Classification

Tzetal classification of biota

Figure 2.2 Highly schematic representation of the first plant dedication, biological order and their respective flowers. Phylogenetic species are identified by their flowering position. Fossil genera are represented as one of the lineages here along with their systematic characters of the organs. Phylogenetic positions represent to separate regions of affinity, where closer affinities are indicated by greater similarity. Common names in the figure are described in the legend.

Classification

Three main systems of classifications in western civilization

- Artificial: suites of characters
  - Thaophrastus
  - Herbalists
  - Carolus Linnaeus
  - good example of an “artificial” system of classification

- Natural: evolutionary interpretation
  - Andre Caesalpinio
  - John Ray
  - Pierre Magnol
  - Antoine-Laurent de Jussieu

- Phylogenetic: workability
  - George Bentham
  - Engler/Prantl
  - Charles Bessey
  - Arthur Cronquist
  - Robert Thorne
  - Roll Delgrren
  - APG
  - “Hawkless”

Classification

Carolus Linnaeus (1707-1778) - Swedish taxonomist

- greatest achievement - *Species Plantarum* in 1753 arranged as *Systema Sexuale*
  - classification based on reproductive features chosen *a priori* simply on workability

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Take a closer look inside Species Plantarum

• prime divisions based on number of stamens
• secondary divisions based on number of pistils

Classification

The shift from "artificial" systems of classification to "natural" systems basically involved the departure away from reliance on a single or few characters used to "pigeon-hole" a plant (e.g., habit, medicinal property, # of stamens). Instead, large numbers – or "suites" - of characters were later used.

Classification Systems

Artificial --- Index of characters --- Natural --- Phylogenetic

Thomson --- Bentham --- Linnaean Classification --- New Phytologist --- Jussieau

The de Jussieau family of systematists and ecologists at the Paris Herbarium experimented by replanting the species so that those most "similar" looking on the basis of many features would be in proximity.

Antoine de Jussieu later developed the first "natural" system of classification of flowering plants - aspects of which are still in use today.

Classification

This switch from artificial to natural systems of classification was aided by a fad in the 18th and 19th centuries - laying out botanical gardens to reflect the current classification scheme in vogue.

Shown here is the famous Linnaean Gardens in Uppsala, Sweden, in which the plants are arranged by stamen number as in Carolus Linnaeus' "Sexual System of Classification"
The shift from "natural" systems of classification to "phylogenetic" systems required the concept from Charles Darwin that organisms are tied together by genealogical descent - one of the two basic evolutionary paradigms.

It is important to realize that evolution predicts a "tree"-like pattern to life; not the Greek "ladder of life" pattern. This confusion is the basis of a lot of miscommunication in the "evolution-creationist" debate.

Angiosperms have traditionally been divided into two classes: the dicotyledons and the monocotyledons. As demonstrated here, monocots are embedded within the dicots - thus, the separation of flowering plants into two classes of dicotyledons and monocotyledons is no longer recognized.

Most modern phylogenetic studies depict their results in the form of a tree or phylogeny.

Major surprises were uncovered including the recognition of the first diverging flowering plants - which include the water lilies.
**Magnoliophyta - Flowering Plants**

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The basal angiosperms are those groups that are now shown to be the oldest diverging. They include some primitive dicots and all monocots.

All other angiosperms - the bulk of the dicots - are called the "eudicots" and considered more advanced.

**Nymphaeales - water lily order**

- Floating or submersed leaves
- Air cavities in tissue
- Mucilaginous coverings
- Lack of vessels

The order is almost the first flowering plants that split off after the rise of angiosperms - only one monotypic family in New Caledonia is more basal.

**Magnoliaceae - magnolia family**

One species of *Magnolia* in the Great Lakes region, and part of the Alleghenian flora. Tropical trees with ethereal oils which leads to a strong scent. They typically have simple, alternate entire leaves.

Flowers are spiralled rather than whorled with elongated receptacle

\[ P \approx A \approx G \approx T \]

Tepals, laminar stamens, apocarpic

Fruit = "cone" of follicles

Dehiscent fruit with one suture, derived from one carpel

**The Monocots**

The remainder of the basal angiosperms are the monocotyledons.

The main features of the monosperms separating them from all other flowering plants (and why they have long been separated out as a distinct group) are:

1. 3 merous flowers
The Monocots

The remainder of the basal angiosperms are the **monocotyledons**.

The main features of the monocots separating them from all other flowering plants (and why they have long been separated out as a distinct group) are:

1. 3 merous flowers
2. Parallel-veined leaves
3. Absence of woody tissue

The Monocots

The monocots are comprised of 3 main groups:

1. Alismatids
2. Lilioids
3. Commelinids

Alismatids - the aquatic monocots

Emergent, floating, or submerged aquatic group of monocots

These are the first diverging monocots
Alismatids - the aquatic monocots

Associated with the aquatic habit is the trend from insect-pollinated, showy flowers to water-pollinated, reduced flowers.

The group shows increasing effort to vegetative reproduction over sexual reproduction.

Lilioid Monocots (Liliales + Asparagales)

The lilioid monocots represent two orders and contain most of the showy monocots such as lilies, tulips, blue flags, and orchids.

They are defined by 3 features:

1. Geophytes: herbaceous above ground with bulbs, corms, rhizomes, tubers as modified, perennial stems below ground.

2. Tepals: showy perianth in 2 series of 3 each; usually all petaloid, or outer series not green and sepal-like.

3. Nectaries: usually well-developed nectar tissue at the base of ovary or stamens; insect or bird-pollinated.

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**Commelinids**

The commelinid monocots show continual progression to loss of most floral parts and specialization of reduced florets for wind pollination. The inflorescence - **spikelet** - becomes the most important structure ecologically.

- Male florets
- Female florets

*Carex pensylvanica*  
Pennsylvania sedge

The sedges and grasses are the most important families of this large group.

**Eudicots**

The true dicots = **eudicots** all have 3-pored pollen.

They are the largest group of angiosperms, and are quite diverse. The main groups include:

- Ranunculids
- Caryophyllids
- Rosids
- Asterids

**Ranunculids**

The first diverging group of true dicots or **eudicots**

The largest family is the Ranunculaceae or buttercup family. Flowers are primitive looking with many parts and no fusion.

*Anemone canadensis* - anemone

**Caryophyllids**

The caryophyllid group is a strange mixture of plants including cacti, carnations, and some carnivorous families.

Many of them are found in marginal habitats - deserts, salt environments, nutrient poor sites, and weedy areas. This distribution is accompanied by unusual physiological or morphological adaptations.
Many of the species are introduced (either by Native Americans or Europeans or later) and either naturalized – well-established, often widespread plant that is not originally in our flora – or adventive – only casually established, not persistent.

**Gypsophila paniculata**  
Baby’s-breath  
Caryophyllaceae

**Asterids**

Asterids are the second of the two large groups of dicots.

- Fused petals

**Rosids**

Rosids are one of the two large groups of eudicots

- Separate petals

Asterids

- The basal asterids include blueberries and dogwoods and relatives
- The rest of asterids have the typical asterid flowers - (1) fused petals, (2) stamens = or less than number of petals, (3) stamens fused to petals