Heterotrophic Nutrition in Plants

Most plants can and are called make their own food Autotrophs. However, their are many plants which lack chlorophyll. They are unable to make their own food. There are some green plants which fulfil a part of their nutrient requirements from the protein-rich body of insects.

**Plants which obtain their food from other sources are called Heterotrophic plants.**

**Such mode of nutrition in plants is called heterotrophic mode of nutrition.**

Depending on the source of nutrition, heterotrophic plants are categorized as

- Parasitic Plants or parasites
- Saprotrophs
- Symbionts or symbiotic plants
- Carnivorous or insectivorous plants

**Parasitic Plants or Parasites**

Parasites absorb their food from other living organisms. Organisms from which parasites absorb their food is called host. For absorbing food from the host, they develop special sucking roots called haustoria. These haustoria penetrate deep into stem or the roots of host plant to absorb food.

**Some examples of parasites are discussed bellow:**

**Cuscuta** is commonly known as Dodder. It is a non green, thread like golden yellow plant. It cannot synthesize its own food as it lacks chlorophyll and leaves. It obtains its nutrition from other plants on which it climbs. It develops special small roots, called haustoria, which penetrate into the stem and branches of the host to suck food from it. It leaves the host plant deficient of essential nutrients, so it called parasite.

We also called cuscuta as total stem parasite because it derives its entire nutrition from the stem of the host.
RAFFESIA (Biggest flower in the world)

Rafflesia, another parasitic plant, is known for its largest flower in the world. It is found in rainforests of Sumatra and Borneo. This parasitic plant lacks stem, leaves and proper roots. It has a thread-like haustorium for absorbing nutrients from the roots of Vines in the forests of Sumatra (East Indies). It is a total root parasite as it depends entirely on roots of the host plant to obtain its nutrition.

Viscum (commonly known as Mistletoe) is a rootless parasite bearing large leathery green oval leaves in pairs. It grows on the branches of trees like Oak, Walnut, Juniper, etc. Its haustorium penetrates into the stem of the host and absorbs only liquid food from it. Being a green plant, Viscum can make its own carbohydrate food with the help of its green leaves. Thus Viscum is a partial stem parasite as it is partially dependent on stem of host for its liquid nutrition.

Test your learning outcome

1. What are heterotrophic plants?
2. What are parasites? Name a stem parasite and a root parasite.
3. Why do we say that
   (a) Cuscuta is a total stem parasite?
   (b) Viscum is a partial stem parasite?
   (c) Rafflesia is a total root parasite?
4. What is haustorium?
Saprotrophs

- Saprotrophs (sapro means rotten; trophe means mode of nutrition) lack chlorophyll and obtain their food from dead and decaying plant and animal bodies. Saprophytes include microorganisms like fungi and bacteria. Most common saprophytic fungi include mushrooms, moulds that grow on stale food such as bread and pickles, etc.

- Some commonly moulds are Mucor, Rhizopus, Penicillium, and Aspergillus. Moulds may bear spores of different colours, may be pale, yellow black, blue-green or blue. Saprophytes secrete digestive juices on dead matter to convert it into soluble form and then absorb it as their nutrition. This mode of nutrition is called Saprotrophic nutrition.

- Monotropa (Indian pipe) and certain orchids and some saprotrophic flowering plants. These saprotrophic plants are incapable of absorbing nutrients directly from dead and decaying matter. Their roots associate themselves with fungal mass which assist them in absorbing soluble nutrition from dead and decaying matter.

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**Activity 6**

**Aim:** To study the growth of bread mould

**Materials required:** A slice of bread, a cardboard box, water, plate, and a magnifying glass

**Procedure:**
1. Take a fresh slice of bread and moisten it slightly with water.
2. Place the slice on a plate and keep it in a closed cardboard box at a warm place. Leave the box undisturbed for 3-4 days.
3. After 3-4 days open the box carefully and observe the slice of bread through a magnifying glass.

**Observation:** You will see some white cottony stuff growing on the bread slice. If you see it through magnifying glass, you find fine thread-like structures.

**Inference:** The white cottony growth is the bread mould, a saprophytic fungus. The thread-like structures are the hyphae (branches) of the fungus. Moulds can be seen growing on moist stale bread, decaying vegetables and fruits, animal dung and other humid organic matter, including wet leather. Moulds may be found bearing globular sporangia (the spore bearing bodies) growing up vertically.
Some interesting Saprotrophs

There are some fungus plants which grow and feed on the body of the insects and may finally kill them. These fungi belong to the group entomophthorales (entomo meaning insects). Then there are certain saprotrophic fungi which grow and multiply on the dead body of animals.

Test your learning outcome

1. What are saprophytes?
2. Name any two common saprophytic fungi?
3. How do saprophytes derive their nutrition from dead organic matter?

Symbionts or Symbiotic Plants

Another heterotrophic mode of nutrition is the one where two different types of organisms live together to benefit from each other. Such organisms are called symbionts and their association is known as symbiotic association or symbiosis. In this symbiotic association, fungus helps the green alga (autograph) to survive in very harsh conditions by providing water and minerals in exchange of the carbohydrate food from it.
Carnivorous or Insectivorous Plants

Carnivorous plants are green plants that are able to make their own food but they grow in soil that lack mineral nutrients especially nitrogenous nutrients. These plants trap insects, kill them, digest and absorb the nitrogenous nutrition (proteins) from their body with the help of their modified leaves and make up for the deficiency of nitrogen from the soil. Some of the examples are Pitcher plant, Sundew, Venus fly trap & Bladderwort.
The tip of green leaf of pitcher plant (or *Nepenthes*) is modified into tubular pitcher-like structure with a lid. The bottom of the pitcher has sweet digestive juice which attract insects to get into the pitcher. From inside, the pitcher is lined with downward pointing hair which do not allow the visiting insect to escape. The insect slips down and gets drowned in the juice where it gets killed & the nutrients from the insect bodies are absorbed into the leaf.

**Sundew**

Leaves of Sundewv (or *Drosera*) are covered with numerous sensitive glandular hair which glitter in the sun as dew-drops, hence the plant has its name. Insect which comes in contact with these hair gets entangled, killed and the nutrients are absorbed into the leaves.

**Venus fly trap**

Leaves in Venus fly trap (or *Dionaea*) are green with extended flat petiole. The petiole bears a leaf blade that is divided into a pair of terminal lobes hinged at the midrib. The upper surface of the lobes contain a red pigment and stiff sensitive glandular hairs. As soon as an insect comes in contact with the hair of the leaf, the two lobes of the leaf get closed. It kills and digest the insect, and absorb nutrients from its body.
Utricularia or Bladderwort

Bladderwort is an aquatic plant. The leaves of the plant are modified into small bladders with trap-door entrance. These bladders allow entery but not the exit of the insect. An insect coming near the mouth of the blader is sucked into it, is killed and digested.

HOW IS SOIL ENRICHED WITH NUTRIENTS?

Plants obtain mineral nutrients from soil. Nitrogen, phosphorus and potassium are the prime nutrients required by plants for their growth and nutrition. They absorb these minerals along with water from soil through their roots. When a crop is harvested, the soil becomes nutrient deficient, especially in nitrogen. In forests, the nutrients are replenished naturally by decay and decomposition of plants and animals. In farms, mineral nutrients should be replenished in the soil before another crop is planted on the same soil. The soil can be replenished as follows:

By Adding Manure and Fertilizers to the Soil

We can add manure and fertilizers to the soil. They are source of mineral nutrients for plants. Manure and compost are prepared from decaying dead leaves, plant material and animal droppings (dung and urine). Synthetic or chemical fertilizers are prepared in factories. For example, NPK is a fertilizer which includes nitrogen, phosphorus and potassium. These nutrients are required for healthy growth of plants. Urea is the nitrogen-rich fertilizer which is used in large amounts. It also comes from urine of the animals.

Enriching Soil with Nitrogenous Nutrition by the Growth of Leguminous Crops

Nitrogen is required for healthy growth of plants. As we have learnt earlier in this chapter that leguminous plants are a good source of nitrogen nutrition for plants. Plants such as beans and pulses, bear nodules on their roots. These nodules contain certain symbiotic, nitrogen fixing bacteria, called Rhizobium. These bacteria change the atmospheric nitrogen into soluble nitrates, a usable form of nitrogen for plants.
**Differences Between Autotrophs and Heterotrophs**

<table>
<thead>
<tr>
<th>Autotrophs</th>
<th>Heterotrophs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. They prepare their own food by the process of photosynthesis.</td>
<td>1. They cannot prepare their own food. They depend on plant parts and other sources (like animals) for food.</td>
</tr>
<tr>
<td>2. They contain chlorophyll in their cells.</td>
<td>2. They may or may not contain chlorophyll.</td>
</tr>
<tr>
<td>3. They depend on sunlight for the production of food.</td>
<td>3. They do not need sunlight to obtain their nutrition.</td>
</tr>
<tr>
<td>4. They are also called producers.</td>
<td>4. They are also called consumers.</td>
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**Good to Know**


2. In many big trees, fungus lives in symbiotic association with root cells of trees. Fungus supplies nitrogenous food to the tree by fixing atmospheric nitrogen and in exchange, it derives water and carbohydrate food from the tree. This association is also known as mycorrhiza (myco means fungus; rhiza means root). If fungal hyphae penetrates the root cells, it is called endomycorrhiza. If fungal hyphae do not penetrate the root cells, it is called ectomycorrhiza.
**TERMS AT A GLANCE**

- **Autotrophs**: Organisms which make their own food
- **Heterotrophs**: Organisms which obtain their food from other sources
- **Photosynthesis**: Process of making food by using sunlight, chlorophyll, carbon dioxide and water
- **Parasite**: Organism which partially or completely depend on another organism for food
- **Host**: Organism on which the parasite depends for food
- **Saprophytic plants**: Plant that obtains its nutrition from dead and decaying plant or animal matter
- **Symbionts**: Two organisms that live in association for mutual benefit with respect to food and other resources

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**Exercises**

**Objective Type Questions**

**A. Multiple choice questions.**

1. First product of photosynthesis is  
   a. Starch  
   b. Glucose  
   c. Oil  
   d. Protein

2. Which one of the following is an autotroph?  
   a. Cuscuta  
   b. Tomato  
   c. Mucor  
   d. Mushroom

3. Which one of the following is a parasite?  
   a. Rafflesia  
   b. Sunflower  
   c. Nepenthes  
   d. Mushroom

4. The relationship between root nodules on bean plant and *Rhizobium* bacterium is  
   a. Saprophytic  
   b. Parasitic  
   c. Symbiotic  
   d. None of these

5. Insectivorous plants grow in soil that is deficient mostly in  
   a. Nitrogen  
   b. Phosphorus  
   c. Potassium  
   d. Water
B. **Match the following:**

**Column ‘A’**

1. Pore through which carbon dioxide is taken in from air into the leaf
2. A total stem parasite
3. Process of synthesizing food in green plants
4. First stored food in green leaf
5. A partial stem parasite
6. A symbiont

**Column ‘B’**

a. Rhizobium
b. Stoma
c. Starch
d. Cuscuta (*Amarbel*)
e. Mistletoe
f. Photosynthesis

C. **Fill in the blanks.**

1. Taking food in and utilizing it by an organism is called ________________.
2. Test for starch with iodine solution is termed as ________________.
3. Nitrogen nutrition by *Nepenthes* plant is obtained from ________________.
4. Green plants synthesize food and give out ________________ and ________________.
5. Mode of nutrition in non-green *Mucor* (fungus) is ________________.

D. **State whether ‘true’ or ‘false.’**

1. Chlorophyll is soluble in water.
2. Mistletoe plant is a total parasite.
3. *Drosera* plant is an insectivore.
4. Haustoria help a parasite in sucking nutrition from the body of the host plant.
5. Stomata on leaves remain open during night and close during the day.

E. **Give one word for the following:**

1. The components of food that provide nutrition.
2. The organisms capable of making their own food.
3. The organisms which obtain food from others.
4. The green-coloured pigment in plants that helps in photosynthesis.
5. The pores on the undersurface of green leaves.
6. A leafless, rootless non-green plant which obtains its complete food from an autotroph.
7. The organisms living together for mutual benefit.
Theoretical Questions

A. Short answer type questions.

1. How nutrition serves living organisms?

2. What is the role of chlorophyll in the process of photosynthesis?

3. List the conditions necessary for photosynthesis.

4. What is bleaching of leaf? Why it is necessary to do before conducting tests for presence of starch?

5. What is lichen? Explain the kind of association the lichen has?

6. How is soil enriched with nitrogenous nutrients?

B. Long answer type questions.

1. Where do we find chlorophyll in the plant? Why is it essential for photosynthesis? Explain with the help of suitable set up.

2. How will you show that during photosynthesis green plants give out oxygen?

3. Describe the mode of nutrition in Nepenthes.

4. Differentiate between the following:
   - Autotroph & heterotroph
   - Total parasite and partial parasite
   - Parasite and insectivore plant

5. Write short on:
   - Essentials for photosynthesis
   - Saprophytes