

THE OPEN UNIVERSITY OF SRI LANKA  
 B.Sc. DEGREE PROGRAMME – LEVEL 04  
 FINAL EXAMINATION – 2011/2012  
 BOTANY  
 BOU 2101/BOE 4101 – GENETICS and EVOLUTION



DURATION : TWO (02) HOURS

DATE : 29<sup>th</sup> December 2011

TIME : 9.30 – 11.30 a.m.

ANSWER FOUR (04) QUESTIONS SELECTING AT LEAST ONE (01) FROM EACH PART

**PART A**

1.

A) Explain briefly why three-point crosses are useful in learning about the nature of gene linkage.

B) Three recessive genes in linkage group V of the tomato are *a* producing absence of anthocyanin pigment, *hl* producing hairless plants, and *j* producing jointless fruit stems (pedicels). Among 3000 progeny from a trihybrid testcross, the following phenotypes were observed:

259 hairless	268 anthocyaninless, jointless, hairless
40 jointless, hairless	941 anthocyaninless, hairless
931 jointless	32 anthocyaninless
260 normal	269 anthocyaninless, jointless

i) How the genes were originally linked in the trihybrid parent?

ii) Estimate the distance between the genes.

2.

- A) In a plant species, curled leaves ( $C$ ) are dominant to elongated leaves ( $c$ ). Round pollen ( $R$ ) are dominant to irregular pollen ( $r$ ). The progeny resulting from a cross between a plant bearing curled leaves, round pollen with that of curled leaves and irregular pollen is given below.

Plants with	curled leaves, round pollen	108
	curled leaves, irregular pollen	102
	elongated leaves, round pollen	31
	elongated leaves, irregular pollen	34

- i) Explain these results.

- B) A pair of co-dominant alleles is known to govern cotyledon leaf colour in soybeans. The homozygous genotype  $C^G C^G$  produces dark green, the heterozygous genotype  $C^G C^Y$  produces light green, and the other homozygous genotype produces yellow leaves so deficient in chloroplasts that seedlings do not grow to maturity.

- ii) If dark green plants are pollinated only by light green plants, what genotypic and phenotypic ratios would be expected in the mature progeny plants ?

3.

- A) What is epistasis ?

- B) Briefly explain different types of epistasis observed.

- C) Red colour in wheat kernels is produced by the genotype  $R-B-$ , white by the double recessive genotype ( $rrbb$ ). The genotypes  $R-bb$  and  $rrB-$  produce brown kernels. A homozygous red variety is crossed to a white variety.

- i) What phenotypic results are expected in the  $F_1$  and  $F_2$ ?

- ii) If the brown  $F_2$  is artificially crossed at random, what phenotypic and genotypic proportions are expected in the offspring ?

**PART B**

4. (i) Briefly explain the agents that can change the gene frequencies in a population.
- (ii) A population study carried out 20 years ago in a separated grassland area indicated that the colour of the shell of the single snail population inhabiting it was normally distributed and it had extremely higher number of individuals with greenish shells compared to brownish or yellowish individuals. A recent survey carried out in the same area showed that the snail population had considerably higher numbers of brownish and yellowish individuals and the number of greenish individuals was very low. During the period between the two studies, the area had been subjected to erosion and brownish rocky areas and sandy patches were more common in the area and grasses were confined to few small patches.

Explain the type of evolution that this snail population had been experienced.

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5. Describe how the eukaryotic organisms evolved from prokaryotes.
6. Write short notes on any three (3) of the following:
- (a) Adaptive radiation
  - (b) Allopolyploidy
  - (c) The Miller - Urey Experiment
  - (d) Cambrian period
  - (e) *Homo erectus*

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