

Al-Mustaqbal University

College of Science

General biology-Botany

Professions Theoretical Lecture 3

Assist. Prof. Dr. Dhurgham Ali Al-Sultany

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**Plant morphology**

**Introduction**

**Plant Morphology** is the branch of biology that studies the external form, structure, and physical features of plants. It is essential for understanding plant identification, classification, and adaptation to diverse environments. Below is a detailed discussion of plant morphology:

**Basic Plant Morphology**

Plants are primarily divided into **two major systems**:

1. **The Root System**: Below-ground part of the plant.
2. **The Shoot System**: Above-ground part, including stems, leaves, flowers, and fruits.

**I. The Root System**

**Roots** are underground structures responsible for anchorage, absorption, and storage.

**Types of Roots**

1. **Taproot System**:
   * Found in dicots.
   * Consists of a single main root (taproot) with smaller lateral roots.
   * Example: Carrot, radish.
2. **Fibrous Root System**:
   * Found in monocots.
   * Consists of many thin roots of similar size growing from the base of the stem.
   * Example: Wheat, grass.
3. **Adventitious Roots**:
   * Originate from non-root organs like stems or leaves.
   * Example: Banyan tree (prop roots), maize (stilt roots).

**Root Modifications:**

1. **Storage Roots**: Store food.
   * Example: Sweet potato, carrot.
2. **Prop Roots**: Provide extra support.
   * Example: Banyan tree.
3. **Respiratory Roots (Pneumatophores)**: Help in gaseous exchange in marshy areas.
   * Example: Mangroves (Rhizophora).
4. **Climbing Roots**: Help plants climb structures.
   * Example: Money plant.

**II. The Shoot System**

The shoot system includes the **stem**, **leaves**, **flowers**, and **fruits**.

**1. Stem**

The **stem** is the aerial part of the plant that supports leaves, flowers, and fruits. It conducts water, minerals, and food.

**Functions**:

* Provides structural support.
* Transports nutrients and water through xylem and phloem.
* Sometimes stores food (e.g., potato).

**Types of Stems**:

1. **Herbaceous**: Soft, green stems (e.g., spinach).
2. **Woody**: Hard, lignified stems (e.g., mango tree).

**Stem Modifications**:

1. **Storage**: Swollen stems for food storage.
   * Example: Potato (tuber), ginger (rhizome).
2. **Climbing**: Tendrils for climbing.
   * Example: Grape vine.
3. **Protection**: Thorns for defense.
   * Example: Bougainvillea.
4. **Photosynthesis**: Green stems act as photosynthetic organs.
   * Example: Cactus.

**2. Leaves**

Leaves are flattened, green structures that grow on stems or branches and are the primary site for photosynthesis.

**Parts of a Leaf**:

1. **Leaf Blade (Lamina)**: Broad and flat part.
2. **Petiole**: Stalk attaching the leaf blade to the stem.
3. **Stipules**: Small leaf-like structures at the base of the petiole (in some plants).

**Types of Leaves**:

1. **Simple Leaf**: Undivided leaf blade.
   * Example: Mango.
2. **Compound Leaf**: Leaf blade divided into leaflets.
   * Example: Neem (pinnately compound), silk cotton (palmately compound).

**Venation (Leaf Vein Patterns)**:

1. **Parallel Venation**: Veins run parallel to each other.
   * Found in monocots. Example: Banana, grass.
2. **Reticulate Venation**: Veins form a network.
   * Found in dicots. Example: Peepal, guava.

**Leaf Modifications**:

1. **Storage Leaves**: Store water and food.
   * Example: Onion, succulent plants.
2. **Tendrils**: Help in climbing.
   * Example: Pea.
3. **Spines**: Reduce water loss and provide protection.
   * Example: Cactus.
4. **Insectivorous Leaves**: Trap insects for nutrition.
   * Example: Pitcher plant, Venus flytrap.

**3. Flowers**

The **flower** is the reproductive organ of the plant. It is responsible for sexual reproduction and is typically colorful to attract pollinators.

**Parts of a Flower**:

1. **Calyx (Sepals)**: Green, leaf-like structures protecting the flower bud.
2. **Corolla (Petals)**: Colorful structures that attract pollinators.
3. **Androecium**: Male reproductive part, consisting of stamens (anther and filament).
4. **Gynoecium**: Female reproductive part, consisting of carpels (stigma, style, and ovary).

**Flower Types**:

1. **Complete Flower**: Contains all four whorls (sepals, petals, stamens, carpels).
   * Example: Hibiscus.
2. **Incomplete Flower**: Lacks one or more whorls.
   * Example: Maize.

**Flower Symmetry**:

1. **Actinomorphic**: Radial symmetry (e.g., mustard).
2. **Zygomorphic**: Bilateral symmetry (e.g., pea).

**Pollination Mechanisms**:

1. **Self-Pollination**: Pollen from the same flower pollinates its ovule.
2. **Cross-Pollination**: Pollen from one flower pollinates another flower.

**4. Fruits and Seeds**

After fertilization, the ovary develops into a **fruit**, and the ovule develops into a **seed**.

**Types of Fruits**:

1. **Simple Fruits**: Develop from a single ovary.
   * Example: Mango.
2. **Aggregate Fruits**: Develop from multiple ovaries of a single flower.
   * Example: Strawberry.
3. **Multiple Fruits**: Develop from the ovaries of multiple flowers.
   * Example: Pineapple.

**Seed Morphology**:

* **Dicots**: Two cotyledons (e.g., pea, mango).
* **Monocots**: One cotyledon (e.g., rice, wheat).

**Significance of Plant Morphology**

1. **Identification**: Helps in classifying and identifying plants.
2. **Adaptation**: Reveals how plants have adapted to diverse environments (e.g., xerophytes, hydrophytes).
3. **Agriculture**: Assists in breeding and improving crop varieties.
4. **Evolutionary Studies**: Offers insight into evolutionary relationships among plant species.