UNIVERSITY OF EMBU

2019/2020 ACADEMIC YEAR

SUPPLEMENTARY/SPECIAL EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE DEGREE OF SCIENCE IN AGRICULTURE (CROP PROTECTION MAJOR)

ACP 301: BREEDING FOR RESISTANCE TO INSECTS AND DISEASES

DATE: OCTOBER 22, 2020   **TIME: 8:30 AM – 10:30 AM**

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions.

QUESTION ONE (30 MARKS)

a) A tomato breeder is using wild germplasm to improve commercial cultivars on resistance to *Tuta absoluta*. State two challenges he may face in his breeding program

(2 marks)

b) State three types of host plant resistance against insect pests   (3 marks)

c) Explain three conditions that are assumed in Hardy-Weinberg equilibrium (3 marks)

d) Explain why breeding for horizontal resistance is more challenging compared with vertical resistance   (2 marks)

e) Calculate the frequency of heterozygotes for an autosomal recessive trait that has an occurrence of 1/3600   (2 marks)

f) Explain the importance of centers of origin to a plant breeder   (2 marks)

g) Explain the significance of DNA polymorphisms in plant breeding   (2 marks)

h) Explain how migration can alter gene frequencies in a population   (3 marks)

i) What are microsatellite markers and what is their source of polymorphism?
                                                                           (2 marks)

j) State the gene-for-gene hypothesis and its application when breeding against plant pathogens   (2 marks)

k) A researcher examined a locus in which there is a particular C/T polymorphism. She obtained the following genotypic counts: CC:42, CT:16, TT:32. Test if the population is in Hardy-Weinberg equilibrium using a chi-square test at 5% significance level
                                                                           (4 marks)

l) Consider a population with two alleles 'A' and 'a' classified genotypically as follows:

AA	Aa	aa	Total
16	8	1	25

Calculate the allele frequencies in the population and genotype frequencies after one generation of random mating   (3 marks)

QUESTION TWO

In common bean, a recessive locus, *bc-3* confers resistance to Bean Common Mosaic Necrosis Virus (BCMNV). Describe the steps you will take to introgress the gene for resistance into a commercial cultivar using backcross method   (20 marks)

QUESTION THREE (20 MARKS)

a) In relation to variability of fungal pathogens, explain the mechanisms through which new races can be produced   (8 marks)

b) You have been given four varieties of sorghum to screen for resistance to *Colletotrichum sublineola* under field conditions. Explain your steps   (12 marks)

QUESTION FOUR (20 MARKS)

a) Discuss the factors affecting expression of disease and insect resistance   (10 marks)

b) Write short notes on five strategies that may be used by a breeder to make vertical resistance a success   (10 marks)

QUESTION FIVE (20 MARKS)

a) Imagine a species in which a given locus has two alleles, A and a. There are two populations of this species, one on the mainland and one on an island. The frequency of A on the mainland is represented by pm and the frequency of A on the island is pi. Assume that pi = 0.4 and pm = 0.6 and that 10% of the parents of the next generation are migrants from the mainland. Calculate the frequency of allele A in the island in the next generation (2 marks)

b) Explain the three categories of gene pools of cultivated species and their applications in plant breeding (9 marks)

c) Describe the three basic forms of selection (9 marks)