RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIRST SEMESTER EXAMINATION, DECEMBER 2019

FIRST YEAR (BATCH 2019-22)

Date : 13/12/2019 **ZOOLOGY (Honours)**

Time : 11 am – 1 pm **Paper : II [CC2]** Full Marks : 50

1. ***Answer <u>any five</u> questions*:** [5×2]

   a) Define Pleiotrophy.

   b) What do you mean by Epistasis?

   c) What are multiple alleles?

   d) Prove that the change in allele frequency due to gene flow (migration) is dependent on the migration rate and the difference in allele frequency between the two populations.

   e) What is Bottleneck effect?

   f) What is hybrid dysgenesis?

   g) State Lyon's hypothesis.

   h) What is mutagen?

2. ***Answer <u>any four</u> questions:*** [4×10]

   a) In a certain African population, 4 % of the population is born with sickle cell anemia (aa). Calculate the percentage of individuals who enjoy the selective advantage of the sickle-cell gene (increased resistance to malaria)?

   Distinguish between stabilizing, directional and disruptive types of natural selection.

   Allele *T*, for the ability to taste a particular chemical, is dominant over allele *t*, for the inability to taste the chemical. 400 university students were surveyed and 64 were found to be nontasters. Calculate the percentage of heterozygous students. Assume that the population is in H-W equilibrium [4+3+3]

   b) Suppose you have a triploid heterozygote stock of *Drosophila* sp. regarding 3 marker genes (x, y and z).You performed a test cross and observed, all eight combinations of progenies are not present in equal proportions.

      (i) What would you infer?

      (ii) Justify with proper reasons.

      Three of the many recessive mutations in *Drosophila melanogaster* that affect body color, wing shape, or bristle morphology are black (*b*) body, versus grey in the wild type; dumpy (*dp*), obliquely truncated wings, versus long wings in the wild type; and hooked (*hk*) bristles at the tip, versus nonhooked bristles in the wild type. From a cross of a dumpy female with a black, hooked male, all the F1 were wild type for all three characters. The testcross of an F1 female with a dumpy, black, hooked male gave the following results:

wild type 169

black 19

black, hooked 301

dumpy, hooked 21

hooked 8

hooked, dumpy, black 172

dumpy, black 6

dumpy 304

Total 1,000

(iii) Construct a genetic map of the linkage group (or groups) these genes occupy.

(iv) If applicable, show the order and give the map distances between the genes.

(v) Determine the coefficient of coincidence.

(vi) How much interference is there? [1+3+3+1+1+1]

c) Write down characteristics of pseudoallele with proper example. Discuss about different types of lethal alleles. Two fruit flies of wild type phenotype were crossed, and in the progeny there were 202 females & 98 males. (i) What is unusual about this result? (ii) Provide a genetic explanation. (iii) Provide a test of your hypothesis. What is sex-influenced inheritance?

[2½+2½+(1+2+1)+1]

d) How do you detect a sex-linked lethal mutation? Explain the mechanism. Differentiate between back and suppressor mutations. Demonstrate the phenomenon 'tautomeric shift'. What is sterile polyploid? Mention any human cells which are polyploidy in nature.

[2+1+2½+2½+1+1]

e) What is dosage compensation? Explain the mechanism of dosage compensation in *Drosophila* sp. What is the role of XIST and TSIX? What is a Barr body? [2+4+(1+1)+2]

f) What do you mean by transition and transversion? Define nonsense, mis-sense, silent and neutral mutation. What do you mean by SOS repair? [2+(1½+1½+1½+1½)+2]

g) What is attached X strain of *Drosophila* sp.? Explain how this strain is used for detection of mutation in *Drosophila* sp. What do you mean by reciprocal translocation and Robertsonian translocation? [2+4+(2+2)]

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