Nutrition in Plants

Mode of Nutrition

Nutrition is the process by which living organisms take in food and utilize it for growth, repair, and energy. Plants are autotrophs, meaning they make their own food using water, carbon dioxide, and minerals from their surroundings. Animals and other organisms that depend on plants for food are called heterotrophs.

Cell Structure

All living organisms are made of cells, the basic units of life. A cell has a nucleus, cytoplasm, and a cell membrane. The nucleus controls cell activities, cytoplasm is where chemical reactions occur, and the cell membrane regulates the entry and exit of substances.

Photosynthesis

Food Making Process

Leaves are the food factories of plants. Water and minerals absorbed by roots travel through vessels to the leaves. Carbon dioxide enters leaves through tiny pores called stomata, which are surrounded by guard cells that regulate their opening and closing.

Role of Chlorophyll and Sunlight

Leaves contain chlorophyll, a green pigment that captures sunlight energy. This energy is used to synthesize food from carbon dioxide and water in a process called photosynthesis. Oxygen is released as a byproduct.

Photosynthesis Equation

The process can be summarized as: Carbon dioxide + water + sunlight (chlorophyll) → carbohydrate + oxygen.

Photosynthesis in Other Plant Parts

Besides leaves, green stems and branches can also perform photosynthesis. Plants without chlorophyll, such as some desert plants, rely on green stems for food synthesis.

Importance of Photosynthesis

Photosynthesis is vital for life on Earth as it produces food and oxygen, supporting almost all living organisms.

Synthesis of Other Food Components

Proteins and Fats

Plants synthesize carbohydrates through photosynthesis and use them to make other food components like proteins and fats. Proteins require nitrogen, which plants absorb from the soil in a usable form, thanks to nitrogen-fixing bacteria.

Other Modes of Nutrition

Parasitic Plants

Some plants like Cuscuta lack chlorophyll and cannot make their own food. They depend on host plants for nutrition by extracting water and nutrients, acting as parasites.

Insectivorous Plants

Plants like the pitcher plant trap and digest insects to obtain nutrients, especially in nutrient-poor soils. Their leaves are modified into traps with digestive juices.

Saprotrophic Nutrition

Fungi and some other organisms obtain nutrients by absorbing from dead and decaying matter. This mode of nutrition is called saprotrophic nutrition, and such organisms are saprotrophs.

Symbiosis

Some fungi live in symbiotic relationships with plants, exchanging nutrients and shelter for mutual benefit, such as lichens where algae and fungi coexist.

Nutrient Replenishment in Soil

Fertilizers and Manure

Plants absorb nutrients from soil, which depletes over time. Farmers add fertilizers and manure to replenish nutrients like nitrogen, phosphorus, and potassium.

Nitrogen Fixation

Bacteria like Rhizobium convert atmospheric nitrogen into forms usable by plants. These bacteria live in root nodules of legumes, forming a symbiotic relationship that enriches soil nitrogen.

Solved Examples

Example 1: Explain why plants are called autotrophs.

Solution: Plants prepare their own food using simple substances like water, carbon dioxide, and minerals in the presence of sunlight and chlorophyll. This process is called photosynthesis. Since they make their own food, they are called autotrophs.

Example 2: Describe the role of stomata in photosynthesis.

Solution: Stomata are tiny pores on the leaf surface surrounded by guard cells. They allow carbon dioxide to enter the leaf, which is essential for photosynthesis. They also enable oxygen and water vapor to exit, regulating gas exchange and water loss.

Practice Set

- **Level 1 (Easy):** What is the main pigment involved in photosynthesis?
- **Level 1 (Easy):** Name the process by which plants make their own food.
- **Level 2 (Moderate):** Explain how parasitic plants obtain their nutrition.

- **Level 3 (Challenging):** Describe the symbiotic relationship between Rhizobium bacteria and leguminous plants.

Answer Key

- **Level 1:** Chlorophyll.
- **Level 1:** Photosynthesis.
- **Level 2:** Parasitic plants like Cuscuta lack chlorophyll and cannot make their own food. They attach to host plants and extract water and nutrients from them.
- **Level 3:** Rhizobium bacteria live in root nodules of leguminous plants. They convert atmospheric nitrogen into forms usable by plants, providing nitrogen. In return, the plants supply food and shelter to the bacteria, benefiting both.

Quick Reference Table

- **Autotrophs:** Organisms that make their own food (e.g., green plants).
- **Heterotrophs:** Organisms that depend on others for food (e.g., animals, parasitic plants).
- **Photosynthesis:** Process by which plants make food using sunlight, carbon dioxide, and water.
- **Chlorophyll:** Green pigment in leaves that captures sunlight.
- **Stomata:** Pores on leaves for gas exchange.
- **Parasitic Plants:** Plants that derive nutrients from host plants (e.g., Cuscuta).
- **Insectivorous Plants:** Plants that trap and digest insects for nutrients (e.g., pitcher plant).
- **Saprotrophs:** Organisms that feed on dead and decaying matter (e.g., fungi).
- **Symbiosis:** Mutual relationship between two organisms (e.g., Rhizobium and legumes).
- **Nitrogen Fixation:** Conversion of atmospheric nitrogen into usable forms by bacteria.

Common Mistakes and Misconceptions

- Not all green parts of plants perform photosynthesis; mainly leaves and some green stems do.

- Plants do not absorb nitrogen directly from the air; they rely on bacteria to convert it into usable forms.
- Parasitic plants are not independent; they depend on host plants for nutrition.
- Insectivorous plants still perform photosynthesis; they supplement their nutrition by digesting insects.
- Fungi are not plants and do not perform photosynthesis; they are saprotrophs.

Glossary

- **Autotroph:** An organism that makes its own food.
- **Chlorophyll:** Green pigment in plants that captures sunlight.
- **Heterotroph:** An organism that depends on others for food.
- **Host:** A plant that provides nutrients to a parasitic plant.
- **Insectivorous Plant:** A plant that traps and digests insects.
- **Nutrient:** Substances required for growth and energy.
- **Nutrition:** The process of taking in and using food.
- **Parasite:** An organism that lives on and takes nutrients from another.
- **Photosynthesis:** Process of making food using sunlight.
- **Saprotroph:** An organism that feeds on dead matter.
- **Stomata:** Pores on leaves for gas exchange.