



The Monocots

Basal Angiosperm Phylogeny
APGIII - 2009

Monocots - those possessing one seed leaf.

The other main features of the monocots separating them from all other flowering plants are:

1. 3-merous flowers

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2. Parallel-veined leaves

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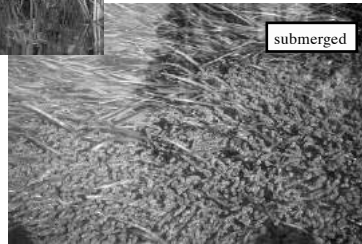
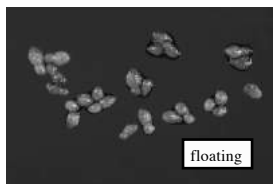
1. 3-merous flowers
2. Parallel-veined leaves
3. Absence of woody tissue

The Aquatic Monocots



Emergent, floating, or submerged aquatic group of monocots

These are the first diverging monocots



The Aquatic Monocots



Showy flowers, insect-pollinated

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

Reduced unisexual flowers, water-pollinated



*Alismataceae - water plantain family



Aquatic or wetland family, especially in north temperate regions

Leaves long petioled, often with sagittate-shaped leaves

Tubers starchy, often edible



Sagittaria - arrowhead

*Alismataceae - water plantain family

CA 3 CO 3 A 6-∞ G 6-∞

Calyx of 3 green sepals, corolla of 3 white petals

Carpels apocarpic

1-seeded achenes

Flowers can be unisexual



Head of achenes

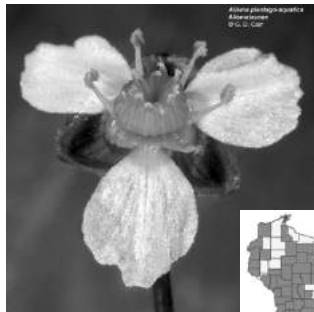


Sagittaria - arrowhead

***Alismataceae - water plantain family**



Alisma plantago-aquatica
Alismataceae
© G. D. Carr



Similar to *Sagittaria*, but with carpels in one ring rather than globose head

Alisma subcordatum - water plantain

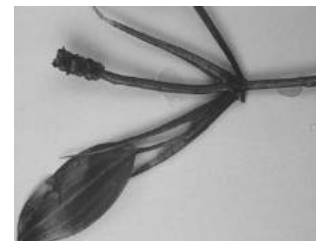
***Potamogetonaceae - pondweed family**



Aquatic plants with dimorphic leaves

Wind (and water) pollination

25 species in Wisconsin difficult to identify, hybridize, and some are troublesome weeds



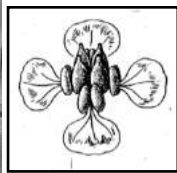
Potamogeton sp. - pondweed

***Potamogetonaceae - pondweed family**



CA 0,4 CO 0 A 4 G 4

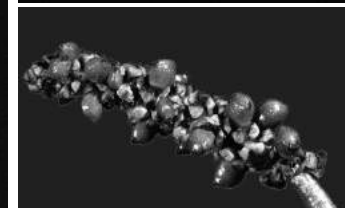
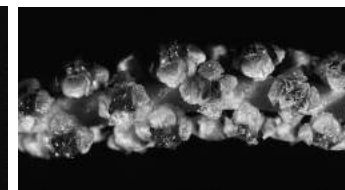
Perianth of 4 clawed segments if present
Gynoecium typically of 4 free, 1-ovuled carpels
Fruit drupe-like



***Potamogetonaceae - pondweed family**



Potamogeton nodosus - pondweed



Flowers (top) and fruits (bottom)

**Araceae - jack-in-the-pulpit family

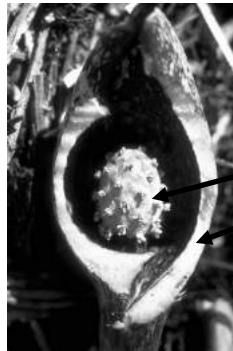
Large family primarily of the tropics
Mainly epiphytic, others terrestrial, a few aquatic

Vegetative parts often containing **raphides** in the vacuoles with mucilage; raphides often **calcium oxalate** - an irritant

Inflorescence a fleshy **spadix**, surrounded by bract called the **spathe**

CA 0 CO 0 A 6-∞ G (2-3)

Flowers unisexual or perfect
Fruits berries clustered on spadix



spadix

Spathe
(cut away)

Symplocarpus foetidus - skunk cabbage



Arisaema triphyllum - jack-in-the pulpit

**Araceae - jack-in-the-pulpit family

Rotting flesh odor, mottled purple and yellow-green coloration indicate specialized pollination syndrome



Symplocarpus foetidus - skunk cabbage



flesh flies - *Sarcophagidae*



carrion flies - *Calliphoridae*

gnats - *Mycetophilidae*



**Araceae - jack-in-the-pulpit family



Arisaema triphyllum - jack-in-the pulpit
[or jill-in-the-pulpit ?]



**Araceae - jack-in-the-pulpit family



Symplocarpus foetidus - skunk cabbage

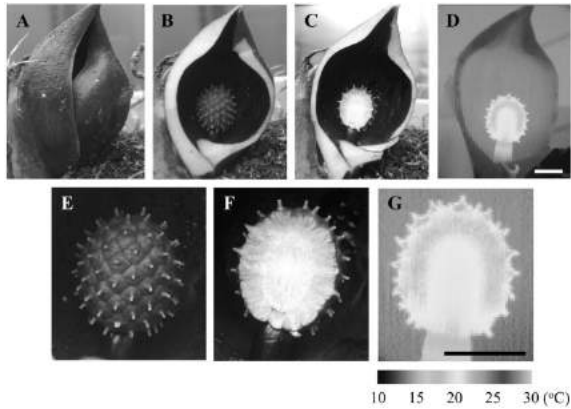


Cabbage-like leaves emerge later in the spring

Foetid smelling inflorescence emerges early in spring or late winter; attracts carrion flies by heating up and volatilizing off the odor

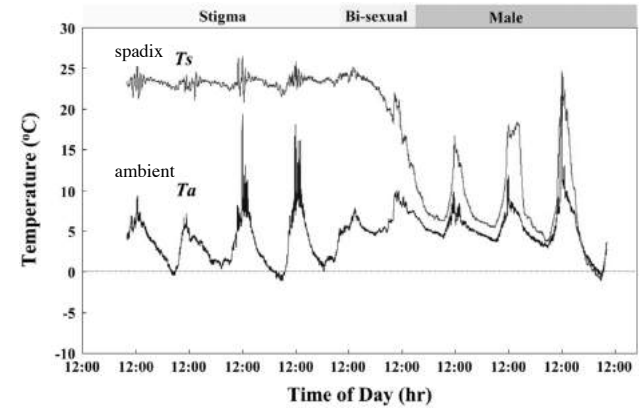


Endogenous heating of skunk cabbage (*S. renifolius*) spadix



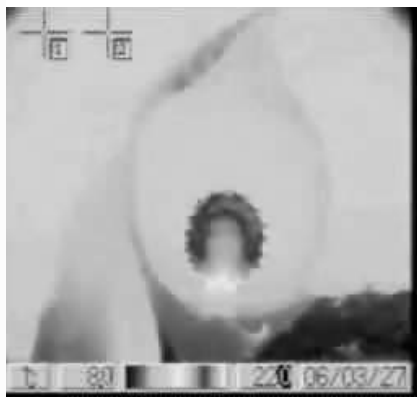
Onda Y. et.al. Plant Physiol. 2008:146:636-645

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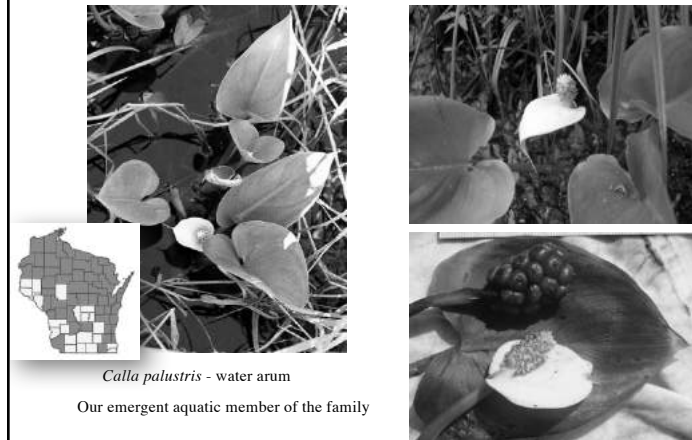


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Cyclical heating of the skunk cabbage spadix in the male phase



**Araceae - jack-in-the-pulpit family



Calla palustris - water arum

Our emergent aquatic member of the family

**Araceae - jack-in-the-pulpit family



Floating or submersed aquatics derived from within jack-in-the-pulpit family

Vegetative reproduction primarily

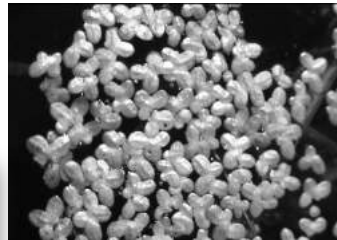
Lemma minor - small duckweed

Includes the smallest angiosperm, and the smallest flower

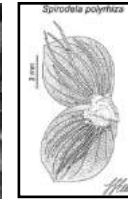
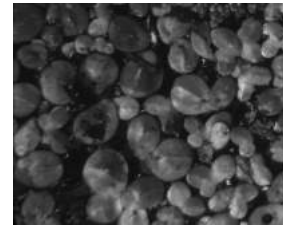
Inflorescence reduced to 1 female and 1-2 male flowers



Lemma turionifera - perennial duckweed



**Araceae - jack-in-the-pulpit family

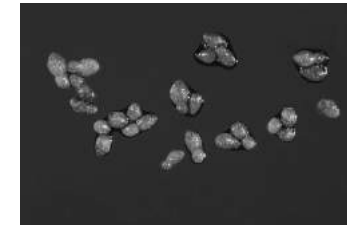


Spirodela polyrhiza
great duckweed

Largest of the aquatics

Smallest member of the family and the angiosperms

Wolffia columbiana - water meal



Petaloid Monocots (Liliales + Asparagales)



The petaloid 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

Petaloid Monocots (Liliales + Asparagales)

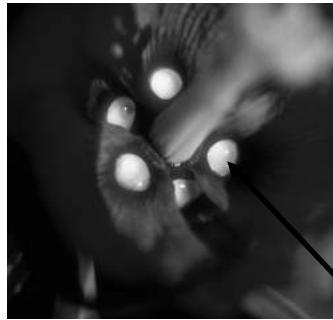


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2. **Tepals:** showy perianth in 2 series of 3 each; usually all petaloid, or outer series not green and sepal-like
3. **Nectaries:** usually well-developed nectar tissue at the base of ovary or stamens; insect or bird-pollinated

Petaloid Monocots (Liliales + Asparagales)

The orders of Liliales and Asparagales contain 15 families in the new classification system, but these are not well demarcated based on morphological features.

Warning! The families used and placement of genera in the *Field Manual of the Michigan Flora* are often wrong (but correct in Wisflora). See the handout provided and on the Student Herbarium cabinets for correct naming and placements.

“Liliaceae” is often used to house many of these unrelated plants



Crow-poison, false garlic

Nothoscordum bivalve

Amaryllidaceae
NOT Liliaceae

Petaloid Monocots (Liliales + Asparagales)

Genus	APG family - use!	Wisflora online	WI Flora book	MI Flora	Gleason/Cronquist
	Student Herbarium				
<i>Alettris</i>	Nartheciaceae	Nartheciaceae	Liliaceae	Melanthiaceae	Liliaceae
<i>Allium</i>	Amaryllidaceae	Amaryllidaceae	Liliaceae	Alliaceae	Liliaceae
<i>Anticlea</i>	Melanthiaceae	Melanthiaceae	(as <i>Zigadenus</i>)	Melanthiaceae	(as <i>Zigadenus</i>)
<i>Asparagus</i>	Asparagaceae	Asparagaceae	Liliaceae	Asparagaceae	Liliaceae
<i>Camassia</i>	Asparagaceae	Asparagaceae	Liliaceae	Hyacinthaceae	Liliaceae
<i>Chintonia</i>	Liliaceae	Liliaceae	Liliaceae	Convallariaceae	Liliaceae
<i>Convallaria</i>	Asparagaceae	Asparagaceae	Liliaceae	Convallariaceae	Liliaceae
<i>Erythronium</i>	Liliaceae	Liliaceae	Liliaceae	Liliaceae	Liliaceae
<i>Hemerocallis</i>	Asphodelaceae	Xanthorrhoeaceae	Liliaceae	Hemerocallidaceae	Liliaceae
<i>Hypoxis</i>	Hypoxidaceae	Hypoxidaceae	Hypoxidaceae	Hypoxidaceae	Liliaceae
<i>Lilium</i>	Liliaceae	Liliaceae	Liliaceae	Liliaceae	Liliaceae
<i>Maianthemum</i>	Asparagaceae	Asparagaceae	Liliaceae	Convallariaceae	Liliaceae
<i>Medeola</i>	Liliaceae	Liliaceae	Liliaceae	Convallariaceae	Liliaceae
<i>Muscari</i>	Asparagaceae	Asparagaceae	Liliaceae	Hyacinthaceae	Liliaceae
<i>Narcissus</i>	Amaryllidaceae	Amaryllidaceae	Liliaceae	Amaryllidaceae	Liliaceae
<i>Ornithogalum</i>	Asparagaceae	Asparagaceae	Liliaceae	Hyacinthaceae	Liliaceae
<i>Polygonatum</i>	Asparagaceae	Asparagaceae	Liliaceae	Convallariaceae	Liliaceae
<i>Scilla</i>	Asparagaceae	Asparagaceae	Liliaceae	Hyacinthaceae	Liliaceae
<i>Smilacina</i>	(as <i>Maianthemum</i>)	(as <i>Maianthemum</i>)	(as <i>Maianthemum</i>)	(as <i>Maianthemum</i>)	Liliaceae
<i>Streptopus</i>	Liliaceae	Liliaceae	Liliaceae	Convallariaceae	Liliaceae
<i>Tofieldia</i>	(as <i>Triantha</i>)	(as <i>Triantha</i>)	(as <i>Triantha</i>)	(as <i>Triantha</i>)	Liliaceae
<i>Triantha</i>	Tofieldiaceae	Liliaceae	Liliaceae	Melanthiaceae	Liliaceae
<i>Trillium</i>	Melanthiaceae	Melanthiaceae	Liliaceae	Trilliaceae	Liliaceae
<i>Uvularia</i>	Colchicaceae	Colchicaceae	Liliaceae	Convallariaceae	Liliaceae
<i>Yucca</i>	Asparagaceae	Asparagaceae	Liliaceae	Agavaceae	Agavaceae
<i>Zigadenus</i>	(as <i>Anticlea</i>)	(as <i>Anticlea</i>)	Liliaceae	(as <i>Anticlea</i>)	Liliaceae

**Liliaceae s.s. - lily family



The family comprises herbaceous perennials common in the north temperate forests

Leaves usually do not have a well-developed petioles and leaves are either sessile or basal



****Liliaceae s.s. - lily family**



CA 3 CO 3 A 6 G(3)

Flowers are showy and 3 merous with 6 tepals

3 fused carpels (superior) form capsule or berry with numerous seeds



****Liliaceae s.s. - lily family**



Lilium michiganense - Turk' s cap lily



Medeola virginica - Indian cucumber root [special concern]

****Liliaceae s.s. - lily family**



Clintonia borealis - Yellow bead lily



****Liliaceae s.s. - lily family**



Erythronium americanum
- yellow trout lily



Tulipa sp. - tulip



*Melanthiaceae – trillium family



Trillium recurvatum
- prairie trillium

Trillium grandiflorum
- large flowered trillium



*Colchicaceae – bellwort family



Uvularia grandiflora - bellwort

*Asparagaceae – asparagus family



Asparagus officinalis – asparagus
adventive, cultivated



*Asparagaceae – asparagus family



Maianthemum canadense -
wild lily of the valley



*Asparagaceae – asparagus family



Maianthemum racemosum -
False Solomon' s-seal



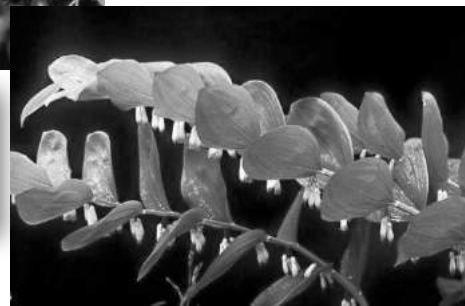
Maianthemum stellatum -
Starry false Solomon' s-seal



*Asparagaceae – asparagus family



Polygonatum pubescens -
Solomon' s-seal



Amaryllidaceae – amaryllis family



Allium tricoccum -
Wild leek

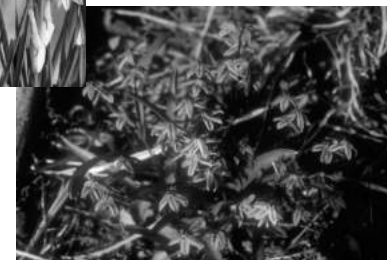


some common cultivated species



Scilla sibirica - English bluebell
[Asparagaceae]
cultivated

Narcissus sp. - daffodil
[Amaryllidaceae]
Cultivated, note corona



some common cultivated species



Hemerocallis fulva - day lily
[Asphodelaceae]
cultivated

*Smilacaceae - catbriar family



Small family, mainly of South Hemisphere
Climbing via **tendrils** (modified stipules)
Starchy tubers, edible

Distinctive with large, net-veined leaves and
definite petioles



Smilax herbacea - bristly greenbriar

*Smilacaceae - catbriar family

Flowers unisexual, dioecious plants; carrion
flowers are foetid

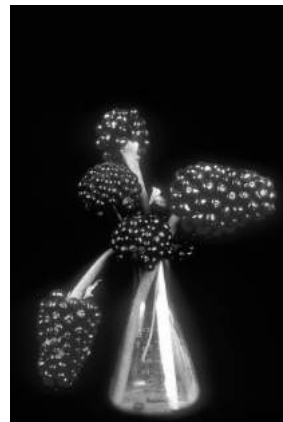


Smilax herbacea - common carrion-flower

Male umbel

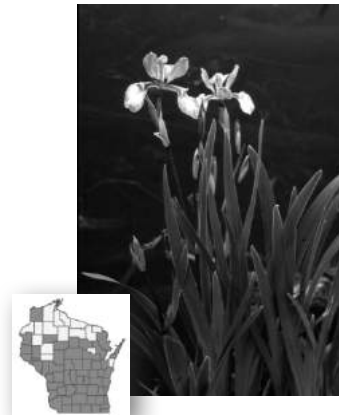
Female umbel

Fruit an umbel of black berries (red berries
are from jack-in-the pulpit)



**Iridaceae - iris family

A family primarily of Mediterranean climate geophytes. Leaves are basal
and **equitant** - folded and overlapping.



Iris virginica - Blue flag, iris

****Iridaceae - iris family**

CA 3 CO 3 A 3 \overline{G} (3)

Tepals 6, the 3 inner (petals) forming the "flags or standards"

The 3 outer (sepals) forming the "falls"
Note the nectar guides for insects

The 3 stamens are positioned under the 3 petal-like styles

The gynoecium is inferior and forms a 3-parted capsule



Iris virginica - Blue flag, iris



****Iridaceae - iris family**



Iris versicolor - Blue flag



Iris pseudacorus - Yellow flag
Introduced and potentially invasive



****Iridaceae - iris family**



Endangered species restricted to fringe areas of northern Great Lakes; clonal growth

Iris lacustris
Dwarf lake iris



****Iridaceae - iris family**

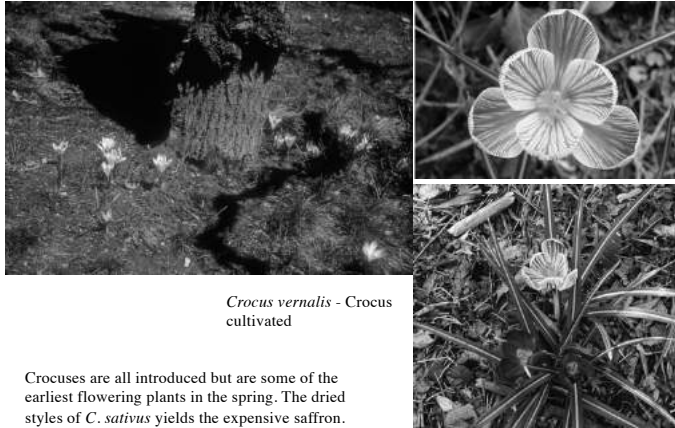


Sisyrrinchium campestre - blue-eyed grass



Sisyrrinchium found in drier areas than *Iris*

****Iridaceae - iris family**



Crocus vernalis - Crocus cultivated

Crocuses are all introduced but are some of the earliest flowering plants in the spring. The dried styles of *C. sativus* yields the expensive saffron.

****Orchidaceae - orchid family**

Orchids are **mycotrophic** (= fungi dependent) lilioids; some are mycotrophic parasites

The family is diverse with about 800 genera and over 19,000 species, mainly of the tropics



Cypripedium acaule
Stemless lady-slipper



Corallorhiza striata
Striped coral root

Main features of the family:

- Pollen masses or pollinia
- Specialized floral structure and pollination biology
- Reduced stamen number
- Many, minute, dust-like seeds in capsules

Remember the Ericaceae!

****Orchidaceae - orchid family**

CA 3 COZ 2+1 A 3,2,1 \bar{G} (3)



The lower petal is elaborated into the **labellum/lip** - the landing platform



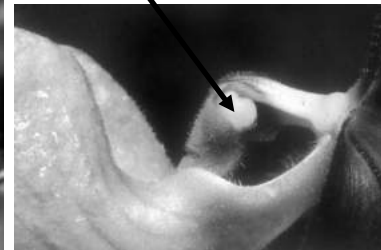
Cypripedium acaule - stemless lady' s-slipper

****Orchidaceae - orchid family**

CA 3 COZ 2+1 A 3,2,1 \bar{G} (3)



The lower petal is elaborated into the **labellum/lip** - the landing platform




Lady' s-slippers have two functional stamens with pollen masses






Cypripedium acaule - stemless lady' s-slipper

****Orchidaceae - orchid family**




Other lady' s-slippers . . .







Cypripedium arietinum
Ram' s-head lady' s-slipper
threatened


Cypripedium calceolus
Yellow lady' s-slipper





****Orchidaceae - orchid family**


Cypripedium reginae
showy lady' s-slipper



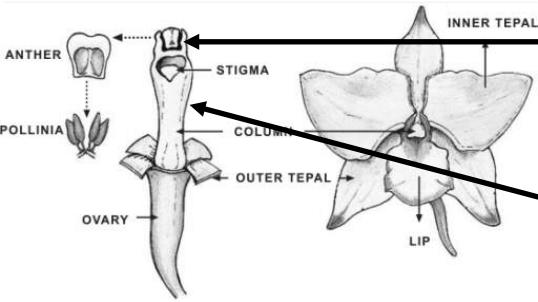
****Orchidaceae - orchid family**

Cypripedium candidum
white lady' s-slipper
Threatened, fen or calcareous soils



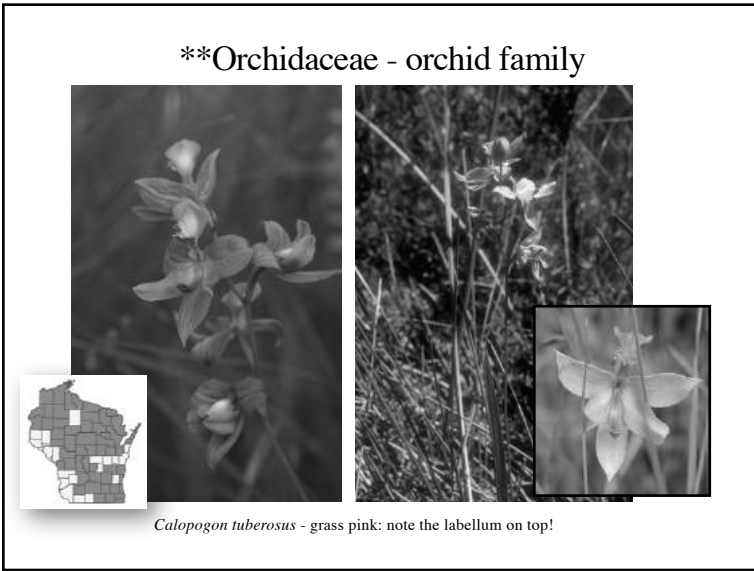
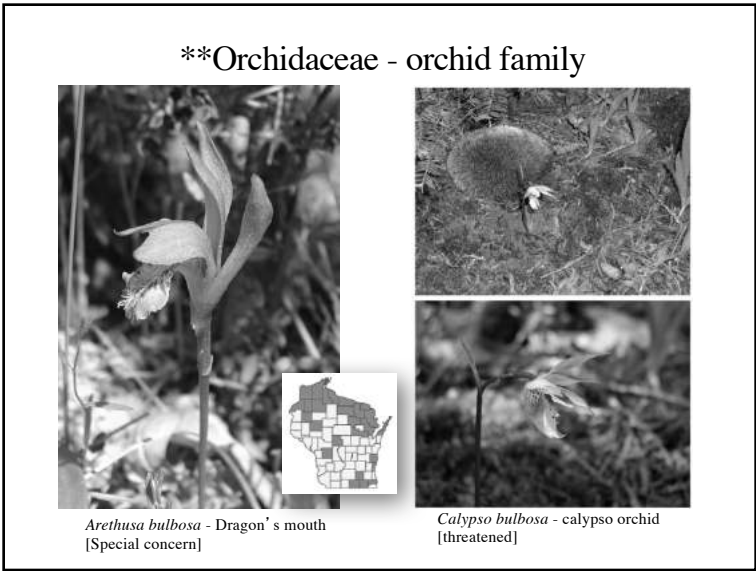
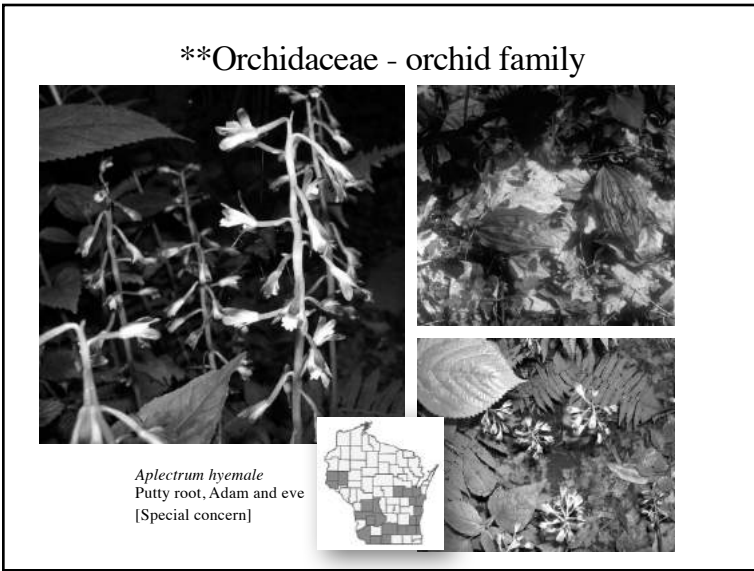
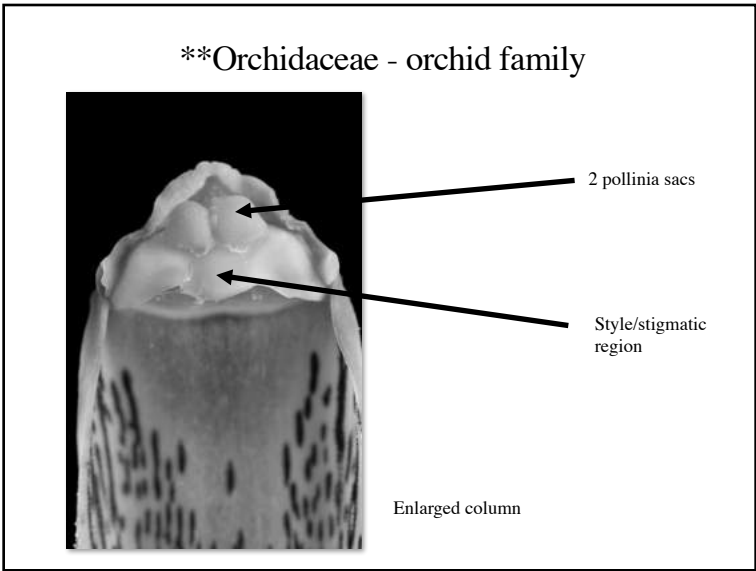
****Orchidaceae - orchid family**





Labels in diagram: ANTHUR, POLLINIA, OVARY, STIGMA, COLUMN, OUTER TEPAL, INNER TEPAL, LIP.

All our other orchids have only 1 functional stamen with one or two pollinia



The stamen is situated on a **column** formed by fusion with the top of the inferior gynoecium



****Orchidaceae - orchid family**






Goodyera pubescens
Rattlesnake plantain






Goodyera tessellata
Rattlesnake plantain

****Orchidaceae - orchid family**






Corallorhiza trifida - Early coral root





Corallorhiza striata - Striped coral root

****Orchidaceae - orchid family**






Galearis spectabilis - showy orchid





Malaxis monophyllos - adder's mouth

****Orchidaceae - orchid family**

Platanthera leucophaea
Prairie fringed orchid
State endangered,
Federally threatened



**Orchidaceae - orchid family



Pogonia ophioglossoides - snake mouth



Spiranthes cernua - nodding ladies' -tresses

*Dioscoreaceae - yam family

Small family, mostly of the tropics, with viney stems and net-veined leaves. Fruits are 3-winged.

Source of edible yam; sources of steroids, cortisones, first oral contraceptives (diosgenin, progesterone)



Dioscorea villosa - wild yam

