An excerpt from

BOTANY READINGS

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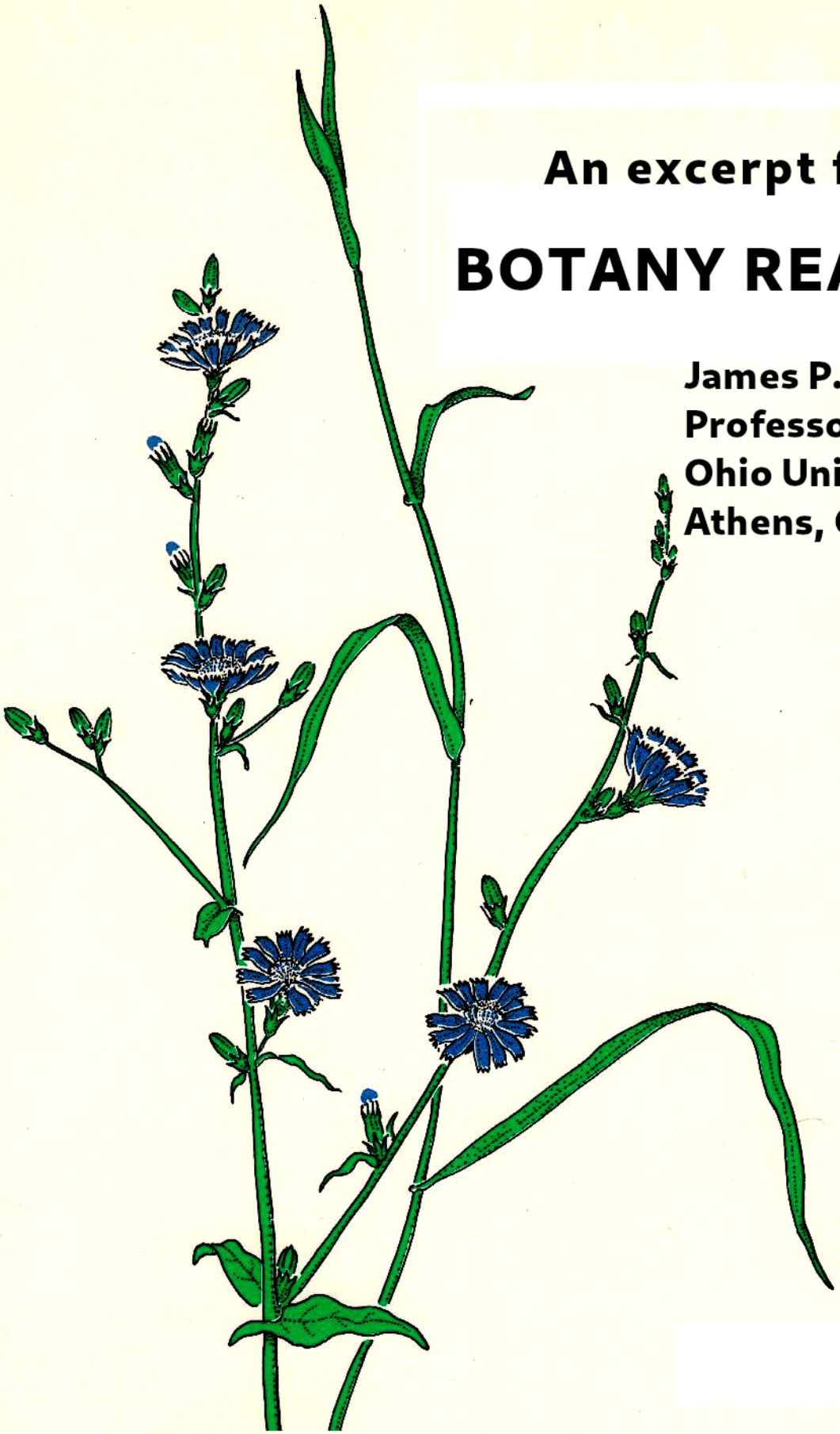

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How Are Plants Named?

Taxonomy is the discipline in biology that is concerned with the naming of organisms. Systematics, which generally includes taxonomy, is the placing of organisms into categories, i.e., classification. Since systematics and taxonomy go hand-in-hand, many people consider the two disciplines as being synonymous. Before considering the principles involved in establishing different categories of plants, we should consider the kinds of names used for plants: common and scientific names.

Common Names

Examples of common plant names you may use include potato, maple, tulip, aster, rose, beech, bean, tomato, garlic, wheat, beet, spinach, spider plant, and peach. If you were to refer to any of the above plants by its common name, most people would know what plant you are talking about.

We sometimes, however, may run into problems when using common names. Most people in the USA know what is meant when someone says "corn." If we took a walk on a farm in southern Minnesota and someone said, "Look at the corn plant," most of us would look for what we all know is corn.

But if we went for a walk with a farmer in Scotland, and s/he said, "Look at the corn," when we looked around we would not see what people in Minnesota call "corn." We would see, however, what we commonly recognize as "oats." The common name "corn" means something different to an Minnesotan than it does to a Scots(wo)man. Could we use the term "corn" if we were talking to someone from China, Argentina, Germany, or England? Another example of confusion resulting from use of common names is given at the end of this reading.

Scientific Naming: Linnaeus and Binomial Nomenclature

Carl von Linne (he Latinized his name to Carolus Linnaeus), an 18th century Swedish botanist often called either the "Prince of Botany" or "Father of Botany," is recognized as the originator of scientific naming of plants and other organisms. Linnaeus' principles of naming were set forth in a monumental work in 1753 entitled *Species Plantarum* and later in another work *Systema Naturae,* 10th Edition (1758).

When Linnaeus was in his early twenties, he was commissioned to study the flora (plant life) in Lapland. For over five months he observed and collected plants throughout this beautiful wilderness that reaches across northern Norway, Sweden, and Finland. Part of Linnaeus' task was to name the new plants he found. In the days Linnaeus was discovering new plants and animals, the method for naming organisms was to briefly describe them with a phrase in Latin. Some phrases contained six, 10 or more Latin words.

Writing out all those Latin descriptions became very cumbersome for Linnaeus as he attempted to list the plants he found in Lapland. By the time he published one of his first books about the plants he found in Lapland, Linnaeus started using methods for shortening the descriptions by naming each kind of plant with two Latinized words. This two-word method for naming plants and other organisms is known as **binomial nomenclature**.

Linnaeus' contributions to biological nomenclature are recognized by his popularity in Sweden even today, and by the fact that his two major works, *Species Plantarum* and *Systema Naturae* (10th Edition), have been accepted by international agreement as the official starting points for botanical and zoological nomenclature. Linnaeus' collections are now maintained by The Linnaean Society of London, which include 14,000 plants, over 3,000 insects, approximately 1,500 shells, and 158 dried fishes.

Binomial Nomenclature

A recognizable group of plants with similar characteristics that can be distinguished from other plants is called a **species**. In the Linnaean binomial system of nomenclature each species is designated by two Latinized words, hence binomial (two) nomenclature (names). An important point concerning the Linnaean system is that species that

appear to be closely related to each other are grouped into a broader group called the genus. These groupings are reflected in the names as exemplified in the following paragraphs.

Quercus alba is the binomial for the species with the common name "white oak." Individual white oak trees are more like other white oak trees than they are to any other plant. The group of white oaks, however, is similar to other species. The species that are very similar to white oaks also are oaks. In order to show that oaks are similar, they are grouped into the larger, more inclusive group, the genus. All oaks are included in the genus *Quercus*. The binomial for any oak, therefore, will have *Quercus* as the generic name, and some other Latinized word to identify the particular species, the **specific epithet**. For the white oak, *Quercus* is the generic name, *alba* the specific epithet. *Quercus suber* is the cork oak. *Quercus macrocarpa* is the bur oak.

A rule in biological nomenclature is that the binomial is italicized or underlined and the genus is capitalized. Note that the specific epithet is often descriptive. "Macrocarpa" means large fruit; "suber" refers to suberin, the substance in cork that makes it waterproof; and "alba" means white. Other descriptive specific epithets are macrophylum (large leaf), multiflora (many flowers), grandiflora (large flowers), vulgare (common), odorata (strong odor), virginiana (from Virginia), and ohioensis.

NOTE WELL! In many introductory textbooks the specific epithet is referred to incorrectly as the "species." For example, the text may incorrectly say something like: "The genus is *Quercus* and the species is *alba*." Once again, calling *alba* the species is NOT CORRECT! THIS IS CORRECT: *Quercus* is the genus, *alba* is the specific epithet, and *Quercus alba* is the species.

Use of scientific names for plants eliminates confusion such as you would experience when talking to a Scottish farmer about the year's crop. If she or he told you about how well the *Avena sativa* did during the year, you would know that there was a good crop of oats. If you told him or her that you eat flakes of *Zea mays* with cream or milk for breakfast, s/he would know that you eat corn flakes.

Principles of Classification

When plants are named and put into categories, the goal of the plant systematist is to use categories that reflect the natural relationships, or evolutionary history, of the plants. This is opposed to basing groups on artificial relationships.

Artificial groups

An example of artificial grouping is referring to plants as either herbs, vines, shrubs, or trees. Herbs are plants with no or little secondary growth, i. e., they are not woody. Vines climb and may be either herbaceous or woody. Shrubs are woody, may reach a height of 2-3.5 meters, and have more than one major stem. Trees are woody, generally have one major stem (the trunk), and may reach a height from over 3.5 meters to 100 meters or more. This way of grouping plants is very useful if you are interested in landscaping, but the groupings do not reflect how plants in the various categories are related to other plants. There are some trees that botanically are more closely related to some herbs than they are to other trees. For example, red bud trees are more closely related to beans and clover (herbs) than they are to maple trees. Trees, shrubs, vines and herbs are not natural groups for classification based on common evolutionary history: They are artificial groups.

Natural groups

The natural system of classification attempts to group organisms as determined by their common or shared evolutionary history. All the individual plants that are in a given species are related, i. e., they share a common history, and are more like other members of the species than they are to any other plant. All the species within a genus also are related and share a common history. All the plants within a genus are more like each other than they are to any plant that is not in the genus. Genera that have similar characteristics and that, therefore, share common history, are grouped into a family. All genera within a family are more closely related to each other than they are to any genus in another family. For example, the genus *Quercus* (oaks) is related to the genus *Fagus* (beeches); these

genera are in the family Fagaceae. Oaks and beeches are more like each other and share a common history more than they are to any plant not in the Fagaceae.

The story continues. Families with similar characteristics are grouped into orders. All families within an order are more closely related to each other than they are to families in other orders. What family do you think would be included in the order Fagales?

Orders are grouped into classes. Classes are grouped into the division.

All plants that produce flowers are classified in the division Magnoliophyta (*aka* angiosperms or flowering plants). The angiosperms contain two classes, the monocots (Liliopsida) and dicots (Magnoliopsida). The monocot class contains all the orders with individuals that have seeds with one "seed leaf" (cotyledon) attached to the embryo within the seed. The dicot class has orders with individuals that have two cotyledons attached to the embryo within the seed.

Following along with what was said for other groupings of plants, all orders in the class Liliopsida are more closely related to each other than they are to any order in the class Magnoliopsida. All orders in the Magnoliopsida are more closely related to each other than they are to any order in the Liliopsida. All species of flowering plants are more closely related to each other than to any plant species in a division other than Magnoliophyta.

A summary of the levels of classification is included in the example below showing the classification of the species commonly called "white oak," Quercus alba L.

- KINGDOM—Plantae
  - DIVISION—Magnoliophyta (Angiosperms)
    - CLASS—Magnoliopsida (Dicotyledons)
      - ORDER—Fagales
        - FAMILY—Fagaceae
          - GENUS—*Quercus*
            - SPECIFIC EPITHET— *alba*

For comparison, the following example shows the classification of the species commonly known as the "Easter lily," Lilium longiflorum Thunb.

- KINGDOM—Plantae
  - DIVISION—Magnoliophyta (Angiosperms)
    - CLASS—Liliopsida (Monocotyledons)
      - ORDER—Liliales
        - FAMILY—Liliaceae
          - GENUS—*Lilium*
            - SPECIFIC EPITHET— *longiflorum*

What's That?

Sometimes in more advance botanical writings and the two examples preceding this paragraph you might come across a letter, name or abbreviation after the binomial for a species. An example would be *Allium cepa* L. (*Allium cepa* L. is the common table onion.) What does the "L." stand for? The "L." stands for the authority, i.e., the

individual credited with assigning the binomial to the species. In this case, "L." stands for Linnaeus. The "Thunb." after *Lilium longiflorum* stands for Carl Peter Thunberg.

An Illustration About Plant Names

This little story may illustrate the value of scientific names and classification and how common names may lead to confusion. I would not be surprised if you had to read this section more than once, so please do not give up after the first reading.

One of the first flowers that we see in the spring throughout Appalachia is what we call the crocus. Our common spring-flowering crocus is in the genus *Crocus*, which is in the iris family, the Iridaceae. Some members of the genus *Crocus* flower in the fall, and appropriately are called "autumn crocuses." An economically significant autumn crocus, *Crocus sativus*, also goes by the common name "saffron." It is the source of the valuable spice also known as saffron, which is made up of dried stigmas. In summary, the spice saffron is dried stigmas of an autumn crocus known as saffron, which scientifically is known as Crocus sativus L. (Iridaceae).

There is another plant commonly called the meadow saffron which also is sometimes referred to as an autumn crocus, but it is in a different family than the Iridaceae. *Colchicum autumnale* is in the Colchicaceae. An important drug, colchicine, is isolated from *Colchicum autumnale*. In summary, the drug colchicine is obtained from an autumn crocus known as meadow saffron, which scientifically is known as Colchicum autumnale L. (Colchicaceae).

The above two paragraphs may seem confusing to you. Let's do something that you might get some practice doing in writing classes: Let's rewrite the summary sentences of the preceding two paragraphs. In **Version A** only the common names of the plants will be used; in **Version B** only the scientific names will be used. Is there any confusion when you read the sentences that use only common names? Scientific names?

- **Version A**
  - The spice saffron is obtained from the autumn crocus which is known as saffron.
  - The drug colchicine is obtained from the autumn crocus which is known as meadow saffron.
- **Version B**
  - The spice saffron is obtained from *Crocus sativus* (Iridaceae).
  - The drug colchicine is obtained from *Colchicum autumnale* (Colchicaceae).