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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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Thanksgiving Gardens

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Taxonomy

- ◆ What is Taxonomy?
 - The science of naming and classifying organisms into similar groups based on different and similar physical characteristics 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

- ◆ Archaea
- ◆ Bacteria
- ◆ Eukarya

Biochemical evidence suggests three different broad categories of living organisms

Kingdoms

- ◆ 6 Kingdom system recognizes
 - Archaea (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
- ◆ Bryophytes- includes mosses and liverworts
- ◆ Vascular Plants- plants with a vascular system
- ◆ Vascular plants are then divided into 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 (Ginkgos)
- ◆ Coniferophyta- seeded (Conifers)
- ◆ Anthophyta- seeded (Angiosperms)Phyla
- ◆ 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
- ◆ (Ginkgo 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- Plantae

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 Leaf

- ◆ 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