



The “Early-Diverging” Flowering Plants

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The Flower – 4 Basic Whorls

Calyx [CA]: the green sepals (#3)

Corolla [CO]: the showy petals (#4)

Androecium [A]: the stamens or male structures (#6-8)

Gynoecium [G]: the carpels or pistils or female structures that contain an ovary (#9-12)

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The Flower – 4 Basic Whorls

Variation in flowers – immense and what makes them successful!

- number of parts
- symmetry
- fusion of like parts
- fusion of unlike parts
- placentation
- position of ovary
- inflorescence type

will use floral formulas as shorthand

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Magnoliophyta - Flowering Plants

Basal Angiosperm Phylogeny
APGIII - 2009

Early Diverging Angiosperms

We will begin our survey of Great Lakes’ flowering plants by examining the “early diverging angiosperms”

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The Flower

Early diverging angiosperms tend to have floral parts not fused

Ovary superior
Flower hypogynous
No hypanthium

Ovary superior
Flower perigynous
Hypanthium present

Ovary inferior
Flower epigynous
Hypanthium present

Connation: fusion of floral parts from same whorl Adnation: fusion of floral parts from different whorls

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The Flower

Early diverging angiosperms tend to have floral parts not fused . . . and have many parts at each whorl

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Magnoliaceae - magnolia family

Not found in Wisconsin, but part of the Alleghenian flora. Sub-tropical and warm temperate trees

$P \infty \quad A \infty \quad \underline{G} \infty$

Tepals, laminar stamens, apocarpic

Magnolia

Fruit = "cone" of follicles

Dehiscent fruit with one suture, derived from one carpel

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Derivation of the follicle fruit

1 floral "leaf" or carpel with ovules

Folded carpel

1 carpel with 2 rows of seeds; the fruit opens along the 1 line of suture

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Magnoliaceae - magnolia family

Tulip tree (*Liriodendron*) is also not native, but commonly planted.
Pollinated by beetles

Liriodendron - tulip tree,
yellow poplar

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Aristolochiaceae - birthwort family

8-10 genera and about 600 species worldwide; 1 species in Wisconsin. Mostly vines in the tropical regions, but herbs in temperate regions.

Artistolochia clematis: doctrine of signatures
- birthwort, "well born", aristocrat

cordate or heart-shaped leaves.

Aristolochia - birthwort
Asarum - wild ginger

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Aristolochiaceae - birthwort family

Asarum canadense - wild ginger

Used by eastern native Americans as a contraceptive, thick rhizome root can be cut up, boiled, and cooked in heavy sugar syrup to make candied ginger.

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Aristolochiaceae - birthwort family

Asarum canadense - wild ginger

Rare pipevine swallowtail in WI - does shift from host pipevine (*Aristolochia*) to wild ginger (*Asarum*)

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Aristolochiaceae - birthwort family

Asarum canadense - wild ginger



fly or beetle pollinated.

CA 3 CO 0 A 12 \bar{G} (6)

Inferior ovary with 3 sepals and the stamens arising from top.

The petals are almost absent.

Seeds are dispersed by ants; these seeds possess an aril-like structure.

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Nymphaeaceae - water lily family



These are aquatic herbs and have an obvious ecological niche - they inhabit still waters

Many of their characteristics reflect adaptations to this habitat.

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

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Nymphaeaceae - water lily family



Nymphaea - water lily



Nelumbo - lotus lily

Convergence [unrelated plants with similar adaptations] common

Check out Birge Hall lobby "Aquatic Plants" display!

For extra credit on first exam, find one of two aquatic invasive genera in Great Lakes Region that have leaves just like *Nymphaea* – one is an Eudicot and the other is a Monocot:

N _____ and H _____



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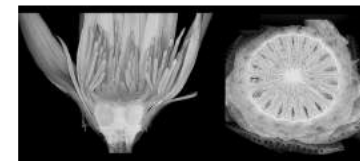
Nymphaeaceae - water lily family



Nymphaea odorata - water lily

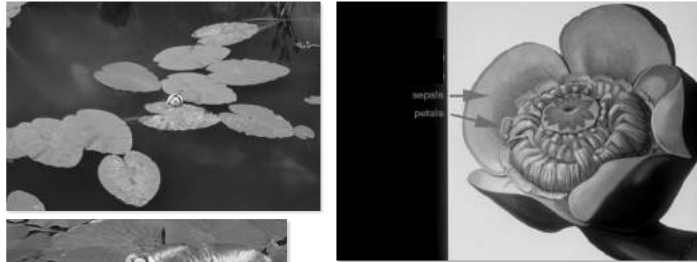
CA 3+ CO ∞ A ∞ \bar{G} (∞)

- Showy flowers with strong scent
- Many parts at each whorl
- Flat, leaf-like stamens
- Superior, syncarpic pistil



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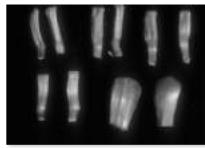
Nymphaeaceae - water lily family



Nuphar variegata - yellow pond lily


Petaloid sepals & reduced petals

Leaf-like stamens grading from petals to pistils



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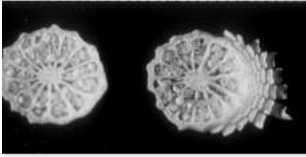
Nymphaeaceae - water lily family



Nuphar variegata - yellow pond lily

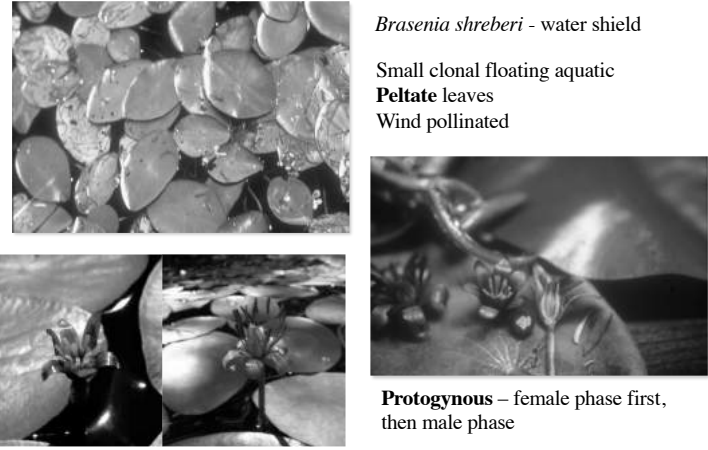
Superior pistil of many carpels

Beetle pollination



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Cabombaceae - water shield family



Brasenia shreberi - water shield

Small clonal floating aquatic **Peltate** leaves
Wind pollinated

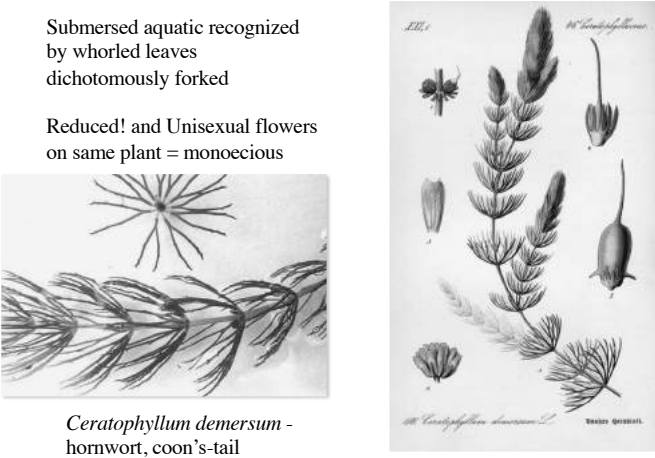
Protogynous – female phase first, then male phase

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Ceratophyllaceae – coon’s-tail family

Submersed aquatic recognized by whorled leaves dichotomously forked

Reduced! and Unisexual flowers on same plant = monoecious



Ceratophyllum demersum - hornwort, coon’s-tail

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Ranunculaceae - buttercup family

Eudicot Phylogeny
APC III 2009

Largest family of the ranunculid lineage which is the first diverging group of true dicots = eudicots

Worldwide but is centered in temperate and cold regions of the northern and southern hemispheres. 13 native genera, 53 species in WI, 20 of these in *Ranunculus*

Important family of our Wisconsin "Spring Flora" – you will see these species!

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Ranunculaceae - buttercup family

- Herbs, sometimes woody or herbaceous climbers or low shrubs - often poisonous

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Ranunculaceae - buttercup family

Frank Cook – UK botanist


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Ranunculaceae - buttercup family


- Herbs, sometimes woody or herbaceous climbers or low shrubs - often poisonous




Golden-seal



Black cohosh






Monk's-hood



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Ranunculaceae - buttercup family

- *Nigella sativa* (& *N. damascena*)
- Black seed tea (e.g., Egyptian tea)
- Condiments, Black seed bread
- Middle Eastern, Bengali cuisine
- flavor wines and snuff

Nigella
Love-in-a-mist
Black seed
Black cumin
Fennel flower
Roman coriander

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Other uses for *Nigella*




TEH HERBA PREMIUM
NIGELLA SATIVA
PURE PREMIUM
RAMBUTUS SAUDA TEA
<http://barekahgroup.blogspot.com>

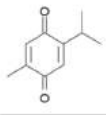


BLACK CUMIN
LOOK INSIDE
THE MAGICAL EGYPTIAN HERB
for Allergies, Asthma,
and Immune Disorders
Fawaz Schlotterbeck, M.D., and
Michael J. Smith, M.D.



BLACK SEED
Male Entry Tea

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thymoquinone


Other uses for *Nigella*

Is Nestlé trying to patent the fennel flower?

Q Is Nestlé patenting the fennel flower?

No. We're not claiming to 'own' the fennel flower, nor are we trying to patent it. Our patent application relates only to the specific way that thymoquinone - a compound that can be extracted from the seed of the fennel flower - interacts with opioid receptors in the body and helps to reduce allergic reactions to food.


The fennel flower (also known as *Nigella sativa*, black seed and black cumin) is a natural species, and nobody could, or should, benefit from ownership over it. In accordance with the Convention on Biological Diversity, we fully support the principle of fair access and benefit-sharing when it comes to the raw materials we use.




FENNEL FLOWER: Also known as *Nigella sativa*, black seed and black cumin.


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Ranunculaceae - buttercup family



- Herbs, sometimes woody or herbaceous climbers or low shrubs - often poisonous
- Leaves, alternate, usually basal and cauline, often divided or compound, or palmately lobed.
- No stipules.








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Ranunculaceae - buttercup family

- Flowers very variable: except many stamens and many free carpels (apocarpic)


CA 3+ CO (0) 5+ A ∞ G 3+

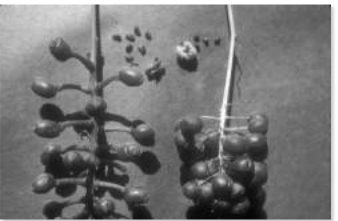
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Ranunculaceae - buttercup family

Fruit Diversity!



Caltha - marsh marigold

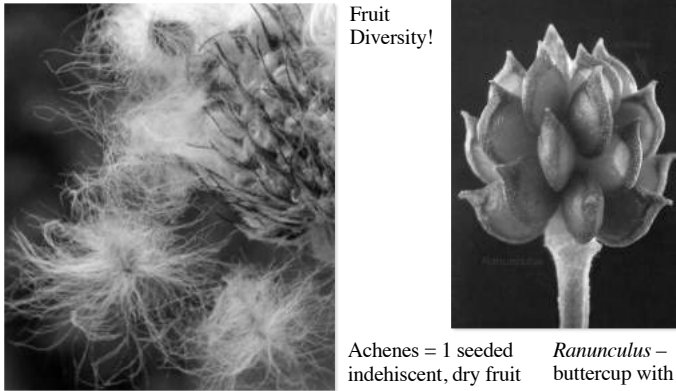


Actaea - baneberry

Follicles = ∞ seeded dehiscent fruit Berries = ∞ seeded fleshy fruit

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Ranunculaceae - buttercup family



Fruit Diversity!


Achenes = 1 seeded indehiscent, dry fruit

Ranunculus – buttercup with animal dispersed achenes

Anemone - thimbleweed with wind dispersed achenes

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Ranunculaceae - buttercup family




Aconitum columbianum - monks' hood

Aconitum 'noveboracense' - monks' hood

Great Lakes – western North American disjunct pattern

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Ranunculaceae - buttercup family

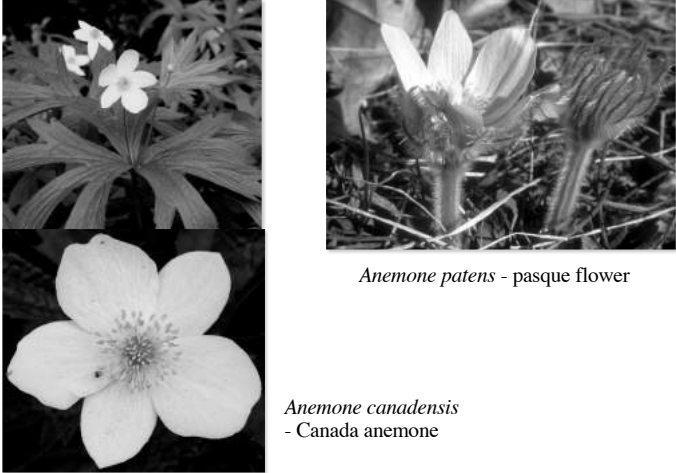


Actaea rubra - red baneberry

Actaea alba - white baneberry

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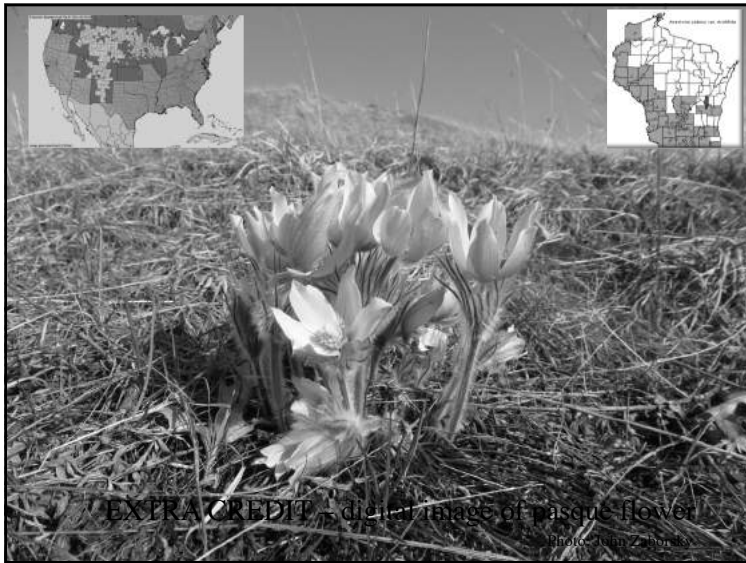
Ranunculaceae - buttercup family



Anemone patens - pasque flower

Anemone canadensis - Canada anemone

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Ranunculaceae - buttercup family

Anemone quinquefolia
- wood anemone

Anemone acutiloba (Hepatica acutiloba) - sharp-lobed liverleaf

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Ranunculaceae - buttercup family

Aquilegia canadensis - American columbine

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Ranunculaceae - buttercup family

Caltha palustris - marsh marigold

No petals – only sepals
Follicle fruits

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Ranunculaceae - buttercup family



Enemion biternatum [*Isopyrum biternatum*]
- false rue anemone


One of most abundant spring ephemerals forming large colonies

No petals; 3-5 follicle fruits





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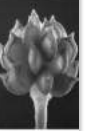
Ranunculaceae - buttercup family




Ranunculus abortivus - cursed crowfoot



Ranunculus acris - tall buttercup


sepals + petals
achenes




Ranunculus hispidus - bristly buttercup

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Ranunculaceae - buttercup family



Thalictrum dioicum - early meadow-rue




Large herbs of more open habitats; wind pollinated


Dioecious; with separate male and female plants

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Ranunculaceae - buttercup family



Anemone thalictroides - rue anemone



achenes

Now called *Thalictrum thalictroides*

... and so it is "the thalictrum with the thalictrum-like leaves" !

Original name after *Thalictrum* because the leaves were so similar, although showy, insect-pollinated flowers

Good example of the re-evolution of insect pollination within a wind pollinated group

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