POPULATION GENETICS

1. Panmictic populations

CHAPTER OUTLINE

- Autosomal gene with two alleles
- Alleles frequencies estimation
- Populations in Hardy-Weinberg equilibrium
- Different initial alleles frequencies in both genders
- Multiple alleles
- Multiple alleles frequencies
- X- linked genes
- Estimation of X- linked genes frequencies
- H-W equilibrium in X-linked genes
- Linkage disequilibrium
- Populations reproduced sexual and asexual

LEARNING OUTCOMES

After completing this chapter, the student will be able to:

- Calculate genotypic and allelic frequencies in autosomal or X- linked genes from a sample population under various circumstances
- Estimate if a population is under Hardy – Weinberg equilibrium for a specific gene
- Estimate linkage disequilibrium between two genes in a population

2. Inbreeding

CHAPTER OUTLINE

- Decrease of heterozygosity under inbreeding
- Genotypes frequencies in inbred populations
- Inbreeding coefficient estimation from genotypes frequencies
- Inbreeding coefficient estimation from pedigrees
- Coefficient of consanguinity
- Systems of inbreeding
- Self – fertilized population to a certain extent
- Inbreeding depression
- Inbreeding in small populations
- The concept of ideal population
- Effective population size
- Heterozygosity and effective number of neutral alleles
- Structured populations and F statistics

LEARNING OUTCOMES

After completing this chapter, the student will be able to:

- Estimate inbreeding coefficient from genotypic frequencies and pedigrees
- Estimate the coefficient of consanguinity from pedigrees
- Estimate the effective population size under various circumstances
- Estimate inbreeding coefficient in small populations
- Estimate inbreeding coefficient under various systems of matings

3. Assortative and dissortative mating

CHAPTER OUTLINE

- Assortative matings
- Disassortative matings
- Homogamy
- Heterogamy
- Self sterility alleles in plants
- Pin and Thrum flower type

LEARNING OUTCOMES

After completing this chapter, the student will be able to:

- Estimate the value and variance of Parsons Index for assortative and disassortative matings

4. Random genetic drift

CHAPTER OUTLINE

- Population subdivision
- WAHLUND effect
- Population bottleneck
- Founder effect

LEARNING OUTCOMES

After completing this chapter, the student will be able to:

- Estimate the possible outcomes concerning alleles frequencies changes in populations due to random genetic drift
- Estimate the consequences of WAHLUND effect in the genetic structure of isolated subpopulations
- Estimate the genes frequencies variance in isolated subpopulations
- Estimate the genetic and evolutionary consequences of bottleneck and founder effect

5. Natural selection

CHAPTER OUTLINE

- Changes in alleles frequencies
- Genes with two alleles
- Genes with multiple alleles
- Balanced polymorphism
- Meiotic drive
- Natural selection in different types of dominance
- Heterozygote advantage and disadvantage
- Fundamental theorem of natural selection
- Estimation of selection coefficient
- Frequency – dependent selection
- Natural selection and H-W equilibrium
- Cost of natural selection

LEARNING OUTCOMES

After completing this chapter, the student will be able to:

- Estimate the possible outcomes concerning alleles frequencies changes in populations due to natural selection
- Estimate the fitness coefficient of different genotypes
- Estimate the genes frequencies equilibrium under various scenarios of natural selection
- Estimate the genetic and evolutionary consequences of natural selection effect

6. Mutation

CHAPTER OUTLINE

- Changes in alleles frequencies due to mutations
- Selection – mutation equilibrium

LEARNING OUTCOMES

After completing this chapter the student will be able to:

- Estimate the possible outcomes concerning alleles frequencies changes in populations due to mutation and random genetic drift
- Estimate the genes frequencies equilibrium under various scenarios of natural selection and mutation rate
- Estimate the genetic and evolutionary consequences of mutation effect

7. Migration and gene flow

CHAPTER OUTLINE

- Continent – island model
- Migration and random genetic drift equilibrium

LEARNING OUTCOMES

After completing this chapter the student will be able to:

- Estimate the possible outcomes concerning alleles frequencies changes in populations due to migration and gene flow
- Estimate the genes frequencies equilibrium under various scenarios of natural selection and gene flow
- Estimate the genetic and evolutionary consequences of migration and gene flow effect

8. Genetic load and genetic polymorphism

CHAPTER OUTLINE

- Genetic load due to mutation, recombination, migration, Mendelian segregation and meiotic distortion
- Genetic polymorphism and evolution

LEARNING OUTCOMES

After completing this chapter the student will be able to:

- Estimate the genetic load caused by mutation, recombination, migration, Mendelian, segregation and meiotic distortion

9. Laboratory practicals

More than 60 laboratory exercises covering all fields of population genetics deepen the students ability to understand and apply the concepts and techniques presented in the theory.