CMG GardenNotes #122

Taxonomic Classification

One of the most useful classification systems utilizes plant taxonomy. Taxonomy is the science of systematically naming and organizing organisms into similar groups. Plant taxonomy is an old science that uses the gross morphology (physical characteristics, [i.e., flower form, leaf shape, fruit form, etc.]) of plants to separate them into similar groups. Quite often the characteristics that distinguish the plants become a part of their name. For example, *Quercus alba* is a white oak, named because the underside of the leaf is white.
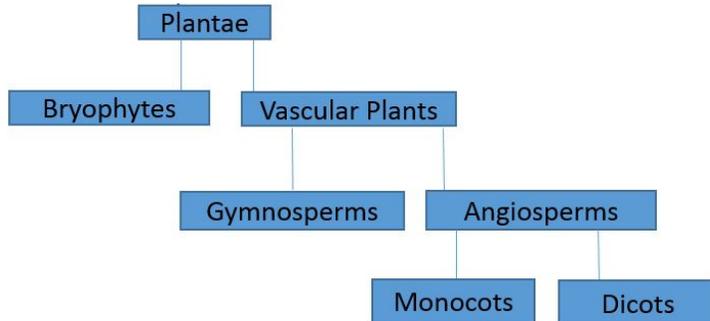
The science of plant taxonomy is being absorbed into the new science of systematics. The development of more sophisticated microscopes and laboratory chemical analyses has made this new science possible. Systematics is based on the evolutionary similarities of plants such as chemical make-up and reproductive features.

It should be noted that plant taxonomic classification changes with continuing research, so inconsistencies in nomenclature will be found among textbooks. Do not get caught-up in which is correct, as it is moving target. Rather focus on "are you communicating?"

An overview of plant taxonomy helps the gardener understand the basis of many cultural practices. For example, fire blight is a disease of the rose family; therefore, it is helpful to recognize members of the rose family to diagnose this disease.

Common Taxonomic Divisions

The scientific system of classification divides all living things into groups called **taxa** (singular, **taxon**). Plants are in the kingdom of *Plantae*. Other kingdoms include *Fungi, Protista* (one-celled organisms including yeasts, bacteria, and protozoans), and *Animalia* (animals).

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                    Plantae
                   /       \
         Bryophytes      Vascular Plants
                         /            \
                  Gymnosperms       Angiosperms
                                   /           \
                             Monocots         Dicots
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The plant kingdom is divided into two taxa: **broyophytes** (including mosses and liverworts) and **vascular plants** (plants with a vascular system of xylem and phloem).

Vascular plants (sometimes called higher plants) are divided into two subgroups: seedless and seeded. The seeded plants divides into two taxa, **Gymnospermae (Gymnosperms)** and **Angiospermae (Angiosperms).** These make up most of the plants in the landscape.

Gymnosperms (meaning naked seed) do not produce flowers, but rather produce seeds on the end of modified bracts, such as pine cones. Many have scale or needle-like leaves. Arborvitae, junipers, Douglas-fir, fir, pine, and spruce are examples of gymnosperms.

Agiosperms (*Magnoliophyta* or broadleaf flowering plants) produce seeds through flowering. Most have broadleaf leaves. Angiosperms are divided into two taxa: *monocotyledon* (monocots) and *dicotyledon* (dicots). Distinguishing between monocots and dicots is a common practice in landscape management. For example, some of our common herbicides work at the monocot/dicot level. Lawn weed sprays (such as 2,4-D and dicamba) kill dicots (broadleaf plants like dandelions) but not monocots (the grass). Other herbicides will kill monocots but not dicots, allowing the gardener to kill grass (a monocot) in the shrub or flowerbed (dicots).

These taxa divide into *Divisions* (or Phylum). Division names end in 'phyta'. Examples of phyla include *Ginkgophyta* (ginkgo), *Pinophyta* (conifers), and *Magnoliophyta* (flowering plants).

Additional taxa in descending order include **family, genus,** and **species**.

Families

Families of higher plants are separated from one another by characteristics inherent in their reproductive structures (flowers, fruit, and seed). Many family members share common characteristics in plant appearances, seed location and appearance and growth habit. However, some families have a lot of diversity in appearance.

Families have primary importance in gardening as they generally share comparable cultural requirements and similar insect and disease problems. Pest management and cultural techniques are often discussed at the family level.

Family names end in '*aceae*'. Examples of common families include the following:

- *Caprifoliaceae* – Honeysuckle family, including elders, honeysuckle, snowberry and viburnum
- *Fabaceae* – Pea family, including Japanese pagoda, locust and Siberian peashrub
- *Oleaceae* – Olive family, including ash, forsythia, lilac and privet
- *Rosaceae* – Rose family, including apple, cotoneaster, crabapple, potentilla, peach, plum, mountain ash and 250 common landscape plants

Genus and Species

The taxonomic divisions beyond the family level are the genus and specific epithet names, together called the species. Plants are named using a binomial system. The genus name comes first and is analogous to a person's last name (like Smith). The specific epithet names follows as a more specific identifier. It would be analogous to a person's first name (like John).

Genus	Specific epithet
Smith	John
Catalpa	*speciosa*

Genera (plural of genus) are groupings whose members have more characteristics in common with each other than they do with other genera within the same family. Similarity of flowers and fruits is the most widely used feature, although roots, stems, buds, and leaves are also used.

Common names of plants typically apply to genera. For example *Acer* is the genus of maples, *Fraxinus* of the ash, and *Juniperus* of the junipers.

Specific epithet generally refers to interbreeding sub-groups of a genus or groupings of individual plants that adhere to essential identification characteristics but show sufficient variation so as not to be categorized as duplicates of one another. The specific epithet name is always used in conjunction with the genus.

When genus and specific epithet names are written, they should always be underlined or italicized to denote they are Latin words. The genus name is always capitalized, but the specific epithet name is not.

The singular and plural spelling of *species* is the same. In writing, the abbreviation "sp." following the genus indicates a single unidentified species and "spp." indicates multiple species. For example, "*Acer* sp." would indicate an unidentified species of maple, and "*Acer* spp." refers to multiple species in the maple genus. The "sp." or "spp." is not underlined or italicized.

In technical papers, the person who first identified the species, called the **Authority**, follows the specific epithet names. For example, Japanese maple would be written *Acer palmatum* Thunberg or *Acer palmatum* T. The Irish potato would be written *Solanum tuberosum* Linnaeus or *Solanum tuberosum* L.

Some suggested sources of scientific names include the following:

- o *USDA Plant Data Base* at http://plants.usda.gov/
- o *Manual of Woody Landscape Plants*
- o *Hortus Third* or *Hortus Fourth*

Variety and Cultivar

The taxonomic divisions beyond the genus and species level are variety or cultivar. This is an even more specific identifier, similar to a person's middle name.

Genus	Species	Cultivar
Smith	John	'David'
Quercus	*rubra*	'Aurea'
Salvia	*greggii*	'Furman's Red'

Variety or **subspecies** is a sub-grouping of species assigned to individuals displaying unique differences in natural populations. The differences are inheritable and reproduce true-to-type in each generation. For example cauliflower and cabbage are varieties of the same species *Brassica oleracea.*

In technical writing, variety and subspecies names must be denoted with 'var.' or 'ssp.' when following a species name. Names are italicized or underlined, while var. or ssp. is not italicized or underlined. For example, the thornless variety of honeylocust would be written *Gleditsia triacanthos* var. *inermis*. The bigfruit evening primrose would be written *Oenothera macrocarpa* ssp. *incana*.

Cultivar is a sub-grouping of species assigned to cultivated plants ("cultivated variety") that display rather unique differences and, when reproduced by seeds or cuttings, retain its distinguishing characteristics. For example, 'Early Girl' and 'Big Boy' are cultivars of tomatoes.

In technical writing, the cultivar name follows the genus and specific epithet and is always capitalized and written inside single quotes but not italicized or underlined. For example, October Glory Red Maple is *Acer rubrum* 'October Glory'.

It is possible to have a cultivar of a variety. For example, *Cornus florida* var. *rubra* 'Cherokee Chief'.

> **Strain** is a sub-group of cultivar with specific characteristics, like resistance to a disease or better color. An example is 'Early Girl VFN' tomato.

Clone is a sub-group of a cultivar derived by asexual propagation (i.e., cuttings). The offspring have one parent and therefore are identical to the parent because no exchange of genetic materials has occurred.

Line is a sub-group of a cultivar propagated by seed

Form is based on selection by growth habit, not reproducible by seed. For example, <u>Columnar</u> Norway Maple.

Scientific Names

Carl Linnaeus (1707-1778) was a Swedish botanist and is known as the father of modern taxonomy. When Linnaeus published the first books on classification, Latin was used in Western Europe as the language of science. Scientific names of plants are Latinized. Linnaeus continued this trend using Latin and Greek names.

Latin is still a part of science, medicine, law, and philosophy. For example, a prescription for a medication may use, "*quater in die*" (Q.I.D.) meaning "four times a day". "*E Pluribus Unum*", an early motto of the United States, means "out of many, one". Today, Latin has the advantage that it provides lingual neutrality between countries and languages.

<u>Pronouncing Scientific Names</u>

Genus and specific epithet names are universal <u>in spelling</u> (that is, each plant has a single genus and specific epithet name, <u>spelled the same</u> worldwide). By using Latin, plants can be positively identified from over 200,000 known plant species.

However, pronunciation of scientific names is not universal and will vary based on the local language. For example, the tomato may be pronounced 'toe-may-toe' or 'toe-mah-toe'. Based on the native language and local dialect of the user, scientific names may actually sound rather different in various countries.

Many Latin names have become 'generic' common names. For example: anemone, rhododendron, crocus, and viburnum.

Here are a few basic guidelines for American-English:

- Latin was meant to be entirely phonetic. There are no silent letters. What you see is what you say.
- Consonants are pronounced as you normally would. The letters 'c' and 'g' are normally in front of the vowels 'a', 'o' and 'u'. When in front of 'i' and 'e', the sound becomes soft ('Cecil" and "Gentle").
- The letters "ch" are pronounced like "k".
- Vowels are long in an accentuated syllable. For example, *Acer* becomes AY-ser and *Pinus* become PIE-nus.
- There are no silent syllables. For example, *Rudbeckia* becomes rood-BEK-ee-uh and *Miscanthus sinensis* becomes miss-can-thus seye-NEN-sis

- Where the accent goes is a matter of local language styles. Here are some suggestions for American-English.
  - In two syllable words, generally accentuate the first syllable. For example, *Cornus* become KOR-nus.
  - In most other words, accentuate the syllable before the last syllable. For example, *Rhododendron* becomes row-doe-DEN-dron.
  - If the last syllable contains two vowels, accentuate on the third to last syllable. For example, *Buddleia* becomes BUD-lee-ah and *Campanula* becomes kam-PA-nu-la.
- When pronouncing a name based on a person's name, try not to change the sound; accentuate on the first part of the name.
- Examples
  - *Quercus macrocarpa* (bur oak) – KWER-kus ma-crow-CAR-pa
  - *Elaeagnus angustifolia* (Russian olive) – eel-a-EE-ag-nus an-gus-tih-FOL-ee-uh
  - *Ptelea trifoliata* (hoptree/wafer ash) – Tea-LEE-uh try-foal-lee-AH-tuh

Latin Names Add Meaning

Latin names often add meaning about the plant's description, for example:

  - ***americana*** = of America – *Fraxinus americana* (white ash)
  - ***baccata*** = berry bearing – *Taxus baccata* (common yew)
  - ***micro*** = little, small – *Antennaria microphylla* (littleleaf pussytoes)
  - ***officinalis*** = medicinal – *Rosemarius officinalis* (rosemary)
  - ***repens*** = creeping, crawling – *Mahonia repens* (creeping Oregon grape)
  - ***undulata*** = wavy – *Quercus undulata* (wavyleaf oak)
  - ***variegatus*** = variegated – *Miscanthus sinensis* 'Variegatus' (variegated Japanese silver grass)
  - ***vulgaris*** = common -- *Syringa vulgaris* (common purple lilac)
  - ***alba*** = white – *Quercus alba* (white oak)
  - ***niger*** = black – *Pinus nigra* (black pine)
  - ***rubra*** = red – *Acer rubrum* (red maple), *Quercus rubra* (red oak)
  - ***sanguineus*** = blood-red – *Geranium sanguineum*

Common Names

On the other hand, common names are often local in use and many times do not clearly identify the specific plant. For example, *Liriodendron tulipifera* is known as the tulip tree in the north and as yellow poplar in the south. *Carpinus caroliniana* goes by American hornbeam, blue beech, musclewood, water beech and ironwood. The European white lily, *Nymphaea alba*, has 15 English common names, 44 French common names, 105 German common names, and 81 Dutch common names.

References on Plant Taxonomy

Books
- *Gardener's Latin: A lexicon* by Bill Neal.
- *Manual of Woody Landscape Plants* by Michael Dirr

Web based
- *International Plant Name Index* at www.ipni.org/
- *Royal Botanic Gardens, Kew Resource Page* at www.kew.org./data/subjects.html
- *USDA Plant Data Base* at http://plants.usda.gov/

Several web-based sites offer pronunciation guides for plant names. For example, http://www.finegardening.com/pguide/pronunciation-guide-to-botanical-latin.aspx

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Examples of Taxonomic Classification

Vascular plants
- Seedless
  - *Pteridophyta (Pterophyta)* – ferns
- Seeded
  - *Gymnospermae* – **Gymnosperms** (naked seed plants)
    - *Cycadophyta* – Cycads
    - *Pinophyta (Coniferophyta)* – **Conifers** (cone bearing plants)
      - *Cupressaceae* (cypress family)
        - *Juniperus* spp. – **junipers**
          - *Juniperus horizontalis* (creeping Juniper)
            - *Juniperus horizontalis* 'Blue Chip' (blue chip juniper)
        - *Thuja spp.* – **arborvitae**
      - *Pinaceae* (pine family)
        - *Abies* spp. – **fir**
        - *Larix* spp. – **larch**
        - *Picea* spp. – **spruce**
          - *Picea pungens* – Colorado spruce
            - *Picea pungens* 'Bakeri' – Bakeri Colorado spruce
        - *Pinus* spp. – **pines**
          - *Pinus ponderosa* – ponderosa pine
        - *Pseudotsuga menziesii* – **Douglas-fir**
  - *Angiospermae* – **Angiosperms** (flowering plants) / *Magnoliophyta (Anthophyta)*
    - *Aceraceae* – Maple family
      - *Acer* spp. – **maples**
        - *Acer platanoides* – Norway maple
          - *Acer platanoides* 'Crimson King' – Crimson King Norway maple
    - *Salicaceae* – Willow family
      - *Populus* spp. – **cottonwood, poplar, and aspen**
        - *Populus deltoides* – eastern cottonwood
          - *Populus deltoides* 'Siouxland' – Siouxland eastern cottonwood
        - *Populus tremuloides* – quaking aspen
    - *Rosaceae* – rose family
      - *Rosa* spp. – **roses**
        - *Rosa rugosa* – Rugosa rose
          - *Rosa rugosa* 'Hansa' – Hansa rugosa rose
      - *Cotoneaster* spp. – **cotoneasters**
        - *Cotoneaster apiculatus* – cranberry cotoneaster