QUANTITATIVE TRAITS

LEARNING OBJECTIVES & SCIENCE COMPETENCIES

Once you have understood and can apply the principles outlined in each chapter, you will have acquired the following science competencies

1. Mendelian genetics and quantitative traits

OUTLINE

- Quantitative traits heritability
- Additive effect of alleles and genes

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- Calculate the number of genes which affect a quantitative trait
- Estimate the contribution of each allele in the phenotype of a quantitative trait

2. Phenotypic value

OUTLINE

- Phenotypic value of an individual
- Phenotypic value of a population
- Average effect of a gene
- Breeding value
- Dominance deviation
- Epistatic deviation
- Phenotypic value of a population and inbreeding
- Heterosis

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- Calculate the phenotypic value of an individual in the metric scale of
- quantitative traits
- Calculate the phenotypic value of a population
- Calculate the genotypic value of different genotypes
- Calculate Estimate the effective population size under various circumstances
- Calculate the average effect of a gene and the average effect of the gene
- substitution
- Calculate the breeding value and the dominance deviation of a genotype
- Calculate heterosis or hybrid vigour

3. Phenotypic variance

OUTLINE

- Genetic and environmental effects
- Genotype – environment correlation and interaction

LEARNING OUTCOMES

After completing this chapter the students will be able to:

- Estimate the genotype – environment correlation and interaction

4. Genotypic variance

OUTLINE

- Additive genetic variance and dominance variance
- Epistatic and linkage disequilibrium variance
- Repeatability of a quantitative trait

LEARNING OUTCOMES

After completing this chapter the students will be able to:

- Calculate the additive and the dominance genetic variance of a quantitative trait
- Calculate the repeatability of a quantitative trait

5. Relatives identity

OUTLINE

- Variance within and between groups of relatives
- Cotterman –k coefficients between relatives
- Genetic covariance among relatives
- Environmental covariance

LEARNING OUTCOMES

After completing this chapter the students will be able to:

- Calculate the variance within and between groups of relatives
- Calculate Cotterman k- coefficients between relatives
- Calculate the genetic covariance and the correlation among relatives

6. Heritability coefficient

OUTLINE

- Factors affecting heritability coefficient
- Estimation of heritability coefficient
- Twins study. Data from human populations

LEARNING OUTCOMES

After completing this chapter the students will be able to:

- Estimate the heritability coefficient and the extent of identity among relatives
- Estimate the heritability coefficient
- Estimate the variance of heritability coefficient

7. Artificial selection

OUTLINE

- Artificial selection and response to selection
- Intensity of selection
- Selection limit
- Total response to selection
- Repeatability of response to selection
- Phenotypic variance and artificial selection
- Mutation and genetic variance
- Asymmetry of response to selection
- Pleiotropic gene action , linkage disequilibrium and artificial selection
- Reverse response to selection
- Family selection
- Quantitative traits loci identification and chromosome location

LEARNING OUTCOMES

After completing this chapter the students will be able to:

- Calculate selection differential and response to artificial selection
- Calculate the intensity of selection
- Calculate the total response of selection
- Estimate the asymmetry of response to selection
- Estimate selection limits
- Identify and locate quantitative traits loci with genetic neutral markers

8. Inbreeding and artificial selection

OUTLINE

- Variance among experimental crosses
- General combining ability
- Applications of experimental crosses in artificial selection

LEARNING OUTCOMES

After completing this chapter the students will be able to:

- Estimate the general combining ability of experimental crosses between inbreeding lines

9. Correlated traits

OUTLINE

- Genetic and environmental correlations
- Correlated response of selection

LEARNING OUTCOMES

After completing this chapter the students will be able to:

- Estimate the genetic correlation between two traits
- Estimate the correlated response to selection

10. Threshold traits

OUTLINE

- Genetic contribution in threshold traits
- Evolution of threshold traits

LEARNING OUTCOMES

After completing this chapter the students will be able to

- Estimate the heritability coefficient of threshold traits

11. Scale change

OUTLINE

- Effect of scale change in distribution and variance of quantitative traits

LEARNING OUTCOMES

After completing this chapter the students will be able to:

- Estimate the effect of scale change in distribution and variance of quantitative traits

12. Path coefficients

OUTLINE

- Path coefficient and coefficient of determination
- Chains of causes and effects

LEARNING OUTCOMES

After completing this chapter the students will be able to:

- Estimate the path coefficient and coefficient of determination between causes and effects in quantitative traits

13. Laboratory practicals

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