Monday’s lecture

Nomenclature and classification

Class entry quiz results

SPECIES PLANTARUM.

Volume 85
Number 4
1998

Annals of the Missouri Botanical Garden

AN ORDINAL CLASSIFICATION FOR THE FAMILIES OF FLOWERING PLANTS

Abstract

Who enquires families, will have better order in their thoughts? It is indeed important to remember that species are classified in groups, and these groups are classified in other groups. Knowledge of the hierarchical organization of plant groups is important. This knowledge is important for understanding the diversity of plant species and how they are related to each other. In this lecture, we will discuss the classification of flowering plants and how it is used in understanding the diversity of plant species. We will also discuss the system of classification and how it is used in understanding the diversity of plant species.
Natural vs. artificial classification

Artificial classification:
Does not correspond with evolutionary relationship

Natural classification:
Representative of evolutionary relationship

Allows comparison of equivalent units
Invests names with predictive power

History of plant classification

Linnaeus, 1753

Bessey, 1915
History of plant classification

Takhtajan, 1967

Fig. 31. Dendrogram showing the probable relationships of the orders of flowering plants. (Modified after Takhtajan, 1964.)

History of plant classification

Cronquist, 1981

Fig. 1.2 Putative evolutionary relationships among the subclasses of dicotyledons. The size of the balloons is proportional to the number of species in each group.

Heirarchical grouping of taxa according to authority
Natural or artificial, subjective
Phylogenetic classification

Chase et al., 1993; APG II, III – classification based on phylogeny inferred from DNA sequences (rbcL)

Heirarchical grouping of taxa according to phylogenetic relationships
Natural, objective, and transparent

Today’s lecture

Understanding phylogenetic trees (part I)
**What is phylogeny?**

**Phylogeny** = the pattern of evolutionary relationships among species, their descent from common ancestors

“… the great Tree of Life, which fills with its dead and broken branches the crust of the earth, and covers the surface with its ever-branching and beautiful ramifications.” Charles Darwin, On the Origin of Species (1859)

![Phylogenetic Tree of Life](image1)

Augustin Augier, 1801  Heinrich Bronn, 1858  Haeckel, 1866  Haeckel, 1874

**What is phylogeny?**

Phylogeny is often presented as a diagram (**a phylogenetic tree**).

![Phylogenetic Tree of Life](image2)

1. Haeckel, 1866  
2. Wikipedia  
3. APweb  
4. Gomez, 2010  
5. Cameron, 2000
Interpreting phylogenetic trees

**Ingroup** = the lineage under consideration. **Outgroup** = a lineage that is not part of the ingroup. **Sister group** = the lineage that is most closely related to the lineage under consideration.

**Topology** = the branching pattern of a phylogenetic tree

Sister relationships are reciprocal; sister groups are each other’s closest relatives (share a more recent common ancestor with each other than with any other group).
Systematists try to recognize and name only: **monophyletic groups**

**Monophyletic group** (or **clade**) = a single lineage; a group composed of a common ancestor and all of its descendants.

mono = one, phylum = tribe
**Paraphyletic group** = a group containing a common ancestor and some, but not all, of its descendants.

para = near, “not quite”, phylum = tribe

**Polyphyletic group** = multiple lineages; a group that does not contain the common ancestor of its members.

poly = many, phylum = tribe
Phylogenetic classification = a hierarchical ordering of taxa, according to phylogenetic relationships.

The use of phylogeny to produce the classification. Often referred to as **cladistics**.

Our goal is to recognize and name only **monophyletic groups**, to achieve nested sets that are hierarchically organized.

**Phylogenetic classification**

Homeothermia: an example of a **polyphyletic group**
Phylogenetic classification

Reptiles, dinosaurs: examples of **paraphyletic** groups

Why no polyphyletic groups?
- Natural classification should reflect evolutionary relationship

Why no paraphyletic groups?
- Taxa at same rank should not contain one another
- All members of a group should have their closest relative also belong to that group

Recognizing monophyletic groups allows greater predictive power
Before:

Chamaecyparis nootkatensis

Now:

Xanthocyparis vietnamensis
Before: *Lycopersicon esculentum*

Now: *Solanum lycopersicum*

Fig. 1. One of two most-parsimonious 608-step Wagner trees (as a phenogram) of the cpDNA data, and the single most-parsimonious weighted tree (I.1 and I.3 weights of site gains over site losses), with collapsed homoplasy values and number of mutations supporting each branch (arrows in the same direction as unique transitions, parallel boxes, and parallel gaps). The taxonomy follows Child (1990), except that the names as *Lycopersicon* are used here.

Spooner et al., 1993