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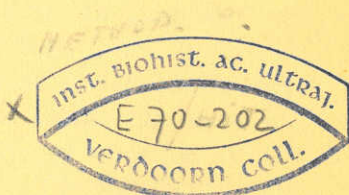
METHODS OF  
DESCRIPTIVE SYSTEMATIC  
BOTANY

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## CHAPTER II

### CATEGORIES USED IN THE NATURAL SYSTEM

Classification serves the double purpose of showing relationships and of aiding in identification. From the practical standpoint of descriptive taxonomy, classification is primarily a matter of convenience in so far as it aids in the identification of groups. The number of the species of plants is so large that some method of orderly arrangement becomes necessary as a basis for any kind of an investigation concerning them. This need was recognized early in botanical history. The first attempts at classification were based upon such differences as those of use or habit. The history of classification is an interesting subject in itself but can not here be developed. Linnaeus devised a system based upon the number and position of the stamens and pistils. This system, known as the sexual or Linnaean system, was a great advance over the systems previously in use, as it rendered much easier the identification of species. All these systems were artificial ones, as they did not arrange plants according to their natural affinities. Linnaeus himself declared that the ultimate system of classification would be a natural one which would show affinities. A natural system, which was proposed later and which has been developed as our knowledge has increased, is the one now in general use.

#### Species

The earth abounds with individual plants. Every individual is the offspring of a parent (in nearly all cases among the higher plants, of two parents) and is a given point in an indefinite line of descent. The innumerable lines of descent reach back into the remote past, and at every stage

each line may merge with other lines. According to our present theory of development, there has been a gradual change in the species through variation of the individuals, but all are genetically related through the branching lines of descent. This means that all the individuals of a family of plants would be found to be related to one another if the genealogy were traced far enough into the past. What may once have been a homogeneous group has now become hundreds of differentiated groups.

The unit of classification is a coherent group of like individuals, called a species. The term is difficult to define with precision because a species is not a definite entity but a taxonomic concept. Where the line shall be drawn is often a matter of convenience in classification. Diagrammatically, we may consider the present as a cross section of the lines of descent from the past, each individual being represented by a dot. If the lines of descent are arranged according to the degree of resemblances the dots will be arranged in groups on a plane. We may now outline the groups of dots and call them species. Certain groups are definitely separated from the others, and form distinct or well-marked species. Other groups are connected by scattered dots. In some cases, there is a definite group of dots which shows a strong tendency to be segregated into two minor groups connected by numerous scattered dots. Botanists will differ as to whether we have here two species with intermediate individuals, one species with two varieties or subspecies, or one variable species. In practice we are handicapped by lack of knowledge. We usually know only a relatively small number of individuals of a species and must draw our conclusions from these. It may readily be seen that the actual delimitation of a species is a matter of judgment and experience. The various races and tribes of men are usually recognized as belonging to a single species. With many this example forms a basis for the concept of a species. The unit of classification, as stated above, is the species. The species are grouped into genera, the genera

into families, the families into orders, and the orders into higher groups.

### Genera

Genera are groups of related species. By general consent and common observation, mankind has long recognized certain groups of related species, such as the oaks, the pines, the grapes and the goldenrods. Such groups form the basis of the botanist's concept of a genus. But we find differences of opinion among botanists as to whether the plums should be grouped with the cherries, the apples with the pears, the blackberries with the raspberries, the spruces with the firs, or whether the two members of each of these pairs should be recognized as distinct genera. The tendency now is to recognize distinguishable groups of species, like the above-mentioned, as distinct genera; but, after all, it is largely a question of the personal judgment of the classifier, modified by custom.

There are many cases where a single species has no near allies and forms a genus by itself. On the other hand, there are genera, such as *Carex* and *Senecio*, that include hundreds of closely allied species.

Most botanists attempt to be consistent in delimiting the genera of a single family, basing the concept on essentially the same degree of differences in the several cases.

Convenience may play a rôle in determining generic lines. Extremely large groups may be broken up on the basis of differences of smaller degree, if common to a group of closely allied species, than if the group consisted of a few species.

In general, the botanist, in delimiting genera, keeps in mind two important requirements, that of showing natural affinities, and that of aiding correct identification.

### Families

Families are groups of related genera. There are several groups of this kind which have been long recognized and

which are known as natural families. They consist of genera in which the relationships are obvious. Such families, for example, are the grasses (Gramineae or Poaceae), the sedges (Cyperaceae), the crucifers or mustard family (Cruciferae or Brassicaceae), the umbellifers or parsley family (Umbelliferae or Apiaceae), and the composites or sunflower family (Compositae or Asteraceae). Because of our lack of knowledge, the grouping of many genera is as yet only tentative, and many families consist of genera the affinities of which are doubtful.

### Higher Groups

As it is not the purpose of this book to deal with the comparative morphology of the higher groups of plants, we need only mention here that related families are grouped into orders. The grasses and sedges form an order; the lilies, rushes, irises, amaryllises, and a few allied families form the Liliales or lily order; the morning-glories, borages, verbenas, mints, figworts, and allied families form the order Polemoniales. The orders are the highest aggregates of which a given group is a type. The orders are aggregated into successively higher groups on the basis of a few fundamental morphological characters common to the members of each category. The more prominent subdivisions of the Vegetable Kingdom, given in reverse order, are shown below. The two great branches are the cryptogams (Cryptogamia) consisting of fungi, algae, hepatics, mosses and ferns, all of which are plants without true seeds; and the phanerogams, spermatophytes, or seed plants (Phanerogamia or Spermatophyta), which are plants with seeds. The seed plants are again divided into the Gymnospermae (cone-bearing plants and their allies), and the Angiospermae, the ordinary flowering plants. The Angiospermae are divided into two great classes, the Monocotyledoneae and the Dicotyledoneae. The latter class is again divided into Archichlamydeae, or Choripetalae (corolla absent or of separate petals) and Metachlamydeae, or Gamopetalae

(corolla of united petals); but the distinction here is often rather arbitrary and may separate allied orders.

### Subdivisions of the Species

From what has been said of the species it is clear that in many cases the individuals tend to group themselves according to minor characters. Representative individuals may be sufficiently different to be assigned to distinct species. But an examination of a large number of individuals may show intergrades which connect the groups so that no sharp line can be drawn between them. It is sometimes convenient to give names to these more or less distinct groups within the species.

The primary subdivisions are usually known as varieties or as subspecies. Some authors carry the classification of the species further, and, in very polymorphous groups, recognize several categories. They may have subspecies, varieties, subvarieties, forms and subforms. Cultivated plants are susceptible of a high degree of classification in this respect.

The tendency, especially among most American botanists, is to recognize among wild plants only one subdivision of the species. It is evident that the subdivisions may have very unequal rank, and this inequality may be indicated by several categories of minor groups; but from the standpoint of convenience in the use of the terms and in the designation of groups, the method of having a single category below the species is preferable. In naming the subdivisions of species two concepts are recognized.

According to the first concept, the varieties are appended to the species. There is, then, the typical or original form, the form which was first recognized and described, which is known as the species. The variations are appended to this species as varieties (or subspecies).

*Example.* In Gray's Manual, *Carex stricta* is described as a definite group. To this are appended three varieties, *curtissima*, *angustata* and *decora*.

According to the second concept, a species is considered to be a group of varieties, and the varieties stand in the same relation to the species as the species to a genus. The typical form is given a varietal name, usually such as *genuinus*, *typicus*, or the specific name with the prefix *eu-*. This method is more common in Europe.

*Example.* The example cited above might become *Carex stricta*, with four varieties of which the first might be var. *genuina* (or *typica*, or *eu-stricta*).

## CHAPTER III

### NOMENCLATURE

The botanical names of plants are composed of Latin words. Each species is distinguished from all others by its name, which consists of two parts, the generic and the specific, the first indicating the genus to which the species belongs and the second distinguishing the species of that genus. Precision in distinguishing species by name requires that no two valid genera shall bear the same name, and that no two valid species in one genus shall bear the same name, though the same specific name may be used in different genera.

*Example.* The Latin name of the oak genus is *Quercus*; the white oak is *Quercus alba*. The poplars belong to the genus *Populus*; the white poplar is *Populus alba*. There can be but one valid genus *Quercus* or *Populus*, and only one valid species named *alba* in each genus.

#### The Generic Name

The name of the genus is a noun in the singular and is always written with a capital letter. The noun may be derived from a language other than Latin, but in this case it is Latinized in form or is treated as a Latin word.

The generic name usually indicates some character prominent in its included species, or it may be given in honor of a person. Sometimes it indicates the aboriginal name of the plant; sometimes it is an anagram or some other meaningless combination of letters. Many of the genera of the earlier authors bear the original Latin or Greek names by which the plants were commonly known before the days of technical nomenclature.

*Example.* *Quercus*, *Betula*, *Alnus* and *Fagus* are the ancient Latin names for the oaks, the birches, the alders and the beeches. *Phyllanthus* is from the Greek *phyllon*, leaf, and *anthos*, flower, because in some species



the flowers are borne along the margins of flat leaf-like branches. *Zanthoxylum* is from the Greek *zanthos* (or *xanthos*), yellow, and *xylon*, wood, because of the color of the wood. *Liquidambar* is from the Latin *liquidus* and the Arabic *ambar*, amber. Such a name as the last, derived from two languages, is not formed according to the best usage. *Jeffersonia* was named in honor of Thomas Jefferson. *Anogra* is an anagram of *Onagra*. *Crotonopsis* is from *Croton* and the Greek *opsis*, like or near, from its resemblance to the genus *Croton*. *Cornucopiae* (*Cornu copiae*, horn of plenty) is a rare case of a generic name formed from two separate Latin words, the genitive ending, *ae*, giving the word the aspect of a plural.

### The Specific Name

The specific name may be (1) an adjective, (2) a noun in apposition, or (3) a noun in the genitive case.

1. **An Adjective.** — The word then agrees in gender with the generic name. When the specific name is an adjective it usually indicates some distinguishing character, or at least a character present in the species. Sometimes it indicates a locality or a person.

*Examples.* *Rosa alba* would be a white rose; *Rosa gallica*, a French rose; *Rosa virginiana*, a Virginia rose; *Carex Deweyana*, Dewey's *Carex*.

**Note on Latin Grammar.** — Since the study of taxonomic botany is not always preceded by the study of Latin, attention will here be called to the few rules necessary for a proper understanding of generic and specific names.

The generic name is always in the singular number and in the nominative case. In Latin there are three genders, masculine, feminine and neuter. The following examples will show the forms assumed by some common adjectives to indicate gender.

<i>Masculine</i>	<i>Feminine</i>	<i>Neuter</i>	<i>English Equivalent</i>
albus	alba	album	white
niger	nigra	nigrum	black
tener	tenera	tenerum	delicate
viridis	viridis	viride	green
acer	acris	acre	sharp
repens	repens	repens	creeping
velox	velox	velox	swift
altior	altior	altius	higher
bromoides	bromoides	bromoides	brome-like

The gender of the generic names can be determined from a Latin lexicon if they are classical words. Many generic names, however, have been coined in recent times and will not be found in lexicons. The rules governing the gender of nouns are too complex to be of value to those who have not studied Latin. The student can determine the gender of generic names used in manuals by noting the form of the adjective specific names. By noting the genus *Carex* one will see that adjectives of the form of *albus*, when used with the generic name *Carex*, end in *a*, indicating that the generic name is feminine; similar specific names in *Andropogon* end in *us*, and in *Panicum* end in *um*, indicating that these genera are masculine and neuter respectively.

Nouns ending in *a* are usually feminine, and those ending in *um* are neuter. Nouns ending in *us* are usually masculine, except the names of trees, which are feminine (e.g., *Quercus*, *Populus*, *Fagus*, *Pyrus*).

A genus named in honor of a person is formed by adding *a* or *ia* to the name of the person, and is feminine (e.g., *Bartonia* for Professor Barton, *Torreya* for Doctor Torrey).

When a species is transferred from one genus to another, the termination changes, if necessary, to accord with the gender of the new generic name (e.g., *Panicum italicum* when transferred to *Setaria* becomes *Setaria italica*).

**2. A Noun in Apposition.** — A noun used thus is in the same case as the noun with which it is in apposition. As a generic name occurring in English discourse is always in the nominative case, this is also the case of the specific name when the latter is a noun in apposition. Such a specific name does not necessarily agree in gender with the generic name.

*Examples.* *Pyrus Malus*, the apple; *Prunus Cerasus*, the sour cherry; *Allium Cepa*, the onion.

**3. A Noun in the Genitive Case.** — This is a common form when a species is named for a person. Such names are formed by adding *i* or *ii* to the name of the person (or

*ae* if named for a woman). Such a name does not necessarily agree in gender with the generic name.

*Examples.* *Carex Davisii*, the equivalent of the *carex* of Davis; *Carex Fraseri* (whether *i* or *ii* is added is a matter of euphony); *Carex Jonesae*.

Occasionally the specific name is a common noun in the genitive plural.

*Examples.* *Polygonum dumetorum* (of the thickets); *Convolvulus sepium* (of the hedges).

### Varietal or Subspecific Names

The varietal name follows the same rules as the specific name. If an adjective, it agrees with the generic name; if a noun in apposition or in the genitive, it does not necessarily agree.

There are two general methods of indicating the variety or subspecies.

The first method is to interpolate the word variety (*varietas*) or subspecies, usually abbreviated, between the specific and varietal names.

*Example.* *Carex stricta* var. *curtissima*. In older works the subdivisions are often indicated by Greek letters. *Carex stricta*  $\beta$  *curtissima* (alpha being reserved for the typical form); *Carex stricta*  $\gamma$  *angustata*; and *Carex stricta*  $\delta$  *decora*.

The second method is to place the varietal name immediately after the specific name, the whole forming a trinomial.

*Example.* *Carex stricta curtissima*.

### Names of Groups Superior to the Genus

As stated previously, genera are grouped into families, families into orders, and orders into various higher groups. In practice the important category above the genus is the family. In large families it may be convenient to interpolate subfamilies and more especially tribes.

The names of the families and of the tribes are made by adding to the stem of an important included genus the termination *-aceae* or *-eae*, respectively.

*Examples.* *Rosaceae*, the rose family, from *Rosa*, the rose genus; *Ranunculaceae* from *Ranunculus*; *Cyperaceae* from *Cyperus*; *Roseae*, the rose tribe; *Agrostideae*, the *Agrostis* tribe.

A few families have special names which have the sanction of custom, but there is a tendency to replace these by names regularly formed. These families are: Gramineae, the grass family (or Poaceae); Cruciferae, the mustard family (or Brassicaceae); Leguminosae, the legume or pulse family (or Fabaceae); Umbelliferae, the parsley family (or Apiaceae); Labiatae, the mint family (or Menthaceae); Compositae, the composite family (or Asteraceae).

### Changes in the Names of Plants

It is confusing to the beginner to find that different names are applied to the same plant by different people or in different books. The technical details concerning nomenclatural changes are taken up in subsequent chapters, but a few of the more common reasons for the use of different names will be explained here.

The existence of different names for the same plant may be due either to the fact that more than one name has been applied to the same species, or to a mistake in the identity of a species. Different names applied to the same plant are called synonyms. Synonyms may arise independently, as where two persons describe a species under different names; or they may be due to differences in opinion as to the genus to which a species belongs. The peach is called *Prunus persica* by some and *Amygdalus persica* by others, because some place the peach in the same genus as the plum and others keep the peaches in a separate genus, *Amygdalus*. In like manner there may be different opinions as to the forms of a variable species. For example, the species of *Crataegus* as described in Gray's Manual are difficult to distinguish. Some botanists would include under *Crataegus crusgalli* all the species of the group (species 2-6). Others would distinguish still more species, recognizing as valid the ones that now appear as synonyms in the text (*C. Palmeri*

and *C. grandis* under *C. pratensis*; *C. Pennypackeri* under *C. Canbyi*). These differences depend upon the judgment or opinion of different botanists.

Changes of names in successive editions of the same work may be due to the correction of errors. *Panicum scoparium* of the sixth edition of Gray's Manual is changed to *P. Scribnerianum* in the seventh edition, because in the former the name was applied to the wrong plant.

## CHAPTER IV

### AUTHORS OF TAXONOMIC GROUPS

The person who first properly publishes (see Chapter V) the name of a genus, species, or other taxonomic group is said to be the author of that group, and in formal citations the author's name, usually abbreviated, is placed after the name of the group.

*Examples.* *Geum* L. Linnaeus first published the name *Geum* for a genus of plants. *Geum strictum* Ait. Aiton first published the name *Geum strictum* for a species of the genus *Geum*.

#### Abbreviations of Authors' Names

For convenience, the names of well-known authors are abbreviated. There is no definite standard or rule for the abbreviation of a name, but it is generally understood that the abbreviation should not be ambiguous. The names of obscure or little-known authors are not usually abbreviated. In general, the abbreviation retains the letters of the author's name in sequence up to the part omitted. The better known the author the more his name can be abbreviated. Certain names are so familiar that they allow of extreme abbreviation, as L. for Linnaeus, DC. for De Candolle, H.B.K. for Humboldt, Bonpland and Kunth. On the other hand, Robinson, though well-known, is not usually abbreviated because of the danger of confusion with other names, such as Roberts, Robin, Robins and Robertson. Different persons with the same name require initials or some other designation. W. J. Hooker and his son, J. D. Hooker, are usually distinguished by abbreviating the first as Hook. and the second as Hook. f. (filius). The elder De Candolle is abbreviated DC., the son, Alphonse, A. DC., and the grandson, Casimir, C. DC. The American Asa

Gray is distinguished from the English S. F. Gray by giving his initial.

In some older works one may find abbreviations, such as W. for Willdenow, F. for Fries, or Lmk. for Lamarck, that are not intelligible except to those familiar with the region or the group of plants concerned. The common practice now is to preserve in the abbreviation enough of the word to identify the name in a catalog of literature. The letters T. & G. would be admissible for Torrey and Gray though the individual letters would not be sufficient for these authors separately.

The following are a few of the rules governing the abbreviation of authors' names appearing in the Contributions from the National Herbarium.

1. Names of one syllable are not abbreviated.
2. Names of more than one syllable, when abbreviated, should always stop before a vowel and should go at least to the vowel of the second syllable.
3. The following names of authors are specially abbreviated: L., DC., B.S.P., H.B.K., Michx., R. Br.
4. To distinguish different authors of the same name, initials may be used; or in case of father and son, the name of the latter, or its abbreviation, may be followed by f. (filius).
5. Names that, to avoid confusion, are not abbreviated when standing alone, may be abbreviated when combined with another (Britton; Britt. & Rose).

The following list of names and their abbreviations is representative:

Bentham . . . . .	Benth.	<i>or Bth.</i>
Braun, Alexander . . . . .	A. Br.	
Brown, Robert . . . . .	R. Br.	
De Candolle . . . . .	DC.	
Engelmann . . . . .	Engelm.	
Humboldt, Bonpland and Kunth . . . . .	H.B.K. or HBK.	
Lamarck . . . . .	Lam.	<i>or Lmk.</i>
Linnaeus . . . . .	L. or Linn.	

Marshall.....	Marsh.
Meyer, C. A.....	C. A. Mey. — there are several Meyers.
Michaux.....	Michx., or less desirably Mx.
Muhlenberg.....	Muhl.
Nuttall.....	Nutt.
Poiret.....	Poir.
Pursh.....	Preferably not abbreviated.
Roemer and Schultes.....	Roem. & Schult. or R. & S.
Swartz.....	Unabbreviated, or Sw.
Torrey.....	Torr.
Willdenow.....	Willd.

### Use of the Parenthesis

When a species, originally described in one genus, is later transferred to another genus, the name of the author of the original specific name (if the parenthesis system is used) is placed in a parenthesis, and this is followed by the name of the author who has placed the species in the accepted genus.

*Example.* *Agrostis indica*, first described by Linnaeus, was later placed in the genus *Sporobolus* by Robert Brown. The name is therefore written *Sporobolus indicus* (L.) R. Br.

This is a relatively recent innovation and is not yet commonly used except in America. The object is to show that the species was first described under a different genus. Sometimes it happens that the original author of the species transfers it later to another genus. In this case the name within the parenthesis is the same as that after it. However, botanists are not in accord as to the practice in this particular case, and usually the parenthesis is omitted.

When an author transfers a species from one genus to another he is said to make a new combination. At the time of publication he may place his own name after the new combination or, if the authorship is clear from the context, he may omit his name.

It is often the practice among zoölogists and occasionally among botanists to cite only the original author of the



species in parenthesis and omit the author of new combinations.

*Example.* *Agrostis indica* L.; *Sporobolus indicus* (L.).

The parenthesis system is applied also to varieties and subspecies, and to genera and their subdivisions.

*Examples.* *Nyssa biflora* Walt. is made a variety of *N. sylvatica* by Sargent, and the name is written *N. sylvatica biflora* (Walt.) Sarg. The genus *Amygdalus* L. is considered by some botanists to be a section of *Prunus* and would be written by them *Prunus* sect. *Amygdalus* (L.) Benth. & Hook.

A particular application of this system is made in the case of generic names that were in use before the publication of Linnaeus' "Species Plantarum" in 1753, the date of the beginning of binomial nomenclature (see page 152). If a generic name used by Linnaeus or his successors was employed in a formal manner by an earlier author (in the same sense), the first author's name is, by some botanists, placed in parenthesis or in square brackets. Such generic names are said to be adopted from pre-Linnaean authors.

*Example.* The genus *Prunus* was first formally described by Tournefort (1700) and was taken up by Linnaeus. It may be written *Prunus* [Tourn.] L.