Unit A: Basic Principles of Plant Science with a Focus on Field Crops

Lesson 4: Understanding Leaf Anatomy and Morphology
Vocabulary

- Compound leaf
- Cuticle
- Dichotomous venation
- Epidermis
- Guard cells
- Leaf blade
- Midrib
- Palisade mesophyll
- Parallel veins
- Petiole
- Pinnately netted
- Simple leaf
- Spongy mesophyll
- Stomata
What Are the Main Parts of a Leaf?

- Leaves are the primary food producing organs of a plant.
- They are designed to efficiently collect light and use that light energy to produce food.
  - Remember that this process is called photosynthesis.
- There are several parts of a leaf:
1. Tip or apex – this is the top of the leaf; It can be pointed, round, smooth, etc
2. Margin – is the edge of the blade; This is quite specific to each species of plant
   - Some are smooth, toothed, lobed or incised
3. **Midrib** – the central vein running down the center of the blade
4. Veins – contain the xylem & phloem of the plant
   - They can be parallel or netted in arrangement
5. **Base** – is found at the bottom of the blade; Like the apex, it can be round, heart shaped, flat, etc.

6. **Petiole** – is known as the leaf stem; It is not exactly like a stem, but it does hold xylem & phloem; Holds the blade away from the stem.

7. **Blade** – the main collecting structure of the leaf; Has a large, broad surface.
   - Has many layers which help the plant move and store photosynthetic materials and by-products.
Main Parts of a Leaf

- Tip/Apex
- Midrib
- Margin
- Veins
- Base
- Petiole
- Blade

Leaf

Courtesy of Corinne Banowski
What Are Some of the Major Types of Leaves?

- There are many different types of leaves

  - Some are adapted to hot, dry climates
    - They store water in their leaves or are smaller in size
  - Some have very large blades to collect maximum light in shady locations
  - Some plants have their blades broken into many sections
A leaf which has only one blade on its petiole is called a **simple leaf**
- Most plants have simple leaves

When the blade is divided into three or more sections, it is said to be a **compound leaf**
- There are many different kinds

Courtesy of Wm. C. Brown Publishers
Types of Compound Leaves

- Odd Pinnately Compound
- Even Pinnately Compound
- Palmately Compound

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Veins of flowering plants are found in several patterns

- Most patterns can be categorized into two main groups

A. *Parallel veins* – found in monocots
   - None of the veins on the whole leaf will cross each other
   - It may look like they fuse together at the top or bottom of the blade
B. *Netted veins* – found in dicots

- They connect & branch from each other
- Some have several smaller veins branching out of a dominant midrib
  - Known as *pinnately netted*
- Other leaves have several dominant veins (midribs) branching from the petiole
  - Known as *palmately netted*
- A few have a spreading vein pattern called *dichotomous venation*
  - Seen in the *Ginkgo* tree
Types of Leaf Venation

- Parallel Netted Veins
- Pinnately Netted Veins
- Palrnately Netted Veins
- Dichotomous Netted Veins

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How Is A Leaf Organized?

- A leaf is organized to collect sunlight and turn it, through photosynthesis, into food.
- The leaf has many layers of tissue to allow this to happen:
  - 1. **Cuticle** – on top of the leaf is a waxy non-cellular layer
    - Prevents water from escaping the leaf
    - It is usually very thick on plants in arid regions
2. **Epidermis** – the next layer of the leaf
   - Used for protection
   - Skin-like layer found on the top & bottom of the leaf surface
   - May be one or more cell layers thick

3. **Palisade mesophyll** – directly beneath the epidermis
   - Standing on end & packed very tightly
   - Responsible for most photosynthesis
4. **Spongy mesophyll** – under the palisade layer
   - Loosely packed cells
   - Have numerous air spaces which hold the raw materials used and products of photosynthesis

5. **Stomata** – usually on the lower epidermis
   - Tiny holes for gas exchange; They can open & close

6. **Guard cells** – control the opening & closing of the stomata
   - Found on either side of the stomata
Internal Parts of A Leaf

- Petiole
- Blade
- Cuticle
- Upper Epidermis
- Palisade Mesophyll
- Vein
- Spongy Mesophyll
- Lower Epidermis
- Air Spaces
- Stomata
- Guard Cell
- Stoma, singular

Courtesy of Wm. C. Brown Publishers
Summary

- How is a blade different from a leaf?
- Compare a midrib to a vein.
- What is the edge of a leaf called?
- How is a simple leaf different from a compound leaf?
- Can you give an example of a simple or compound leaf?
- What are the four types of venation within the leaf?
What protects the leaf on the outside? (It is a waxy coating).
What is the function of the epidermis?
Compare the palisade layer with the spongy layer.
What is the purpose of a guard cell?
Where does gas exchange occur on the leaf?