

A close-up photograph of a plant showing two clusters of small, yellow, star-shaped flowers with long stamens. The flowers are arranged in a whorl-like pattern. The plant has thick, green, hairy stems and large, broad, dark green leaves. The background is blurred green foliage.

Plant Taxonomy

Flower Diversity

Organ fusion

- Connation (prefix ‘syn-’ or ‘sym-’): organs of the same kind
- Adnation (prefix ‘epi-’): organs of different kinds
- How to know if organs are fused?



Epipetalous stamens:
Lonicera
Caprifoliaceae



Sympetalous corolla:
Ipomopsis
Polemoniaceae



Staminal column:
Hibiscus
Malvaceae

Many examples of sympetalous flowers

- Evolutionary advantages?



Sympetalous: Ericales



Blueberry
Vaccinium
Ericaceae



Jacob's ladder
Polemonium
Ericaceae

Sympetalous: Gentianales



Partridgeberry
Mitchella
Rubiaceae



Dogbane
Apocynum
Apocynaceae

Sympetalous: Solanales

Horse-nettle
Solanum
Solanaceae



Bindweed
Calystegia
Convolvulaceae



Sympetalous: Asterales

Bellflower
Campanula
Campanulaceae



Buckbean
Menyanthes
Menyanthaceae

Sympetalous: Lamiales

Butter-and-eggs
Linaria
Plantaginaceae



Monkeyflower
Mimulus
Phrymaceae



Bugleweed
Ajuga
Lamiaceae



Sympetalous: Dipsacales

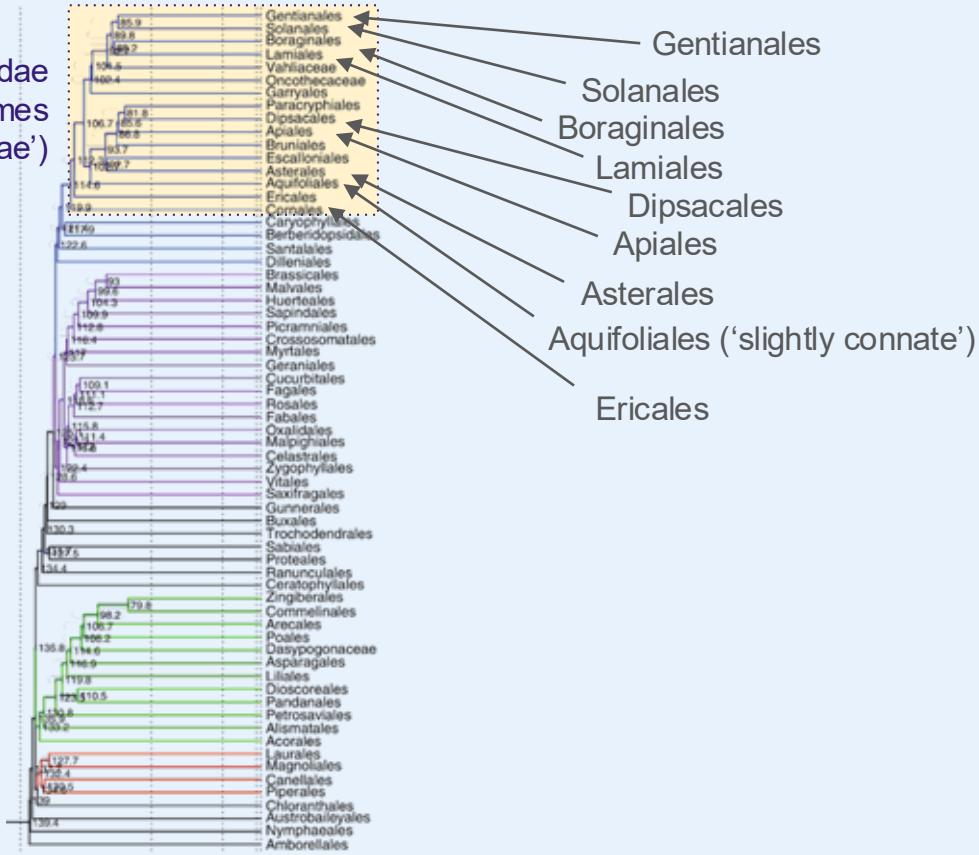


Moschatel
Adoxa
Adoxaceae



Sympetalous

Asteridae
(sometimes
'Sympetalae')



Organ fusion: floral formulas

- Recall circle for fusion of same organ kind (e.g., syncarpous)
- Line below connects fused organs of different kinds

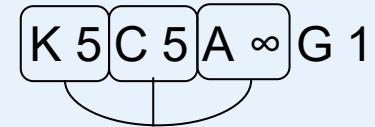


Moschatel
Adoxa
Adoxaceae

K 5 C 5 A 10 G 5

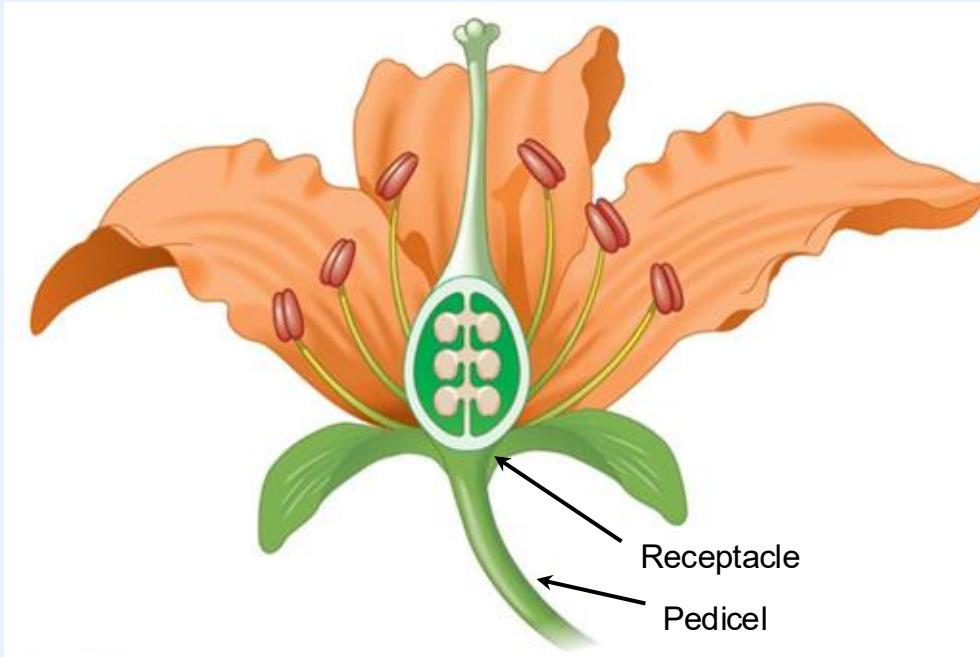
Hypanthium

- *Hypanthium*: perianth and stamens fused together
- May or may not also be fused to ovary



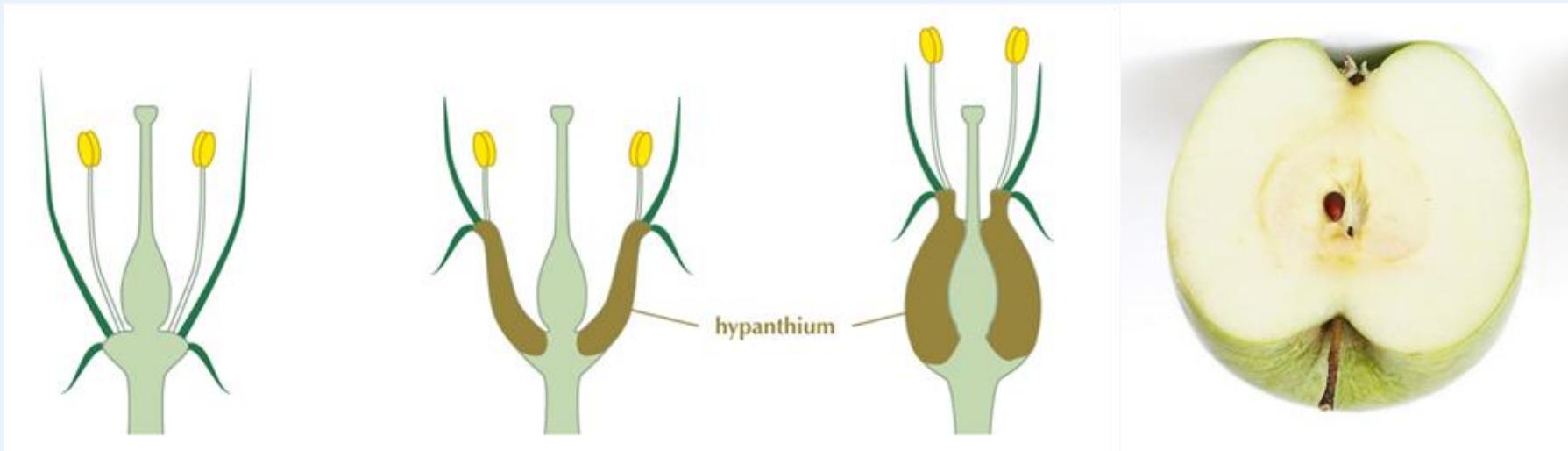
Supporting roles

- *Receptacle*: base of flower
- *Pedicel*: stalk leading to flower (flowers without pedicels are *sessile*)



Ovary position

- Ovary superior (flower hypogynous or perigynous)
- Ovary inferior (flower epigynous)
- *Hypanthium*: fused perianth+androecium



Flower longitudinal sections

Inferior ovaries are syncarpous



...because the receptacle is located below the ovary, all flower organs must be fused together in this region

Inferior ovaries

- Often visible from outside the flower



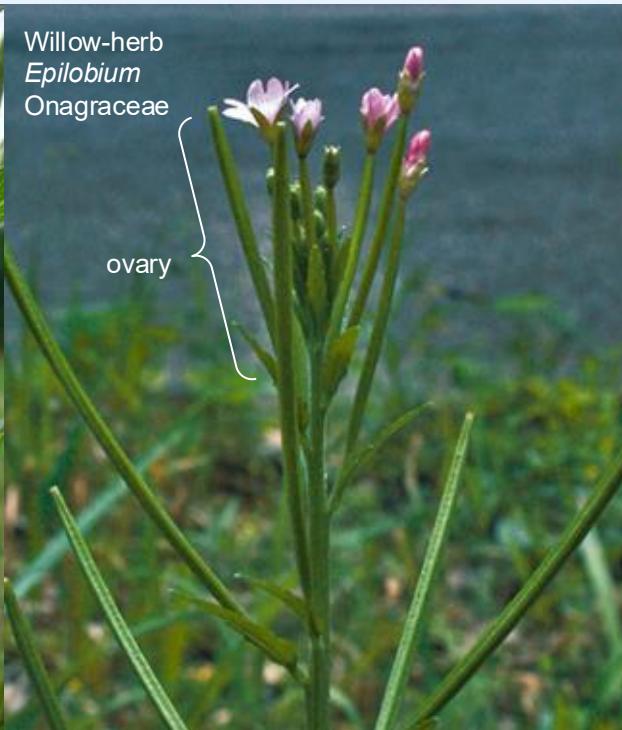
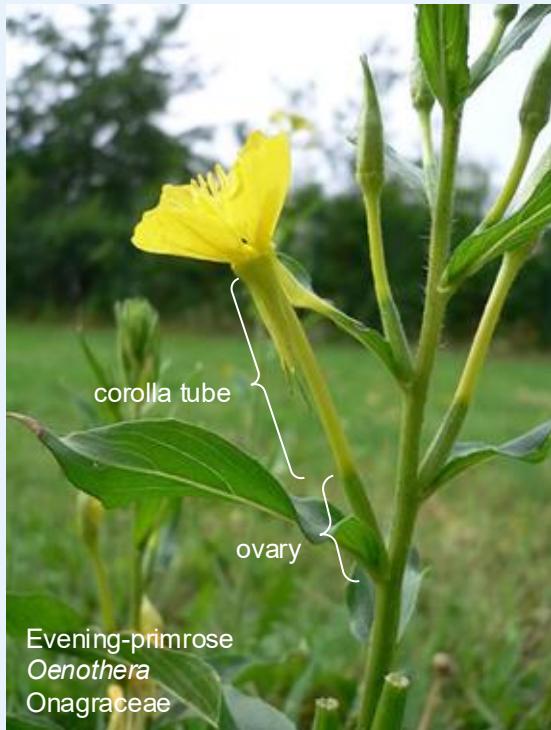
Fuchsia
Onagraceae



Willow-herb
Epilobium
Onagraceae

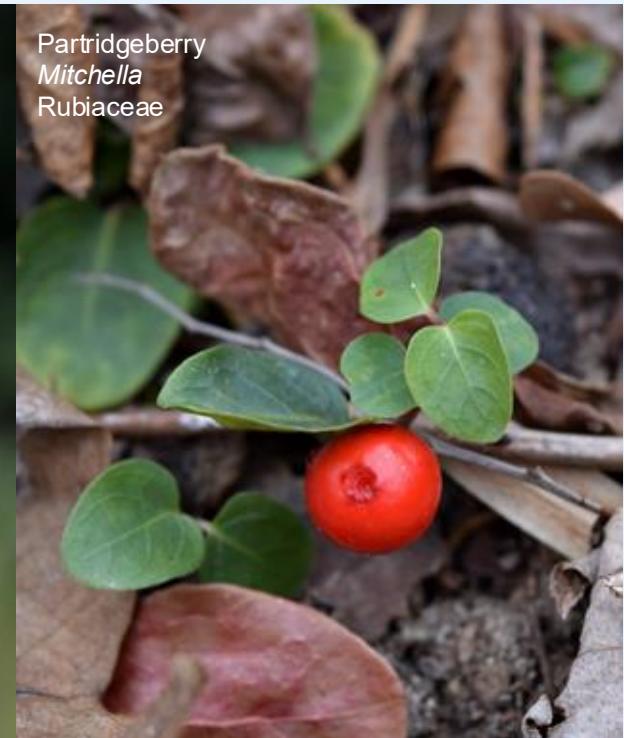
Onagraceae (evening primrose family)

- Inferior ovary



Rubiaceae (coffee family)

- Inferior ovary



Cactaceae (cactus family)

- Inferior ovary basically sunk into stem, thus able to have spines



Prickly-pear
Opuntia
Cactaceae



Ovary position: floral formula

- Line above or below 'G' reflects the attachment point of other organs
- Notice that sympetalous flowers can have superior or inferior ovary

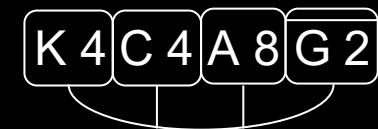


Petunia
Solanaceae

... corolla/androecium
fused together around the
ovary, but not fused *to* the
ovary



Fuchsia
Onagraceae



... recall that all
organs are fused
together by definition
because of the inferior
ovary

Flower symmetry

- Radial symmetry
- Bilateral symmetry
- Advantages of each?



Beardtongue
Penstemon
Plantaginaceae



Liver-leaf
Hepatica
Ranunculaceae

Flower symmetry floral formulas

* = radial / × = bilateral



Monkshood
Aconitum
Ranunculaceae

$$\begin{array}{c} * \text{ P } 9 \text{ A } \infty \text{ G } \infty \\ \xrightarrow{\hspace{1cm}} \\ \xleftarrow{\hspace{1cm}} \\ \times \text{ K } 5 \text{ C } 2 \text{ A } \infty \text{ G } 3 \end{array}$$



Meadow-rue
Thalictrum
Ranunculaceae

Radial symmetry with unfused petals



Grove-sandwort
Moehringia
Caryophyllaceae



Bloodroot
Sanguinaria
Papaveraceae

Radial symmetry with fused petals

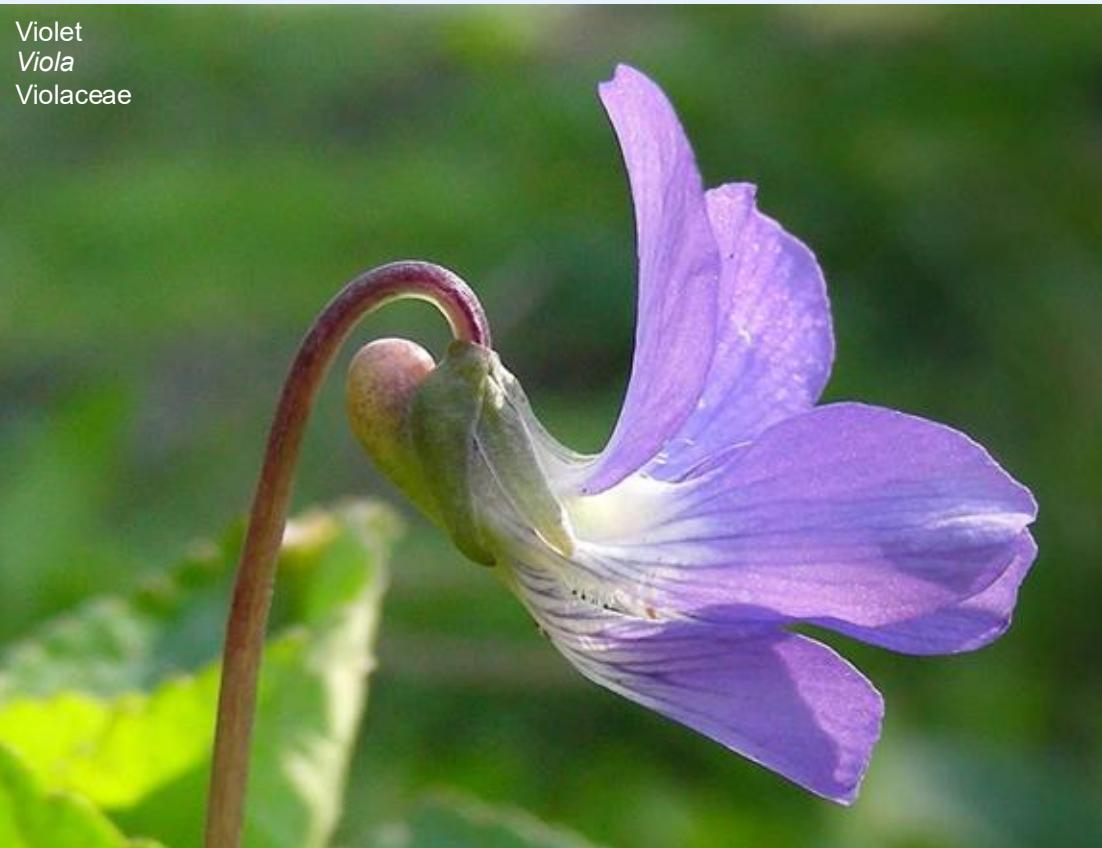
Phlox
Polemoniaceae



Bellflower
Campanula
Campanulaceae



Bilateral symmetry unfused petals



Bilateral symmetry fused petals

Hyssop
Stachys
Lamiaceae



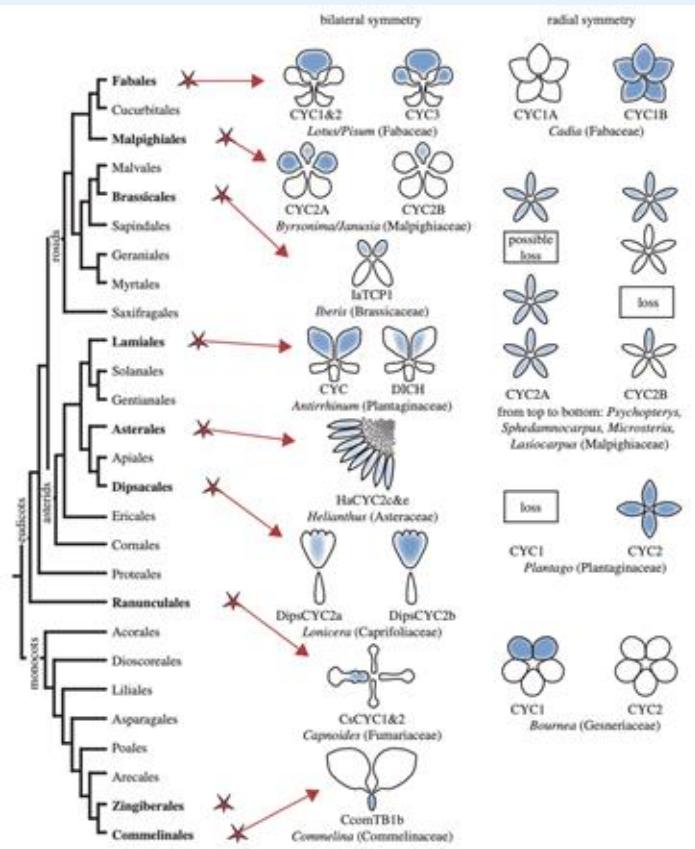
Lobelia
Campanulaceae



CYCLOIDEA gene strongly influences symmetry

- Multiple independent origins of bilateral symmetry

<https://doi.org/10.1098/rstb.2013.0348>



Floral formula summary

* = radial / × = bilateral

P = perianth (undifferentiated)

K = calyx

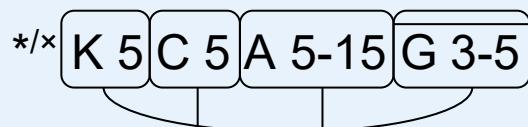
C = corolla

A = androecium

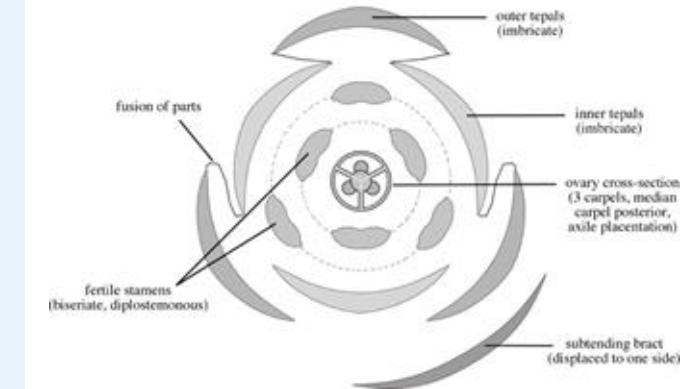
G = gynoecium (line indicates receptacle position)

or = connation

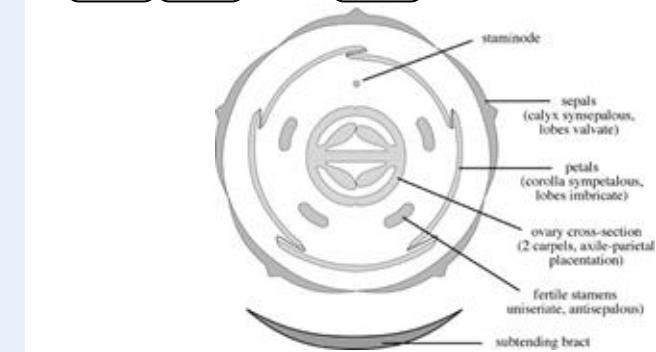
Curved line = adnation



* **P 6 A 6 G 3**



* **K 5 C 5 A 4 G 2**



Flower sexuality

- Bisexual ('perfect') flowers were ancestral
- Unisexual flowers result from losing male or female function



Thalictrum
Ranunculaceae

Pistillate and staminate

- ‘Male’ flowers also known as ‘staminate’ (stamens)
- ‘Female’ flowers also known as ‘pistillate’ (pistils)
- Both kinds are required for sexual reproduction



Functionally unisexual

- Unisexual flowers often have vestigial organs of the non-functional sex



Winterberry
Ilex
Aquifoliaceae

Plant sexuality

- Unisexual flowers
 - Monoecious plant
 - Dioecious plant
- Bisexual flowers
 - Bisexual plant

Bur-reed
Sparganium
Typhaceae



Bisexual flowers are the most common

One-sided wintergreen
Orthilia
Ericaceae



Leatherwood
Dirca
Thymelaeaceae

Mixed bisexual and unisexual in the same family

Male (staminate) flower on male plant



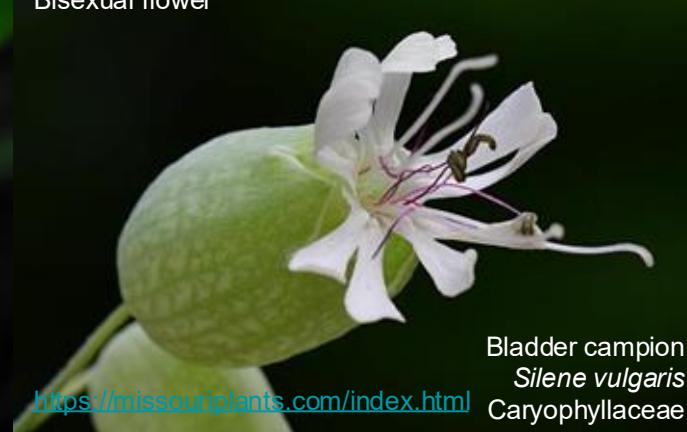
White campion
Silene latifolia
Caryophyllaceae

Female (pistillate) flower on female plant



White campion
Silene latifolia
Caryophyllaceae

Bisexual flower



Bladder campion
Silene vulgaris
Caryophyllaceae

<https://missouriplants.com/index.html>



Pistillate flower with ovary



Staminate flower lacking ovary



Entirely monoecious

- Uncommon for a family to be entirely monoecious



Entirely dioecious: Salicaceae (willow)

Male flowers on male plant



Willow ♂
Salix
Salicaceae

Female flowers on female plant



Willow ♀
Salix
Salicaceae

Entirely dioecious: Smilacaceae (greenbrier)

Female flowers on female plant



Greenbrier
Smilax
Smilacaceae

Male flowers on male plant



Greenbrier
Smilax
Smilacaceae

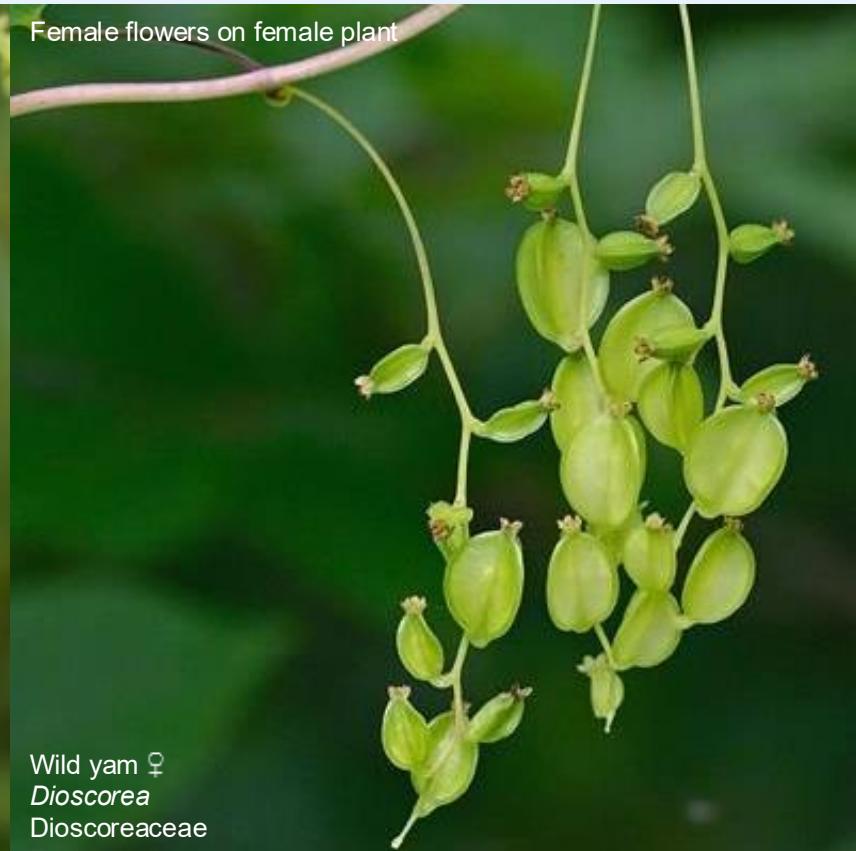
Entirely dioecious: Dioscoreaceae (yam)

Male flowers on male plant



Wild yam ♂
Dioscorea
Dioscoreaceae

Female flowers on female plant



Wild yam ♀
Dioscorea
Dioscoreaceae

Entirely dioecious: Moraceae (mulberry)



Mulberry ♀
Morus
Moraceae



Mulberry ♂
Morus
Moraceae

Missing parts

- Besides sexual organs, flowers may lack other parts

