

Plant Systematics

Some Definitions

Nomenclature – The naming of groups of organisms and the rules governing application of the names.

Identification – The referring of individual organisms or specimens to a previously classified and named group.

Taxonomy – The study of the principles and methods of classification.

Systematics – All of the above in the context of evolutionary history

Early History of Classification

Theophrastus (372-287 B.C.) – *Enquiry into Plants* – described and classified ca 500 species of plants into herbs, undershrubs, shrubs, and trees

Pliny the Elder (23-79 A.D.) – *Historia Naturalis* – a compendium of ancient scientific and medical knowledge including classifications of plants and animals

Dioscorides (ca 40-90 A.D.) – *De Materia Medica* – compilation of known medical knowledge

The Age of Herbals (1400-1700) – Several herbalists published richly illustrated books known as herbals, which dealt largely with the identification, collection, and preparation of medicinal plants

By the beginning of the 18th century, it was common to name plants using a polynomial, which included a single word name (= generic name) for the plant followed by a lengthy list of descriptive terms

Carolus Linnaeus (1707-1778) – brought classification of plants and animals into the modern age

Systema Naturae (1735) – introduced a sexual system of classification for the plant kingdom

Species Plantarum (1753) – formalized the combination of a generic name with a trivial name (the specific epithet) to form a binomial; used as the starting point for scientific names under the International Code of Botanical Nomenclature

The ultimate goal of nomenclature is to provide a consistent and stable method of naming organisms, thus allowing for ease of communication.

How Plants are Named

Common names

Common names may commemorate a person, describe a physical quality, indicate a use, indicate origin, location or season, be the same as scientific names

Common names are not universal

A single species of plant may have many common names or no common name at all

The same common name may apply to more than one species of plant

Scientific names

In general, each kind of organism is a species, and similar species form a genus

The name of a species is a Latin or Latinized binomial composed of a generic name followed by a specific epithet; it is always underlined or italicized

Generic names are nouns and are always capitalized; they may be commemorative, describe physical qualities, be of aboriginal or classical origin, indicate use, indicate location

Specific epithets are usually adjectives and are written in lower case (a commemorative name may be capitalized if one desires to do so); they may be commemorative, describe physical qualities, indicate use, indicate origin, location or season

A complete scientific name also includes the name(s) of author(s) who described it and, if there has been a change in the name, other author(s) who have in some way changed the name

What is a species?

Biological species concept

A population or group of populations whose members have the potential to interbreed and produce viable, fertile offspring, but who cannot produce viable, fertile offspring with members of other species

Limits to the biological species concept

Does not address organisms that reproduce asexually

Some things that are very different from one another can interbreed successfully

Some things that are very similar to one another cannot interbreed successfully

Morphological species concept

Species are defined by measurable anatomical criteria

Ecological species concept

Ecological roles (niches) define species

Evolutionary species concept

Evolutionary lineages form the basis of species identification

Taxonomic Hierarchy – Plant species are grouped into categories with related organisms using a phylogenetic system, which ideally reflects evolutionary history

The term taxon (pl., taxa) is used generally for any unit of classification

In accord with the International Code of Botanical Nomenclature:

Related species form a genus

Related genera form a family

Related families form an order

Related orders form a class

Related classes form a division

Related divisions form a kingdom

The International Code of Botanical Nomenclature sets standard grammatical endings from Division (= Phylum) down to subtribe. There are eight exceptions to the family level “–aceae” ending that may be used if desired:

Gramineae = Poaceae (Grasses)

Cruciferae = Brassicaceae (Mustards)

Leguminosae = Fabaceae (Beans, etc.)

Guttiferae = Clusiaceae (St. John’s Wort)

Umbelliferae = Apiaceae (Carrot, etc.)

Labiatae = Lamiaceae (Mints)

Compositae = Asteraceae (Sunflowers, etc.)

Palmae = Arecaceae (Palms)

Methods of Plant Identification (referring of individual organisms or specimens to a previously classified and named group)

Ask an expert

Do it on your own

Compare to photos and drawings in books

Compare to previously identified specimens

Compare with written descriptions

Become an expert

Use a taxonomic key

Taxonomic Keys

Structure of a key

Series of paired mutually exclusive statements (couplets)

Divides a set of objects into progressively smaller subsets

Using a key

Always read both choices

Understand the terms – don't guess

Measure carefully – don't guess

Magnify structures when necessary

Try to make multiple observations

Go both ways if necessary

Check answer against a photo, illustration, or herbarium specimen

Taxonomic Literature

Floras, Manuals, Guides

Floras and manuals usually treat plants of a particular geographic area and include keys and descriptions. Sometimes they include illustrations and distribution maps.

Guides are usually fairly simple picture books, but some are more sophisticated and include keys, brief descriptions, natural history information, etc.

Monographs and Revisions

A monograph is a comprehensive taxonomic treatment of a group that includes an exhaustive literature review; original research regarding morphology, cytology, chemistry, ecology, phytogeography, and phylogeny; a phylogenetic classification with keys, descriptions, illustrations, distribution maps, and complete synonymy.

A revision is usually less detailed, but includes keys, descriptions, distribution maps, and a classification system. Should include most or all synonymy.

Herbaria (singular – herbarium)

A collection of pressed, dried plant specimens arranged in a specific order for reference and/or study. A herbarium may contain anywhere from a few hundred specimens to several million. The University of Texas Herbarium contains about 1.1 million specimens.

The overall goal of herbaria is to collect and preserve plant specimens with adequate label notes, and to collect taxonomic literature in the herbarium library.

Functions of herbaria include:

- Provide a standard reference collection for verifying the identification of newly collected plants

- Serve as a reference collection for educational purposes

- Document the presence of species at particular locations and provide geographical and ecological data

- Serve as a basis for floristic and monographic studies

- Provide plant material for other kinds of studies (pollen, DNA, chemical, etc.)

- Serve as a repository for type specimens

This lecture outline was prepared partly from *Plants and Society*, by Levetin and McMahon, 2003 (3rd edition), and may contain phrases or entire sentences taken verbatim from that source.