

Topic 1. Introduction to Plants

Introduction: Because of its history, several unrelated taxa have been grouped together with plants into the discipline of botany. Given this context, in this first lab we will carefully consider exactly what a plant is in order to better understand why fungi, algae and bacteria are each uniquely different. We will then apply what we learn about plant structure, to introduce the use of a field guide to the common woody plants on campus.

Plants are **photosynthetic autotrophs** which are also **structurally complex**. The tissues of higher plants are organized into **roots, stems, and leaves** which are the organs of the plant body. The leaf and the stem, together, make up the **shoot**. Both leaves and stems are derived from growth at an **apical meristem**. Each leaf is associated with an axillary bud on the stem which can give rise to lateral branches. The upper angle formed by the leaf and stem is called an **axil** and the buds formed in that location are called **axillary buds**.

Teaching resources: The learning objectives are clearly outlined below. We expect you to learn terms relating to plant structure and to be able to relate these to plants in general. We also want you to be able to apply what you learn, in the context of a simple identification guide to the common woody plants on campus. To assist you in reviewing this activity, and all future lab topics, we have a lab page (not at learn@uw!) at

http://botit.botany.wisc.edu/botany_130

Also note that we have an open lab in room 122 from 10:00 until 12:00 every Friday if you want additional help with these and future lab materials.

Learning objectives:

Gross morphology - terms you will be required to know and be able to use

Plant body

root
shoot
stem
leaf

Leaf structure

blade
petiole
compound leaf
stipule

Stem structure

axillary bud
apical meristem
node
internode
bud scales

Leaf arrangement

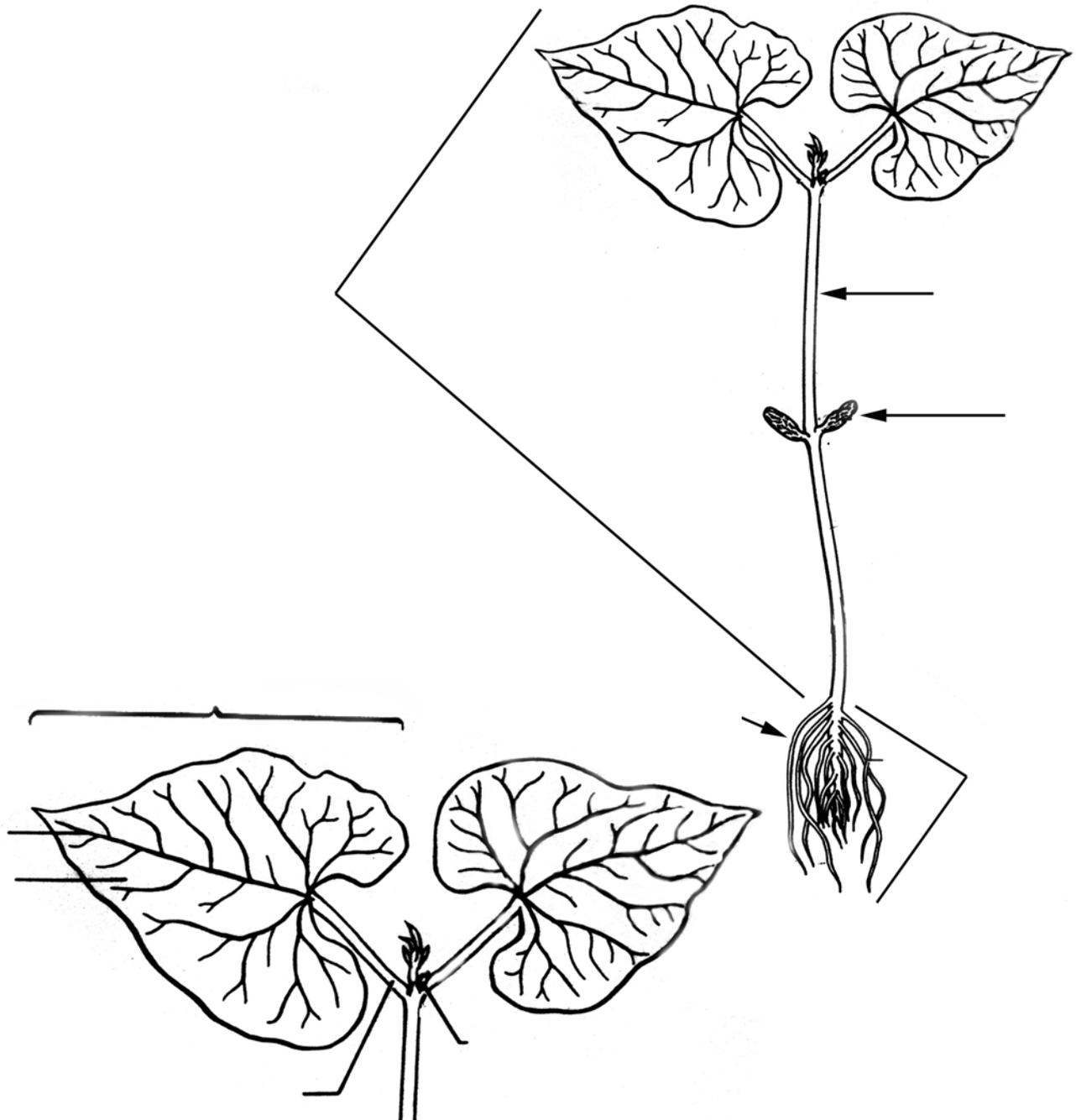
opposite
alternate
whorled
leaf scar

- I. At the demonstration bench and carefully uproot a seedling. At your seat, study the plant for about five minutes. Try to associate as many of the terms listed as possible. Then, with the help of your teaching assistant, label the figures.

Axillary Bud
Petiole
Stem
Stipule

Blade
Root
Vein
Cotyledon

Root System
Shoot System
Leaf



II. Examples of Other Plants. Around the room are examples of plants with the following characteristics:

Opposite leaves
Whorled Leaves
Stipules

Alternate leaves
Compound Leaves

Draw an example of each character below:

View of leaf, and stem with an axillary bud
(label node and internode)

A compound leaf
(include a axillary bud)

Opposite leaves

Alternate leaves

Whorled leaves

**Stipule of *Hibiscus*
or *Geranium***

Dormant Shoots: Morphology of a Woody Twig

Take a *Malus* (Apple) twig from the front bench and carefully study it for five minutes. Consider the following questions:

1. The twig is encased in a water-proof, air-tight covering (the bark). Can you discern any observable structures in the bark that may be related to gas exchange
2. Based on your observation of the dormant twig, were the leaves arranged in an opposite or alternate fashion?
3. Speculate. Botanically, what are the bud scales?
4. Without looking at the cross section of the stem determine how many years growth is represented by your twig.

Identification of Winter Twigs

The winter (dormant) characteristics of woody plants are as distinctive as the summer ones, and trees and be readily identified by their twigs. In this final activity, we want you to apply what you have learned about plant structure to identify to species a sampling of winter twigs. On the next page is a type of identification guide called a key. Reading through the key you will be confronted with a series of contingencies relating to an unknown twig. Based on the unique set of structures of each twig, you follow through the key to arrive at an identification. Your TA will first guide you through this key using the apple twig from the preceding activity. We then want you to identify eleven other twigs at the front of your bench. As you identify each twig, check off the name in the key. By the end of the period you should have checked off each possible name in the key.

Key to Selected Winter Twigs

- A. Leaf scars alternate
 - B. Twig armed with thorns or spines
 - C. Stipules modified into thorns at each nodeBlack Locust (*Robinia*)
 - C. Dwarf shoots modified into thorns.....Hawthorne (*Crataegus*)
 - B. Twig not armed
 - D. Stipule scars forms a complete ring around the twig at each node..... *Magnolia*
 - D. Twig with no visible stipular scars
 - E. Twig with shoots modified into tendrils.....Grape (*Vitus*)
 - E. Twig without shoots modified into tendrils
 - F. Twig without a true apical bud, but with the axillary bud at the tip appearing to be terminal. Look for both a leaf scar and a shoot scar associated with this bud.....Basswood (*Tilia americana*)
 - F. Twig with well developed terminal bud
 - G. Current year's growth more than 3mm thick.....Apple (*Malus*)
 - G. Current year's growth less than 3mm thick
.....Black Cherry (*Prunus*)
 - A. Leaf scars opposite or whorled
 - I. Leaf Scars whorledCatalpa (*Catalpa speciosa*)
 - I. Leaf scars opposite
 - J. Bark bright red.....Red Osier Dogwood (*Cornus*)
 - J Bark gray, green, or dull red
 - K. Twig without an obvious line connecting the leaf scars at each node.
Apical bud conical and fuzzy.....Green Ash (*Fraxinus*)
 - K. Twig with a line connecting the leaf scars at each node
 - L. Axillary buds are embedded (Hence invisible)
.....Mock Orange (*Philadelphus* sp.)
 - L. Axillary buds are not embedded They are large and obvious with two overlapping bud scales. Leaf scars are v-shaped.
.....High bush cranberry (*Viburnum opulus*)

Supermarket Botany- Discussion Activity

Shoot Systems - Stems, Buds and Leaves

Cabbage. A single compact shoot: Leaves are curled over the apical meristem to form a head. Longitudinal sections show buds in the axils of leaves. Head lettuce shows a similar morphology. Note that commercial cabbage and lettuce were bred for this heading quality. Wild cabbage and lettuce show normal stem elongation.

Brussels sprouts. Same species as cabbage: bred for its compact and edible lateral buds.

Kohlrabi. Same species as cabbage: central stalk serves as a fleshy storage organ.

Broccoli and Cauliflower. Same species as cabbage: bred for compact edible flower heads.

Artichokes. Another edible inflorescence: artichokes are composites similar to a giant thistle; edible parts are bracts and receptacles.

Onions. These are bulbs that consist of tightly arranged layers of starchy- succulent leaves which are connected by a short stem; longitudinal sections show the shoot tip(s).

Potato. An underground stem modified for storage with no leaves called a tuber. Eyes are buds from which above ground shoots grow. Potato tubers form at the ends or sides of rhizomes (you might wish to draw a diagram of a mature plant showing the three shoot types - aerial, rhizome, tuber).

Celery. These stalks are enlarged succulent petioles whose blades are much reduced. Commercial celery was also bred for non-elongation of central stem. Rhubarb is another example of a plant bred for edible petioles.

Root Systems

Carrots. This is a tap root with parenchyma predominating in the secondary xylem and phloem tissues.

Sweet Potato. Another root modified for storage but, unlike carrot, cambia form around vessels in the secondary xylem.

Beets. A tap root modified for storage. Secondary growth takes place in a series of cambia. These form from the inside to the outside with the most recent cambium (the outer one) being functional. These cambia give the root its characteristic pattern of concentric rings in cross-section.

Fruits

Tomato. This fruit develops from a single, fertilized flower the ovary of which becomes greatly enlarged. It is technically a berry.

Cucumber and Squash. Both are berries in the cucumber family. Each develops from a single flower. In cross-section one has an air space, the other is solid and succulent.

Pineapple. A multiple fruit developing from an entire stalk of fertilized flowers: The receptacle and the ovaries are enlarged and fleshy. A longitudinal-section shows the entire stalk and the positions of individual fruits.