Chapter 13

Organisms and Populations

1. State Gause's Competitive Exclusion principle.
   Ans. Gause's Competitive Exclusion Principle states that two closely related species competing for same resources, cannot coexist indefinitely, (the inferior will be eliminated) by the superior one.
2. What does nature's carrying capacity for a species indicate?
   Ans. In nature, a given habitat has enough or limited resources to support a maximum possible number of population and nature's carrying capacity indicates that how much growth is possible in a population.
3. Why do predators avoid eating Monarch butterfly? How does the butterfly develop this protective feature?
   Ans. The Monarch butterfly is highly distasteful to its predator (birds) because of a special chemical present in its body. It acquires this chemical during its caterpillar stage by feeding on a poisonous weed.
4. Give two reasons as to why a weed such a Calotropis flourishes in abandoned fields.
   Ans. Calotropis flourishes in abandoned fields because of: (i) It has dry hairy seeds which help in dissemination (ii) Its have xerophytic adaptations like thick hair on leaves and stems. (iii) It is not grazed by animals as it produces poisonous substances like cardiac glycosides.
5. Why are cattle and goats not seen browsing on Calotropis growing in the fields?
   Ans. Calotropis produces highly poisonous cardiac glycosides. Therefore, cattle and goats do not browse on them.
6. If 8 individuals in a laboratory population of 80 fruit flies died in a week, then what would be the death rate of population for the said period?
   $\text{Death rate} = \frac{\text{Number of individuals dead}}{\text{Total number of individual}} = \frac{8}{80} = 0.1$. The death rate will be 0.1 individuals per week.
7. What does J-shaped growth curve of a population indicate?
   Ans. The J-shaped growth curve indicates the minimum or absence of environmental resistance.
8. What does sigmoid growth curve of a population indicate?
   Ans. Sigmoid growth curve of a population indicates following characteristics: (i) Initially the growth is slow. (ii) The growth becomes rapid and the curve becomes steady due to environmental resistance.
9. Pollinating species of wasps show mutualism with specific fig plants. Mention the benefits the female wasps derive from the fig trees from such an interaction.
   Ans. The wasp uses the fruit as oviposition, i.e., egg laying and the developing seeds for nourishing its larvae.
10. Give an example of an organism that enters 'diapause' and why.

Ans. Many species of Zooplankton under unfavourable conditions enters diapause which delay overall development and hence they can pass unfavourable conditions.

11. Name the type of association that the genus Glomus exhibits with higher plants.
Ans. Symbiosis/Mycorrhizae/Mutualism

12. Name the interaction between a whale and the barnacles growing on its back.
Ans. Commensalism

13. Explain the response of all communities to environment over time.
Ans. Environmental factors like temperature, water, light, soil, etc., may influence the members of communities in varying degrees. Organisms in response to these factors try to adapt according to their capacities, by maintaining a constant internal environment through homeostasis or migration to a less stressful environment or suspending activities till favourable conditions return.

14. (a) What is "r" in the population equation given: dN/dt = rN? (b) How does the increase and the decrease in the value of 'r' affect the population size?
Ans. (a) 'r' is called intrinsic rate of natural increase. (b) Population size increases with increase in 'r' and it decreases with decrease in 'r'.

15. Explain Verhulst-Pearl Logistic Growth of a population.
Ans. According to Verhulst–Pearl Logistic growth, a population growing in a habitat with limited resources initially shows a lag phase, followed by phases of acceleration and deceleration and finally an asymptote when the population density reaches the carrying capacity. It is given by the following equation:

$$\frac{dN}{dt} = rN\left[\frac{K-N}{K}\right]$$

where, N = population density at time t, r = intrinsic rate of natural increase, K = carrying capacity.

16. Co-evolution is a spectacular example of mutualism between an animal and a plant. Describe co-evolution with the help of an example. OR Describe the mutual relationship between fig tree and wasp and comment on the phenomenon that operates in their relationship.
Ans. Co-evolution can be observed in Fig (plant) and wasp (animal). The female wasp uses the fruit for oviposition or egg laying. It also uses developing seeds within the fruit for nourishing its larvae. The wasp in turn pollinates the fig inflorescence. The given Fig species can be pollinated by its 'partner' wasp species and no other species.

17. Egrets are often seen along with grazing cattle. How do you refer to this interaction? Give a reason for this association.
Ans. The interaction between them can be referred to as commensalism. Egrets always forage close to where the cattle are grazing because the cattle, as they move stir up and flush out insects from the vegetation which otherwise might be difficult for the egrets to find and catch.

18. Explain brood parasitism with the help of an example.
Ans. Koel is a parasitic bird (which has lost the instinct to make its own nest to lay eggs), has evolved the technique of laying eggs in the nest of a crow. Its eggs bear resemblances to those of crow.

19. Explain parasitism and co-evolution with the help of one example of each.

Ans. Mode of interaction between two species in which one species (parasite) depends on the other species (host) for food and shelter is called parasitism. In this one organism is benefitted and the other is harmed. For example, Human liver fluke or Malarial parasite or Cuscuta. Co-evolution is the relationship between two interacting organisms where an organisms fails to survive in the absence of the other. For example, Fig and fig wasp or Ophrys and bumble bee.

20. What is mutualism? Mention any two examples where the organisms involved are commercially exploited in agriculture.
Ans. Interaction between two species in which both are benefited is called mutualism. (i) Rhizobium in the roots (nodules) of legumes. (ii) Mycorrhiza → Glomus living with the roots of higher plants.

21. How does the Mediterranean orchid Ophrys ensure its pollination by bees?
Ans. The petals of the Ophrys resembles the female of a bee species in size, colour and odour, etc. Male bee mistakes the Ophrys for female bee and tries to copulate. Few pollen grains adhered with the body of the male bee fall over stigma of the flower thereby leading to pollination.

22. How do plants benefit from having mycorrhizal symbiotic association?
Ans. Mycorrhizal association is found between fungi and the roots of higher plants. The fungi help the plant in the absorption of essential nutrients from the soil while plant in turn provides energy yielding carbohydrates to fungi.

23. (a) How is Cuscuta adapted to be a parasitic plant? (b) Why do cattle avoid browsing on Calotropis plants? Explain.
Ans. (a) Cuscuta has lost its chlorophyll and leaves during evolution and thus it derives its nutrition from host plant, thus, it is a parasitic plant. (b) Cattle avoid browsing on Calotropis plants because it produces poisonous cardiac glycosides.

24. Why do clown fish and sea anemone pair up? What is this relationship called?
Ans. The clown fish gets protection from predators which stay away from stinging tentacles of anemone but anemone does not derive any benefit from the fish. This relationship is called commensalism.

25. Besides acting as 'conduits' for energy transfer across trophic levels, predators play other important roles. Justify.
Ans. Besides acting as 'conduits' of energy transfer across trophic levels, predators play other important roles like (i) They keep prey population under control. (ii) Predators also help in maintaining species diversity in a community by reducing the intensity of competition among competing prey species.

26. An organic farmer relies on natural predation for controlling plant pests and diseases. Justify giving reasons why this is considered to be a holistic approach.
Ans. Besides acting as 'conduits' for energy transfer across trophic levels, predators are used in biological control of plant pests. This ability of the predator is based on its regulating the prey population. The natural predators reduce interspecific competition and do not harm the crop plants. For example, in an area the invasive cactus can be brought under control by cactus-feeding predator (a moth). Using natural predation, the ecosystem is kept stable without harming any of the trophic levels.

27. Apart from being part of the food chain, predators play other important roles. Mention any two such roles supported by examples.

Ans. (i) Keeps prey population under control. For example, the invasive prickly. Pear cactus in Australia was brought under control only after a cactus feeding predator (a moth) was introduced in the country. (ii) Maintains species diversity by reducing intensity of competition among prey species. For example, when the starfish Pisaster was removed from its community of American Pacific Coast, more than 10 species of invertebrates became extinct.

28. Predation is usually referred to as a detrimental association. State any three positive roles that a predator plays in an ecosystem.
Ans. (i) They predators act as conduits for energy transfer across trophic levels. (ii) They keep prey populations under control. (iii) They help in maintaining species diversity in a community by reducing the intensity of competition among prey species.

29. (a) List the different attributes that a population has and not an individual organism. (b) What is population density? Explain any three different ways the population density can be measured, with the help of an example each.
Ans. (a) Attributes of population Birth rate, death rate, sex ratio, age pyramids/age distribution. (Any two) (b) Population density: Number of individuals per unit area at a given time/period (i) Biomass/%Cover, e.g., Hundred Parthenium plants and 1 huge banayan tree (ii) Relative Density, e.g., Number of fish caught per trap from a lake (iii) Numbers, e.g., Human population (iv) Indirect estimation, e.g., without actually counting/seeing them, e.g., tiger census based on pug marks and faecal pellets.

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