Diversity and Evolution of Asterids

... honeysuckles, ginseng, and carrots...
Adoxaceae and Caprifoliaceae – viburnum and honeysuckle families

Two related woody families with opposite leaves and inferior ovary

Short-styled flowers vs. long-styled flowers

Viburnum – viburnum
Adoxaceae

Lonicera – honeysuckle
Caprifoliaceae
**Adoxaceae - honeysuckle family**

Corolla 5 merous, rotate, inferior ovary and berries with few seeds

*Sambucus canadensis* - Common elder

Coarse herbaceous shrub of open areas with compound leaves; flat-topped inflorescence; black berries used for wine
**Adoxaceae - honeysuckle family**

*Sambucus racemosa*
Red-berried elder

Common in understory or edge of forests; fruits red in more paniced umbels

Botany 401 final exam plant!
**Adoxaceae - honeysuckle family**

Viburnums are simple leaved shrubs, but often lobed, or coarsely toothed

*Viburnum opulus (trilobum)* high-bush cranberry

Note enlarged, sterile flowers on periphery of inflorescence for pollinator attraction.
**Adoxaceae - honeysuckle family**

Viburnum acerifolium - Maple-leaved viburnum

Viburnum lentago - nannyberry

Other spring or early summer blooming species; many have glands on petioles

Viburnum rafinesquianum - arrowwood
*Caprifoliaceae - honeysuckle family

Northern hemisphere family (and tropical mountains) species of shrubs or subshrubs – includes teasels and valerians

Family (and related families) recognized by opposite leaves and inferior ovary

*Lonicera* - honeysuckle

*Linnaea* - twinflower
*Caprifoliaceae - honeysuckle family

Flowers are 5 merous and either bell-shaped or strongly zygomorphic.

Inferior ovary forms berry.
*Caprifoliaceae - honeysuckle family*

Long-styled genera include 4 genera - and are now combined with Dipsacaceae (teasels) and Valerianaceae (valerians)

Honeysuckles include native (right) and introduced aggressive shrubs (below) or vines

*Lonicera tatarica* - tartarian honeysuckle

*Lonicera canadensis* - fly honeysuckle
*Caprifoliaceae - honeysuckle family

*Lonicera reticulata - grape honeysuckle

*Lonicera dioica - red honeysuckle
*Caprifoliaceae - honeysuckle family

Lonicera xylosteum - European fly honeysuckle

Lonicera tatarica - tartarian honeysuckle

Lonicera X bella - pretty honeysuckle

Botany 401 final exam plant!
*Caprifoliaceae - honeysuckle family

Diervilla lonicera - bush honeysuckle

other native species

Triosteum perfoliatum
Horse gentian

Note the “perfoliate” leaves - opposite leaves whose blade tissue continue across the stem and connect
*Caprifoliaceae - honeysuckle family

Characteristic subshrub of (circum)boreal forests where it forms large colonies. Two flowers form per inflorescence.

Linnaea borealis - twinflower
*Caprifoliaceae - honeysuckle family*

Carolus Linneaus modestly named the genus after himself because of the diminuitive stature of the plant.

*Linnaea borealis* - twinflower

Linnaeus on his wedding day
*Caprifoliaceae - honeysuckle family*

Herbaceous plants with opposite or basal leaves.

Valeriana uliginosa - marsh valerian

Valeriana edulis - edible valerian
The congested inflorescence is part of the floral reduction seen in this group of Asterids. Reduction is also seen in calyx forming a pappus (bristly or scaly structure), and fruit is one-seeded achene. All three features are best seen in the Asteraceae - sunflower family.

*Caprifoliaceae - honeysuckle family*

Valeriana edulis - edible valerian
Besides, the congested inflorescence, pappus (bristly or scaly structure), and achene, the family further shows involucral bracts around the “head” inflorescence - another feature seen later in the Asteraceae - sunflower family.

*Dipsacus fullonum* - teasel
Introduced and adventive
**Araliaceae - ginseng family**

Largely a tropical family of trees, shrubs, or herbs (in Wisconsin). Often combined with the carrot family (Apiaceae). Leaves divided or up to 3 times or more compound; alternate in *Aralia*, whorled in *Panax*. Flowers in umbels. Distinctive aroma and chemicals.

*Aralia hispida* - bristly sarsaparilla    *Aralia nudicaulis* - wild sarsaparilla
**Araliaceae - ginseng family**

Flowers small, non-asterid like (no corolla tube), 5 merous, with 2-5 fused inferior carpels forming berries (2 carpels and dry fruits in Apiaceae).

*Aralia hispida* - bristly sarsaparilla: note 5 styles
**Araliaceae - ginseng family**

*Aralia elata*
Hercule’s-club, Devil’s walking stick
SE USA native, escaped from cultivation

*Aralia racemosa*
spikenard
Araliaceae - ginseng family

Panax quinquefolius - American ginseng

Rich woods; leaflets are stalked. Red berries.

Heavily collected woodland species for roots; now listed as “Special concern” by DNR.
Stewardship Harvesting of Wild American Ginseng

There are a number of harvest practices that must be followed for a collector to be a ginseng steward:

GET PERMISSION TO HARVEST
Whether you are on private or public land, always get permission before digging ginseng. Some National Forests and state-owned lands will allow harvest of ginseng but require you to obtain a permit. Harvest is not allowed in any National Park.

When digging on public land, always obtain required permits and comply with all rules. When digging on private property, get the permission of the landowner or his/hers agent. Also, report any signs of property damage, habitat loss, or trespassing to the landowner.

RESPECT AMERICAN GINSENG'S LIFE CYCLE
American ginseng's life cycle, as shown, illustrates the life stages of the plant. Seedlings have only 1 prong (leaf), which usually has 3 leaflets. The next phase has 2 prongs, with 3 or 5 leaflets on each. Mature plants have 3 or 4 prongs, each with 5 leaflets.

Researchers have estimated that each ginseng plant in the wild needs to produce over 30 seeds to replace each plant harvested. Never harvest seedling (1-prong) or juvenile (2-prong) plants, or plants that are less than 5 years old with at least 4 "bud scars" on the "neck" at the top of the root. Roots from younger plants are not allowed to be exported and many ginseng buyers won’t buy these small roots, so it’s best to leave these plants in the ground for future harvests.

DIG SOME, LEAVE SOME
Good stewardship requires diggers to leave enough plants so that populations continue to be healthy and plentiful. Always leave some mature plants in every ginseng patch where you dig.

HARVEST ONLY IN THE HARVEST SEASON
The harvest season for wild ginseng varies by state. Make sure you know the legal state harvest season where you dig ginseng, and always comply with the state rules.

Never harvest plants before the fruit is ripe (red). This is a requirement in most states, and is an essential good stewardship practice.

PLANT RIPE FRUIT!!!
Experienced harvesters know to plant ginseng's red berries as they dig the roots. This stewardship practice may explain why ginseng is still in the woods after three centuries of digging.

The best practice is to plant the red berries under ¼ to 1 inch of soil. Researchers have found that planting the ripe seeds at this depth can produce up to 8 times more seedlings!

PROTECT AMERICAN GINSENG'S HABITAT
Stewards of wild ginseng must care for the plant, as well as its native habitat.

Be aware of land-use and zoning activities in your community and join with local organizations to make your voice heard. Though landowners' property rights should be respected, make sure they are aware of the value of ginseng and other non-timber plants on their land.

OTHER STEWARDSHIP PRACTICES
Every ginseng steward should be aware of a few other practices:
- After you dig some of the mature plants in a ginseng patch, and have planted all of the red ripe seeds, break the stems off of any remaining plants so that others don’t take more plants from the same population.
- Think about planting your own woodland ginseng patch with local native seeds so that even more ginseng is produced for the future.
**Araliaceae - ginseng family**

*Panax trifolius*
Dwarf ginseng

Rich woods; leaflets are sessile
**Araliaceae - ginseng family**

*Hedera helix*
English ivy

Eurasia - N. Africa; invasive in U.S.
**Apiaceae (Umbelliferae) - carrot family**

Large family of 300 genera and over 3000 species most common in north temperate regions. Economically important (carrot, parsnip, parsley, celery, dill, caraway).

Dill

*Anethum graveolens*

parsnip

carrot
**Apiaceae (Umbelliferae) - carrot family**

Aromatic herbs with **hollow stems**, dissected or **compound** leaves that are strongly **sheathing**, inflorescence **umbellate**

*Heracleum lanatum* - cow parsnip
**Apiaceae (Umbelliferae) - carrot family**

- flowers small in umbels, often compound
- female flowers often along edge of each umbellate
- 5 merous with no corolla tube
- inferior gynoecium of 2 carpels separating at maturity

![Flowers in umbels](image1.png)

![Flowers in umbels](image2.png)
**Apiaceae (Umbelliferae) - carrot family**

- fruit dehiscent and splitting - schizocarp
- 2 dry, 1-seeded mericarps held together by carpophore
- fruits 5-ribbed separated by oil canals - taxonomic character for separating genera
**Apiaceae (Umbelliferae) - carrot family

Angelica atropurpurea - great angelica
Large coarse herb of wetter areas
Apiaceae (Umbelliferae) - carrot family

*Cicuta bulbifera*
Bulblet water hemlock

*Cicuta maculata*
spotted water hemlock

Although containing nasty compounds, *Cicuta* is not the hemlock that Socrates took. Common species of marshes and streams.
**Apiaceae (Umbelliferae) - carrot family**

Three common woodland genera

*Cryptotaenia canadensis* - honewort

*Osmorhiza longistylis* - sweet cicely
**Apiaceae (Umbelliferae) - carrot family**

*Sanicula gregarii* - snakeroot  
*Sanicula marilandica* - snakeroot
**Apiaceae (Umbelliferae) - carrot family**

_Eryngium yuccifolium_
Rattlesnake master

Dry prairie species with sword-shaped leaves with spiny edge. Umbels has become literally a “head” as in Asteraceae.
**Apiaceae (Umbelliferae) - carrot family**

*Zizea aurea* - golden Alexanders

*Hydrocotyle americana* - marsh pennywort

Shown by DNA evidence to be in ginseng family
**Apiaceae (Umbelliferae) - carrot family**

*Heracleum lanatum*
American cow-parsnip
Our most robust species in Wisconsin
**Apiaceae (Umbelliferae) - carrot family**

*Daucus carota* - wild carrot, Queen Anne’s lace

Note umbel with involucral bracts; larger female flowers along edge of umbel; the progenitor of cultivated carrot (same species); common weed
**Apiaceae (Umbelliferae) - carrot family**

*Pastinca sativa* - wild parsnip

Introduced and spreading along roadsides. Dermatitis reaction from leaves is rapid but only in presence of UV light which causes precursor to change to phototoxin. Therefore, collect only by moonlight.
**Apiaceae (Umbelliferae) - carrot family**

*Pastinca sativa* - wild parsnip

Furanocoumarins: give “celery-pickers itch” (Apiaceae) or “bartender’s itch” (Rutaceae)

_Depressaria pastinacella_ – principal herbivore of wild parsnip and tolerant of furanocoumarins
**Apiaceae (Umbelliferae) - carrot family**

Did “leaf-rolling” behavior by UV/furanocoumarin-sensitive insects spur the evolution of dissected leaves in this family?