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CHAPTER 1

Nutrition in Plants

Introduction

- Mode of nutrition
- Autotrophic nutrition
 - Photosynthesis
- Heterotrophic nutrition
 - Parasitic plants
 - Insectivorous plants
 - Saprophytic plants
 - Symbiotic plants
- Replenishment of nutrients



We have already learnt in the previous class that all living beings need food. We have learnt that various components of our food are carbohydrates, fats, proteins, vitamins, minerals, roughage and water. These components of food are called **nutrients**. They provide us with energy and help us to perform various life activities.

Plants can prepare their own food, but animals and human beings cannot do so and obtain food from plants or animals that eat plants. Thus, animals and humans directly or indirectly depend upon plants for food.

MODE OF NUTRITION IN PLANTS

The process of taking in food by an organism and its utilisation by the body is called **nutrition**. All living organisms need energy to perform various activities. They get this energy from food. The food which they eat is broken down into simple substances to get energy. The mode of nutrition in all living organisms can be divided into two categories based on their food habits.

- Autotrophic
- Heterotrophic

AUTOTROPHIC NUTRITION

The mode of nutrition in which organisms make their own food from simple inorganic substances is called **autotrophic nutrition** (auto = self, and troph = nourishment). We have already studied that green plants make their own food through a process called **photosynthesis**. Hence green plants are called **autotrophs**.

HETEROTROPHIC NUTRITION

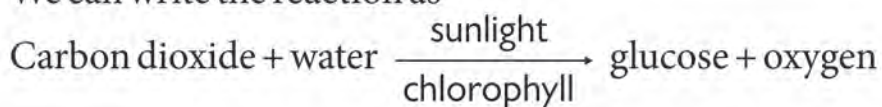
The mode of nutrition in organisms that cannot make their own food and depend upon others is called **heterotrophic nutrition** (heteros = others). Animals including man which depend on plants for their food are called **heterotrophs**.

We shall now learn how green plants make their own food? Which parts of the plant make the food? From where do they get the raw materials? How is the food transported to the various parts of the plant?

PHOTOSYNTHESIS

In green plants, leaves prepare the food. They are the food factories of the plant. Since the leaves prepare food, it is necessary that the raw materials must reach there. They make their own food from carbon dioxide and water in the presence of chlorophyll (a green pigment) and sunlight. This process is called photosynthesis (Photo = light, synthesis = to combine)

We can write the reaction as



The following four things are required for photosynthesis :

CHLOROPHYLL

It is the green pigment present in the leaves. It is found in structures called **chloroplasts**. It helps leaves to capture the energy of the sunlight, which in turn is used to synthesise food from carbon dioxide and water.

SUNLIGHT

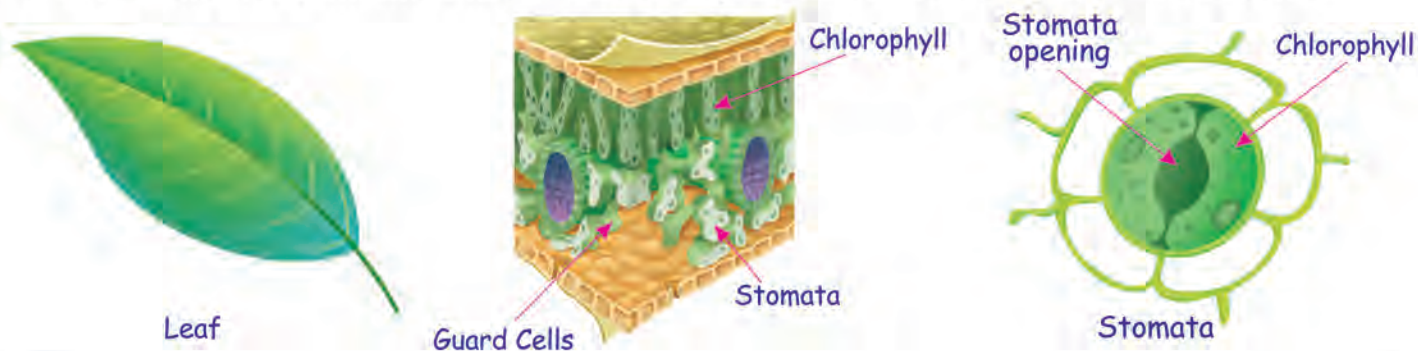
Light energy is absorbed by the chlorophyll.

CARBON DIOXIDE

The leaves absorb carbon dioxide from air through tiny pores present on their surface called **stomata**. They are surrounded by **guard cells**, which regulate the opening and closing of the stomata.

WATER

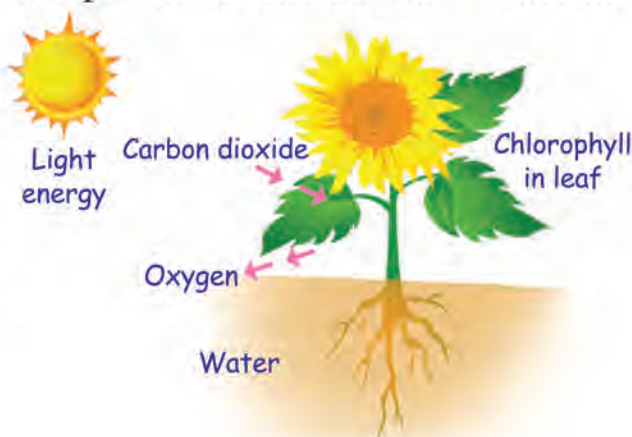
Water and minerals from the soil are absorbed by the roots and transported to the leaves.



This transportation takes place through pipe like vessels present in the roots, the stems, the branches and the leaves.

During photosynthesis solar energy of the sun is converted into chemical energy. This shows that sun is the ultimate energy for all living organisms. You must have seen from the above equation, that oxygen is a by-product of photosynthesis, which is so essential for the survival of all living organisms.

The carbohydrate is converted into starch.



Process of Photosynthesis

CACTUS PLANTS

The desert plants like cacti have spines instead of leaves. This is to reduce loss of water by transpiration. Cacti have green stems which carry out photosynthesis.

Photosynthesis can take place in green stems and green branches also.



Activity - 1

Take two potted plants with green leaves. Keep one plant in the sun and the other in a dark room. Perform the iodine test with the leaves of both the plants after 48 hours. Now keep both the pots of plants in sunlight. Repeat the iodine test after 3–4 days. Note down your observations? What do you conclude?

PHOTOSYNTHESIS IN PLANTS WITH COLOURED LEAVES

You must have seen plants with red, brown or violet leaves. These plants also contain chlorophyll. However, the amount of red, brown or yellow pigment present in these leaves masks the green colour. Photosynthesis takes place in these coloured leaves also.



Facts to know

Some plants like money plants, crotons have white and green part in the same leaf. Photosynthesis does not take place in the white part.

ALGAE

Have you seen green patches on the surface of ponds or lakes. These are due to the growth of organisms called **algae**. They are green in colour as they contain chlorophyll. They too can manufacture their own food through photosynthesis.

Synthesis of Nutrients Other Than Carbohydrates

As we have seen plants produce carbohydrates. They are made up of carbon, hydrogen and oxygen. They are used for the synthesis of proteins and fats. For the synthesis of proteins plants also require nitrogen. From where do they get this nitrogen from? Although nitrogen is present in air up to approx. 78%, plants cannot use this free nitrogen. There are some nitrogen-fixing bacteria in the soil which convert this free nitrogen into a form which can be used by the plants. The plants absorb this soluble form along with water through its roots. Farmers also add fertilizers, rich in nitrogen to the soil. Plants are then able to synthesise other components of food like fats and proteins.

Let's Remember

Give one word for each one of the following.

1. Define autotrophs and heterotrophs.
2. Where is chlorophyll found in plants?
3. Is man an autotroph or a heterotroph?
4. Where do you find guard cells?

HETEROTROPHIC NUTRITION

How do plants which do not contain chlorophyll derive their nutrition from? These plants depend on other plants for food as they cannot synthesise their own food. They use the **heterotrophic mode** of nutrition.

Heterotrophic plants are of four types:

1. Parasitic plants
2. Insectivorous plants
3. Saprophytic plants
4. Symbiotic plants

Parasitic Plants

Plants which live on other living organisms and obtain their food from them are called **parasitic plants**. The organism from which a parasite derives its nutrient from is called a **host**.

Examples: Cuscuta (amarbel). It does not produce chlorophyll. It has yellow tubular structures which wrap around the stem and branches of a tree. It takes ready made food from the tree on which it climbs. Other example is **mistletoe**.



Facts to know

Giant Water lilies in Amazon can grow upto 6 feet in diameter.



Cuscuta on host plant



Mistletoe on host plant



Pitcher plant showing pitcher and lid

Insectivorous Plants

There are some plants which can even eat insects. They are called **insectivorous plants**. These plants are usually green in colour and leaves of these plants are modified to trap the insects.

Examples: Pitcher plant and Venus fly trap. In pitcher plant, the leaves are modified into a pitcher like-structure with a lid. The tip of the leaf is modified to form a lid which can open and close the mouth of the pitcher. The inside of the pitcher is lined with downward pointing hair that do not allow the trapped insect to escape. The lid closes, once an insect enters the pitcher. The

pitcher secretes digestive juices that digest the insect. Have you wondered that if the pitcher plant is green, then why does it need to feed on insects? This is because the pitcher plants grow in areas where the soil is deficient in nitrogen. It gets nitrogen by trapping and eating insects.

Saprophytic Plants

Saprophytes are those organisms which cannot make their own food and obtain their nutrition from dead and decaying plant and animal matter. These plants have no leaves at all. They cannot carry out photosynthesis. Examples are mushrooms, mould and yeast.

You must have seen umbrella like structures growing on logs of wood during the rainy season. These structures are called **Mushrooms**. They secrete digestive juices on the dead and decaying matter and convert it into a solution. They then absorb the nutrients from it. The mode of nutrition in such plants is **saprophytic nutrition** and the plants are called **saprophytes**.



Mushroom



Activity - 2

Take a piece of bread and moisten it with water. Keep it in a closed box in a warm place, for 2–3 days. Observe the piece of bread. You will notice a white cottony growth on the piece of bread. This growth is due to a fungus called **bread mould**. They appear as cotton like threads if observed with a magnifying glass.



Bread mould

In the rainy season you must see white patches on your unused shoes and bags which have been left in the hot and humid weather. These white patches are also due to fungi.

The spores of fungi circulate in the air. When they settle on wet and warm things they germinate and begin to grow.

Symbiotic Plants

Some plants live in association with other organisms and share shelter and nutrients. Both the plants gain from each other. Such plants are called **symbiotic plants**, and the relationship is called **symbiotic relationship**.

Symbiotic Relationship

Example: Certain fungi live in the root of trees. The tree provides nutrients to the fungi. The fungi in return provides certain nutrients from the soil to the tree.

Another example is of lichens— It is a green algae and a non green fungus. The algae is an autotroph and provides food to the fungus. Fungus provides shelter, water and minerals from the soil to the algae.



Lichens



Rhizobium-the roots of a leguminous plant



Facts to know

Mushroom is a fungi. All varieties of mushroom are not edible. Some are extremely poisonous.

Let's Remember

Give one word for each one of the following.

1. Do mushrooms have leaves?
2. Give examples of parasitic plants and insectivorous plants.
3. What do you mean by a host?
4. Which bacteria lives in the roots of leguminous plants?

REPLENISHMENT OF NUTRIENTS IN THE SOIL

Plants get nutrition from the soil. Since crops/plants are continuously grown in the soil, the amount of nutrients in the soil decline. Manures and fertilizers are added by the Farmers to replenish the nutrients in the soil. They contain nutrients like nitrogen, potassium, phosphorous, magnesium etc. These nutrients need to be added from time to time to maintain the fertility of the soil and for healthy crops and yield. Usually crops require a large amount of nitrogen. We can grow leguminous plants like gram, moong, beans, peas etc in the fields. Rhizobium bacteria which lives in the roots of leguminous plants can take in atmospheric

nitrogen and convert it into a soluble form in the soil. Rhizobium cannot prepare its own food. These leguminous plants provide food to it. Thus a symbiotic relationship exists between leguminous plants and Rhizobium. In this way, the farmers do not need to add nitrogen for

Glossary

nutrition	: the mode of taking food by an organism and its utilisation by the body
autotrophic	: the mode of nutrition in which organisms make food for themselves from simple substances
insectivorous	: insect eating plants which usually grow in nitrogen deficient soil
chlorophyll	: green pigment present in the leaves which help in the photosynthesis process
parasite	: the organism which lives on or in other organism
host	: the organism on which parasite grows or survives
stomata	: the openings present in the leaves

Summary

- ◇ All living organisms need food. Food provides energy for growth and maintenance.
- ◇ Green plants are autotrophic as they prepare their own food by the process of photosynthesis.
- ◇ Four things are required for photosynthesis-carbon dioxide, water, sunlight and chlorophyll.
- ◇ During photosynthesis solar energy of the sun is converted into chemical energy which is stored in the leaves form of food.
- ◇ Some plants depend on other plants for food as they cannot synthesise their own food. They are called heterotrophs.
- ◇ Heterotrophic plants are of four types-parasitic, saprophytic, insectivorous and symbiotic plants.
- ◇ The nutrients in the soil need to be replenished regularly.



Exercise

A. Multiple Choice Questions (MCQs)

Tick (✓) the right option.

1. During photosynthesis solar energy is converted into _____.
- | | | | |
|---------------------|--------------------------|-----------------------|--------------------------|
| (a) light energy | ☐ | (b) mechanical energy | ☐ |
| (c) chemical energy | ☐ | (d) electrical energy | ☐ |

2. By-product of photosynthesis is _____.
 (a) oxygen ☐ (b) water ☐
 (c) carbon dioxide ☐ (d) nitrogen ☐
3. This is a symbiotic plant _____.
 (a) mistletoe ☐ (b) venus fly trap ☐
 (c) lichen ☐ (d) mushroom ☐
4. This can convert free nitrogen into a soluble form _____.
 (a) mushroom ☐ (b) bread mould ☐
 (c) yeast ☐ (d) rhizobium ☐
5. Amarbel is an example of _____.
 (a) autotroph ☐ (b) parasite ☐
 (c) saprophyte ☐ (d) insectivore ☐

B. Write 'T' for true and 'F' for false statements.

1. Oxygen is used for photosynthesis.
2. All plants can prepare their own food.
3. Saprophytes cannot prepare their own food.
4. The mode of nutrition in lichens is symbiotic.
5. Plants also need nitrogen for growth.

C. Fill in the blanks with the correct words.

starch soil chlorophyll energy cacti

1. _____ is the green pigment present in the leaves.
2. Light _____ is absorbed by the chlorophyll.
3. The carbohydrate is converted into _____.
4. _____ have green stems which carry out photosynthesis.
5. Plants get nutrition from the _____.

D. Answer the following questions in short.

1. What is the difference between a parasite and a saprotroph?
2. Why cannot all plants prepare their own food?
3. What is the mode of nutrition of an algae?
4. What is common between a mushroom and a bread mould?
5. What are the requirements of photosynthesis?

E. Answer the following questions.

1. Describe the role of leaves in photosynthesis.
2. What is symbiosis? Explain with the help of an example.
3. How are the leaves of the pitcher plant modified to catch insects?
4. Why are saprophytes called cleaners of the environment?
5. Why do farmers grow leguminous crops after harvesting of cereals?



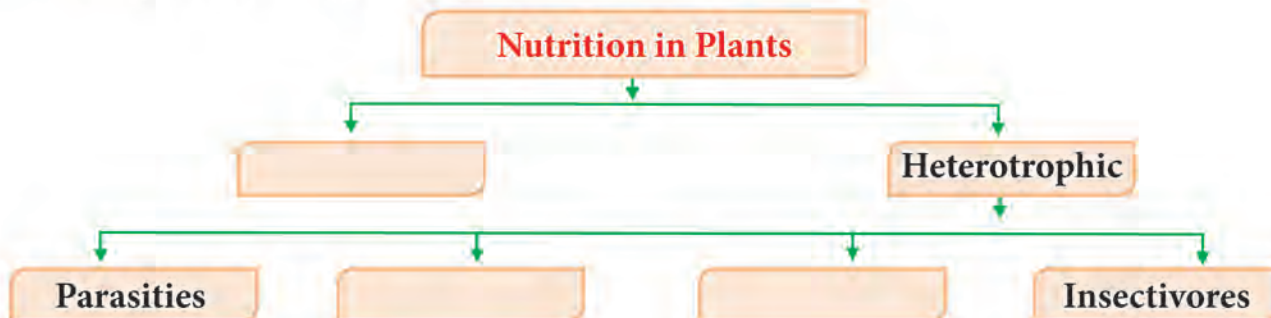
HOTS (Think and Answer)

1. Why do you think we say a pitcher plant is both an autotroph and a heterotroph?
2. What do you think will happen if you coat the leaves of a green plant with oil?



Let's Recall

Complete the following diagram.



Group Discussion

1. A plant without a chlorophyll cannot survive.
2. Insectivorous plants have different mode of nutrition than parasites.



Activity to do

Conduct an experiment to see that carbon dioxide is needed for photosynthesis.

- ⦿ Take a healthy potted green plant. Keep it in a dark room for 5-6 hours. Water it.
- ⦿ Take a conical flask. Pour potassium hydroxide solution into it. This solution absorbs carbon dioxide from the air.
- ⦿ Now place one of the leaves while on plant, inside the flask as shown in the figure. Do not break the leaf. Close the mouth with a cork.
- ⦿ Keep the plant along with the flask in the sun.
- ⦿ After a few hours, test this leaf which was in the flask and another leaf from the plant for starch.
- ⦿ Note down your observations :
What do you conclude?



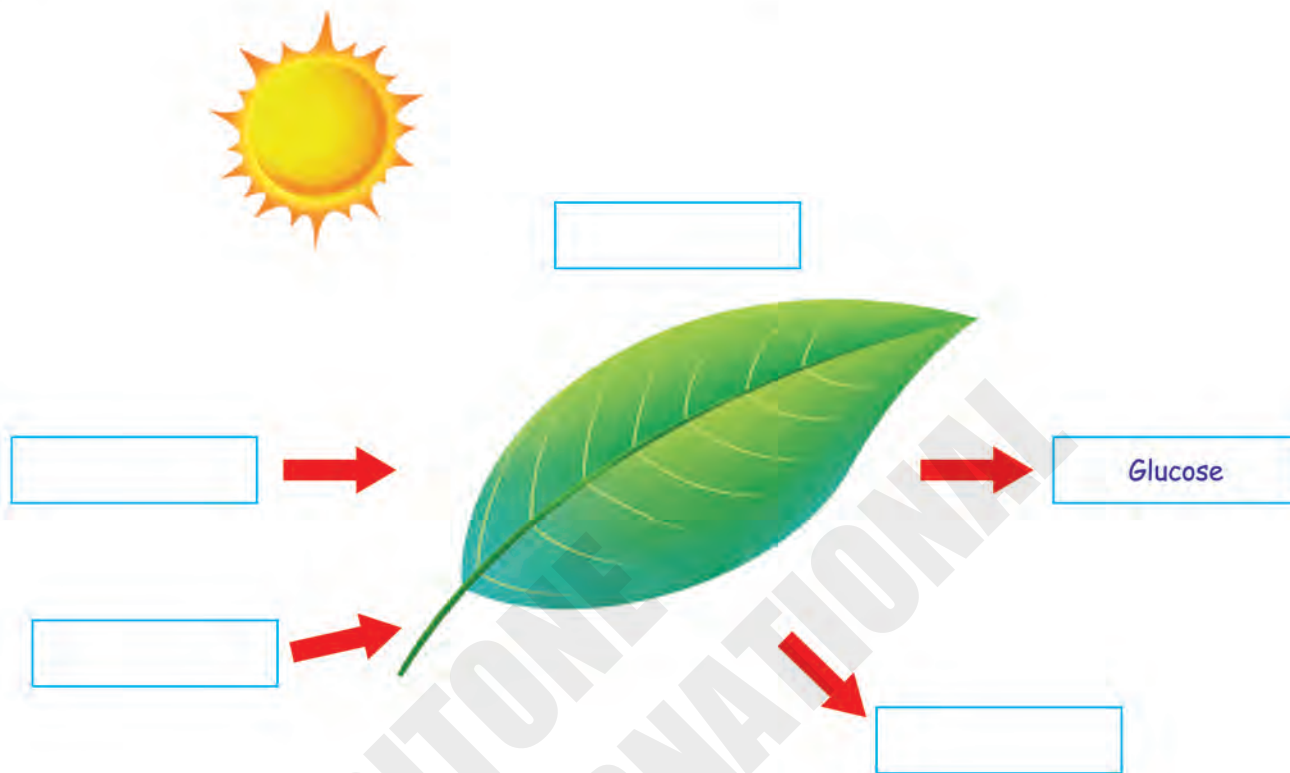
Creative Task

Collect pictures of different Insectivorous plants and prepare an album. Learn about their habitat, either from a magazine or with the help of your teacher.



WORKSHEET-1

1. Label the diagram given below and name the process it shows.



2. Write the differences between a total parasite and a partial parasite.

3. Complete this equation.

