MAJOR FAMILIES LAB- Grasses and Legumes

INTRODUCTION

The goal of this laboratory is to familiarize you with the two most important food plant families-- grasses (Poaceae) and legumes (Fabaceae). We as humans devote more than 70% of the Earth's farmlands to production of cereal grains, which are fruits of the family Poaceae. Harvests of grasses provide at least half the world's caloric intake. Humans, as well as domesticated livestock are fed primarily by grains and forage grasses. In fact, some anthropologists have the opinion that the use of cereal grains was a prerequisite for civilization. The Fabaceae, or legume family, is second to grasses in overall importance to humankind. Nearly every major civilization since the development of agriculture has had a grain and legume as part of its support system.

With the idea that you will gain a better understanding of the Poaceae and Fabaceae, today's laboratory activity involves a study of the floral and vegetative morphologies of certain members of these families. In addition, you will make a survey of important food crops that are members of either the grass or legume family.

By the end of today's laboratory exercise you should be able to recognize and identify the floral and vegetative parts of a typical legume and grass plant. You should also be able to recognize by name (common name, scientific name, and family name) the highly important grass and legume food crops on display.

EXERCISE

1. **POACEAE-** Floral and vegetative morphology of this family is both interesting and unique. Grasses are **monocots** and thus have **parallel-veined leaves** and **flower parts which occur in multiples of three** (3-merous). However, the **perianth is highly reduced or absent** in grasses. **Vegetative characters include: culm (stem), nodes, internodes, leaf, blade, sheath, ligule, fibrous roots, rhizomes, stolons. Flowers of the grass family are highly reduced** and non-showy, and are described using unique terminology. The perianth has been reduced to structures called **lodicules**, which are located at the base of the ovary. Thus, the grass flower simply consists of stamens and a compound pistil composed of an ovary, styles, and plumose stigmas. The mature ovary (fruit) is known as a **grain** or **caryopsis**. Each flower is enclosed by two fertile bracts: the larger bract **(lemma)** usually encloses the smaller bract **(palea)** and the flower. This unit-- two bracts and the flower-- is known as a **floret**. One or more florets make up a **spikelet**, which is the basic unit of a grass inflorescence. Thus, you could say that the basic unit of a spikelet is the floret. The spikelet is a group of florets (or just one) subtended by two sterile bracts (bracts not in direct association with a flower) known as **glumes**. The glumes define the spikelet-- they and everything above them (florets) make up the spikelet.

1.Examine an oat **(*Avena*)** spikelet. Note the two basal glumes, which completely enclose the florets. There should be three florets above the glumes, with the terminal one not completely developed. Separate a palea from the lemma that encloses it. Is there any difference between a palea and a lemma? Also, observe the flower.

2.Diagram the oat (*Avena)* spikelet labeling glumes, florets, and the lemma and palea of one floret.

3.Examine and diagram a ***Bromus*** spikelet labeling the organs of its basic structure, i.e., glumes and paleas and lemmas of each floret.

4.Examine specimens of other grass genera on display.

2. FABACEAE-- Traditionally the Fabaceae were treated as one broad family composed of **three subfamilies**. More recently, the three subfamilies have been treated as **three separate families: Fabaceae, Caesalpiniaceae, and Mimosaceae**. Together, whether treated as three families or lumped into one, these three groups are commonly referred to as "legumes" in reference to the fruit type. The subfamily Papilionoideae, otherwise known as the family Fabaceae (strict sense), is most important as a source of food crops.

Here we will consider the contemporary view of three separate families: Fabaceae, Caesalpiniaceae, and Mimosaceae. These three families share the **characteristic fruit type, the legume**. The differences between the three families are in the arrangement and structure of the androecium and perianth, otherwise collectively known as the "**androperianth**."

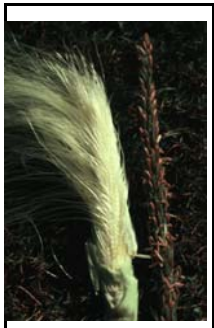
1. Compare the sample material with descriptions and terminology given in lecture and laboratory notes. For each floral sample, examine floral structure, paying close attention to the arrangement and structure of the androecium and perianth. How are the petals arranged? Are any fused? Is the corolla actinomorphic or zygomorphic? How are the stamens arranged? Do they all match?

2. Draw samples representing each of the three families.

3. Become familiar with the following specialized corolla and androecium terminology that will help you distinguish between the three legume families: PAPILIONACEOUS FLOWER, STANDARD/BANNER, WING, KEEL, DIADELPHOUS STAMENS, ZYGOMORPHIC FLOWERS, ACTINOMORPHIC FLOWERS, GLOBOSE HEADS (INFLORESCENCE).

TAXA STUDIED IN THIS LAB Many of these you have seen in other labs, so this will be largely review.

Common Name	Genus	Specific Epithet	Family	Class (Monocot/Dicot)	Origin
 bamboo					
  barley					

 corn (maize)					
millet					
 oats					
  rice					

 rye					
 sorghum					
 sugar cane					
teff					

 wheat					
 wild rice					
  alfalfa					

 green bean					
 kidney bean					
 pinto bean					
 black bean					
 _navy bean					
 bean sprout (mung bean)					

 blackeyed pea, cowpea					
chickpea, garbanzo					
 lentil (come in red, yellow, brown)					
 lima bean					
 split pea (same as below)					

 snow pea					
 English pea, sugar snap pea					
 peanut					
 pigeon pea, gandule					
soybean					

 tamarind					
 amaranth					
 buckwheat					
 quinoa					

In addition, you should know what hummus, bulgur, and couscous are (look them up in your book and/or get info from lab cards), and you should be able to give the common name of some forage legumes (clover, sweet clover, alfalfa, bur

clover) and lawn grasses (Bermudagrass, St. Augustine, buffalo grass, etc.)
QUESTIONS FOR THOUGHT, REVIEW, AND STUDY: Refer to lecture and lab notes, as well as to what you learned during the laboratory activity.

1. Diagram the vegetative portion of a grass plant and label the parts.

2. A grass leaf is strikingly different from the typical leaf you may be used to, such as an oak or maple leaf. What are the parts that make up a grass leaf? What part of the grass leaf grasps (sheaths) the grass culm?

3. What is a grass culm?

4. Vegetative reproduction is common in the grass family. Name the two modified stems that help in this type of reproduction. Which of these modified stems grows above ground? Which grows below ground?

5. What is the basic unit of a grass inflorescence?

6. What is the basic unit of a grass spikelet?

7. Diagram a spikelet that contains three florets, and label the parts.

8. Diagram a spikelet that contains a single floret only, and label the parts.

9. Diagram a grass flower and label the parts.

10. What is a lodicule?

11. Grass flowers are highly reduced and obviously lack any type of showy perianth. Showy perianths are thought to attract insects and birds for pollination. How do you suppose grasses are pollinated?

12. Where do glumes occur? Where do the lemma and the palea occur? Draw a floret, labeling the flower, palea, and the lemma.

13. Know how to tell the difference between a floret and a spikelet. Remember: a spikelet is subtended by two sterile bracts (glumes). Two bracts subtend a floret as well, but since these bracts enclose the flower parts, we refer to them as fertile bracts (palea and lemma).

14. Traditionally the "legumes" are included in one family, the _____, which consists of three subfamilies, the _____, the _____, and the _____. Which subfamily is most important in terms of food crops?

15. In recent times, the "legumes" have been divided into three individual families. Name these three families. Which family is most important in terms of food crops?

16. What is a papilionaceous flower? In other words, what does the flower resemble? Why do we refer to the flowers of the family Fabaceae (in the strict sense) as "papilionaceous?"

17. Which family of "legumes" is characterized by actinomorphic flowers (many lines of symmetry)? Which families of "legumes" are characterized by having zygomorphic flowers (only one line of symmetry)?

18. What is a diadelphous stamen arrangement? Which family of "legumes" is characterized by having diadelphous stamens?

19. Diagram a trifoliate, palmately compound leaf.

20. Diagram a bipinnately compound leaf.

21. How many petals do flowers in the Fabaceae have? What is a keel?

22. How many petals do flowers in the Caesalpiniaceae have? Do these flowers have a true keel?

23. What type of inflorescence is characteristic of the Mimosaceae?

24. What is a legume? How many carpels do legumes consist of? Draw a cross-section of a legume and name the placentation type.

25. Be able to name some of the most important grass and legume genera.

26. In the Fabaceae (Faboideae), is the banner/standard situated inside or outside of the two wings? How about in the Caesalpiniaceae (Caesalpinioideae)?