



**RAJARATA UNIVERSITY OF SRI LANKA  
FACULTY OF APPLIED SCIENCES**

**B.Sc. (General) Degree in Applied Sciences  
Second Year -- Semester II Examination -- February/March 2019**

**BIO 2203 – GENETICS & EVOLUTION**

**Time: Two (02) hours**

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**Answer FOUR (4) questions only.**

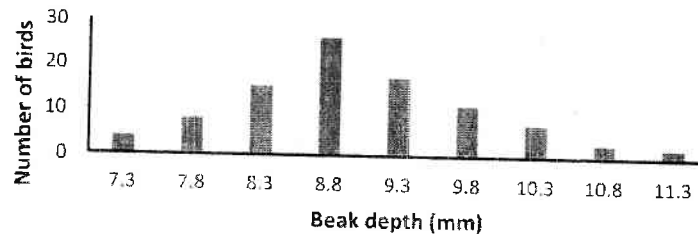
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1. A newly discovered plant from Singharaja rainforest produces a seed capsule, in which two independently assorting genes A and B control the shape of the seed capsule. Both genes have only two alleles for each locus (alleles 'A' and 'a' for gene A and alleles 'B' and 'b' gene B). When plants of the genotype 'AaBb' were crossed, ~6% of the progeny were found to possess ovoid-shaped seed capsules while the other ~94% of the progeny had triangular-shaped seed capsules.
  - a) Construct a Punnet square for the above cross and deduce all possible genotypes of the progeny. **(40 marks)**
  - b) What is the phenotypic ratio approximated by the progeny in the above cross? **(10 marks)**
  - c) Briefly describe the genetic phenomenon taking place during the determination of the shape of seed capsules in this plant. **(20 marks)**
  - d) What is the genotype of the ovoid-shaped seed capsules? **(10 marks)**
  - e) Is it possible to get triangular-shaped seed capsules by crossing two plants with ovoid-shaped seed capsules? Give reasons for your answer. **(20 marks)**
2. Oculocutaneous albinism is an autosomal recessive monogenic disease. In a native South American tribe of 60,000 individuals, 24 were found to be affected with Oculocutaneous albinism.
  - a) Describe what a monogenic autosomal recessive disease is, using Oculocutaneous albinism as an example. **(30 marks)**
  - b) Briefly state the assumptions of the Hardy-Weinberg equilibrium. **(20 marks)**

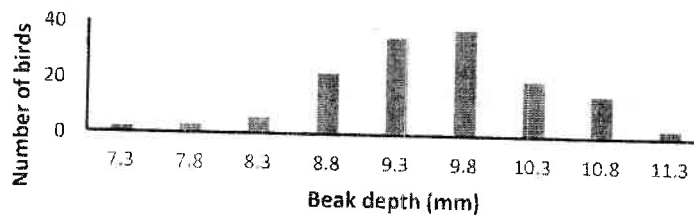
- c) If the population is in Hardy-Weinberg equilibrium, calculate the allele and genotype frequencies. (30 marks)
- d) How many of the above population are carriers of the disease? (20 marks)

3. The figures below (a & b) depict the distribution of bill depth in granivorous weaver birds obtained during two time periods from Wasgomuwa National Park (WNP). WNP experienced intense drought between 1983 and 1984. The drought caused a significant decline in the plants that produce small soft seeds. Plants that produced larger hard seeds were found to be less susceptible to the draught. The draught also resulted in high levels of mortality among weaver birds.

(a) 1982- Before drought



(a) 1985-After drought



- a) Comment on figures a and b. (15 marks)
- b) Using your understanding of the concepts of evolution, discuss the plausible mechanisms that may have given rise to the phenomenon depicted in figures a and b. (85 marks)
4. Discuss the different modes of speciation. (100 marks)
5. Write short notes on any **four (4)** of the following.
- Activation in prokaryotic transcriptional control
  - Structure of a gene

- c) Sexual cannibalism and copulatory suicide
- d) Georges Cuvier
- e) Disruptive selection

**(100 marks)**

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