

Writing a Dichotomous Key to Wildflowers

Objectives:

1. Understand how to use and make dichotomous keys.
2. Understand common terminology of plant morphology.
3. Learn to recognize some fall wildflowers.

The biological world is diverse. One example of that diversity is the enormous number of species on the planet: about 2 million species have been described and named. This large number precludes anybody being able to recognize all species of organisms. Even a lifelong devotee of beetles cannot recognize all 300,000 species that have been discovered. More locally, in Virginia, there are about 2500 species of plants, over 500 species of birds, over 200 species of fish, and thousands of species of insects.

Biologists use dichotomous keys to aid them in the identification of organisms. A dichotomous key is series of paired statements that describe various characteristics an organism might possess. The two statements are mutually exclusive. You read both statements and see which statement accurately describes the unknown organism you are trying to identify. If one of the statements accurately describes the organism, you proceed to the next choice that is indicated. Step-by-step, choice-by-choice, you narrow down the organism to a final taxonomic level. Keys generally begin with broad characteristics and become more specific as you go along. Here's a simple example of a dichotomous key:

A dichotomous key to common house pets

- | | |
|--------------------------------------------|----------|
| 1a. Animal with hair | Go to 2 |
| 1b. Animal without hair | Go to 3 |
| 2a. Claws sharp, and retractable | Cat |
| 2b. Claws dull, not retractable | Dog |
| 3a. Gills present | Goldfish |
| 3b. Lungs present | Go to 4 |
| 4a. Torso encased by shell. | Turtle |
| 4b. Torso not encased by shell | Lizard |

When using a dichotomous key to identify an organism

- A. Read both choices carefully. Sometimes the first one may seem to fit, but the second might fit even better.
- B. Sometimes it may be hard to choose one choice over another. If that happens, just follow each fork (one at a time) and see which one pans out.
- C. When looking at a plant, don't look at just one leaf or one flower. Considerable variation (both from genetic and environmental causes) may exist, so observe several of each.
- E. When you have keyed out an organism, it is good to check your identification with another method. Compare it to a picture, or to an individual with a known identity.
- F. Make sure you understand the terms used in the key.
- G. Make sure you understand the measurements used.

Methods:

Assignment 1: To ensure you understand the format and principle of dichotomous keys, it might be helpful to write a short key to something familiar. For example, you could write a key to the following snacks: cupcake, chocolate candy bar, taco chips, potato chips, and pretzels. Or you could write a key to several of the people in your lab section. Your instructor may have other suggestions.

Here are some guidelines for writing dichotomous keys.

1. Start with the most general characteristics and progress to increasingly more specific characteristics.
2. Leave a space between each pair of choices to make the key easier to read.
3. Make the key **dichotomous**. That is, you should have two, and only two, choices (a couplet) at each number. Number the two statements of each couplet with the same number. For example, a key to the phyla of plants might begin:
 1. Seeds present (2)
 1. Seeds absent (3)
4. Words like “long” or “short” or “many” or “few” or “narrow” or “wide” are vague; don’t use them. Instead use actual measurements like:
 1. Leaves longer than 5 cm
 1. Leaves shorter than 4 cm
5. The two choices in a couplet should be **mutually exclusive** and should begin with identical words. To be **mutually exclusive** they need to refer to **different** qualities of the **same** character. The two choices shown at #4 above cannot **both** apply to the same plant, thus they are mutually exclusive.
6. Don’t use overlapping descriptions like this:
 1. Legs 6 or fewer (2)
 1. Legs 4 or more (6)

If someone was trying to key out an organism with 5 legs, he/she wouldn’t know whether to go to 2 or 6.

7. Start descriptions with a subject.
 5. Flowers with 5 petals
 5. Flowers with 6 petals

NOT: 5. Five petals per flower
NOT: 5. Six petals per flower

8. Don’t use more words than you must:

Plants with flowers that have 5 petals
Plants with flowers that have 6 petals

The same information can be said more briefly, as in #7 above.

Assignment 2: Write a key to several species of wildflowers.

First, you need to know some characteristics of each plant. Some of the terminology used to describe flowering plants is shown in a glossary at the end of this lab. Once you have become familiar with some of these terms, choose several wildflowers and fill out the character table (Table 1). You may find some of these characters helpful in constructing your key. Depending on what flowers you use, some of the characters might not be used. Some space has been left for you to add characters you think might be helpful. Characteristics that are most valuable are ones that don’t vary within a species, but that do vary between species.

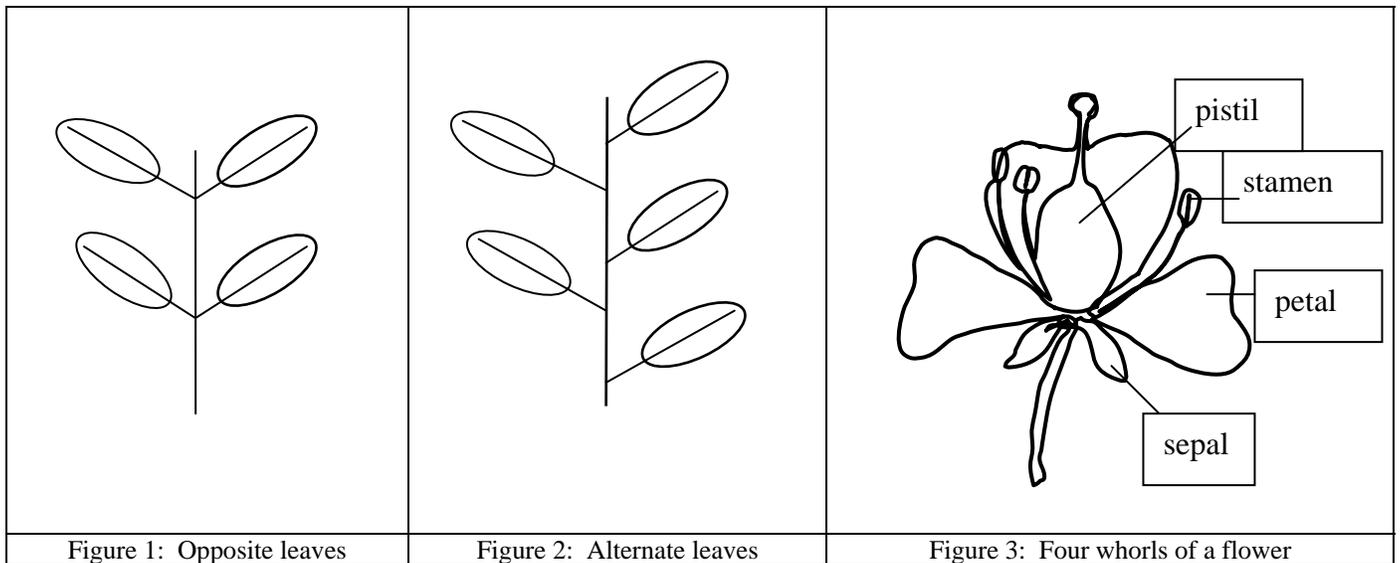
After filling in the data table, you can start constructing your key. Group plants together that share several similar characteristics. Pick a characteristic that gives you a couple of subgroups. Use this characteristic to write your first pair of statements and start your key. Start with a general characteristic, and move to more specific ones. For each subgroup, determine how to break them further into smaller subgroups.

Table 1: Characters of fall wildflowers

Characters \ Taxon								
Plant herbaceous or woody								
Plant upright, decumbent, or climbing vine								
leaf venation: parallel or net								
Leaf length								
Leaf width								
Leaf length/width ratio								
Petiole: present/absent								
Leaves: simple or compound								
Leaves: opposite or alternate or whorled								
Flower color								
Petal length								
Petals: fused or free								
# of petals								
# of sepals								

Table 2: A glossary of terms used in Table 1

Plant herbaceous or woody	Herbaceous - green and flexible throughout, not woody Woody – stems and older twigs are stiff
Plant upright, decumbent, or climbing vine	Decumbent – stems lying on ground, only the tips are upright If vine is climbing, note whether it climbs using tendrils, roots, or by twining itself around other stems. Tendrils are leaves that are modified for grasping.
leaf venation: parallel or net	Veins made up of vascular tissue are visible in the surface of a leaf. The veins may be parallel to each other and run the length of the leaf, or they may form a branched network throughout the leaf.
Petiole: present/absent	A petiole is the stalk that attaches the relatively broad, flat portion of the leaf to the stem. The broad portion of the leaf is called the blade. Some leaves lack petioles. See Figure 2.
Leaves: simple or compound	A compound leaf has a blade divided into leaflets; a compound leaf may appear to be several leaves. A “3-leaf clover” is actually one leaf with three leaflets. A leaf will have a bud at its base next to the stem, but a leaflet will not.
Leaves: opposite or alternate or whorled	A node is the spot on a stem from which leaves arise. Leaves are alternate, if there is 1 leaf per node. Leaves are opposite if there are two leaves per node. See Figures 1 and 2. Leaves are whorled if there are three or more leaves per node.
sepals	Flowers may have four whorls of parts. The outermost whorl of parts is made up of several sepals. On some plants sepals are green, on others they are colorful. See Figure 3.
petals	Just inside the whorl of sepals, is a whorl of petals. See Figure 3.
Petals fused or free	Petals are ‘free’ if they appear as 3 or 4 or 5 separate units. In some flowers, the petals are fused to form funnel-like or trumpet-like shapes.



1. Once your key is finished, share it with another group, and have them use it to key out a plant. Does the key enable them to identify the wildflowers correctly? What problems do they have with it? Can you improve your key?

3. What is a potential problem in using color as a character?

4. What is a potential problem in using plant height as a character?

5. Characteristics of flowers are often used in keys to flowering plants. In light of the biological species concept and the flower's role in a plant's life cycle, why does it make sense to have characteristics of flowers as part of a key?