Walters & Keil (1996) *Vascular Plant Taxonomy*, 4th ed.
Pp. 13-24

CHAPTER 2

Botanical Nomenclature

Nomenclature is the giving and using of names. Naming is a basic component in our language. Our speech requires it. Grammatically, names are the nouns we use to represent the objects and phenomena around us. Names allow us to communicate without resorting to lengthy descriptions. For example we can say "cow" to represent the large four-legged animated hairy object with a large sack underneath that gives us milk. Communication is aided by names that are readily understood by those hearing or reading the words.

COMMON NAMES

Historically, there have been two more or less independent kinds of nomenclature devised for plants. These are **common names** and **scientific names**. Common names are the older. Common names are created by people doing the everyday living of life. They are words in the language of the layman and thus are easy to understand and use. There actually are many different systems of common names that have developed in different cultures and languages.

Although they are widely used, there are some disadvantages to common names. Common names develop in the language of a given people and may not be useful to people with a different language or dialect. Wide-ranging plants often have several different common names, some of them widely used and others unique to a given locality or language. The common garden pansy, for example, has at least two hundred known common names, about one fourth of which are Spanish, and another fourth each in French, German and English. This multiplicity of common names can cause confusion. Would you suspect from the names that California bay-laurel, pepperwood, and Oregon-myrtle are the same plant?

Sometimes two or more kinds of plants share the same common name. Rattlesnake plant, for instance, is used for several different plants that have dry pods with loose seeds that rattle when the wind blows. On a local basis such common names may be very useful, but over a broader geographical area they may lead to problems in communication. Loosestrife is the widely used common name for two unrelated and dissimilar genera, *Lythrum* and *Lysimachia*, that have widely overlapping geographical ranges in eastern North America. The common name could be a barrier to communication between individuals using the name for different genera.

People develop words only for those objects they see or use. If a plant is inconspicuous or rare, it may not have a common name. Often the common or conspicuous members of a genus have their own common names. The less common or less conspicuous species of the same genus may be known only by the common name of the genus (if it has one). Sometimes common names represent what a botanist would consider to be a single species and sometimes they represent a genus or still larger grouping. Daisy, for instance, might be used to refer to a single species or to any of an indefinite number of more distantly related plants.

Common names have a place in everyday speech, but often they are not precise enough to be used in serious scientific studies or even in horticultural activities. Indeed they can be misleading. Since there is no possible way to regulate the formation of common names or to legislate which ones gain acceptance, there is no way to be sure the names used are accurate. For example, there is a plant with bright red fruits that ripen around Christmas time. Its common name is Christmas-cherry. Unfortunately, it is not an edible cherry but a poisonous nightshade. The name Christmas-cherry suggests a set of relationships that is dangerously misleading.

Some botanists use hyphenation to indicate which common names show false relationships. Black oak (not hyphenated) is a true oak; poison-oak (hyphenated) is not an oak at all, but instead is a member of the cashew family. If everyone followed this practice, at least some of the confusion caused by common names would be eliminated. Unfortunately not all botanists use hyphenation in this fashion, and very few members of the general public are even aware of this convention. In this book we are using hyphenation of common names as described above. Kartesz and Thieret (1991) have published a lengthy discussion of recommendations for construction of common names.

Certain "common names" are not in common use by laymen. Many have been coined by botanists to satisfy a perceived need for non-technical names for communication with members of the general public. For example, the common name, "thread-leafed eriastrum" is merely a translation of the scientific name, *Eriastrum filifolium*. Laymen probably use this "common name" about as often as they use the scientific name. Some translations such as these are actually erroneous. One botanist who was attempting to standardize common names for California plants listed the common name of *Lupinus ludovicianus* as Louisiana lupine under the mistaken impression that the word, "*ludovicianus*", was derived from Louisiana. Actually, the plant is the county flower of San Luis Obispo County, California, the only place in the world where it grows. The word *ludovicianus* was derived from Luis instead of Louisiana, and the plant is usually called the San Luis Obispo lupine. Some translated common names have gained wide acceptance, though, particularly if a plant is conspicuous and there are no competing common names. For example, Jeffrey pine is the widely accepted common name for *Pinus jeffreyi*.

SCIENTIFIC NAMES

Scientific names evolved out of the study and reporting of plants in books during the period from the 13th to 18th centuries. This was a period when Europeans were finding out about the world beyond their continent and many unfamiliar plants and animals were being seen for the first time. There was a need to catalog these new finds, some of which had potential economic or medicinal value.

Because the language of learned men of this period was Latin, names of plants were written in Latin. This use of Latin has been passed on in the formal naming of plants. Even today scientific names are considered to be a part of the Latin language regardless of their original derivation.

Initially the process of naming plants varied from one botanist to another and there was little standardization of the procedures whereby names were created and assigned. A plant was often named differently by different individuals. The name of a species typically consisted of a generic name (a noun) followed by one or more Latin modifiers (usually adjectives or descriptive phrases). This system worked reasonably well as long as the number of kinds (species) of a given genus (those described with the same noun) was small. When the number of species became large, the names became quite long. For example, a species of buttercup ended up with the lengthy phrase-name, *Ranunculus calycibus retroflexis, pedunculis falcatis, caule erecto, foliis compositis*, which means "the buttercup with bent-back sepals, curved flower-stalks, erect stems and compound leaves." These long, cumbersome names are now known as **polynomials**. Such a name carried two roles. It was a name and it was also a **diagnosis** [a set of distinguishing features] of the plant.

Starting with the work of the great Swedish naturalist, **Carolus Linnaeus** (1707–1778) botanists gradually adopted a set of standard procedures for naming plants. Linnaeus began to formulate a set of underlying principles for botanical nomenclature in the 1730's and in 1751 he published a book called ***Philosophia Botanica*** [*Botanical Philosophy*] in which he set forth the principles of nomenclature he had adopted. These principles served as a sound foundation for later botanists. Today we have a set of formalized rules for naming plants called the **International *Code of Botanical Nomenclature*** (discussed below). Many of the rules of nomenclature found within this book had their beginnings with Linnaeus.

In 1753 Linnaeus published a very influential work called ***Species Plantarum*** [*Species of Plants*]. In this book Linnaeus used **binomial nomenclature** instead of the unwieldy polynomials. Binomials are two-word names written in Latin. The first word is a noun, the name of the genus to which the plant is assigned. The second word is usually either an adjective or a possessive noun. For the buttercup described above, Linnaeus coined the name, *Ranunculus bulbosus.* Linnaeus did not originate the idea of two-word names. These had been used occasionally by other workers in the 16th and 17th centuries, but these early taxonomists had not used binomials consistently, and use of these names had not become widely accepted. Linnaeus was the first to use binomial nomenclature consistently for all the plants known in his day. His system was simple to use and very logical and was accepted readily by most of his contemporaries. He is credited with being the father of the modern scientific nomenclature.

One of the major benefits of binomial nomenclature was almost immediately apparent. The name no longer had to serve as a diagnosis of the plant. The name of a plant could remain stable even though new discoveries might require a modification of the list of characteristics that distinguished the plant from others. Today the use of the binomial system of scientific nomenclature is universally accepted. It has changed little from the time it was first applied and perfected by Linnaeus. The system of naming plants works because it has been agreed upon by botanists throughout the world.

Names of Taxa above the Genus Level

The *International Code of Botanical Nomenclature* provides for the naming of plants at various taxonomic ranks. The names of taxa above the genus level have standardized suffixes that indicate the rank of the taxon (Table 2-1). The taxonomic rank can automatically be determined from the name. Except at the kingdom level, the names are formed by appending the appropriate suffix to the name of a genus. Thus Magnoliopsida and Magnoliophyta are based on the genus *Magnolia.* Asteridae, Asterales, and Asteraceae are based on *Aster.* Lactucoideae and Lactuceae are based on *Lactuca.* The names of taxa above the genus level are *not* underlined or italicized.

Table 2-1. The classification hierarchy for the common dandelion (in the system of Cronquist, 1981).

TAXON	SCIENTIFIC NAME (with suffix emphasized)
Kingdom	Meta**phyta**
Division	Magnoli**ophyta**
Class	Magnoli**opsida**
Subclass	Asteri**dae**
Order	Aster**ales**
Family	Aster**aceae**
Subfamily	Lactuc**oideae**
Tribe	Lactuc**eae**
Genus	*Taraxacum* (no standardized suffix)
Species	*Taraxacum officinale* (no standardized suffix)

The *International Code of Botanical Nomenclature* provides for an exception to the use of standardized suffixes in the case of eight families. Each of these families has two different equally correct names (Table 2-2). These distinctive families were recognized by early taxonomists and given names that came to be widely accepted. This took place long before the formation of names by appending a suffix to the end of a genus name was standardized. These traditional names were so well established and widely used that there

Table 2-2. Families with alternate names.

Standardized name	Traditional name
Apiaceae	Umbelliferae
Arecaceae	Palmae
Asteraceae	Compositae
Brassicaceae	Cruciferae
Clusiaceae	Guttiferae
Fabaceae	Leguminosae
Lamiaceae	Labiatae
Poaceae	Gramineae

was resistance to their replacement by less familiar names based on genus names. In recognition of the preferences of some botanists for standardization and of others for tradition, the *Code* allows the use of either name. Each of the eight families thus has both a traditional name and a name with the standardized *-aceae* suffix. Both names are equally acceptable. It is recommended, however, that botanists be consistent within the context of a particular work (e.g., the flora of a region). If the traditional name is used for one family, traditional names should be used for the others as well.

In the survey of plant families (Chapters 7–20) in this book, we have listed families by their standardized names, but both names are presented. As you, as a taxonomy student, learn the features of these families you should learn both names. Some manuals and floras use the traditional names and others use the standardized names.

Generic Names

A **generic name** (the name of a genus) is treated as a Latin noun. It should be capitalized and either underlined or written in italics. Generic names come from various sources (Table 2-3). Some are ancient Latin plant names. Many others have been coined by botanists. Many generic names are derived from Greek or Latin word roots. Some are formed from the names of mythological beings or historic personages. Taxonomists have often named genera in honor of a contemporary, such as an explorer or fellow botanist.[1] A generic name may even be a meaningless [but pronounceable] combination of letters.

Latin nouns have a grammatical gender. This usually has nothing to do with the actual gender, if any, of the object being named. A generic name may be masculine, feminine, or neuter. The ending of a name often indicates its grammatical gender.[2] Names ending in *-a* usually have feminine gender (e.g., *Potentilla*). Those ending in *-us* are commonly masculine (e.g., *Lupinus*), though a significant minority are feminine (especially genera of woody plants such as *Pinus* and *Quercus*). Names ending in *-is* may be masculine or feminine though the majority are feminine (e.g., *Physalis*). Names ending in *-um* (e.g., *Cirsium*) are neuter. Names ending in *-e* may be feminine (*Chorizanthe*) or neuter (*Secale*).

Table 2-3. Examples of derivation of generic names.

Generic name	Derivation
Acer	ancient Latin for maple
Conium	Latinized form of ancient Greek name
Tsuga	Japanese name for hemlock
Pseudotsuga	Greek and Japanese meaning false hemlock
Ribes	Arabic name for gooseberry
Artemisia	Greek mythology—Artemis, the goddess of the hunt
Dimorphotheca	Greek, meaning two forms of fruits
Trifolium	Latin, meaning three leaves
Campanula	Latin, meaning little bell
Kalmia	Named for Peter Kalm, a student of Linnaeus and botanical explorer in eastern North America
Brandegea	Named for T. S. Brandegee, California botanist
Allium	Ancient Latin for garlic
Muilla	Anagram of *Allium*

[1] When a genus is named in honor of an individual, the name is usually formed by adding -ia to the individual's surname, except in those cases in which the surname ends in a vowel.

[2] Names may end with letters other than those discussed here. You may wish to consult Botanical Latin (Stearn 1993) for additional information about Latin grammar. It is often possible to determine the gender of a name from the adjectives that modify it (see footnote 3).

Species Names

A **species name** is a *two-word name* that consists of a **generic name** and a **specific epithet.** For example, *Trillium grandiflorum* is the scientific name of a common spring wildflower in eastern North America. *Trillium* is the generic name, and *grandiflorum* is the specific epithet. The specific epithet by itself is *not* a species name. A specific epithet is usually written in lower case and underlined or italicized. [Certain specific epithets may be capitalized (e.g., those derived from a person's name), but the *International Code of Botanical Nomenclature* recommends that specific epithets always be written in lower case].

A specific epithet is usually either a Latin adjective, or a noun in the genitive (possessive) case (Table 2-4). If the specific epithet is an adjective it must agree with the noun it modifies in gender and in number (singular) and thus often has the same ending as the noun.[3] Such a specific epithet may be descriptive of the plant, it may refer to its geographical range or it may be descriptive of habitat or some other important information.

Specific epithets are often coined to honor a person [generally someone who has some connection with botany]. When a specific epithet is derived from a man's surname, it is usually formed by adding the suffix *-ii* to the man's name (e.g., *wrightii*), except in those cases where the surname ends in the letter "r" or a vowel (including "y"). The suffix *-ii*, which is the possessive case for the Latinized version of a man's name, is the equivalent of -'s in English. *Eriogonum wrightii*, for instance, means Wright's buckwheat. If the surname ends in r or a vowel, the suffix is usually *-i* (e.g., *porteri, parryi, greenei*). For a woman's name the suffixes are *-iae* and *-ae* respectively. A specific epithet may also be formed as an adjectival form of a name. For instance, *Eriogonum butterworthianum* means the Butterworth buckwheat.

Table 2-4. Examples of derivation of some specific epithets (adjectival epithets all with feminine ending).

Epithet	Derivation
albiflora	Latin compound meaning white-flowered
chrysantha	Greek compound meaning yellow-flowered
serrata	Latin for saw-toothed
arvensis	Latin meaning of fields
borealis	Latin for northern
americana	from America
pensylvanica	from Pennsylvania
neomexicana	from New Mexico
engelmannii	for George Engelmann
greenei	for Edward Lee Greene
eastwoodiae	for Alice Eastwood
eastwoodiana	for Alice Eastwood

There are exceptional cases in which the specific epithet is a second noun that is not possessive. Examples are discussed in Nicolson (1986).

Scientific names are often written with their **author** or **authors**, the individual or individuals who are responsible for having given the plants their names. Consider the following examples of species names.

Lotus corniculatus L.

Lotus heermannii (Dur. & Hilg.) Greene

In both cases the generic name is *Lotus*, a genus in the pea family. The specific epithet of the first species is an adjective that in Latin means "bearing a horn-like projection". The second species was named in honor of A. L. Heermann, a nineteenth century plant collector. The latter name means Heermann's lotus.

[3]The ending of a Latin adjective depends on the gender of the noun it modifies (e.g., *Scrophularia californica* [f], *Caulanthus californicus* [m], and *Taraxacum californicum* [n]). The endings of a specific epithet can often be used to determine the gender of the generic name it modifies (e.g., *Rhamnus californica*). From the feminine ending of the specific epithet it can be determined that *Rhamnus* has feminine grammatical gender.

The name or names of the authors follow the binomials. The surnames of these individuals are often abbreviated. The author for the first species is Linnaeus, whose name as an author is customarily abbreviated as L. The history of the second name is a bit more complicated. The species was originally named by two naturalists from Philadelphia, E.M. Durand and T.C. Hilgard, as *Hosackia heermannii*. Several years later, E.L. Greene, a California botanist, concluded that the genus *Hosackia* should be merged with *Lotus*, and transferred the specific epithet, *heermannii* from *Hosackia* to *Lotus*. Durand and Hilgard (**the parenthetical authors**) get credit for having published the epithet, *heermannii*. Greene (**the combining author**) gets credit for transferring the epithet to *Lotus* and publishing the combination, *Lotus heermannii*.

Sometimes two or more authors are listed after a species name. These names may be separated by an ampersand (&) or by the prepositions, "ex" or "in". The ampersand indicates that two authors worked together on the description, whereas "ex" means that the second author published a name proposed by the first. The word "in" is used to designate the situation where the first author wrote a section of a book or article edited by the second.

In formal taxonomic publications such as floras, identification manuals, revisions, and monographs, the names are generally written with their authors. This helps to trace the history of a name and to avoid confusion, since a scientific name may have been independently applied to different plants [accidentally] by different taxonomists. For example, *Erigeron canescens* Torr. & A. Gray applies to an entirely different plant than does the *Erigeron canescens* Hook. & Arn. Some manuals include a list of the abbreviations of authors' names with the name spelled out and a bit of biographical information provided for each.

Names of Infraspecific Taxa

Taxonomists sometimes encounter species that are variable. If these variations represent geographical races, a botanist may recognize them as **subspecies** or **varieties**. Subspecies are more inclusive than varieties. In a highly variable species both subspecies and varieties may be recognized. [This does not happen very often]. If a variant is sporadic in its occurrence and does not have a geographical range of its own, most taxonomists will not formally name it. Some botanists, however, recognize such plants as **forms**. The name of an infraspecific taxon is an epithet similar in construction to a specific epithet and preceded by a word or abbreviation that indicates its rank (e.g., *Penstemon heterophyllus* ssp. *australis*; *Lupinus densiflorus* var. *aureus*). It should be emphasized here that the horticultural "cultivar" is *not* a part of the formal system of botanical nomenclature.

When a species is divided into infraspecific taxa or when a taxonomist recognizes that two or more taxa that previously had been recognized as separate species are actually geographical races or forms of a single species, names must be adjusted accordingly. One of the infraspecific taxa that results includes the type specimen of the species[4]. Its subspecific (varietal, formal) epithet will be exactly the same as the specific epithet, and the name will be written as in the following example:

Hemizonia parryi Greene ssp. *parryi*

Notice that the epithet of the subspecies that contains the type specimen is written without an author. This is often referred to as the "typical" subspecies because it contains the type specimen of the species, but other subspecies may be more common or widespread. We prefer to call it the **type subspecies**. All other subspecies are written together with their author(s):

Hemizonia parryi Greene ssp. *australis* Keck

Hemizonia parryi Greene ssp. *congdonii* (Robinson & Greenman) Keck

Hemizonia parryi Greene ssp. *rudis* (E. Greene) Keck

[4]See discussion of General Principles of Botanical Nomenclature below.

PRONOUNCING SCIENTIFIC NAMES

Latin is now a seldom-spoken language, and we do not know precisely how it was spoken in the Roman world. Many scientific names are words that were not a part of ancient Latin and would sound as foreign to the Romans as Latin does to us. Many English-speaking botanists pronounce Latin names as if the words were written in English. This is known as the Traditional English system. There are many variations and these are often passed on from teacher to student. Individual botanists are not always consistent in pronunciation, often pronouncing names as they first learned them, even if words of similar construction end up with differing pronunciations.

On the other hand, most classicists and many European botanists prefer Reformed Academic Latin in which strict rules govern the pronunciation of particular letters or combinations of letters. Phonetically the latter undoubtedly comes closer to the Roman pronunciation than does the English system. As an example, the family name, Rosaceae, is usually pronounced Ro-záy-see-ee by most English-speaking taxonomists and Ro-sáh-seh-ah by continental botanists. Differing pronunciations can hinder communication in some cases. In our increasingly internationalized world it is increasingly likely that American botanists will come in contact with scientists from other regions. A good source of information on pronunciation in the Reformed System is *Botanical Latin* by W. T. Stearn (1993). Weber (1986) suggested a set of pronunciation guidelines for American botanists who wish to communicate with botanists educated in other countries.

Although there is no consensus among botanists of the world regarding the pronunciation of vowel sounds, there are some general guidelines. Look at the word carefully and pronounce the word phonetically. All vowels in Latin are sounded. In some cases two vowels are pronounced together as a diphthong, making a single syllable. The most common of these are *ae* and *oe*. In most other two-letter combinations, both are pronounced. In an English word such as *advance* that ends in *e*, this terminal letter is usually silent, but in Latin a terminal *e* is always pronounced, as in the word *arvense* (ar-vén-se *not* ar-véns).

The authors of some floras provide accent marks to indicate the syllable of a word to be stressed. In the absence of these marks you may have to guess or ask how to pronounce the name. There are various guidelines for accenting Latin words but these are too detailed for presentation here. Consult a Latin dictionary or *Botanical Latin* if you are interested in learning more about the language and its pronunciation. The editors of *The Jepson Manual* (Hickman, 1993) presented the following recommendations regarding pronunciation:

1. Divide the word carefully into syllables (it is safest to assume that every vowel belongs to a different syllable).
2. Pronounce each syllable (e.g., "co-to-ne-as-ter", not "cot-on-east-er).
3. Listen to others and practice what sounds good to your ear; conviction is important.
4. Attempt to accent all syllables equally; this is likely to show you where accents fall naturally (some manuals, but not this one, specify accents with stress marks).
5. Develop your own standards for pronouncing common endings like "-aceae", "-iae", "-ensis", etc.
6. Retain pronunciation of proper names used in scientific names ("jones-eeee", not "jo-nes-ee-eye").
7. When someone presumes to correct your pronunciation, a knowing smile is an appropriate response.

THE INTERNATIONAL CODE OF BOTANICAL NOMENCLATURE

The rules for use of scientific names are maintained and updated periodically at meetings of botanists called **International Botanical Congresses**. The updated rules and other guidelines are published after each Botanical Congress in a new edition of the ***International Code of Botanical Nomenclature***. It must be emphasized that neither the congress nor the rules have any executive or judicial power. The rules must be accepted or rejected on their own merits. There is no way, outside of peer pressure, to force a recalcitrant taxonomist into line.

A second problem with applying the rules concerns the way in which an experienced taxonomist interprets the variation of plants. The rules say nothing about this. One taxonomist may see three distinct groups of plants that he recognizes as species, whereas another equally qualified taxonomist sees only one. In one case there are three names for a set of plants while in the other there is only one. The "correct" interpretation is the one that becomes used.

With these limitations in mind it is time to make a quick survey of the rules. You should use the current edition of the *International Code of Botanical Nomenclature* as the final word on problems arising from the use of scientific names. The selected reading section has a number of references that discuss the rules section by section. In this exercise only the broad principles upon which the rules are based are discussed.

GENERAL PRINCIPLES OF BOTANICAL NOMENCLATURE

1. Botanical nomenclature is independent of zoological nomenclature.

The *Code* applies equally to names of all taxonomic groups treated as plants, including fungi and algae (the code does not include bacteria other than blue-green algae as plants) whether or not these groups were originally so treated. This is a problem only for some small organisms that are treated as protozoans by zoologists and as algae or fungi by botanists (and that may have separate names under the two different codes). Although both botanists and zoologists adhere to the same general principles of naming, there are many differences in detail. For example, the earliest date for which priority applies for most plant names is 1753, whereas it is 1758 for most animals. There are also differences in citation of authors and in criteria for valid publication. It is possible for a plant and animal to have exactly the same generic or even species names.

2. The application of names of taxonomic groups is determined by means of nomenclatural types.

When a botanist names a new species or infraspecific taxon he or she designates a particular specimen, the **holotype**, to serve as a permanent reference point for the name. This specimen is deposited in a particular herbarium (plant museum) where it may be consulted by other botanists. The holotype is the tangible expression of the description and thus becomes the basis of comparison. Duplicate specimens of the holotype (specimens of the same plant collected at the same time in the same place) are called **isotypes**. Type specimens are often specially curated in herbaria and are particularly important to a taxonomist who is attempting to determine the correct application of a name.

If the taxon being named is a genus, family, or order, the nomenclatural type is a species, genus, or family, respectively. Each genus has a type species, each family has a type genus, etc. Ultimately the type of a genus or higher category is the type specimen of the type species.

Occasionally a taxonomist discovers that no holotype exists for a particular taxon. In some cases the holotype has been lost or destroyed. During World War II thousands of type specimens burned up when the Berlin Herbarium was destroyed during an Allied bombing raid. In other cases a holotype was never designated (the requirement of designating a type is a comparatively recent rule). A botanist may have listed several specimens as types or may have merely listed the specimens he had examined; these are called **syntypes**. If no holotype exists, a knowledgeable taxonomist (generally someone who is studying the plants in question) must choose a specimen to serve as if it were the holotype. The Rules specify from what group of specimens a type can be chosen. For example, an isotype or syntype would have the highest priority. Second in priority would be any other specimen seen and cited by the original author as being included in the taxon. These are known as **paratypes**. A type specimen chosen from these sources is called a **lectotype**. If none of

the original specimens are extant, then a new type or **neotype** must be chosen.

3. The nomenclature of taxonomic groups is based on priority of publication.

Said in its simplest terms, this means that the first correctly published name for a taxon is the one to use. However, this principle has been found to require limitation in practice. Because the publication date of Linnaeus' **Species Plantarum** effectively marks the end of polynomial nomenclature and the beginning point for binomial nomenclature, the date of its publication (May 1, 1753), is considered the earliest listing to which priority of publication applies for all vascular plants, some bryophytes, some algae, and some fungi. Any name published before this date (even if it was a binomial) has no standing as far as priority is concerned. Any binomial correctly published after that date must be considered for priority purposes. For certain plants (and fossils) a later date is the starting point.

Priority is very important when two or more names are discovered to apply to the same taxon. It is not hard to see how a plant could be named more than once. As early taxonomists attempted to sort out and name the many plants that were being sent to them or that they were collecting, it was inevitable that sometimes two or more taxonomists would independently name the same plant. It is not at all unusual for a species to have been discovered and named by several different botanists. Additionally some species are sufficiently variable that their extremes look quite different. Early taxonomists often worked from very limited samples and were not aware of the natural variation encountered in the wild. The importance of priority is that it allows us to decide which of the competing names to use—the earliest one published.

Priority has been limited in certain cases by the concept of **nomina conservanda** (conserved names). In some cases a botanist discovers that a very widely used name is actually predated by an obscure, largely unknown name. The more commonly used name may be conserved or retained as the valid name, but this takes a special action of a Botanical Congress. The name with the earlier publication date becomes a rejected name. The *International Code of Botanical Nomenclature* contains a list of conserved and rejected names. Until recently only generic and family names could be conserved. Under the provisions of the most recent editions of the code, conservation of species names is possible, but only under very limited conditions.

4. Each taxonomic group with a particular circumscription, position, and rank can bear only one correct name, the earliest that is in accordance with the Rules, except in specified cases.

Sometimes botanists disagree as to the placement of a particular taxon. One taxonomist may consider a plant to be a member of one genus whereas a second botanist thinks it belongs in a different genus. Taxonomists may disagree as to the rank of a taxon, one treating a plant as a variety and another treating the same plant as a distinct species. In these cases there is a correct name for the plant in each of the alternative taxonomic placements. In the example discussed above, *Hosackia heermannii* Dur. & Hilg. is the correct name for the species if the genus *Hosackia* is considered to be distinct from *Lotus*. If *Hosackia* is merged with *Lotus*, the correct name is *Lotus heermannii* (Dur. & Hilg.) Greene. Each name is correct in a given context. There is still another interpretation for this taxon. It has been considered to be a variety of another species: *Lotus eriophorus* Greene var. *heermannii* (Dur. & Hilg.) Ottley.

Alternate names for a plant are **synonyms**. There are two types of synonyms. **Taxonomic synonyms** are synonyms in the *opinion* of a taxonomist. They are names based on different type specimens and are considered to be synonyms because a taxonomist who has studied the plants has concluded that they apply to the same taxon. One taxonomist may consider them to be synonyms whereas another does not. **Nomenclatural synonyms** are based on the same type specimen (and almost always have

the same specific or infraspecific epithet). Nomenclatural synonyms are always linked because they share the same type specimen. Synonyms of either type can differ in rank.

Certain names cannot be used because they do not conform to the rules of nomenclature. These are called **illegitimate names**. For instance it is against the rules to use a name that has already been validly published for a different kind of plant. Such **later homonyms** must be rejected. Also against the rules are **tautonyms** (binomial names in which the same word is used for the generic name and for the specific epithet). Certain procedures must be followed when a name is first published (described below); if these procedures have not been followed the name must be rejected (or in some cases it can be published correctly at a later date).

5. Scientific names are Latin or treated as Latin regardless of their derivation.

The origin of the word that is used to make the name can be Latin or any other language if it is written in the Roman alphabet. It is treated as if it were a part of Latin and is subject to the rules of grammar of that language. The words chosen to be Latinized for use as names usually have some relationship to botany. [See the discussion above under Generic Names and Species Names].

6. The Rules of nomenclature are retroactive unless expressly limited.

Early botanists did not have a code of nomenclature. The rules we follow gradually developed through the practices of early taxonomists and were later codified. Not all botanists, of course, did things the same way and certain early practices are now considered to be against the rules. In order to consistently apply the code it has been necessary to retroactively outlaw certain early procedures. Other practices are considered acceptable from 1753 to some later date and after that date they are disallowed. For instance, the requirement that a holotype be designated dates only from January 1, 1958. Prior to that date a species could be named without designation of a type.

NAMING A NEWLY DISCOVERED PLANT

Although taxonomists have been naming plants for over two hundred years, new species are still being discovered. Occasionally taxonomists even discover previously unrecognized genera and families. Most of the new taxa now come from tropical areas that have been poorly explored by trained botanists. On occasion, however, new taxa are discovered even in well-botanized temperate regions.

There are several steps that a taxonomist must follow to **validly publish** the name of a new plant (i.e., publish it in an acceptable format). (1) The name must be properly constructed and it must not be a name anyone has ever used before. (2) The taxonomist must clearly indicate the rank of the taxon being described. (3) A specimen must be designated as the holotype. (4) The taxonomist must publish a description or diagnosis written in Latin. A diagnosis is a brief statement that indicates the ways in which the newly described taxon differs from other plants. A description of the plant in the language of the taxonomist and an illustration are often prepared but these are not requirements. (5) The name and the accompanying information must be **effectively published** (i.e., printed in a publication that would be generally available to other botanists). New taxa are usually described in botanical journals or books such as manuals or floras. Publishing the name of a new plant in a seed catalog, a newspaper, or some other ephemeral publication is not acceptable (although in earlier times such publications were allowed).

The requirement that a description or diagnosis written in Latin be part of the publication of a new taxon may seem archaic, but it actually is a perpetuation of the use of Latin as an international scientific language. Although the remainder of the publication may be in English, German, Russian, Japanese, or some other language, the essential description or diagnosis is in Latin. A taxonomist does not have to learn all the

languages of the world to be able to understand the publication of a new species. Because so much of the early taxonomic work was written in Latin, a professional taxonomist must be able to work with this language. Some botanists who are more skilled than others in the use of Latin often are asked by their colleagues to prepare the required Latin descriptions or diagnoses. Stearn's *Botanical Latin* is a very useful resource for writing and reading botanical Latin.

Proposals have been made to drop the requirement for Latin descriptions or diagnoses and to use English instead. English is more and more becoming the dominant international scientific language. Although there are some good arguments in favor of this proposal it has not received broad international support to date.

WHY DO BOTANISTS CHANGE PLANT NAMES?

Scientific names are often considered to be more stable than common names (see discussion of common names above). This is often, but not always, the case. Now and then a non-taxonomist is dismayed to learn that the scientific name of a familiar plant has been changed. When this affects an economically important species, there are howls of protest.

For many years the standard reference for California plants was *A California Flora* by Philip A. Munz and David D. Keck. When it was published in 1959 it was the most up to date compilation of information about the state's flora. Within a few years, however, so much new information had accumulated that Munz published a lengthy supplement. Over the years since the publication of Munz's supplement, an accumulation of new information and corrections of old information made a new flora more and more necessary. When a new flora, *The Jepson Manual* was finally published in 1993, many professional and amateur botanists pored over the pages to find out what names had been changed. Many were dismayed to learn that the long-familiar names of some plants had been replaced by different, unfamiliar names. Why were there so many name changes?

The answer to the question is not simple. Some changes are a result of the application of the rules of nomenclature. Earlier California botanists in some cases had made errors in the names they accepted and the rules require other names to be used. Some of the changes resulted from an application of the principle of priority of publication. Even today we are still discovering instances where the name that has long been in use for a plant is predated by another name. As early taxonomists attempted to sort out and name the many plants that were being sent to them from western North America or that they were collecting, sometimes two or more taxonomists independently named the same plant. Early botanists who visited California included Russians, Spanish, English, and Americans. It is not at all unusual for a species to have been discovered and named by several different botanists. Some early names that were published in obscure books or serials have only recently come to the attention of California botanists.

In other cases it was the advance of our knowledge of California's plants that brought about reinterpretations of the previous taxonomic treatments for particular genera and species. New methods of gathering or interpreting data sometimes resulted in evidence that relationships were not what earlier botanists had thought. Frequently these realignments result in name changes.

In some cases modern studies indicate that two or more kinds of plants that had previously been treated as members of different species are actually so closely related that they belong in the same species. Some species are sufficiently variable that their extremes look quite different. Early taxonomists often worked from very limited samples and were not aware of the natural variation encountered in the wild. When species are merged, sometimes it turns out that the name that has been applied to a widespread, conspicuous species is not the oldest available name and the combined species end up with the name that had once been applied to a much less widespread plant.

To professional botanists many of these changes were old news. During the 34 years between the publication of *A California Flora* and *The Jepson Manual* many studies

of California plants had been published in botanical journals. It was only when the changes that resulted from these studies were gathered together in *The Jepson Manual* that they seemed so numerous.

The nomenclature of a group of plants is tightly tied to its classification. Sometimes botanists disagree as to the placement of a particular taxon or group of taxa. An early taxonomist may have considered a plant to be a member of one genus whereas a later botanist has evidence that it belongs in a different genus. When this happens, the later botanist may transfer the species from one genus to another. Some taxonomists (splitters) tend to see differences as more important than similarities and divide large groups into smaller taxa. Others (lumpers) may see similarities as more important than differences and merge small taxa into larger groups. As a result of differing taxonomic treatments a species may have correct names in several genera. A taxonomist authoring a particular treatment has to decide which classification is best supported and therefore which name to use.

Taxonomists may disagree as to the rank of a taxon as well, one treating a plant as a subspecies or variety and another treating the same plant as a distinct species. Once again in these cases there is a correct name for the plant in each of the alternative taxonomic placements.

SELECTED REFERENCES

Bailey, L. H. 1933. *How Plants Get Their Names.* MacMillan Co., New York (reprinted in 1963 by Dover Publications, New York).

Benson, L. 1962. *Plant Taxonomy. Methods and Principles.* Ronald Press, New York. pp. 341-387.

Berlin, B. 1973. Folk systematics in relation to biological classification and nomenclature. *Annual Review of Ecology and Systematics* 4:259-271.

Brown, R. W. 1956. *Composition of Scientific Words.* Smithsonian Institution Press, Washington, D.C. (1991 reprint).

Brummitt, R. K., and C. F. Powell (eds.). *Authors of Plant Names.* Royal Botanic Gardens, Kew, England.

Greuter, W., J. McNeill, et al. (eds.). 1994. International Code of Botanical Nomenclature as adopted by the Fifteenth International Botanical Congress, Yokohama, August–September 1993. *Regnum Vegetabile* 131.

Hickman, J. C., ed. 1993. *The Jepson Manual. Higher plants of California.* University of California Press, Berkeley, Los Angeles, and London.

Jeffrey, C. 1977. *Biological Nomenclature.* The Systematics Association, London.

Kartesz, J. T., and J. W. Thieret. 1991. Common names for vascular plants. Guidelines for use and application. *Sida* 14:421–434.

Nicolson, D. H. 1974. Orthography of names and epithets: latinization of personal names. *Taxon* 23:549-561.

———. 1986. Species epithets and gender information. *Taxon* 35:323-328.

Savory, T. 1962. *Naming the Living World.* John Wiley & Sons, New York.

Stearn, W. T. 1993. *Botanical Latin. History, Grammar, Syntax, Terminology and Vocabulary*, 4th ed. David & Charles, Newton Abbot, England.

Weber, W. A. 1986. Pronunciation of scientific names. *Madroño* 33:234-235.