

Tuljaram Chaturchand College, Baramati

(Autonomous)

Department of Microbiology

Question Bank

Class: M.Sc. I

Semester: II

Subject: Evolution and Ecology

Subject Code: MICRO4204

Q.1. Objective questions

2 Marks

1. Define: Ecophenes and ecotones.
2. What is Bergmann's rule?
3. What is Jordan's rule?
4. What is spontaneous mutation?
5. What is Kin selection?
6. What is coevolution?
7. What is evolution?
8. Better adapted individual tend to produce more offspring than individuals within the same species less adapted to that environment. This observation from the principle of
9. What is community stratification?
10. Define biotic community?
11. What is exploitation?
12. What is adaptive radiation?
13. **The natural place of an organism or community is known as**
 - a. Niche
 - b. Biome
 - c. **Habitat**
 - d. Habit
14. **According to Shelford's Law of Tolerance, the organisms wide environmental factor tolerance limit show**
 - a. Narrow distribution with low population size
 - b. **Wide distribution with high population size**
 - c. Narrow distribution with high population size
 - d. Wide distribution with low population size
15. **Which statement is correct with respect to the food chain?**
 - a. Every component of food chain forms trophic level
 - b. Inter-relation between different food chains is known as a **food web**
 - c. All the chains formed by nutritional relations is used to understand energy flow.
 - d. **All of the above**
16. **Which of the following requires maximum energy?**
 - a. Secondary consumer

- b. Decomposer
- c. Primary consumer
- d. Primary producer**

17. Which is not the characteristic of 'r' selected species?

- a. Reproduce quickly
- b. Parental care**
- c. A low survival rate of progenies
- d. Produce a large number of progenies

18. The ability of a population to increase under ideal environmental conditions is called

- a. Natality
- b. Carrying capacity
- c. Biotic potential**
- d. Absolute natality

19. Which one is a 'K' selected species?

- a. Aspergillus
- b. Human**
- c. Taraxacum
- d. Grass

20. The force that initiates evolution is _____

- a. Variation**
- b. Mutation
- c. Extinction
- d. Adaptation

21. Example of a homologous organ

- a. The arm of a human, wing of a bird**
- b. Wing of an insect, wing of a bird
- c. Leg of a dog, leg of a spider
- d. None of the above

22. Observation of species on _____ heavily inspired Darwin's theory of evolution.

- a. Ilha da Queimada Grande
- b. Guatemala
- c. Faroe Islands
- d. Galapagos Islands**

Q.2. Short notes

4 Marks

1. Evolutionary game theory
2. Rhizosphere community structure
3. Neo Darwinism
4. Co-evolution
5. Natural selection
6. Molecular evolution
7. Molecular clock
8. Evolution of species.

9. Ecotone
10. Ecological Niche
11. Hamilton rule
12. Game theory
13. Lotka –Volterra model
14. Allopatric speciation.
15. Sympatric speciation.
16. Parapatric speciation
17. Energy pyramid.
18. Key stone species.
19. Bergmann's rule
20. Lamarckism
21. Prey Predation interaction
22. Ecological indicators.
23. Character Displacement
24. Resource partitioning

Q.3. Answer the following

4 Marks

1. Describe the concept of evolutionary r and k selection
2. What is carrying capacity?
3. What is Hamilton's Rule? Give its significance.
4. For an individual A to help his relative B or C, the fitness benefits and costs are 50 and 20 units respectively. However following Hamilton's Rule, A should help B only but not C. How B and C are genetically related to A?
5. What is genetic drift? Explain with suitable example.
6. The population density of an insect species increases from 40 to 46 in one month. If the birth rate during that period is 0.4. What is the death rate?
7. The population size of a bird increased from 600 to 645 in one year. If the per capita birth rate of this population is 0.5, what is the death rate?
8. What is the significance of Lotka –Volterra model?
9. What is Bottleneck effect? Explain with suitable example.
10. What is speciation? Explain sympatric speciation in detail.
11. What is Allopatric speciation? Give its significance.
12. What is molecular clock? Explain with example.
13. Explain Bottom Up energy control.
14. Explain Top- Down energy control.
15. Explain Bergmann's rule.
16. What is Hardy- Weinberg equilibrium?
17. What is adaptive radiation? Explain this phenomenon by citing suitable example.
18. Discuss the Phenomenon of ammensalism.
19. Explain Character displacement.
20. What is resource partitioning and give its suitable example.
21. Define biotic community and describe in detail its different characteristics.
22. Discuss the role of edaphic factor in ecological studies.
23. Explain ecological niche width and overlap.
24. Explain decomposer community.

Q.4. Short answer questions

6 marks

1. Describe the various mechanisms of speciation sexual and asexual organisms.
2. Elaborate the concept of sexual selection with suitable example.
3. Explain the evolutionary origin of biochemical disorders in context with insulin resistance.
4. Explain r and k selection. Describe the distinguishing characters of r and k selection.
5. Describe the various antagonistic interactions in community using appropriate example.
6. Comment on molecular evolution and its role in origin of new genes and proteins.
7. Explain the structure of rhizosphere . Describe the various interactions which are important in shaping rhizosphere community structure.
8. Describe the diversity of secondary metabolites and its significance.
9. Describe the concept of speciation in asexual organisms.
10. Explain speciation in sexual and asexual organisms.
11. Justify “ Shannon index is better than the Simpson index for expressing bacterial diversity in an ecological sample”.
12. Given data is obtained from soil sample. The total numbers of colonies were counted to be 171×10^6 . Find out the Simpson index.

Sr. No.	Types	Number of colonies
1	Umbonate	37
2	Flat raised	76
3	Convex	58

13. What is coevolution? Explain host – parasite co-evolution.
14. What is Neo- Darwinism. Describe the types of selection based on phenotype characteristics.
15. Explain the succession, competition and predation in community.
16. Explain the evolutionary stability of cooperation and sociality in organisms.
17. From the given data calculate the Shannon diversity index for the river water sample. Total numbers of colonies are 184×10^7 .

Sr. No.	Types of colonies	Number of colonies
1	Pinpoint colonies	50
2	Pigmented colonies	61
3	Colonies larger than 1mm	73

18. Explain molecular evolution with respect to protein evolution.
19. Justify “dominance in number of one type of organism in an ecosystem does not attribute a dominant role for that organism in the ecosystem”.
20. Discuss in brief the evolution of social behaviour with suitable examples.
21. Difference between sexual and asexual selection in organisms.
22. Describe the various agencies involved in speciation of sexual and asexual organisms.
23. Explain in brief “Interaction of Bottom Up and Top- Down control of energy flow in food chain”.
24. Describe the concept of metapopulation Dynamics..
25. Describe in brief habitat and niche.
26. Difference between generalized and specialized niche.
27. Describe the nature of energy flow in ecosystem.
28. Explain hardy Weinberg equation and give its significance in population.
29. Comment on altruism and reciprocal altruism .
30. Describe climax community.
31. Explain the survival growth curve.
32. The following genotypes were observed in a population

Genotype	Number
HH	90
Hh	60
hh	50

what will be the expected number of HH in the given population?

33. Red hair is a recessive trait in human. In a randomly mating population in Hardy Weinberg equilibrium approximately 9% of individuals are red-haired. What is the frequency of heterozygotes?
34. Assume that individual A wants to do an altruistic act to individual B and that benefit and cost of doing this act are, in fitness units 40 and 12 respectively. According to Hamilton's rule. When A and B show altruistic act and how?
35. What is Game theory? Explain with suitable example.
36. What is Island biogeography? Give its role in speciation.
37. For two species A and B in competition, the carrying capacities and competition coefficients are $K_A = 150$, $K_B = 200$, $\alpha = 1$ and $\beta = 1.3$, according to the Lotka –Volterra model of interspecific competition, what is the outcome of competition?
38. For a species having logistic growth, if $K = 20000$ and $r = 0.15$, what will be the maximum sustainable yield.
39. Following table shows the number of individuals of five tree species in a community:

Tree species	Number of individuals
A	50
B	20
C	20
D	05
E	05

Based on the above, find the Simpsons diversity (SD) index of the community.

40. What is interspecific competition? Explain with Lotka –Volterra model.
41. What is speciation? Explain factors responsible for speciation in detail.
42. Difference between r and k selection.
43. A population is growing logistically with a growth rate (r) of 0.15/ week, in an environment with carrying capacity of 400. What is the maximum growth rate (N_0) of (individuals / week) that this population can achieve?
44. The birth rate and death rate s of an insect are 0.25 and 0.05 respectively. In a habitat with a carrying capacity of 5000, when the population density is 100, by how much does the insect population size increase per unit time if (a) the growth is exponential and (b) growth is logistic?
45. The following table shows the number of individuals of each species found in two communities: (Hint : in the values for 0.05, 0.10, 0.25 and 0.80 are -3.0, -2.3, -1.4 and -0.2 respectively)

Community	Species			
	A	B	C	D
C1	25	25	25	25
C2	80	05	05	10

Calculate Shannon diversity index (H) values for communities X and Y.

46. What is Lamarckism? How does it differ from Darwinism
47. Describe Darwinism and explain Neo- Darwinism
48. Give an account of Lamarckism. Give various evidences in Support and criticism of it.
49. Give some examples which support the phenomenon of natural selection.
50. Describe Urey and Miller experiment. How does this experiment support Oparin's hypothesis?
51. What is exploitation? Describe with suitable examples, negative ecological interaction.
52. What is community stratification? Explain the phenomenon with suitable example.

Q.5. Long answer questions

12 Marks

1. Discuss the evolutionary stability of co-operation among microorganisms. Explain with suitable examples how the cooperative competitive interaction influences this stability.
2. Discuss the concept of evolutionary r and k selection. Explain their various regulating factors.
3. What is Neo – Darwinism? Describe the types of selection based on phenotype characteristics.
4. What is island biogeography? Describe with suitable examples? Give its role in speciation.

5. What is niche? Explain generalized and specialized niche with suitable example.
6. Describe interspecific competition. How character displacement is generated in organisms?
7. What is succession? Describe the types, mechanism and changes involved in climax succession.
8. Describe speciation (Allopatric, Sympatric and parapatric) with suitable example.
9. Describe those circumstances which helped Darwin in the formulation of natural selection theory.
10. Explain the modern concept of evolution and discuss how it supports Darwinism.
11. Describe the causes, trends and basic types of succession.
12. Clearly distinguish between allelic, genotypic and Hardy- Weinberg equilibrium, using a specific example to illustrate your answer.
13. Discuss with suitable examples the positive and negative interactions between two different populations.
14. Describe various models explaining the nature of climax communities.
15. Describe different theories for the origin of life on earth. Discuss in detail the Oparin's theory regarding the origin of life.
