CHAPTER

11 ORGANISMS AND POPULATIONS

CLASS 12TH

NCERT EXERCISE AND SOLUTIONS - BIOLOGY

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Q. 1. List the attributes that populations possess but not individuals.

ANSWER:-

A population refers to a group of individuals of the same species living in a specific geographical area at a particular time, functioning as a unit. For instance, all humans residing in a specific location at a given time make up the human population.

The key attributes or characteristics of a population in each area include:

- **Birthrate (Natality):** This refers to the ratio of live births in an area relative to the total population. It is expressed as the number of individuals added to the population in relation to the existing population members.
- **Death rate (Mortality):** This represents the ratio of deaths in an area relative to the population, indicating the loss of individuals within the population.
- **Sex ratio:** This is the number of males or females per thousand individuals in a population.
- **Age Distribution:** This refers to the percentage of individuals in different age groups within a population. A population at any given time consists of individuals from various age groups, and the distribution is typically illustrated using age pyramids.
- **Population density:** Defined as the number of individuals of a population present per unit area at a given time.

Q. 2. If a population growing exponentially double in size in 3 years, what is the intrinsic rate of increase (r) of the population?

ANSWER:-

A population exhibits exponential growth when there is an ample supply of food resources for individuals. The exponential growth can be determined using the following integral form of the exponential growth equation:

$$N_t = N_o \cdot e^{rt}$$

From this equation, we can calculate the intrinsic rate of increase (r) for the population.

According to the question:

- Present population density = x
- Population density after two years = 2x

Where:

- N_t = Population density after time t (t = 3 years)
- N_o = Initial population density
- r = Intrinsic rate of natural increase
- e = Base of natural logarithms (2.71828)

Substituting the values into the formula:

$2x = x \cdot e^{3r}$

Simplifying:

$2 = e^{3r}$

Taking the logarithm of both sides:

$\log 2 = 3r \log e$

$(\log 2 / 3 \log e) = r$

$0.301 / 3 \times 0.434 = r$

$0.301 / 1.302 = r$

$= 0.2311$

Thus, the intrinsic rate of increase for the population is 0.2311.

Q. 3. Name important defence mechanisms in plants against herbivory.

ANSWER:-

Many plants have developed various morphological and chemical mechanisms to defend themselves against herbivory.

Morphological defense mechanisms:

- The leaves of the cactus (*Opuntia*) are modified into sharp spines (*thorns*) to discourage herbivores from feeding on them.
- *Acacia* plants possess sharp thorns along with their leaves to deter herbivores.
- Some plants have spiny or jagged leaf margins, which prevent herbivores from consuming them.

Chemical defense mechanisms:

- All parts of *Calotropis* weeds contain toxic cardiac glycosides, which can be fatal if ingested by herbivores.
- Plants produce chemical substances such as nicotine, caffeine, quinine, and opium as part of their self-defence strategy.

Q. 4. An orchid plant is growing on the branch of mango tree. How do you describe this interaction between the orchid and the mango tree?

ANSWER:-

An orchid growing on the branch of a mango tree is an example of an epiphyte. Epiphytes are plants that grow on other plants but do not derive nutrients from them. The relationship between the

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mango tree and the orchid is an example of commensalism, where one species benefits while the other remains unaffected. In this case, the orchid benefits by gaining support, while the mango tree is unaffected.

Q. 5. What is the ecological principle behind the biological control method of managing with pest insects?

ANSWER:-

Biological control methods are based on the concept of predation, which is a biological interaction where the predator feeds on the prey. In this interaction, predators help regulate the population of prey species in a habitat, thereby aiding in the control of pest insect populations.

Q. 6. Define population and community.

ANSWER:-

- **Population:** A population refers to a group of individuals of the same species living in a specific geographical area at a given time, functioning as a unit. For instance, all humans residing in a particular location at a specific time form the human population.
- **Community:** A community is a group of individuals from different species coexisting within a defined geographical area. These individuals may be similar or different, but they cannot reproduce with members of other species.

Q. 7. Define the following terms and give one example for each:

(a) Commensalism
(b) Parasitism
(c) Camouflage
(d) Mutualism
(e) Interspecific competition

ANSWER:-

(a) **Commensalism:** Commensalism is a type of interaction between two species in which one species benefits while the other remains unaffected. Examples include an orchid growing on the branches of a mango tree and barnacles attaching to the body of whales.

(b) **Parasitism:** Parasitism involves an interaction between two species where one species (usually smaller) benefits, while the other species (usually larger) is harmed. An example is the liver fluke, which lives inside the liver of its host and derives nutrition from it. While the parasite benefits, the host suffers, as the parasite weakens its body and reduces its fitness.

(c) **Camouflage:** Camouflage is a defence strategy used by prey species to avoid predators. Organisms are cryptically coloured to blend in with their surroundings, making it difficult for predators to spot them. Many species of frogs and insects use camouflage to evade predators.

(d) **Mutualism:** Mutualism is an interaction between two species in which both species benefit. For instance, lichens exhibit a mutualistic relationship between fungi and blue-green algae, where both organisms gain advantages from the association.

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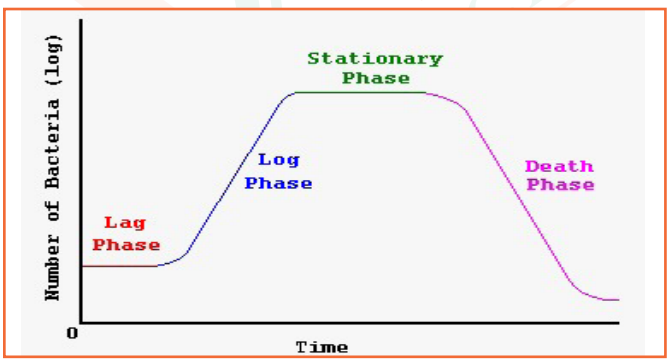
(e) **Interspecific Competition:** Interspecific competition occurs when individuals of different species interact in a way that negatively impacts both species. An example is the competition between flamingos and resident fish in South American lakes for shared food resources, such as zooplankton.

Q. 8. With the help of suitable diagram describe the logistic population growth curve.

ANSWER:-

The logistic growth curve of a population is typically observed in yeast cells cultivated under controlled laboratory conditions. This curve consists of five phases: lag phase, positive acceleration phase, exponential phase, negative acceleration phase, and stationary phase.

- **Lag Phase:** Initially, the yeast population is very small due to limited resources available in the environment.
- **Positive Acceleration Phase:** In this phase, the yeast cells begin to adapt to their new surroundings and start to increase in number. However, at the start of this phase, the growth rate is still relatively slow.
- **Exponential Phase:** During this phase, the population experiences rapid growth, as the yeast cells multiply exponentially. This is due to ample food resources, a stable environment, and the absence of interspecific competition, causing the growth curve to rise steeply.
- **Negative Acceleration Phase:** In this phase, environmental resistance increases, leading to a decrease in the population's growth rate. This is caused by heightened competition among yeast cells for limited resources like food and space.
- **Stationary Phase:** At this stage, the population reaches equilibrium, with the number of new cells produced equalling the number of cells that die. The population size stabilizes and reaches the habitat's carrying capacity.



A Verhulst − pearl logistic curve is also known as an **S-shaped growth curve**.

Q. 9. Select the statement which explains best parasitism.

(a) One organism is benefited.
(b) Both the organisms are benefited.
(c) One organism is benefited, other is not affected.
(d) One organism is benefited, other is affected.

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ANSWER:-

(d) One organism benefits while the other is offected.

Parasitism is an interaction between two species where one (the parasite) gains an advantage, while the other (the host) suffers. For example, ticks and lice (parasites) found on the human body exemplify this relationship, as the parasites benefit by feeding on the host's blood. In contrast, the parasites negatively impact the host's fitness, causing harm to the human body.

Q. 10. List any three important characteristics of a population and explain.

ANSWER:-

A population refers to a group of individuals of the same species living in a specific geographical area at a particular time, functioning as a cohesive unit. For instance, all humans residing in a particular location at a specific time make up the human population.

Three key characteristics of a population include:

- **Birth rate (Natality):** This is the ratio of live births to the total population in a given area, indicating the number of individuals added to the population relative to its current size.
- **Death rate (Mortality):** This is the ratio of deaths to the total population in a given area, reflecting the loss of individuals in relation to the total population.
- **Age Distribution:** This refers to the proportion of individuals of different ages within a population. At any given time, the population consists of individuals from various age groups, which are often represented through age pyramids.

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