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Introduction to Taxonomy

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Introduction to Taxonomy  
USU Extension Service Advanced Master Gardeners 2005

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Taxonomy
◆ What is Taxonomy?
– The science of naming and classifying organisms into similar groups based on
different and similar physical characteristic including leaf shape, fruit form, etc.
◆ The branch of biology that deals with the identification, naming and classification
of organisms
◆ Taxon - a general term that refers to any group of similar organisms

Identifying Trees
◆ Tree Terms You Must Know
  Gymnosperm
  Angiosperm
  Cotyledon
  Monocotyledons
  Dicotyledons

Identifying Trees
◆ Tree Taxonomy You Must Know
◆ Leaf arrangement
◆ Leaf shape
◆ Leaflet arrangement
◆ Leaf blade

Dichotomous Keys
◆ A tool designed to help identify an organism
◆ Most keys are dichotomous - they provide two choices at each step in the key;
selections continually eliminate dissimilar organisms until a single taxon is identified
◆ Most taxonomic keys are based on flowers but our study of woody plants focuses
on vegetative characteristics because they are always available.
◆ Flora or Manual - keys, descriptions, perhaps illustrations, distributions, life
histories, economic importance, taxonomic problems
◆ Keys - only identification tools vs. Guides - generally nontechnical
Web Site http://www.nr.usu.edu/Geography-Department/utgeog/utvatlas/index.html

Common names
◆ Recognized by lay people;
◆ Less imposing, simple, easy to remember
May be descriptive; many different names for same organism or no common name
May be misleading
Often used for more than one taxon

Scientific Names (ideally) a unique Latinized name for each organism used worldwide
Provide a unique "identifier" for a taxon
Provide information about taxa relationships

Classification
The scientific system of classification has all living things divided into groups called taxa (singular, taxon)

Scientific Names
Binomial nomenclature - each species name consists of:
Generic name - e.g. Picea
Specific epithet - e.g. pungens Blue spruce – Picea pungens

Botanists also include an authority(s); indicates who named the taxon and/or revised the classification e.g. Picea pungens Vitman Fulgenzio Vitman 1728-1806, Italian botanist and cergyman,

Classification
The order of classification is
Domain
Kingdom
Phylum
Class
Order
Family
Genus
Species

Standardized endings for Taxonomic Groups
Phylum - ophyta e.g. Magnoliophyta
Class - opsida e.g. Liliopsida
Order - ales e.g. Cyperales
Family - aceae e.g. Poaceae

Domains
Archea
Bacteria
Eukarya

Biochemical evidence suggests three different broad categories of living organisms
Kingdoms
6 Kingdom system recognizes
Archea (may be elevated to Domain)
Bacteria (may be elevated to Domain)
Protista
Fungi
Plantae
Animalia

Kingdom
◆ Plants are in the Plantae Kingdom
◆ The other Kingdoms are
  Fungi
  Protista (one-celled organisms like yeasts, bacteria and protozoans)
  Animalia- Animals

Classification
◆ The plant kingdom is divided into two groups
◆ Broyophytes- includes mosses and liverworts
◆ Vascular Plants- plants with a vascular system
◆ Vascular plants are then divided unto two subgroups : seedless and seeded
◆ These sub-groups divide into Phyla (plural of phylum) and ends in phyta

Phyla
◆ Pterophyta- seedless (Ferns)
◆ Cycadophyta- seeded (Cycads)
◆ Ginkgophyta- seeded (Gingkos)
◆ Coniferophyta- seeded (Conifers)
◆ Anthophyta- seeded (Angiosperms)
◆ Pterophyta-seedless (Ferns)

  Gymnospermae     Angiospermae

Gymnosperms
◆ Trees or shrubs are generally evergreens with a few exceptions and are called softwoods
◆ Bears naked seeds in cones rather than enclosed in ovaries
Gymnosperm Leaves are Needles, Awls or Scales
◆ (Gingko is the exception)

Angiosperms
◆ Usually a flowering plant

Angiosperms
- Produce male flowers containing pollen and/or female flowers with the potential for bearing seed or both male and female parts
- Angiosperms are broadleaf trees, most are deciduous, and called hardwoods
◆ Leaves are broad and flat

Gymnosperms or Angiosperms Learn to tell the difference between these from a distance and know what to look for and expect in each category

Sub Class
◆ Monocotyledonae
Dicotyledonae

Cotyledon
- Seed Leaf - A leaf-like seed structure that functions as a leaf before true leaves emerge

Monocotyledons Angiospermous with a single seed leaf
- Parallel-veined leaves
- No cambium layer (Bamboo, top, palm, bottom)
- Floral parts usually in threes

Dicotyledons Angiosperm with 2 seed leaves
- Net-veined leaves
- A cambium layer in most woody species
- Floral parts usually in fours or fives

Family
- Separated from one another by characteristics inherent in their reproductive structures (flowers, fruit and seed)

- In the Class Gymnosperms there are five families
  Gingkoaceae Family Gingko
  Taxaceae Family Yews
  Pinaceae Family Pines, Firs, Spruces, Larch and Hemlock
  Cupressaceae Family Juniper, Cedar, Arborvitae
  Taxodiaceae Family Cypress

Class
- Gymnosperms have one Subclass Monocotyledon and that is Liliaceae
- In the class Angiosperms, sub-class dicotyledons there are many families
  Magnoliaceae Family Magnolia and Tulip Poplar
  Hamamelidaceae Family Sweetgum
  Platanaceae Family Sycamore
  Ulmaceae Family Elms, Hackberry and Zelkova
  Moraceae Family Mulberry
  Juglandaceae Family Walnut
  Fagaceae Family Beech, Oak and Chestnut
  Betulaceae Family Hornbeam, Birch, Alder and Hazelnut
  Tiliaceae Family Lindens
  Salicaceae Family Cottonwood, Aspen and Willow
  Rosaceae Family Mt. Mahogany, Mt. Ash, Hawthorns, Stone and Pome Fruits, Serviceberry etc.
  Cesalpiniaceae Family Locusts, Honeylocusts, Redbuds and Kentucky Coffee
  Fabaceae Family Locusts, Honeylocusts, Redbuds and Kentucky Coffee (Name Change)
  Mimosaceae Family Mimosa
  Elaeagnaceae Family Russian Olive
Cornaceae Family Dogwood
Rhamnaceae Family Buckthorn
Hippocastanaceae Family Buckeye and Horsechestnut
Aceraceae Family Maple
Simaroubaceae Family Ailanthus
Bignoniaceae Family Catalpa

Genera (Genus) Species groups With Close Genetics
Species
◆ Specific kind of tree
◆ Organisms that are similar in anatomical form and structure that can interbreed to produce fertile offspring

*Acer rubrum*
Kingdom- Plantea
Phylum- Anthophyta
Class- Angiospermae
Subclass- Dicotyledonea
Order- Sapindales
Family- Aceraceae
Genus- Acer
Species- *rubrum*
Cultivar – ‘Autumn Glory’

Identifying Angiosperms
◆ Five features to look for
1. Leaf arrangement on the stem
2. Simple or compound leaf
3a. If the leaf is simple, how are the main veins arranged
3b. If the leaf is compound, how are the leaflets arranged
4. Is the leaf blade lobed
5. Is the edge serrated or entire

How Are The Leaves Arranged on The Stem?
Check several leaves from different parts of the tree
– Distinguish leaves from leaflets
– Leaf scars, axillary buds and branching habits are clues to the true leaf arrangement
Opposite Leaves vs. Alternate Leaves

Is The Leaf Simple or Compound?
◆ True leaves have a petiole and blade
◆ Most leaves are simple

Simple Leaf
◆ A leaf blade with a single flat surface
Compound Leave
◆ A leaf blade may be divided into several individual flat surfaces called leaflets

Check How The Main Veins Are Arranged
◆ Look at the underside of the leaf
  – Pinnately veined- arranged in the fashion of a feather
  – Palmately veined- arranged similarly to fingers on a hand
Pinnately Veined Leaves with one main vein with secondary veins “pinned”
◆ Some leaves are pinnately veined, but two secondary veins at the base of leaf blade are coarse enough to make the leaf appear palmately veined, these are called palma-pinnately
◆ If in doubt classify as pinnately veined

Check How Compound Leaflets Are Arranged
◆ Leaflets are arranged along one central stalk (rachis)
  Pinnate pattern- Pinnately Compound
  Palmate pattern- Palmately Compound
  Compound and compounded again-Twice-pinnately Compound (Bipinnate)

Is The Leaf Blade Lobed
◆ Lobes are leaf indentations going one-quarter or more the distance to the leaf center
Pinnately Lobed, Palmately Lobed, Not Lobed

Is The Edge Serrated or Entire
◆ Looking at the edge (margin) of the leaf blade or leaflet blade is it:
  Toothed or Serrated
  Without teeth-Entire

◆ Teeth may be pointed or rounded and arranged in regular or irregular patterns
  Double-toothed or Irregular Margins

You can learn to identify trees quickly, efficiently and with confidence, however it does take practice and patience

Learn these steps and you will look at plants differently and be a better observer

Check leaf blade and stalk size, and flowers, fruits, seeds and bark. Tree size and shape and other features are also important

The End
We Will Do More Tree Identification In Summer Labs