CHAPTER 3

PLANT NOMENCLATURE

The assignment of names to plants is called *nomenclature*.* It involves principles governed by rules developed and adopted by the International Botanical Congresses. The rules are formally listed in the International Code of Botanical Nomenclature (Voss, 1983) and are often referred to simply as the "Code." The ultimate goal of this precise system, as embodied in the Code, is to provide one correct name for each taxon. The rules of nomenclature are subdivided into *articles*, which must be adhered to, and *recommendations*, which are optional.

Although classification schemes may change with time, the scientific names of plants are relatively stable. The plant retains its name although the family or higher taxonomic categories are changed. Much effort has been devoted to establishing procedures for naming taxa and for changing names that were incorrectly assigned.

Nomenclature and classification are different but inseparable. The placement of a plant or group of plants in the classification scheme may be determined by knowing its name. When the generic name of a plant is known, it is possible with the proper bibliographic aids to determine the family to which that genus is usually assigned. Such a bibliographic tool is *A Dictionary of the Flowering Plants and Ferns* (Willis, 1973).

BASIS OF SCIENTIFIC NAMES

The present system of nomenclature is the result of a historic series of changes that gradually became formalized. The oldest plant names we now use are the common

Nomenclature is pronounced nō-men-clā-chur and its adjective form is *nomenclatural*. The word *nomenclatorial* is the adjective form of *nomenclator*, a person or book that deals with names.

names used in ancient Greece and Rome. Today all plant names have a Latinized spelling or are treated as Latin regardless of their origin. This custom originates from medieval scholarship and the use of Latin in most botanical publications until the middle of the nineteenth century. The assignment of names was relatively unstructured until the seventeenth century when the number of plants known to botanists began to increase greatly. This resulted in a need for a more precise naming system for plants. During several centuries before 1753, names were often composed of three or more words. These names are called *polynomials*. For example, in the herbal of Clusius (1583), the name *Salix pumila angustifolia altera* is used for a species of willow.

This complex name-description system was not workable because it was cumbersome and not readily expandable. In 1753, with Linnaeus's *Species plantarum*, the *binomial* format was substituted for the polynomial. This two-word format made naming more convenient and provided a readily expandable system. Our present formal nomenclature began with the publication of Linnaeus's *Species plantarum* (1753). Since 1753 nomenclatural procedures have become standardized through periodic legalistic revision so that plants are not named haphazardly.

Scientific Names versus Common Names

Latinized scientific names often appear formidable. There is a natural inclination to avoid words with unfamiliar and difficult pronunciations. Although scientific names may be difficult to pronounce, guides to pronunciation do exist (Johnson, 1971). To help in remembering names, Appendix 1 provides the meanings of some Latinized names.

Why do botanists use Latinized scientific names instead of common names? Common names present a number of problems. First, common or vernacular names are not universal and may be applied only in a single language. (Scientific names, on the other hand, are universal and are recognized throughout the world.) Second, common names usually do not provide information indicating the generic and family relationships. Third, if a plant is well known, it may have a dozen or more common names. For example, *Chrysanthemum leucanthemum* is called daisy, white daisy, ox-eye daisy, shasta daisy, or white weed; *Centaurea cyanus* is variously known as cornflower, bluebottle, bachelor's button, or ragged robin. Fourth, sometimes two or more plants may have the same common name. In Georgia, *Sida* in the family Malvaceae is called ironweed; but in the Midwest, *Vernonia* in the family Compositae is called ironweed. Fifth, many species, particularly rare ones, do not have common names.

Composition of Scientific Names

The genus name and specific epithet together form a binomial called the *species name*. The term *species name* is often erroneously used to refer to the specific epithet alone, but the species name consists of both the generic name and the specific epithet. A complete scientific name must be followed by the third element, the name of the person or persons who formally described the plant. For example, the complete scientific name for white oak is *Quercus alba* Linnaeus; the genus is *Quercus*, the specific epithet

alba, and the author citation Linnaeus. The author element of a name is often abbreviated, and "L." is normally used for the authority in place of "Linnaeus." To be correct, the species name of white oak is not "*alba,*" but is *Quercus alba* L. Therefore, a complete scientific name of a species consists of three elements: (1) the genus (plural, genera), (2) the specific epithet, and (3) the author citation.

Generic Names The generic name is a singular Latinized noun or a word treated as a noun. It is always written with an initial capital letter. After a generic name has been spelled out at least once, it may be abbreviated by using the initial capital letter; for example, "*Q.*" for *Quercus*. Generic names may not consist of two words unless they are joined with a hyphen. Latin inflectional endings are used for both generic names and specific epithets. Section 3 of the International Code of Botanical Nomenclature deals with what makes a generic name. Stearn's *Botanical Latin* (1983) is an excellent reference for the mechanics and grammar of botanical Latin.

The name may be taken from any source, and it may commemorate some person of distinction. Genera such as *Linnaea* for Linnaeus or *Jeffersonia* for Thomas Jefferson are commemorative. Many ancient common names, such as *Asparagus* and *Narcissus,* were converted into generic names directly from Greek. Features of plants, such as the liverlike leaves of *Hepatica,* gave generic names to still others, the word *Hepatica* being derived from the Latin word for liver. Information about a plant is sometimes expressed in a generic name because it indicates in a general way the kind of plant under consideration. With familiar genera we can recognize the plants by their generic names, for example, *Rosa* as a rose and *Pinus* as a pine, both of which are ancient colloquial names.

Specific Epithets Specific epithets may be derived from any source and may honor a person, or they may be derived from an old common name, a geographic location, or some characteristic of the plant, or they may even be composed arbitrarily (see Article 23 of the Code). The specific epithet is often an adjective illustrating a distinguishing feature of the species. Specific epithets consisting of two words must be hyphenated, as in the case of *Capsella bursa-pastoris* (L.) Medic.

The specific epithet usually agrees with the gender of the generic name if the specific epithet is an adjective. If the specific name is an adjective placed in a genus that has the masculine ending *-us,* a species might be spelled *albus,* but if it is a genus with a feminine spelling, it would be spelled *alba*. In spite of its *-us* ending, *Quercus* is feminine for the purposes of botanical Latin: thus, *Quercus alba*. It is customary to treat all trees in botanical Latin as feminine, as was usually the situation in classical Latin. A specific epithet may also be a noun in apposition carrying its own gender. When the noun is in apposition, it is normally in the nominative case—for example, *Pyrus malus* for the common apple. When a specific epithet is named after a person and ends in a vowel or *-er,* the letter *-i* is added (e.g., *glazioui*), but if it ends in a consonant, the letters *-ii* are added (e.g., *ramondii*) (Recommendation 73C of the Code). When named for a female, it ends in *-iae* or *-ae;* e.g., *luciliae*. Specific epithets derived from geographical names usually are terminated by *-ensis, -(a)nus, -inus, -ianus,* or *-icus;* examples are *quebecensis, philadelphicus,* and *carolinianus* (Recommendation 73D).

The Code recommends that all specific epithets be written with a small initial letter, but capital letters may be used when epithets are derived from a person's name, from former generic names, or from common names. Both the generic name and the specific epithet are customarily underlined when written or typed; when printed, they are in italics or boldface. The author citation is never underlined.

Author The name of the person or persons following the genus and specific epithet indicates the author. It is a source of historical information regarding the name of the plant (Clausen, 1938). By giving the author's name, one may discriminate among names. The author citation may be abbreviated; for example, "L." for Linnaeus or "Michx." for André Michaux. Frequently a name will have two authors, with the first in parentheses. For example, with *Vernonia acaulis* (Walter) Gleason, the positioning of these two authors shows that this species was first described by Walter, who supplied the specific epithet *acaulis*. Walter put it in a genus other than *Vernonia,* and at some later point Gleason transferred this species to *Vernonia*. When the rank of a taxon is changed or when a species is transferred from one genus to another, the name of the describing author is placed in parentheses and is followed by the name of the person who made the change. Transfers are sometimes necessary in taxonomic studies when new information suggests that taxonomic boundaries be realigned. Name changes should be made only after careful consideration of taxonomic relationships and must follow the requirements of the International Code of Botanical Nomenclature (Weatherby, 1946).

RULES OF NOMENCLATURE

The increased number of plants known to European botanists in the eighteenth century required the development of order and stability in plant nomenclature. The first elemental rules of naming plants were proposed by Linnaeus in 1737 and again in 1751. In the latter part of the eighteenth century, *priority,* or the use of the oldest name, was recognized as the cornerstone of nomenclature, ensuring that each plant had a unique name. Botanists who did not adhere to this principle created confusion in the naming of plants. A. P. de Candolle in his *Théorie élémentaire de la botanique* (1813), set forth a detailed set of rules on the process of assigning names. Later, the rules of A. P. and A. de Candolle evolved into our present International Code of Botanical Nomenclature. Numerous plants were inescapably named two or more times by accident, so in the years following Linnaeus a complex synonymy developed. Steudel in 1821 and 1840–1841 published an index of plant names, *Nomenclator botanicus,* which listed all names known to have been assigned to plants. This was useful for checking names and synonyms. It was the forerunner of *Index kewensis* (discussed in Chapter 11).

In 1867 the First International Botanical Congress was convened in Paris by Alphonse de Candolle, the son of A. P. de Candolle. Botanists from many countries

met and adopted a set of rules for nomenclature. Most of the rules had been proposed by Alphonse de Candolle. The rules were an excellent beginning, but practical applications revealed some inherent deficiencies. The need to modify the rules became evident in the late 1800s when botanists at Kew Gardens in England, at the Botanical Gardens at Berlin, at the New York Botanical Garden, and elsewhere began to stray from the rules adopted in Paris.

Botanical Congresses were held in 1892, 1905, 1907, and 1910 in an attempt to resolve nomenclatural problems and establish internationally acceptable rules. Nomenclatural procedures were standardized on a worldwide basis with general agreement reached by the International Botanical Congress of 1930. Subsequent Congresses have been held on a regular basis and have offered only minor modifications in the rules. A detailed history of the development of the Code is discussed in Lawrence (1951) and Smith (1957). Many of the terms used in the Code are elaborated upon and easy to find in McVaugh, Ross, and Stafleu (1968).

Developments and changes in the Code are often discussed in the journal *Taxon*, published by the International Association for Plant Taxonomy.

Principles

Today botanists throughout the world use the International Code of Botanical Nomenclature, which is written in English, French, and German (Voss, 1983). A set of nomenclatural principles forms the philosophical basis of the Code:

1 "Botanical nomenclature is independent of zoological nomenclature. The Code applies equally to names of taxonomic groups treated as plants whether or not these groups were originally so treated." The first part of this is of practical concern; that is, the Code provides solely for the nomenclature of plants. The same name that has been assigned to a plant may also be used by zoologists for naming an animal. For example, *Cecropia* refers both to a moth and to a large genus of tropical trees in the family Moraceae.

2 "The application of names of taxonomic groups is determined by means of nomenclatural types." The "type" principle provides that each species name must be associated with a particular specimen, the nomenclatural type. The type for a genus is a species, for a family it is a genus, and so on.

3 "The nomenclature of a taxonomic group is based upon the priority of publication." This very important principle provides that the correct name is the earliest properly published name that conforms to the rules. Earliest published names take precedence over names of the same rank published later. Priority for plant nomenclature begins May 1, 1753 for vascular plants and some other groups, but not for all plants. This was the date of publication of the first edition of Linnaeus' *Species plantarum*.

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."

5 "Scientific names of taxonomic groups are treated as Latin regardless of their derivation." This rule requires that generic and specific epithets, as well as other names, be Latin or treated as if they were Latin. The Code must be consulted for details on selecting the proper grammatical endings for names of all taxa.

6 "The rules of nomenclature are retroactive unless expressly limited."

Rules adopted by the Congresses operate to affect nomenclatural matters carried out before the passing of the rules. Botanists should consult the latest International Code of Botanical Nomenclature when confronted with solving current nomenclatural problems.

Procedures

Detailed procedures based upon these principles are divided into *Rules* and *Recommendations*. The Code states, "The objective of the Rules is to put the nomenclature of the past into order and to provide for that of the future; names contrary to a rule cannot be maintained." The Recommendations dealing with minor points provide guidance and uniformity in naming plants. However, names that are contrary to the Recommendations cannot be rejected for that reason.

Ranks of Taxa

The formal taxonomic hierarchy is a system of categorical ranks with associated names (Scott, 1973). Generally, the species is the basic unit of classification (Article 2). Each species belongs to a series of taxa of consecutively higher rank. The International Code of Botanical Nomenclature provides the series of ranks with names that are the hierarchical categories (Articles 3 and 4). The ranks, in descending sequence, provided by the Code are shown in Table 3-1, along with an example of each.

The Code, in effect, defines the categories only by listing their sequence. It may not be necessary to use all the categories provided by the Code for a small order, family, or genus, but the sequence of categories must not change (Article 5). However, certain categories (i.e., species, genus, family) are essential if nomenclature is to function. The categories commonly used in the flowering plants are the class, subclass, order, family, genus, species, and sometimes either subspecies or variety or even sometimes both. Categories such as subfamily, tribe, subgenus, section, and so on may be used and are frequently necessary in large and complex groups. In actual practice, species are grouped into genera and genera into families and so on through the sequence of categories. Each rank in turn is more inclusive than the lower categories. This categorization gives order and accessibility to the classification of plants and provides a meaningful system of information input or retrieval.

The Code requires standardized grammatical endings for the categories from division down to subtribe. However, an exception is the use of certain family names which have been sanctioned by the Code because of old, traditional usage. These names do not end in the usual family ending of *-aceae* (Article 18). The names of these families, along with their alternative names, are Palmae (Arecaceae), Gramineae (Poaceae), Cruciferae (Brassicaceae), Leguminosae (Fabaceae), Guttiferae (Clusiaceae), Umbelliferae (Apiaceae), Labiatae (Lamiaceae), and Compositae (Asteraceae). Botanists are

TABLE 3-1
SERIES OF RANKS PROVIDED BY THE INTERNATIONAL CODE OF BOTANICAL NOMENCLATURE

Ranks of taxa	Example	Endings of ranks above genus
Division	Magnoliophyta	-phyta
Class	Magnoliopsida	-opsida
Subclass	Asteridae	-idae
Order	Asterales	-ales
Suborder		inales
Family	Asteraceae (or Compositae)	-aceae
Subfamily		-oideae
Tribe	Vernonieae	-eae
Subtribe	Vernonineae	-ineae
Genus	*Vernonia*	
Subgenus		
Section	Lepidoploa	
Subsection	Paniculatae	
Series	Verae	
Subseries		
Species	*Vernonia angustifolia* Michx.	
Subspecies	*V. angustifolia* ssp. *angustifolia*	
Variety		
Subvariety		
Form		
Subform		

authorized by the Code to use either of these alternatives. Some manuals use the older names and others use the *-aceae* names. Family names ending with *-aceae* are based on generic names; for example, *Brassica* is the base of Brassicaceae. To follow correct usage, family names are treated grammatically as plural nouns.

The Type Method

Names are established by reference to a nomenclatural type. Taxonomists use the type method as a legal device to provide the correct name for a taxon. The nomenclatural type of a species, a *type specimen,* is a single specimen or the plants on a single herbarium sheet. The type specimen for the species *Vernonia alamanii* DC. is located in the de Candolle Herbarium in Geneva, Switzerland. The type of genus is a species; for example, the type of the genus *Vernonia* is *V. noveboracensis* (L.) Michx. The type of family is a genus; for instance, the genus *Aster* is the type genus for the family Compositae (Asteraceae).

The nomenclatural type is not necessarily the most representative of a taxon; it is the specimen or specimens with which the name of that taxon is permanently associated, whether it is a correct name or a synonym. The type specimen in no way reflects the typological concept of an idealized specimen (as discussed in Chapter 1). The type specimen has nothing at all to do with variation but only indicates the attachment of a name to a particular specimen.

When a species new to science is collected, several things must be done: (1) it is given a name; (2) a Latin diagnosis or description is prepared; (3) a type is designated; and (4) the name and description are published. All these must be done in accordance with the Code. An example of a publication of the name and description of a new species is shown in Table 3-2. In this description, a type was designated and deposited in the New York Botanical Garden Herbarium and a Latin description was provided (see Article 7 and the Guide for the Determination of Types).

The Code designates several kinds of types (Article 7). The *holotype* for the name of a species is the one specimen used or designated by the author in the original publication as the nomenclatural type. If a holotype was designated by the author, it may not be rejected; and any type chosen after the original publication cannot be regarded as the holotype. Today it is essential that a holotype be designated for a newly described species and deposited in an established public herbarium.

An *isotype* is a duplicate specimen of a holotype collected at the same place and time as the holotype. A *lectotype* is a specimen chosen by a later worker from original material studied by the author of the species, when no holotype was designated or when the holotype has been lost or destroyed. A *syntype* is one of two or more specimens cited by an author of a species when no holotype was designated; or it is any one or two or more specimens originally designated as types. A *paratype* is cited in the original publication. It is a specimen other than the holotype or isotype. If the author cited two or more specimens as types, the remaining cited specimens are paratypes. A *neotype* is selected when all the original specimens and their duplicates have been lost or destroyed. If there is no holotype, a lectotype must be selected from among the isotypes or syntypes. If none are known to exist, a neotype may be selected. A

TABLE 3-2
DESCRIPTION OF A SPECIES NEW TO SCIENCE

Vernonia cronquistii S. B. Jones, sp. nov. TYPE: México: Guerrero: semi-open slopes in pine-oak forest in the mountains along the highway ca. 62 rd miles N of Acapulco, and 20 mi S of Chilpancingo, *Cronquist* 9705 (Holotype: NY! Isotypes: GH! MEX! MICH! MO! NY!).

Herba perennis, erecta, 1.5-metralis; caules purpurei necnon glabri. Folia caulina (6.5) 8–12 (15) cm longa, 1.9–4.5 cm lata (ratione longitudinis cum latitudine ca. 3–4), ad medium dilatata, ovato-lanceolata, supra scabridiuscula, infra glabrescentia, apicibus acuminatis, basibus anguste cuneatis, marginibus serratis; petioli 0.5–1.2 cm longi glabrescentes. Inflorescentiae paniculatae-umbellatae. Capitula 10–14(18)-flora, cum pedunculis 0.5–1.3 cm longis. Involucra anguste campanulata 5.5–8.5 mm longa, 3–7.5 mm lata; phyllaria ciliata, laxe imbricata, purpurea, eis interioribus lineari-lanceolatis, 4.2–7.5 mm longis, 0.9–1.5 mm latis, apicibus acutis vel cuspidatis, eis exterioribus lanceolatis, 1–2 mm longis, 0.6–0.9 mm latis. Pappi setae albae, eis interioribus 5–6.1 mm longis, eis exterioribus 0.6–1.1 mm longis. Corollae (7.3) 9–11 (12.6) mm longae, Vernoniapurpureae, glabrae. Antherae 2.7–3.3 mm longae. Achaenia 2.2–3.1 mm longa, piloso-hispida, ca. 9–11 nervata. Chromosome number $n = 17$. Flowering and fruiting occur from October to December. This species is distributed from Guerrero to Oaxaca along the Sierra Madre del Sur . . . It occurs on semi-open slopes in pine-oak or pine forests at elevations of 700–950 m. It is named in honor of Dr. Arthur Cronquist who made the type collection and has provided encouragement to me with my studies of *Vernonia*.

Additional specimens examined include: Mexico: Guerrero: Rincón de la Via, *Kruse* 739 ((ENCB); Plan de Carrizo, Galeana, *Hinton* 11035 (GH, K, MICH, NY, US); Oaxaca: 5–6 km NE Putla rd to Tlaxiaco, *McVaugh* 22273 (ENCB, MICH).*

*The specimens named in the last paragraph are paratypes. *Source: Rhodora,* **78:194,** 1973.

lectotype has precedence over a neotype because a lectotype was studied by the original author.

The early botanists did not designate types as is done today. To these early botanists, species were based upon all specimens, illustrations, and descriptions within the limits of the species. These elements or everything associated with the name at first publication are known collectively as the *protologue*. Recommendation 7B of the Code suggests that when the elements of the protologue are heterogeneous, the lectotype should be selected to preserve current usage.

Priority of Names

Priority is concerned with the precedence of the date of valid publication and determines the acceptance of one of two or more names that are otherwise acceptable. A name is said to be *legitimate* if it is in accordance with the rules and *illegitimate* if it is contrary to the rules (Article 6). The rule of priority states, "For any taxon from family to genus inclusive, the correct name is the earliest legitimate one with the same rank, except in cases of limitation of priority by conservation" (Article 11). The Code contains several limitations on the principle of priority. "The principle of priority does not apply to names of taxa above the rank of family" (Article 11).

To avoid disadvantageous changes caused by strict application of priority, some specific, generic, and family names are conserved by action of the International Botanical Congresses (Article 14). Conserved names are referred to as *nomina conservanda*. This means that some names, even though they are not the oldest legitimate names, are used in preference to the older names. Occasionally, family or generic names, perhaps published in obscure publications or otherwise not used, will have priority over well-known names despite not having been in regular use. Adoption of such generic names usually requires formally transferring specific epithets to the resurrected genus. To avoid the confusion this would cause, names are conserved by decisions of an International Botanical Congress. A list of the conserved family and generic names may be found in Appendixes 2 and 3 of the Code. Conservation of specific names is restricted to names of species of major economic importance (Greuter, 1981). The conservation of specific names was authorized only recently at the International Botanical Congress held at Sydney, Australia in 1981.

Priority of nomenclature for vascular plants (except fossils) begins with the publication of Linnaeus' *Species plantarum* on May 1, 1753 (Article 13).

Effective and Valid Publication of Names

To become a part of the legal botanical nomenclature, names of taxa must meet certain requirements when published. These requirements are explicitly stated by the Code. "Publication is effected, under this Code, only by distribution of printed matter (through sale, exchange, or gift) to the general public or at least to botanical institutions with libraries accessible to botanists generally. It is not effected by communication of new names at a public meeting, by the placing of names in collections or gardens open to the public, or by the issue of microfilm made from manuscripts, typescripts or other unpublished material. Offer for sale of printed matter that does not exist does not constitute publication" (Article 29).

Currently, publication of handwritten descriptions or descriptions printed in nursery catalogs or seed exchange lists is not considered to be effective publication (Article 29). A plant name is not effectively published if printed on a label attached to herbarium specimens even if the specimens are widely distributed (Article 31). Effective publication refers to the place and form of publication of the names of plants. The botanical community must communicate plant names in widely distributed scientific literature.

For valid publication, a name must be *effectively published* in the form specified by the Code. It must be accompanied by a description or a reference to a previously published description for that taxon (Article 32). Since 1935 all diagnoses of new taxa (algae and fossil plants are excepted) must be written in Latin to be validly published. The *diagnosis* is a statement by the author giving the distinguishing features of the taxon. The description itself need not be in Latin, although it is recommended. (See Table 3-2.)

Citation of Author's Name

To be accurate and complete, the name of a taxon should include a citation of the author or authors who originally described that taxon (Article 46): for example, *Vernonia arkansana* DC., for A. P. de Candolle; *Vernonia* Schreb., for J. D. C. von

Schreber; and the tribe Vernonieae Cass., for Henri Cassini. There are many sources of explanations of abbreviated names of authors, including the *Manual of the Vascular Plants of Texas* (Correll and Johnston, 1970), Gray's *Manual of Botany* (Gray, 1950) and the *Draft Index for Author Abbreviations* (1980) prepared at the Royal Botanic Gardens, Kew, England.

The author citation expedites locating the original plant description, which helps determine the type and date of publication for the taxon (Clausen, 1938). Sources providing references to original descriptions are *Index kewensis* on an international basis and the *Gray Herbarium Index* for New World plants. Either source provides references to the original descriptions. Another function of the author citation is to identify the name. Through unfortunate error an author may publish a name that is preoccupied; that is, the specific epithet may have been used for another taxon in the same genus. The author citation allows the distinction between the two names. Of course, only the earlier name is legitimate. Author citations can aid botanists in tracing the transference of species from one genus to another. For example, the author citation for *Vernonia noveboracensis* (L.) Michx. reveals that André Michaux transferred to the genus *Vernonia* a species originally described in another genus by Linnaeus. The original species name used by Linnaeus was *Serratula noveboracensis* L. Since *Serratula* L. was published in 1753 and *Vernonia* Schreb. in 1791, it appears as though *Vernonia* violates the rule of priority. Reference to Appendix 3 of the Code indicates that *Vernonia* Schreb., (1791) nom. cons., non L. 1753, has been conserved by international agreement over *Serratula* L. 1753, so Michaux's combination is legitimate.

When names are published by two authors, the author citations are linked by either & or *et* (Latin, "and")—for instance, *Opuntia pollardii* Britt. et Rose, for N. L. Britton and J. N. Rose. The author citation *Carex stipata* Muhl. ex Willd. indicates that the name was ascribed to G. H. E. Muhlenberg but was published by K. L. Willdenow, who attributed the name to Muhlenberg. When a name with a description supplied by one author is published in a work by another author, the word *in* should be used to connect the names of the two authors, for example *Viburnum ternatum* Rehder in Sargent.

Retention, Choice, and Rejection of Names

The Code has rules outlining the proper procedures for selecting the correct name when taxa are divided, transferred, or rejected. That is, a genus might be divided into two genera or a species transferred from one genus to another genus; or if a name is illegitimate, it is rejected. A brief synopsis of the major points of the most important rules concerning retention, choice, and rejection of names is presented here. Chapter 5 of the Code should be consulted for a complete account of the topic.

A change in the diagnostic limit separating the taxon from its nearest relatives is not justifiable cause for a change in the name of the taxon (Article 51). For example, change in the concept of diagnostic characters of a genus or species is not a reason to change a name. If a genus is divided into two or more genera, the original generic name is retained for the genus that includes the nomenclatural type species for the genus (Article 52). Likewise, when a species is divided into two or more species, the original specific epithet must be retained for the species that includes the type specimen (Article 53). This same rule applies to infraspecific taxa, that is, subspecies and varieties.

When a species is described in one genus and later transferred to another genus, the specific epithet, if legitimate, must be retained (Article 55). *Chrysocoma acaulis* Walt., 1788, is now treated as *Vernonia acaulis* (Walt.) Gleason, 1906. *Chrysocoma acaulis* Walt. is the *basionym* of *Vernonia acaulis* or the name-bringing synonym associated with Walter's type specimen, which is located in the Museum of National History in Paris. For many years this species was called *Vernonia oligophylla* Michx., 1803. In 1906 Gleason properly recognized that there was an older specific epithet and basionym for this taxon, *C. acaulis* Walt., 1788. If a taxonomist considers two previously distinct species to be the same species, the earlier epithet must be selected for the newly combined species. The latter name is then considered to be a taxonomic synonym. In such cases the identity of the basionym is important in determining the correct name for a species. When a subspecies or variety is transferred to another genus or species, it is no different than transferring specific epithets, for epithets hold their priority within rank (cf. Article 56 and Recommendation 60A). If it is transferred without change of rank, the original epithet must be retained, unless there is some nomenclatural barrier.

When two or more taxa of the same rank are united, the oldest legitimate name or epithet is selected (Article 57). For example, if the genera *Sloanea* L., 1753, *Echinocarpus* Blume, 1825, and *Phoenicosperma* Miq., 1865, are united, *Sloanea* L. is the oldest name and would be correct (Article 57). The other two names become taxonomic synonyms.

When identifying plants, one may notice that many manuals will cite one or more synonyms for certain species treated in that flora. This practice is helpful because familiar names may become synonyms. A fine example of this is Radford et al., *Manual of the Vascular Flora of the Carolinas* (1968). Following the description of *Solidago graminifolia* (L.) Salisbury, they cite as synonyms: *Euthamia graminifolia* (L.) Nutt. -S (for Small, 1933); *S. graminifolia* var. *nuttallii* (Greene) Fernald -F, G (for Fernald, 1950, and Gleason and Cronquist, 1963). From this information you can compare treatments of the taxa in different manuals.

During plant identification work, it may be necessary to refer to taxonomic revisions. In a revision, synonyms will be given in a complex and formal listing after the correct name. The following is an example:

Vernonia leiocarpa DC. Prodr. 5: 34. 1836. TYPE: MEXICO: *Karwinski* s.n. (HOLOTYPE: G-DC, as IDC microfiche G-DC!).
Cacalia leiocarpa (DC.) Kuntze, Rev. Gen. Pl. 2: 970. 1891.
Eremosis leiocarpa (DC.) Gleason, Bull. New York Bot. Gard. 4: 232. 1906.
Eremosis melanocarpa Gleason, Bull. New York Bot. Gard. 4: 232. 1906. TYPE: GUATEMALA: Santa Rosa: Chupadero, *Heyde & Lux 3416* (HOLOTYPE: NY!; ISOTYPES: F! GH! MO! US!).
Vernonia melanocarpa (Gleason) Blake, Contr. Gray Herb. 52: 18. 1917.

Vernonia leiocarpa, the correct name for the species, was published by A. P. de Candolle in *Prodromus*, Volume 5, page 34, in 1836. The type was collected in Mexico by Karwinski s.n. (Latin for *sine numero*, meaning "without [collection] number"). G-DC indicates that the type is located in the de Candolle Prodromus herbarium at the Conservatoire Botanique de Genéve, Switzerland. Each herbarium is assigned an abbreviation by the International Association for Plant Taxonomy. These abbreviations are found in Holmgren, Keuken, and Schofield (1981). The type specimen was viewed on IDC microfiche of the de Candolle Prodromus herbarium. The exclamation point (!) is an abbreviation for *vidi* (Latin, "I have seen it"), and it indicates that the author of the revision has seen the specimen cited.

Synonyms in a revision are listed in chronological order. For example, in 1891 Kuntze transferred the specific epithet to the genus *Cacalia*, making the combination *Cacalia leiocarpa* (DC.) Kuntze. In 1906 Gleason made the combination *Eremosis leiocarpa* (DC.) Gleason, by transferring *V. leiocarpa* DC. to *Eremosis*. Gleason also described *Eremosis melanocarpa* Gleason, based on the type collected in Guatemala by Heyde and Lux. *3416* is the collection number of the particular specimen of Heyde and Lux. This holotype is located in NY (New York Botanical Garden) and was examined by the author of the revision, as indicated by "!." Isotypes examined are located in F (Field Museum), GH (Gray Herbarium), MO (Missouri Botanical Garden), and US (United States National Museum). Blake did not recognize *Eremosis* and transferred the specific epithet *melanocarpa* to *Vernonia*. The result was the combination *Vernonia melanocarpa* (Gleason) Blake. The author of this taxonomic revision believed *V. melanocarpa* to be a taxonomic synonym of *V. leiocarpa*. A review of the formal taxonomic treatment provides a taxonomic history of the entity. There is a growing and useful practice to give all the names based on the same type specimen in one paragraph, thus using a paragraph for each basionym, its nomenclatural type, and its taxonomic synonyms. The *basionym* is the epithet with which the type is associated.

Another important rule of the Code is the following: "A legitimate name or epithet must not be rejected merely because it is inappropriate or disagreeable, or because another is preferable or better known, or because it has lost its original meaning" (Article 62). Therefore, the name *Scilla peruviana* cannot be rejected because it grows in the Mediterranean area rather than in Peru. *Vernonia crinita* Raf. is better known than the older *V. arkansana* DC., but *V. crinita* Raf. cannot be retained just because it is better known.

A name is a *later homonym* if it is spelled like a name previously and validly published for a taxon of the same rank based on a different type (Article 64). Different genera or different species within a genus cannot have the same name. If they do, the earlier name is legitimate and the later name is a later homonym. *Tapeinanthus* Boiss. ex Benth, 1848, is a later homonym of *Tapeinanthus* Herb., 1837. *Astragalus rhizanthus* Boiss., 1843, is illegitimate because it is a later homonym of *Astragalus rhizanthus* Royle, 1835.

The Code deals with other matters, including spelling of names and epithets (Nicolson, 1974; Nicolson and Brooks, 1974). The names of plants must be spelled as they were originally published unless there was a spelling or typographic error (Article 73).

A frequent source of confusion is the naming of infraspecific taxa (Clausen, 1941; Fosberg, 1942; Weatherby, 1942). If a subspecies or variety is described in a species not previously divided into infraspecific taxa, there is automatically a "type" subspecies or variety. This bears the same epithet as the species but is not followed by an author citation. This means that a species with infraspecific taxa must have at least two subspecies or varieties. For example, the two subspecies of *Vernonia obtusa* (Blake) Gleason are *Vernonia obtusa* subsp. *obtusa* and *Vernonia obtusa* (Blake) Gleason subsp. *parkeri* S. B. Jones (Subsp. *obtusa* is not followed by an author citation.) The Code requires that the epithet be repeated and the original type specimen be the type of subsp. *obtusa*. The logic for this is simple. Creation of a subspecies (or variety) automatically creates two subspecies: (1) the entity that the author has in mind when erecting the new subspecies, and (2) the remaining materials within the species. The former receives the new name (e.g., *Vernonia obtusa* subsp. *parkeri* S. B. Jones), while the latter is signified by repetition of the specific epithet (e.g., *Vernonia obtusa* subsp. *obtusa*). Names such as *Vernonia obtusa* subsp. *obtusa* are termed *autonyms* or automatically established names. For a discussion of some of the nomenclatural problems related to autonyms, the reader is referred to the paper by Reveal and Broome (1980).

Hybrids between different species in the same genus or between closely related genera are sometimes described and named. In order to be validly published, the names of hybrids follow the same rules as those that relate to names of nonhybrids (Article 40). Additional rules and recommendations needed for the naming of hybrids are found in the Code in Appendix 1, Names of Hybrids. Some of the more important points include the following: Hybrids between two species of the same genus are shown either by a formula—for instance, *Salix aurita* L. × *S. caprea* L.; or if desired, by a formal name—for example, *Quercus* × *beadlei* Trel., a hybrid of *Q. alba* L. × *Q. michauxii* Nutt. It is permissible under the Code to refer to them by formula or to give them a name (binomial). The opinions of plant taxonomists differ as to whether hybrids should or should not be named (Wagner, 1969, 1975).

Cultivated Plants

Article 28 of the Code deals with nomenclature for cultivated plants. Plants brought in from the wild and cultivated retain the names applied to the same taxa in their native habitat (Article 28). Horticultural plants that are produced in cultivation through hybridization, selection, or other processes and that are worthy of being named receive cultivar names. The term *cultivar* denotes an assemblage of cultivated plants that is clearly distinguished by any characters (morphological, physiological, cytological, chemical, or other), and that, following reproduction (sexual or asexual), retains its distinguishing characters (Brickwell, 1980). *Cultivar* is derived from the terms *cultivated variety*. It should be noted that the concept of the cultivar is not analogous to the botanical variety (varietas), the latter being a category below that of species and

governed as such by the International Code of Botanical Nomenclature. Cultivar names are written with a capital initial letter. They are either preceded by the abbreviation cv. (meaning "cultivar") or placed in single inverted commas, for example, *Hosta* 'Decorata.' Cultivar names may be used after generic, specific, or common names. Examples of cultivars are *Camelia japonica* cv. Purple Dawn and *Citrullus* cv. Crimson Sweet (or watermelon cv. Crimson Sweet, or *Citrullus lanatus* cv. Crimson Sweet). The use of the term variety to refer to cultivars is improper, but the usage was traditional for a long time and is only now going out of style (Stuart, 1974).

Detailed information on specialized nomenclatural situations dealing with cultivated plants may be found in the International Code of Nomenclature for Cultivated Plants (Brickell, 1980). The nomenclature for cultivated plants must follow this Code. Some of the more important general rules governing cultivar names are the following:

1 New cultivar names must now be in modern languages and not be Latin names. For example, the Latin '*albo-marginata*' cannot be given to a new cultivar. The only exceptions to this are names of botanical taxa reduced to cultivar ranks.

2 If the botanical name of a species is changed, the cultivar name remains unchanged. For instance, if the scientific name of the tomato should be changed to conform with the Botanical Code, the cultivar names, such as 'Better Boy' or 'Ultra Girl,' remain unchanged.

3 Two or more cultivars in the same cultivar class are not permitted to bear the same name. A cultivar class is usually a genus but may also be a species, a crop type, or a group of cultivars. For example, since there is already a *Hosta* 'Decorata,' a second *H.* 'Decorata' could not be named.

4 Since January 1, 1959, new cultivar names must not be the same as a botanical or common name of a genus or a species. Thus, names such as *Hosta* cv. 'Rose' would not be permitted.

5 New cultivar names published after January 1, 1959, require a published or duplicated description that may be given in any language and dated at least to the year.

6 It is recommended that cultivar names be registered with a registration authority to prevent duplication or misuse of cultivar names. For example, the American Hosta Society acts as the registration authority for cultivars of the genus *Hosta*.

SUMMARY

The International Code of Botanical Nomenclature is a response to the fact that science requires a precise system of naming plants. The Code deals with the terms used to denote the ranks of taxa as well as with the scientific names applied to plants. There are valid reasons for the occasional but necessary changes of familiar plant names. Examples and problems for practice with the application of the Code may be found in St. John (1958) and Benson (1962). The use of the case method with these problems is an excellent way for a potential taxonomist to develop a working knowledge of the Code.

Davis and Heywood (1963) observe, "To most systematists, however, nomenclature is a time-consuming necessity that comes between them and the plant. Nevertheless, it is one of the tools of the taxonomists' trade and for that reason its principles must be mastered." It should be emphasized that for detailed knowledge of the rules of nomenclature, the Code itself must be consulted. Here we have considered only general principles and some of the more important points.

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CHAPTER **4**

PRINCIPLES OF PLANT TAXONOMY

Taxonomy is based on the similarities and dissimilarities among organisms. Historically, taxonomy has been a descriptive science based on the variation and form of morphological characters. The classification schemes of the taxonomists of the 1700s and 1800s placed similar-appearing organisms together in species, comparable species into genera, and genera with resemblances into families. Taxonomists sought the "ground plan" of the Creator.

With the advent of Darwinism in the late 1800s, the concepts of species relatedness and evolution were incorporated into classification. Darwin's evolutionary theory provided the concepts that species represent lineages and that species within a genus have evolutionary affinities with one another. Genera and families represent progressively older divergences in the lineages. Before Darwin, it was believed that each species was created individually by God and remained unchanged through time. This is the idea of *special creation*, a hypothesis now rejected by the scientific community.

Because similar appearance often reflects a close relationship, the Darwinian concept of lineages did not radically alter previous classifications. It did lead to the development of deliberate phylogenetic classification schemes. *Phylogenetic classifications* presume to express genetic relationships. In both theory and practice, genera, families, and so on should reflect the notion that the members of each group share a common origin. This concept had little effect on the species, genus, or family levels of classification, but the arrangement of families changed drastically from a linear sequence to a branching format designed to reflect evolutionary relationships.

Today most taxonomic treatments are implicitly phylogenetic. They attempt to recognize and bring together related groups of plants. New research methods have been developed, and taxonomists now use not only gross morphology but also chem-