

CLASS NOTES

Class: XII

Topic: ECOLOGY (ORGANISM AND POPULATION)

Subject: BIOLOGY

Predation

- It is an interspecific interaction where species A (predator), kill and consumes another species B (Prey).
- Roles of predators:
 - ✓ Acts as 'conduits' for energy transfer across trophic levels.
 - ✓ Keep prey populations under control.
 - ✓ Help in maintaining species diversity in a community, by reducing the intensity of competition among competing prey species.
- Examples:
 - ✓ Prickly pear cactus introduced into Australia caused havoc by spreading rapidly into millions of hectares of rangeland (Grassland, shrublands, woodlands, wetlands, and deserts that are grazed by domestic livestock or wild animals).
 - ✓ The invasive cactus was brought under control only after a cactus-feeding predator (a moth) from its natural habitat was introduced into the country.
- Experiment to show predator-prey inter-relationship:
 - ✓ In the rocky intertidal communities of the American Pacific Coast, the starfish *Pisaster* is an important predator.
 - ✓ In an experiment, when all the starfish were removed, more than 10 species of invertebrates became extinct within a year, because of interspecific competition.
- If a predator is too efficient and overexploits its prey, then the prey

might become extinct following it, the predator will also become extinct for lack of food.

- **Adaptations developed by the prey:**

- ✓ Some species of insects and frogs are cryptically-colored (camouflaged) to avoid being detected easily by the predator.

- ✓ The Monarch butterfly is highly distasteful to its predator (bird) because of a special chemical present in its body.

- ✓ Presence of thorns in certain plant species (Acacia, Cactus).

- ✓ Production and storage of toxic chemicals by plants.

1. Calotropis produces highly poisonous cardiac glycoside.

2. Nicotine, caffeine, quinine, strychnine, opium, etc., are produced by various plants.

8. Prey Adaptations – General

Prey have adaptations to detect and prevent being eaten by predators.



Parasitism:

- In this type of interaction where one of the two interacting species (parasite)

depends on the other species (host) for food and shelter.

- Majority of the parasites harm the host.

- They may reduce the survival, growth, and reproduction of the host and

reduce its population density.

- ✓ They might render the host more vulnerable to predation by making it physically weak.
- ✓ **Adaptation by the Parasite:**
- ✓ Loss of unnecessary sense organs.
- ✓ Presence of adhesive organs or suckers to cling on to the host.
- ✓ Loss of digestive system
- ✓ High reproductive capacity
- ✓ Parasitic life cycle involving one or two intermediate hosts:
- ✓ The human liver fluke depends on two intermediate hosts (a snail and a fish) to complete its life cycle.
- ✓ The malaria parasite needs a vector (Mosquito) to complete its life cycle.
- ✓ **Ectoparasites:** Parasites that feed on the external surface of the host organism.
- ✓ Example: Lice on human, Tick on dogs, Cuscuta: derives its nutrition from the host plant.
- ✓ **Endoparasites:** These are parasites that live inside the host body at different sites (liver, kidney, lungs, red blood cells, etc.)
- ✓ The life cycles of endoparasites are more complex because of their extreme specialization
- ✓ Examples: Tapeworm, Liverfluke, Plasmodium, Hookworm
- ✓ **Brood Parasitism:**
Observed in birds.
- ✓ The parasitic bird lays its eggs in the nest of its host and lets the host incubate them.
- ✓ The eggs of the parasitic bird have evolved to resemble the host's egg in size and color to reduce the chances of the host bird detecting the foreign eggs and ejecting them from the nest.
- ✓ Eg: -Cuckoo and crow

Parasitism

- Parasite benefits, host is harmed.
- Ecto – outside



Endo- inside



Brood Parasitism

The laying, or physical transport, of eggs of one species into the nest of a second species, where they receive parental care



Competition:

- ✓ Competition occurs when closely related species compete for the same resources that are limiting.
- ✓ Totally unrelated species could also compete for the same resource.
- ✓ In some shallow South American lakes visiting flamingoes and resident fishes compete for their common food, the zooplankton in the lake.
- ✓ Resources always need not be limiting for competition to occur.
- ✓ The feeding efficiency of one species might be reduced due to the interfering and inhibitory presence of the other species, even if resources (food and space) are abundant.
- ✓ Example: The Abingdon tortoise in Galapagos Islands became extinct within a decade after goats were introduced on the island, apparently due to the greater browsing efficiency of the goats.

✓ Competitive release:

✓ A species whose distribution is restricted to a small geographical area because of the presence of a competitively superior species is found to expand its distributional range dramatically when the competing species is experimentally removed.

✓ Example: The larger and competitively superior barnacle *Balanus* dominates the intertidal area and excludes the smaller barnacle *Chthamalus* from that zone.

✓ Competition is best defined as a process in which the fitness of one species (measured in terms of its 'r' the intrinsic rate of increase) is significantly lower in the presence of another species.

✓ **Gause's Competitive Exclusion Principle:**

✓ Two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually.

✓ Resource partitioning:

✓ If two species compete for the same resource, they could avoid competition by choosing:

1. Different times for feeding or different foraging patterns.

2. Eg.: Five closely related species of warblers could live on the same tree and were able to avoid competition and co-exist due to behavioral differences in their foraging activities.

Red & Grey Squirrels



Grey Squirrel Range



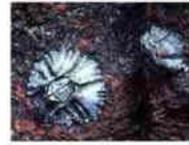
Red Squirrel Range



- **Interspecific competition**
- **The Grey Squirrel** (*Sciurus carolinensis*) was introduced to Britain in about 30 sites between 1876 and 1929. It has easily adapted to parks and gardens replacing the red squirrel.
- **The Red Squirrel** (*Sciurus vulgaris*) is native to Britain but its population has declined due to competitive exclusion, disease and the disappearance mature conifer forests in lowland Britain.

Maps prepared by the Biological Records Centre, CEH Munkia Wood, from records collated by the Mammal Society and others mainly between 1956 and 1993, also including earlier, published records and a few additions up to 1997.

Barnacles and Competition



Observational evidence suggested that the distributions of *Balanus* and *Chthamalus* only partly overlapped. Were they each adapted to live in different regions of the inter-tidal zone (occupy different niches?)

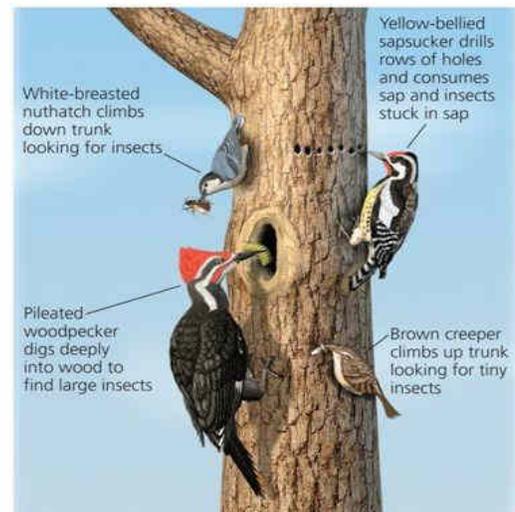
Further observation revealed that larvae of both species settled throughout the inter-tidal zone. Larvae of *Balanus* died out in the upper regions, larvae of *Ch.* Dies out in the lower reaches.

When larvae that had settled on flat rocks were transplanted (ie, the rocks were moved), and other species prevented from colonizing, *Balanus* still died out in the upper inter-tidal, but *Ch.* thrived in the lower inter-tidal.

Resource partitioning

In competitive relationships, each participant has a negative effect on the other participant.

- To reduce competition and coexist, species can use a resource in slightly different ways.
- **Resource partitioning:** when species divide shared resources by specializing in different ways
 - Examples: one species is active at night, another in the daytime; one species eats small seeds, another eats large seeds



Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings

Commensalism:

- ✓ In this kind of interaction one species benefits and the other is neither harmed nor benefited.
- ✓ Example:
- ✓ An orchid growing as an epiphyte on a mango branch.
- ✓ Barnacles growing on the back of a whale.
- ✓ The cattle egret and grazing cattle.
- The cattle egrets are benefitted by the cattle to detect insects because cattle stir up the bushes and insects gets flushed out from the vegetation, to be detected by the cattle egrets.
- ✓ The Clownfish and Sea Anemone:
- The fish gets protection from predators which stay away from the stinging tentacles of the Sea Anemone.
- In the above examples, the mango tree, whale, cattle and Sea anemone –
neither of them derive any benefit by hosting other organisms, nor do they get any harm.

Cattle egret and cows



The cattle egret and cows are an example of commensalism because whenever cows and other such livestock are in the fields, they tend to move insects that have been nestling on the grass. The cattle egret then catches them and preys upon them. The cattle egret gets a benefit from this because they manage to get the insects that they wish to prey on and the cow (or other livestock) remains unaffected or unharmed.

Examples of Commensalism

- Remoras hitch a ride and feed on scraps of food left by sharks. The remoras benefit from this relationship while sharks are unaffected.



Mutualism:

- In this kind of interaction both the interacting species derive benefits from each other.

- Examples:

- ✓ **Lichens:** An Intimate mutualistic relationship between a fungus and photosynthesizing algae or cyanobacteria.

- ✓ **Mycorrhizae:** Associations between fungi and the roots of higher plants.

1. Fungi help the plant in the absorption of essential nutrients from the soil.

2. The plant provides the fungi with energy-yielding carbohydrates.

- ✓ **Pollination:**

- Plants need the help of animals for pollinating their flowers and dispersing their seeds.

- Plants offer rewards in the form of pollen and nectar for pollinators and juicy and nutritious fruits for seed dispersers

- ✓ **Co-Evolution of Mutualists:**

- In many species of Fig trees, there is a tight one-to-one relationship with the pollinator species of wasp.

- Fig species can be pollinated only by its 'partner' wasp species and no other species.

- The wasp pollinates the fig inflorescence while searching for suitable egg-laying sites.

- The female wasp uses the fruit not only as an oviposition (egg-laying) site but uses the developing seeds within the fruit for nourishing its larvae.

- ✓ **Pseudocopulation: (Co-evolution)**

- The Mediterranean orchid *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee.

- One petal of its flower bears an uncanny resemblance to the female of the bee in size, color, and markings.
- The male bee is attracted to what it perceives as a female, 'pseudocopulates' with the flower, and during that process is dusted with pollen from the flower.
- When this same bee pseudocopulate with another flower, it transfers the pollen to it and thus pollinates.



Mutualism



A relationship in which both species benefit.

Example: Bees and Flowers

Bees rely on the flower for a food source. The flower benefits because the bee picks up pollen and transports it to another flower. This aids in the reproduction of the plant.



Mutualism

- An interspecific interaction that benefits **BOTH** species
- They exchange **food** or provide **shelter** or protection, but may still be able to live an independent life



In return for shelter, the clownfish cleans the anemones, chasing away their predators and dropping scraps of food for the anemone to eat

MUTUALISM VERSUS COMMENSALISM

Mutualism is a type of symbiotic relationship among two or more different species where both species benefit	Commensalism is a type of symbiotic relationship where only one species benefits and the other is unaffected
Both species receive benefits	Only one species receive benefits
Examples include the relationship between bees and flowers, digestive bacteria and humans, oxpeckers and zebras, etc.	Examples include hermit crabs using dead gastropods for their protection, millipedes traveling on birds, etc.

Visit www.pediaa.com

PREDATION VERSUS PARASITISM

Predation refers to the act of preying of one animal on another animal	Parasitism refers to the practice of living as a parasite on or with another animal or organism
Occurs between a predator and a prey	Occurs between a parasite and a host organism
May have several types of preys	A very specific relationship
Lacks any type of metabolic dependency on the prey	Metabolically depends on the host organism
Predator is generally larger and stronger than the prey	Parasite is smaller than the host organism
Predator is very active and uses intense physical effort to catch the prey	Parasite is generally passive in its progression
Predator immediately kills the prey	Parasite does not immediately kill the host
Life cycles of predator and prey are independent of each other	Parasite requires the host in order to complete its life cycle
Ex: lion and zebra, bear and fish, etc.	Ex: lice on humans, tapeworms in cows. etc.
	Visit www.pediaa.com

*Note: This content has been prepared from home.
(All images- Courtesy Google)*