BOTANY, PLANT PHYSIOLOGY AND PLANT GROWTH

Lesson 4: PLANT PARTS AND FUNCTIONS

Leaves

PART 2

Script to Narrate the PowerPoint, 04PowerPointLeaves.ppt

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PowerPoint Slide 1: Title Slide,
"Plant Parts and Functions, Part Two: Leaves"

PowerPoint Slide 2:
Plant Parts and Functions, Part Two – Leaves

- Segment One - Leaf Parts and Their Functions
- Segment Two – Leaf Characteristics
- Segment Three – Leaf and Flower Buds

In Segment One of this lesson we'll inspect the typical leaf parts, with the naked eye and with a microscope. Segment Two introduces just a few of the many identifying characteristics of a leaf, and Segment Three discusses the buds of leaves and flowers.

PowerPoint Slide 3: Segment One - Leaf Parts and Their Functions

Leaves commonly develop into a flattened surface or leaf blade to present a large area for efficient absorption of light energy. Remember, the principal function of leaves is to absorb sunlight for manufacture of plant sugars through a process called photosynthesis.

The blade of a leaf is the expanded thin structure on either side of the midrib. The leaf is supported away from the stem by a stem-like structure called a petiole. It varies in length or may be lacking entirely. The base of the petiole is attached to the stem at the node. The smaller angle formed between the petiole and the stem is called the leaf axil. An active or dormant bud or cluster of buds is usually located in the axil and is referred to as an axillary bud or buds.

PowerPoint Slide 4: Broadleaf and Conifer Leaves

While broadleaf trees such as maples have a large flat blade, cone-bearing trees such as pines have needles.

PowerPoint Slide 5: Leaf Cross-Section

The leaf blade is composed of several layers. On the top and bottom, is a layer of thickened tough cells called the epidermis. The primary function of the epidermis is protection of leaf tissue. The way in which the cells in the epidermis are arranged determines the texture of the leaf surface. Some leaves have hairs that are an extension of certain cells of the epidermis. The African violet has so many that the leaf feels like velvet.

Part of the epidermis is the cuticle that produces a waxy layer called cutin that protects the leaf from dehydration and prevents penetration of some diseases. The amount of cutin is a direct response to sunlight, increasing with increasing light intensity. For this reason, plants grown in the shade should be moved into full sunlight gradually, over a period of a few weeks to allow the cutin layer to build and to protect the leaves from the shock of rapid water loss or sun scald. The waxy cutin also repels water and can shed pesticides if spreader sticker agents or soap are not used. This is the reason many pesticide manufacturers include some sort of spray additive to adhere to or penetrate the cutin layer.

On the underside of leaves, some epidermal cells are capable of opening and closing. These cells regulate the passage of water, oxygen and carbon dioxide through the leaf. These regulatory cells are called guard cells. They protect openings in the leaf surface called stomata (or stoma). The opening and closing of the cells are determined by the weather. Conditions that would cause large water losses from plants (high temperature, low humidity) stimulate guard cells to close. Mild weather conditions leave guard cells in an open condition. Guard cells will close in the absence of light.

The middle layer of the leaf is the mesophyll and is located between the upper and lower epidermis. This is the layer in which photosynthesis occurs. The mesophyll is divided into a dense upper layer called the palisade layer and a lower layer of cells that contain lots of air space, the spongy parenchyma layer. The cells in these two layers contain chloroplasts, which are the actual site of the photosynthetic process.

PowerPoint Slide 6: Leaves as Food

The leaf blade is the principal edible part of several horticultural crops including chive, collard, dandelion, endive, kale, leaf lettuce, mustard, parsley, spinach, and Swiss chard. The edible part of leek, onion, and Florence fennel is a cluster of fleshy leaf bases. The petiole of the leaf is the edible product in celery and rhubarb. In plants like Brussels sprouts, cabbage, and head lettuce, the leaves are clustered in the form of a large naked bud and are the edible parts.

(Pass around the raw vegetables if you brought them to class, so students can examine the examples.)

PowerPoint Slide 7: Modifications of Leaves

Normally, leaves serve as the manufacturing centers where the photosynthetic activity of the plant occurs. But there are some modifications of leaves, just as rhizomes and tubers are modifications of stems. Seed leaves or cotyledons are modified leaves that are found on the embryonic plant and commonly serve as storage organs. A bulb is a large bud composed of a small conical stem surrounded by numerous modified fleshy leaves that also serve a storage function. Spines on plants such as barberry are specialized modified leaves that protect the plant; similar in appearance but not in origin, a thorn is a modified branch. Most tendrils, such as those found on sweet peas, are leaves that are modified to assist the plant in supporting the stems. Very unusual modified leaves appear on carnivorous plants, such as the Venus Flytrap. Other specialized leaves include bracts, which are often brightly colored; the showy structures on dogwood and poinsettias are bracts, not petals.

PowerPoint Slide 8: Segment Two – Leaf Characteristics

- Shape of leaf blade
- Leaf arrangement
- Pattern of veins

Leaves as a Means of Identifying Plants

Clues that lead to plant identification include the anatomy of the stems, buds, flowers, fruits, and several characteristics of leaves. Additional important identifying characteristics include the shape of the leaf blade, the leaf arrangement along the stem, and the pattern of the veins.

PowerPoint Slide 9: Types of Venation

The stem contains tubes called vascular bundles, which form a conducting system composed of xylem and phloem. Recall that xylem conducts water passing upward, while phloem transports food throughout the plant. Vascular bundles from the stem extend through the petiole and spread out in the leaf blade. The term venation refers to the patterns in which the veins are distributed in the blade. Two principal types of venation are parallel-veined and net-veined.

Parallel-veined leaves are those in which there are numerous veins which run essentially parallel to each other and are connected laterally by minute straight veinlets. Possibly

the most common type of parallel veining is that found in plants of the grass family where the veins run from the base to the apex of the leaf. Parallel-veined leaves occur on plants that are part of the monocotyledon group.

Net-veined leaves have veins that branch from the main rib or ribs and then subdivide in finer veinlets that then unite in a complicated network. This system of veins makes the leaf more resistant to tearing than most parallel-veined leaves. Net-veined leaves occur on plants which are part of the dicotyledon group.

Time Check: PowerPoint half-way mark.

- *You should be about 10 minutes into this PowerPoint presentation.*

PowerPoint Slide 10: Leaf Shape

Simple leaves are those in which the leaf blade is a single continuous unit. A compound leaf is composed of several separate leaflets arising from the same petiole.

PowerPoint Slide 11: Leaf Arrangement Along a Stem

Rosulate arrangement is one in which the basal leaves form a rosette around the stem with extremely short nodes. Opposite leaves are positioned across the stem from each other, two leaves at each node. Alternate or spiral leaves are arranged in alternate steps along the stem with only one leaf at each node. Whorled leaves are arranged in circles along the stem.

PowerPoint Slide 12:

- Do animals grow all their lives?
- Do plants grow all their lives?

QUESTION: Now let's move on to the last segment of this lesson, regarding growth. Do animals continue to grow all their lives? Do plants continue growth all their lives?

STUDENT RESPONSE: *For about 1 minute, students can discuss theories, then conclude the discussion by stating that only plants, not animals, will continue a growth cycle all their lives.*

QUESTION: If you look at a plant, at what point will you see this continuous growth?

STUDENT RESPONSE: *For about 1 minute, students can discuss theories, then conclude the discussion by stating that visible growth occurs at leaf and flower buds, while concealed growth occurs at the root tips.*

PowerPoint Slide 13: Segment Three – Leaf and Flower Buds

A bud is an undeveloped shoot from which embryonic leaves, flower parts or both arise. The buds of trees and shrubs of the temperate zone typically develop a protective outer layer of small leathery bud scales. Annual plants and herbaceous perennials have naked buds in which the outer leaves are green and somewhat succulent.

A leaf bud is composed of a short stem with embryonic leaves and with bud primordia in their axils and at the apex. Such buds develop into leafy shoots. Leaf buds are often less plump and more pointed than flower buds.

Mixed buds = Both

A flower bud is composed of a short stem with embryonic flower parts.

Buds are named for the location that they inhabit on the stem surface. Terminal buds are those which are located at the apex of the stem. Lateral buds are borne on the sides of the stem. Most lateral buds arise in the axis of a leaf and are called axillary buds. In some instances more than one bud is formed. Adventitious buds are those which arise at sites other than in the terminal or axillary position. Adventitious buds may develop from the internode of the stem, at the edge of a leaf blade, from callus tissue at the cut end of a stem or root, or laterally from the roots of plants.

PowerPoint Slide 14: Buds as Food

Enlarged buds or parts of buds form the edible portion of some horticultural crops. Cabbage and head lettuce are examples of unusually large terminal buds. Succulent axillary buds of Brussels sprouts become the edible part of this plant. In the case of Globe Artichoke, the fleshy basal portion of the bracts of the flower bud is eaten along with the solid stem portion of the bud. Broccoli is the most important horticultural plant in which edible flower buds are consumed. In this case portions of the stem as well as small leaves associated with the flower buds are eaten.

(Pass around the raw vegetables if you brought them to class, so students can examine the examples.)

PowerPoint Slide 15: Review

Plant Parts and Functions, Part Two – Leaves

- Segment One - Leaf Parts and Their Functions
- Segment Two – Leaf Characteristics
- Segment Three – Leaf and Flower Buds

In this lesson we've learned the functions of leaves, physical characteristics, and leaf buds.

QUESTION: Can anyone list the major parts of a leaf?

STUDENT RESPONSE: *Students provide answers; then show answers on slide 16.*

PowerPoint Slide 16:

QUESTION: List three characteristics of a leaf that help in plant identification.

STUDENT RESPONSE: *Students provide answers; then show answers on slide 17.*

PowerPoint Slide 17: Leaf characteristics

1. Leaf venation
2. Leaf shape
3. Leaf arrangement along the stem

QUESTION: Now name two or three types of leaf buds, according to location on the branch.

STUDENT RESPONSE: *Students provide answers; then show answers on slide 18.*

PowerPoint Slide 18: Types of Leaf Buds

PowerPoint Slide 19: Closure

A leaf is a critical part of a plant's anatomy. While it acts as a factory of a plant's foods, through photosynthesis, it contributes one of the most important aspects to a plant's beauty.