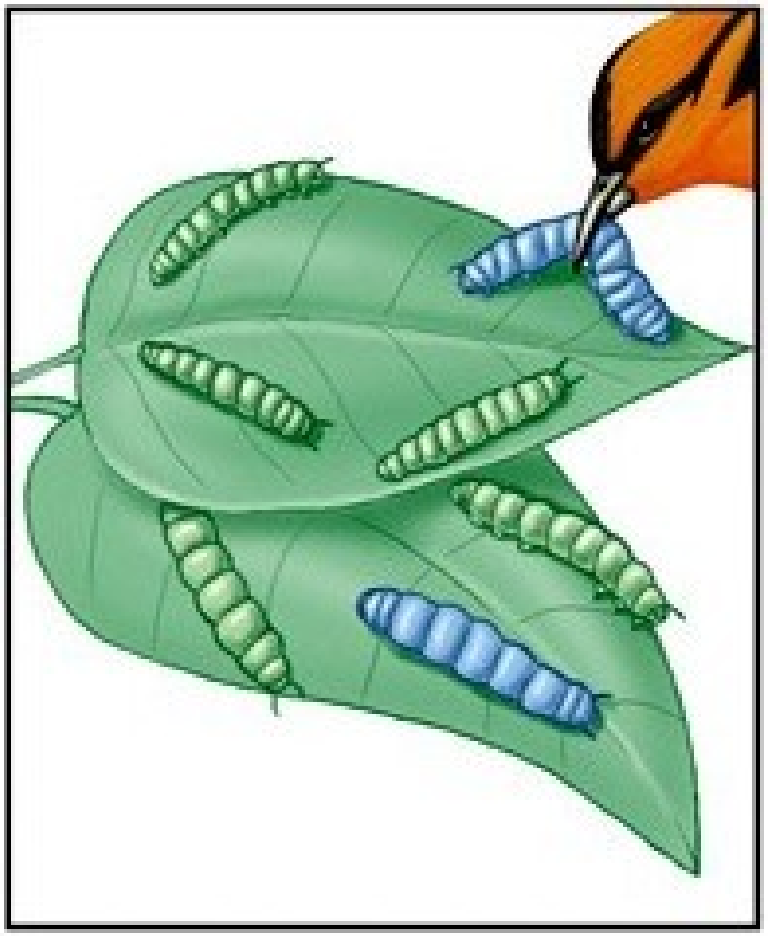


Selecti on

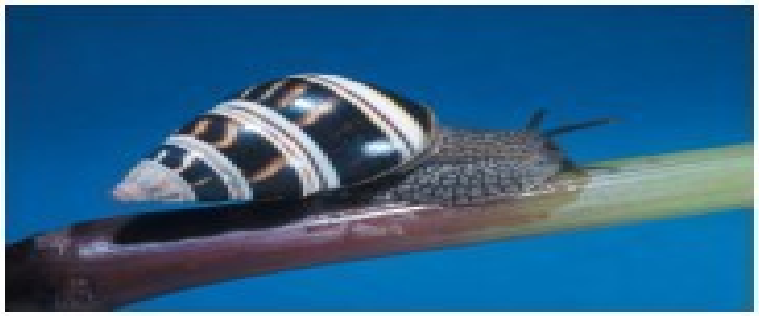
- Some individuals leave behind more offspring than others

- Artificial selection
  - Breeder selects for desired characteristics

- Natural selection
  - Environment selects for adapted characteristics



Genetic Variation in Natural



Brown-banded snail (*Liguus fasciatus*)

Yellow-banded snail

Gray squirrel (*Sciurus carolinensis*)

Albino squirrel

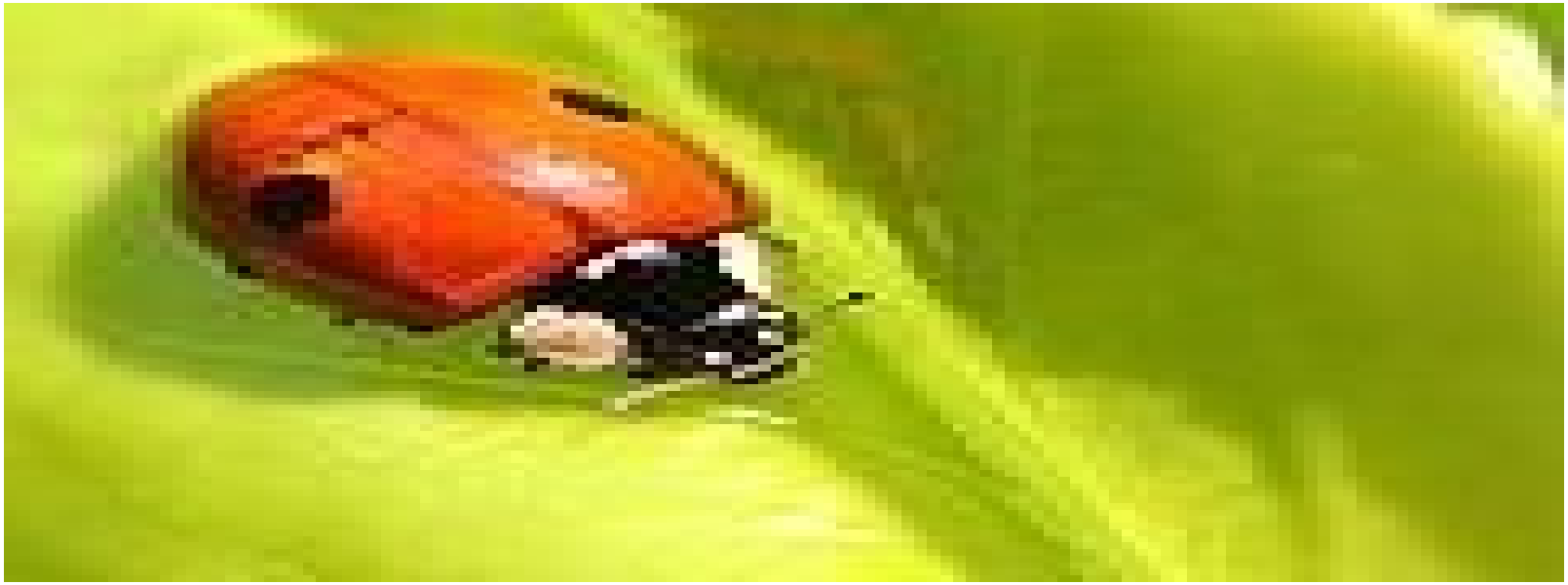
Yellow tiger swallowtail (*Papilio glaucus*)

Black tiger swallowtail

Types of Variation

Phenotypic variation: it's a genetical basis morphological variation its some tie continuous and some time discontinuous.

e.g salmonberry and Two-spotted ladybird



- **Genetic variance**: the variance that is due to variation among individuals in the alleles that they have, excludes environmentally-caused variation

Natural selection

The natural selection is a process by which heritable traits that makes it more likely for an organisms to survive and successfully reproduced become more common in population over successive generation.

Forms of Selection

Three types of natural selection have been identified

- Stabilizing selection
  - Acts to eliminate *both* extreme phenotypes
- Disruptive selection
  - Acts to eliminate intermediate phenotypes
- Directional selection
  - Acts to eliminate a *single* extreme phenotype

Stabilizing Selection

Its a type of natural selection in which genetic diversity decreases as the population stabilizes on a particular trait value.

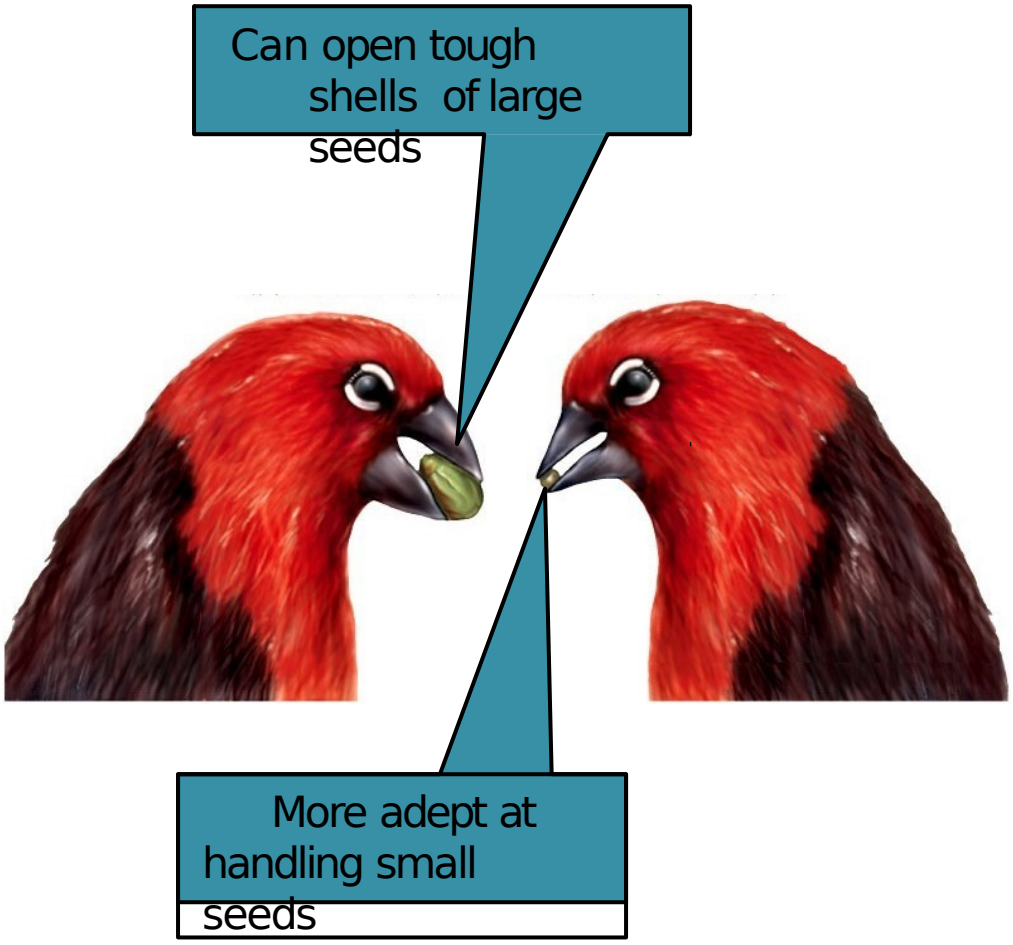
Stabilizing selection act to keep a population well adapted to its environment.

e.g. birth weight of human baby.

Disruptive Selection

the selection, describe change in population genetics in which extreme value for trait are favor over intermediate values.

- In the African seed-cracker finch, large- and small-beaked birds predominate
- Intermediate-beaked birds are at a disadvantage
  - Unable to open large seeds
  - Too clumsy to open small seeds



Directional Selection

- *Direction selection is a mode of natural selection in which a single phenotype is favored, causing the allele frequencies continuously shift in one direction.*
- *E.g industrial melanism*

Polymorphism

. Naturalists have described phenotypic variation within many species. For example,

Brown-banded snail (*Liguus fasciatus*)

Yellow-banded snail

Gray squirrel (*Sciurus carolinensis*)

Albino squirrel

Yellow tiger swallowtail (*Papilio glaucus*)

Black tiger swallowtail

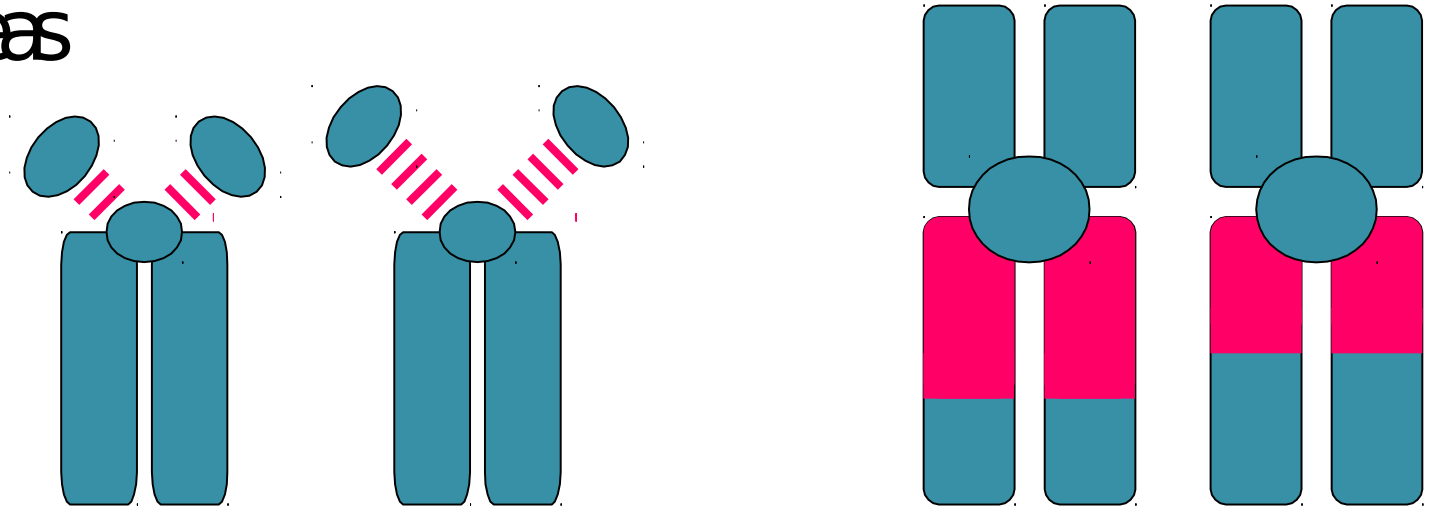
All these sorts of phenotypic differences are called *polymorphisms*

Grove snail; , *Cepaea nemoralis*

- **Grove snail**
- The grove snail, *Cepaea nemoralis*, is famous for the rich polymorphism of its shell. The system is controlled by a series of multiple alleles. The shell colour series is brown (genetically the top dominant trait), dark pink, light pink, very pale pink, dark yellow and light yellow (the bottom or universal recessive trait).

Chromosomal polymorphism

- Different length of p-arms of acrocentric chromosomes
- Different extent of heterochromatin areas



Referenc es

- Principle of genetics. By D. peter snustad.
- Genetics : robbert f. weaver
- www.worlofteaching.com
- www.vadlo.com
- www.google.co.in

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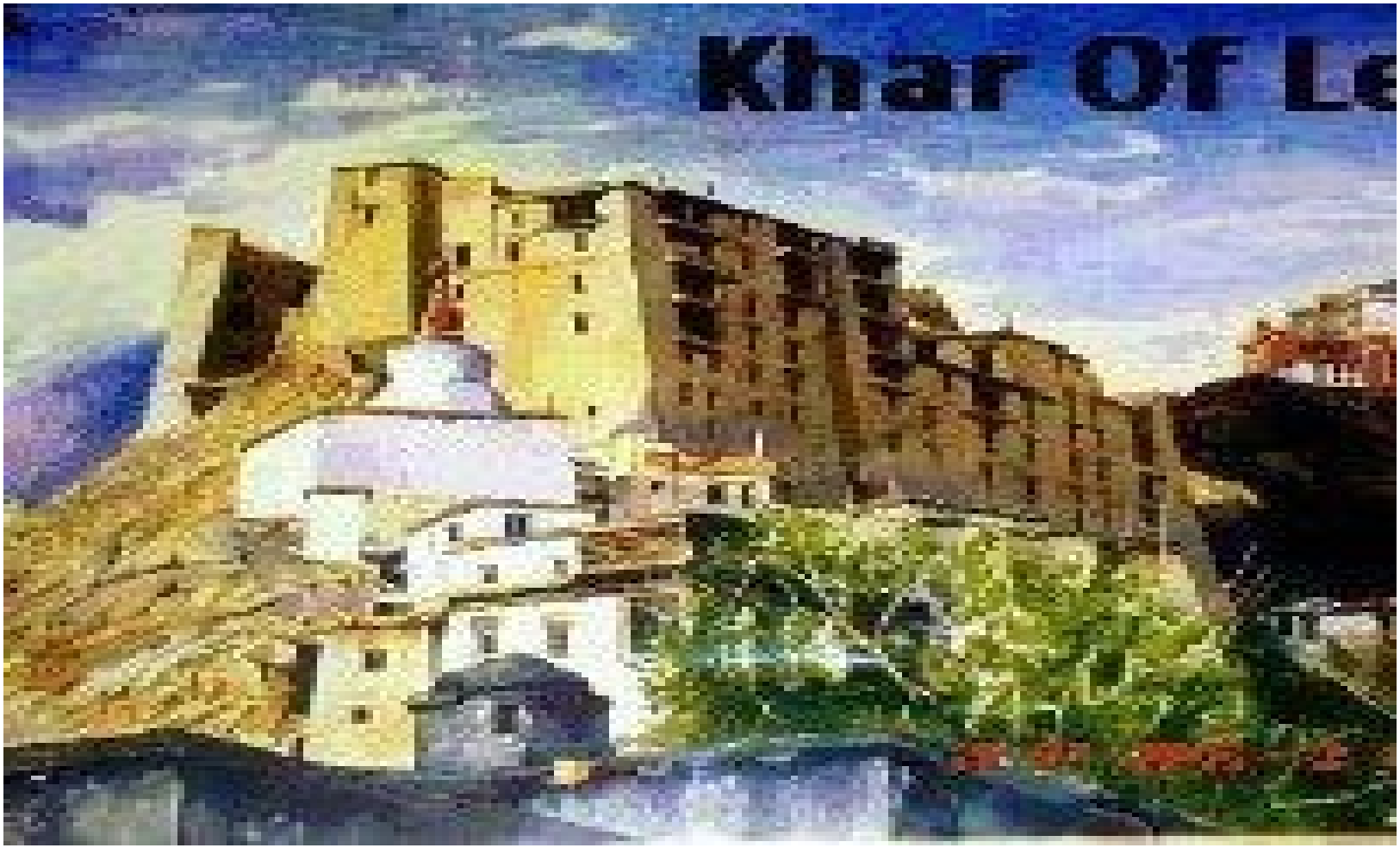

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