1

Missouri easy enough to define, but what is a vine?

~3,000 plant species in most states (± 500)

Dichondra caroliniensis

non self-supporting stem
-- twine, climb, creep, clamber, coil, sprawl?
-- usually sprawling herbs not included; maybe shrub?

2

is partridge berry a vine? shrub? herb?

many of our categories/terms are fairly arbitrary points along a continuum of variation

3

MO has ca 180 species (~75 G, 28 F) of native & naturalized "vines"

-- 1 "basal angiosperm" (*Isotrema/Aristolochia)*

-- 11 monocots (*Dioscorea* & *Smilax*)

-- 168 eudicots (~72 genera in 25 families)

4 largest families = 1/2 spp.

Apocynaceae (incl. Asclepiad): 5 G, ~8 spp.

Convolvulaceae: 8 G, ~30 spp.

Cucurbitaceae: 6 G, 9 spp.

Fabaceae: 20 G, 42 spp.

Smilax 9 spp.
Clematis 8 spp.

4

5

Vine (Plant) ID

-- do you just want to memorize a few random factoids?

-- or do you want to learn about patterns & natural groups?

-- do you want to be able to diagnose/ID something you've never seen before?

- imprinting vs. diagnosing
- understanding the language of botany is a key component
- 5 basic plant ID features (& a little more)
- natural vs. "artificial"
- ID "motifs": e.g., "BA" "TAN"
- understanding phylogeny (relationships) is a key component

- "vines" are not a natural single lineage

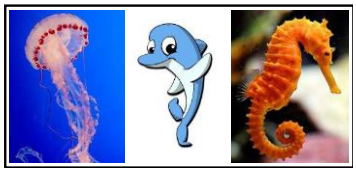
6

imprinting vs. diagnosing



cat vs. dog
day vs. night
run vs. walk
moth vs. butterfly
fruit vs. vegetable
"fish" vs. ??





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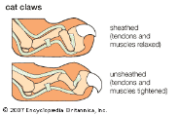
Plant ID Motifs: Simple and Useful Patterns for Field Identification of Plants

- when is the last time you had to look at a cat's retractable claws (or a dog's lack thereof) to ID the animal?
- in the same way, much of what we learn for plant ID motifs may seem overly complicated or an unnecessary detail.
- but it's a big ol' world out there, & if you learn the patterns, they are global!

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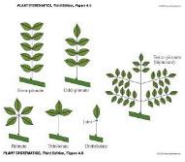
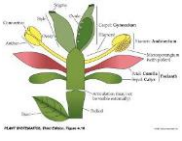
Basic Plant ID features

-- habit (woody/herbaceous, vine/tree/shrub...)
-- leaves simple vs. compound (composition)
-- alternate vs. opposite (arrangement)
-- entire vs. toothed or lobed (margin)
-- stipules present or not
-- pellucid dots (or punctations or stellate hairs)
-- latex present or not
-- foliage with distinct smell or not
-- veins pinnate or palmate (or plinerved)

-- flowers sympetalous or apopetalous
-- hypanthium present or not
-- stamen number & arrangement
-- carpel number
-- gynoecium syncarpous or apocarpous
-- ovary inferior or superior

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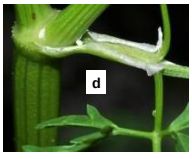
motifs work best if kept simple, e.g., tied to basic features -- details in the eye of the beholder

5 Plant ID Basics

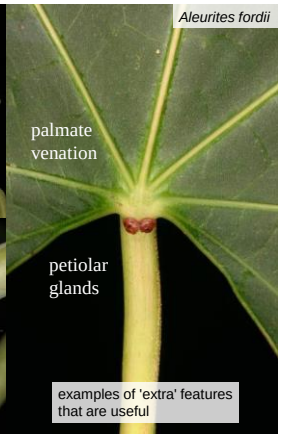
-- habit: growth form (woody vs. herbaceous)
-- leaf composition: simple vs. compound
-- leaf arrangement: alternate vs. opposite
-- margin: entire vs. toothed or lobed
-- stipules: present or not



but a few extra features are also very useful, e.g.:

a) cuticular pits, b) pulvinulus, c) sap, d) sheath, e) tendrils; smell, venation

10



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12

- motifs (patterns tied to phylogeny & vocab)

"**BA**" (basal angiosperms): woody, simple, alternate, entire, no stipules, strong/spicy smell

monocots: linear blade, parallel veins, sheath

grasses: swollen node, open sheath

dicots: broad blade, reticulate veins, no sheath

"**Bberry**": woody, simple, alternate, no stipules

"**CoAl**": compound, alternate

"**MADCap**": woody, opposite

polygonaceae: ocrea

"**rosy**": woody, simple, alternate, stipules

"**VD**": dicots with sheathing petiole base

"milky" - latex/sap
"palmate" - veins; alt
"TAN" - nodal tendrils

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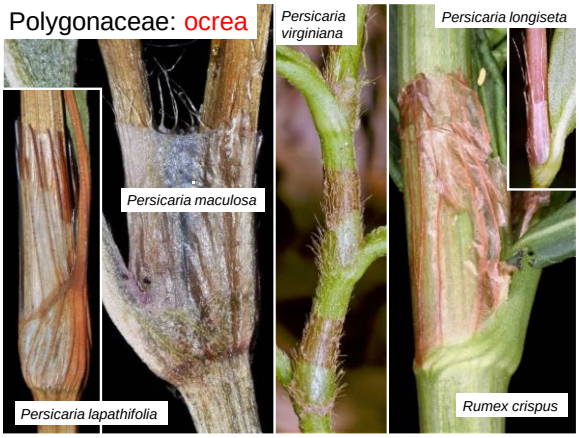

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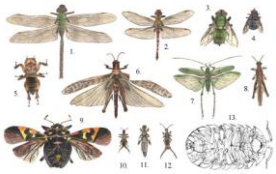
imagine a "group" that included all winged animals. natural? useful?



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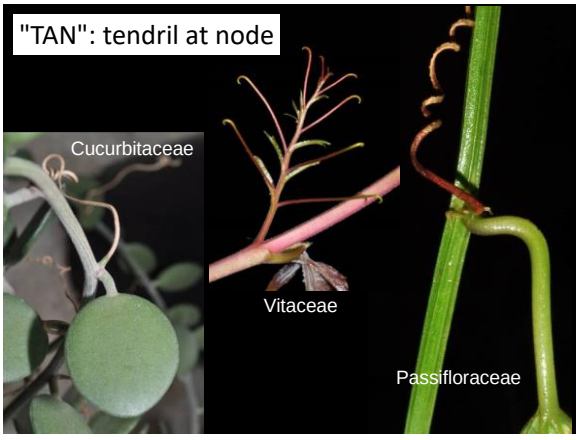

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Even though they might be useful for identification, we want to avoid "artificial" groups for classification

i.e., my "motifs" are great for ID, not so good for classification; natural groups match classification!

Warning:
many natural groups are not readily identified

- ❖ cryptic features
- ❖ no known morphology (DNA-based studies)
- ❖ overlap/intergrade with other groups
- ❖ false similarities & false differences (homoplasy)

Understanding relationships is NOT always predictive for ID
(but it often is very useful)

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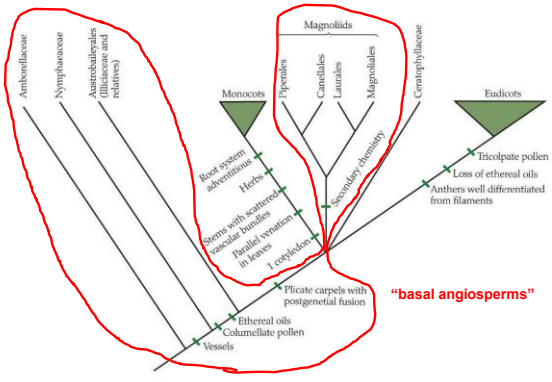
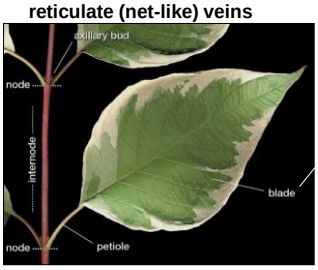


ANGIOSPERMS – phylogenetic overview

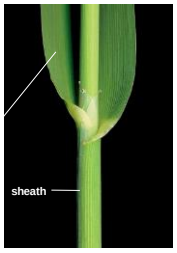
18

Leaf Morphology

dicot:
reticulate (net-like) veins



monocot:
parallel veins



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Leaf venation = pattern of vascular bundles

- **parallel**

monocots

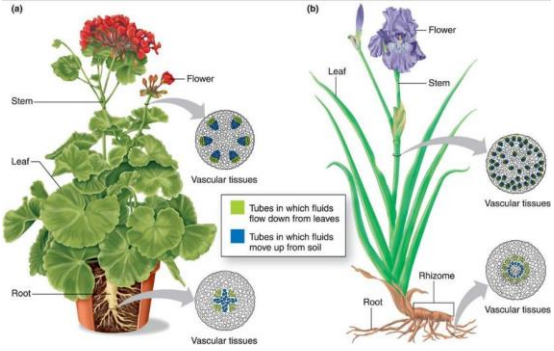
dicots

- **reticulate/net-like (pinnate & palmate patterns)**

20

dicots > 2/3
oak, rose, poppy, soybean

monocots ca 1/4
orchid, lily, corn, palm, iris



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Monocot vs. dicot motifs

these are natural groups, but are they invariant?

- Monocots
  - linear blades (broad in some, e.g., gingers, aroids)
  - parallel veins (reticulate in some, esp. forest understory)
  - sheathing leaf base (only rarely with petiole-like part)
  - [adventitious roots, scattered vascular bundles, 3-merous fls]
  - herbs [anomalous woody], usu. simple, alternate, entire, no stipules --- "graminoids" & grasses (Poaceae)
- Dicots
  - broad blades (rarely linear)
  - net-like (reticulate) veins
  - non-sheathing leaf base
  - [primary taproot, vascular bundles in ring, 4-5-merous fls]
  - [herbs or woody, simple or compound, alternate or opposite, entire or toothed, stipules or not]

22

motif templates -- **Vines/Lianas** (start off with a list of possibilities & then use basics):

Dioscoreac, Smilacac; *Toxicodendron radicans*, some apocs (*Cynanchum*, *Matelea*, *Vinca*), *Hedera*, some asteracs (*Mikania*), bignons (not *Catalpa*), some caprifols (some *Lonicera*), some celastracs (*Celastrus*, some *Euonymus*), most convolvs, cucurbits, some fabacs (*Amphicarpaea*, *Apios*, some *Desmodium*, *Pueraria*, *Vicia*, *Wisteria*), few hydrangeacs, *Akebia*, menisperms, passifloracs, some polygonacs (ocrea), some ranunculacs (*Clematis*), *Berchemia*, some rosacs (several stoloniferous so kinda viny; some *Rosa* & *Rubus* kinda viny), *Cardiospermum*, an introduced weedy *Solanum*, vitacs

Compound:

Toxicodendron, bignons, fabacs, *Akebia*, *Clematis*, rosacs (not usually good vines), balloon vine, some vitacs (*Ampelopsis/Nekemias arborea*, *Cissus*, *Parthenocissus*)

Opposite:

some *Dioscorea*, apocs, *Mikania*, bignons, caprifols, *Euonymus*, *Clematis*

Alternate/Simple/& Entire:

some *Dioscorea*, *Smilax* (some prickly margined but not toothed), some *Hedera* (usually shallowly lobed though), most convolvs (some lobed), some menisperms (almost always lobed), polygonacs

"**TAN**" (**tendril** at node): grapes, passionflowers, squashes, [balloon vine]

23

Natural Plant ID Motifs

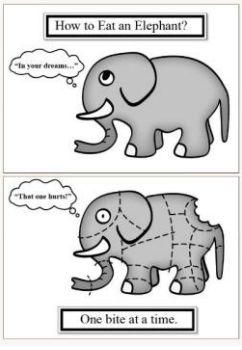
~300,000 extant vascular plant species globally -- ~20,000 in North America, ~3,000 in a state, ~1,000 spp. in a county

~16,000 genera, & 250-400(-600) families of plants; ~160 families in a state

~64 orders of extant flowering plants

❖ **natural groups (clades/lineages):**

- ❖ larger groups -- angiosperm, monocot, dicot
- ❖ orders -- e.g., Ranunculales, Sapindales, Solanales, Lamiales...
- ❖ families -- e.g., Cucurbitaceae, Passifloraceae, Vitaceae...
- ❖ genera -- e.g., *Cardiospermum*, *Brunnichia*, *Aristolochia*...
- ❖ species -- e.g., *Parthenocissus quinquefolia*, *Toxicodendron radicans*...



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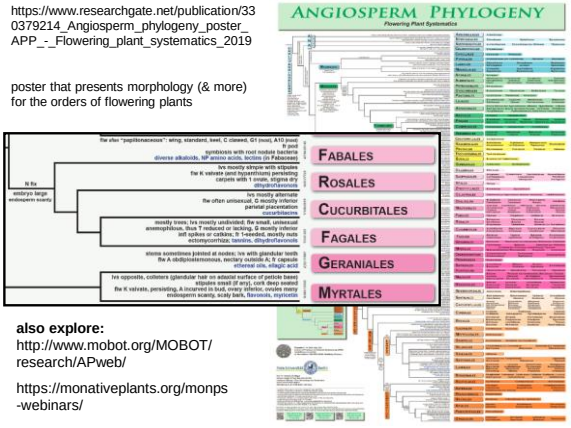
https://www.researchgate.net/publication/330379214_Angiosperm_phylogeny_poster_APP_-_Flowering_plant_systematics_2019

poster that presents morphology (& more) for the orders of flowering plants



also explore:
http://www.mobot.org/MOBOT/research/APweb/

https://monativeplants.org/monps-webinars/

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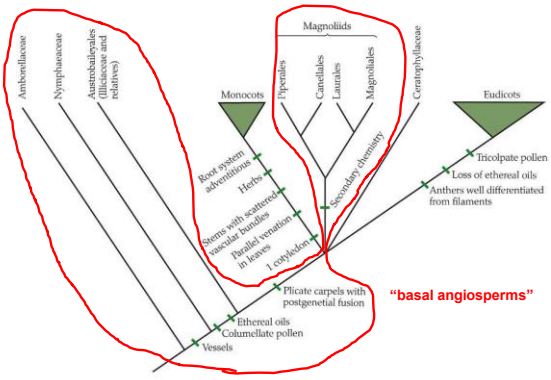

ANGIOSPERMS – phylogenetic overview

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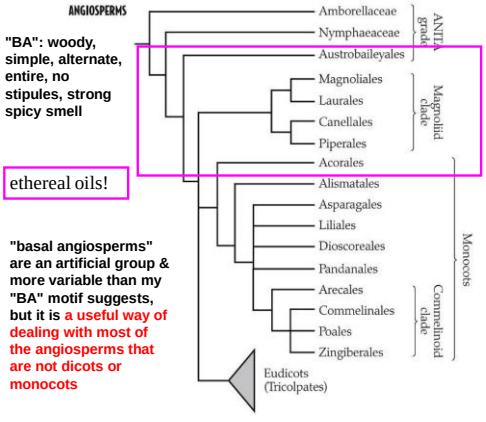

"BA": woody, simple, alternate, entire, no stipules, strong spicy smell

ethereal oils!

"basal angiosperms" are an artificial group & more variable than my "BA" motif suggests, but it is a useful way of dealing with most of the angiosperms that are not dicots or monocots

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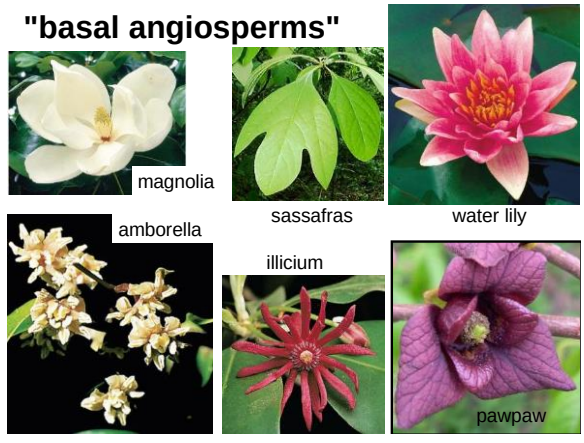
"basal angiosperms"



28

MO has ca 180 species of native & naturalized "vines" (~75 G in 28 F)

-- 1 "basal angiosperm": *Isotrema* (was *Aristolochia*)

-- 11 monocots: *Dioscorea* (2), *Smilax* (9)

-- ca 168 eudicots (in ca 72 genera in 25 families)

-- ca 30 species (in 18 genera in 11 families) have opposite leaves: some Apocynaceae (5/8), some Bignoniaceae (2/2), *Clematis* (8), *Gelsemium*, *Humulus* (2), *Hydrangea*, *Kickxia* (2; alt above), *Lonicera* (5), *Mikania* [this includes 10 that are compound]

-- ca 63 species (in 30 genera in 7 families) have compound leaves (the following are alternate): *Akebia*, *Cardiospermum*, some Fabaceae (20/42), some *Rosa*/*Rubus* (4?), *Toxicodendron*, some Vitaceae (3/5)

-- only 3 genera (11 spp., 2 F) are compound AND opposite: *Bignonia*, *Campsis*, & *Clematis* (8)

-- this leaves ca 78 eudicot vine species with alternate, simple leaves

29

obvious dicot motifs/patterns using basic features (learn all families or create "artificial" groups?)

-- **compound & opposite**: *Bignonia*, *Campsis*, & *Clematis* (8)

-- **compound & alternate**: *Akebia*, *Cardiospermum*, some Fabaceae (20/42), some *Rosa*/*Rubus* (4?), *Toxicodendron*, some Vitaceae (3/5)

-- **simple & opposite**:

entire: some Apocynaceae (5/8), *Gelsemium*, *Lonicera* (5)

toothed: *Humulus* (2), *Hydrangea*, *Kickxia* (2?; alt above), *Mikania*

motifs are about organizing information for fastest retrieval!

-- this leaves 78 eudicot vine species with **alternate, simple** leaves [could add in the "basal angiosperms" & monocots]:

moonseeds (3 G/spp.), knotweeds/buckwheat vine (2 G; 4 spp.), grapes (4(-5) G; 15 spp. total), bittersweets (2 G; 6 spp.), noseburn, passionflowers (2 spp.), rattan vine, squashes (9 G; 11 spp.), morning glories (8 G; 34 spp.), English ivy

30

78 eudicot vine species with **alternate, simple** leaves:

tendrils at node (**"TAN"**), separable by tendril position (~1/3 spp):

- grapes - leaf-opposed
- passionflowers - axillary
- squashes - right-angle (to petiole)

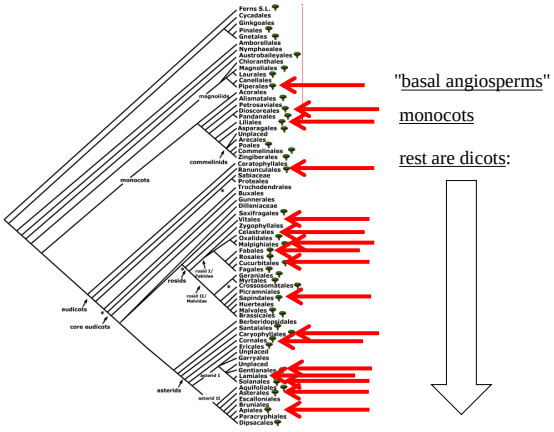
entire (~1/2 spp):

- knotweeds/buckwheat vine - ocrea (stem can be tendril-like)
- morning glories - milky sap (rarely lobed)

toothed &/or lobed:

- moonseeds - twisted/kinked petioles, no stipules, lobed (no teeth)
- bittersweets - nondescript (low teeth, rounded to obtuse base, stipes)
- noseburn - cordate, hairy, jagged teeth, stipules
- rattan vine - pronounced parallel 2° veins (6+?), stipules
- English ivy - slightly sheathing petiole base, smell, no stips, evergreen

31



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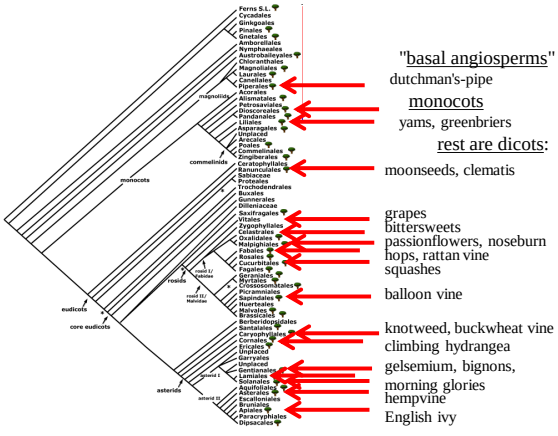

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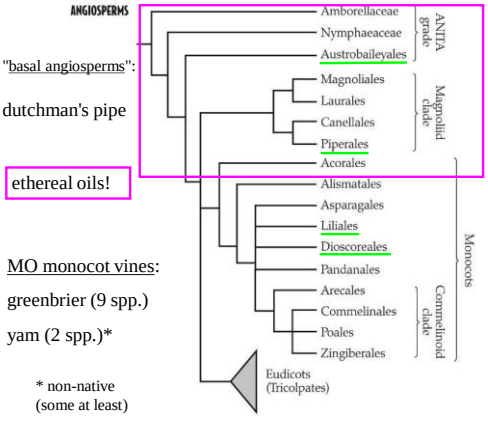

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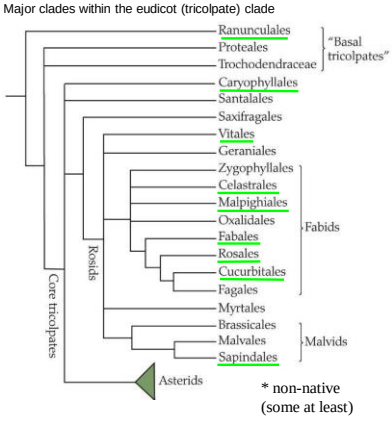

MO dicot vines:

clematis (8 spp.)*/akebia
moonseed (3 G; 3 spp.)
knotweed (2 G; 4 spp.)*
grape (4(-5) G; 15 spp.)*
bittersweet (2 G; 6 spp.)*
noseburn
passionflower (2 spp.)
bean (~20 G; ~42 spp.)*
dewberry/rose (4 spp.?)
hops (2 spp.)*
rattan vine
squash (9 G; 11 spp.)*
poison ivy
balloon vine*

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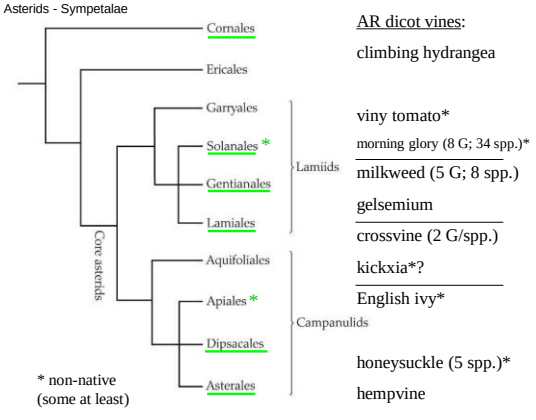

AR dicot vines:

climbing hydrangea

viny tomato*
morning glory (8 G; 34 spp.)*
milkweed (5 G; 8 spp.)
gelsemium
crossvine (2 G/spp.)
kickxia*?
English ivy*

honeysuckle (5 spp.)*
hempvine

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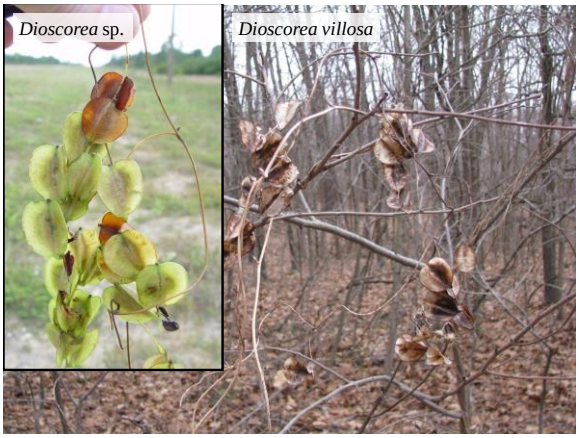

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Smilax – 9 spp. in MO: paired stipular tendrils

more or less woody, with prickly stems
S. bona-nox, S. glauca, S. rotundifolia, S. tamnoides (= *S. hispida*)

herbaceous, stems without prickles
S. ecirrhata, S. herbacea, S. illinoensis, S. lasioneuron, S. pulverulenta

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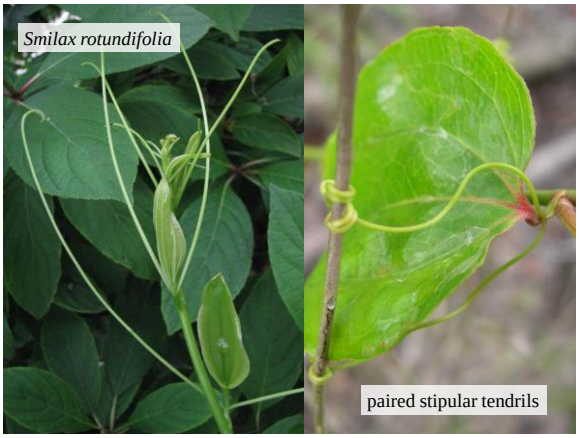

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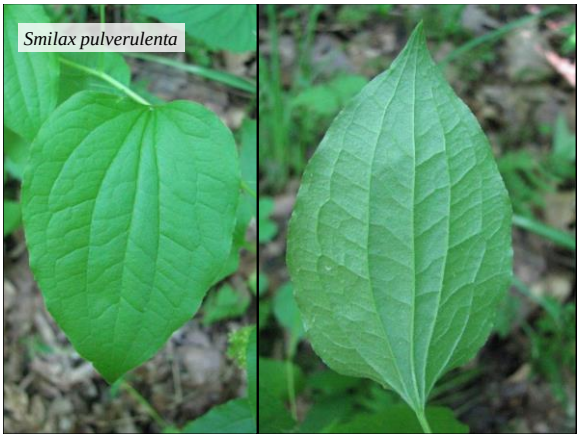

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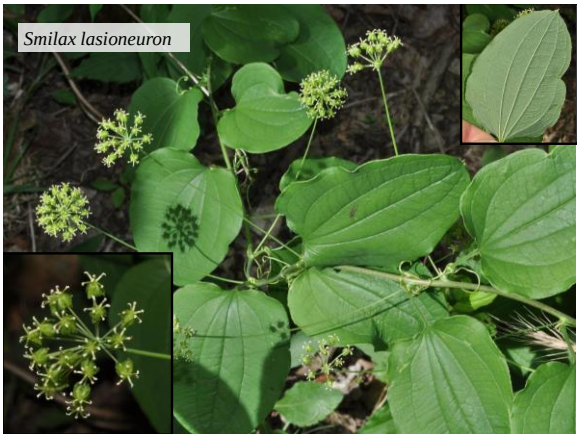

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Clematis – 8 spp. in MO

-- subgenus Clematis: petals white (yellowish), rotate [Virgin's Bower]

C. catesbyana, C. terniflora, C. virginiana

-- subgenus Viorna: petals purplish or bluish, connivent & bell to urn shaped [Leather Flower]

C. crispa, C. fremontii, C. pitcheri, C. versicolor, C. viorna

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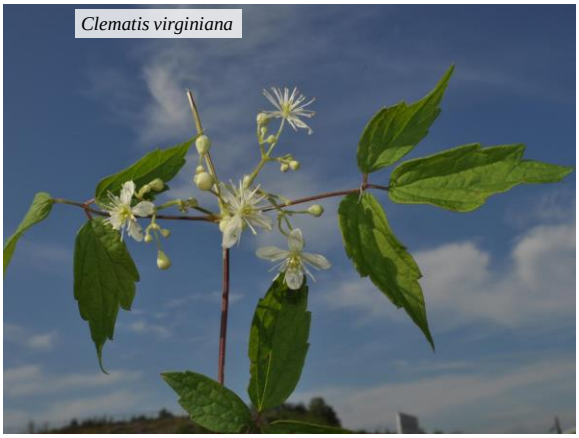

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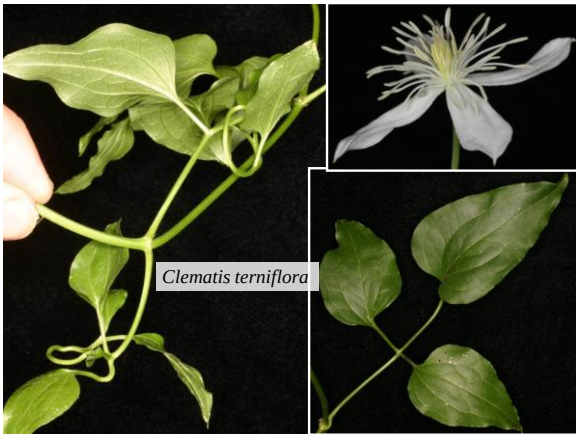

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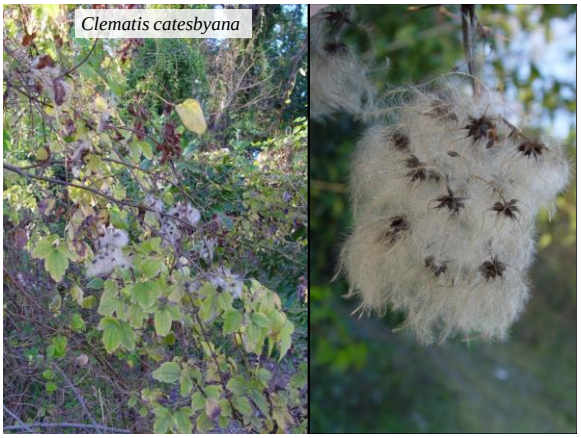

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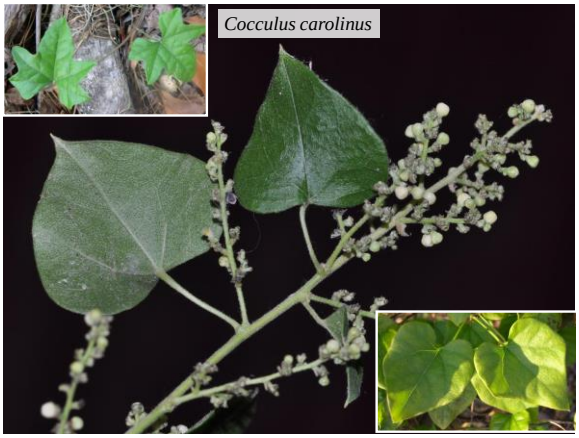

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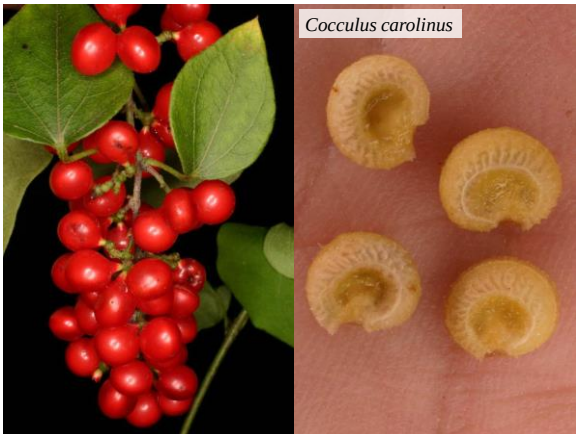

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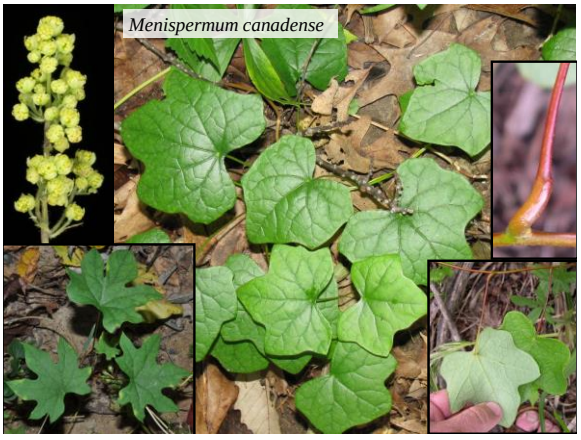

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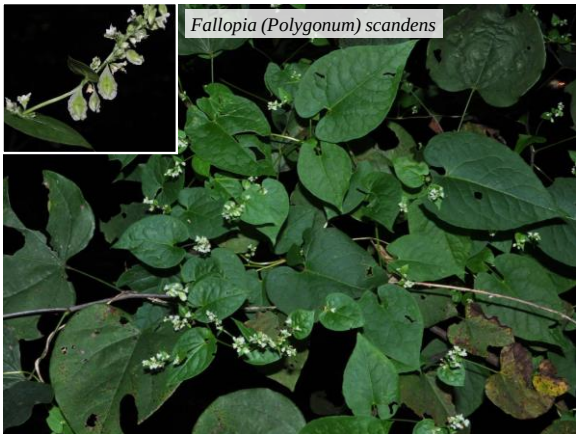

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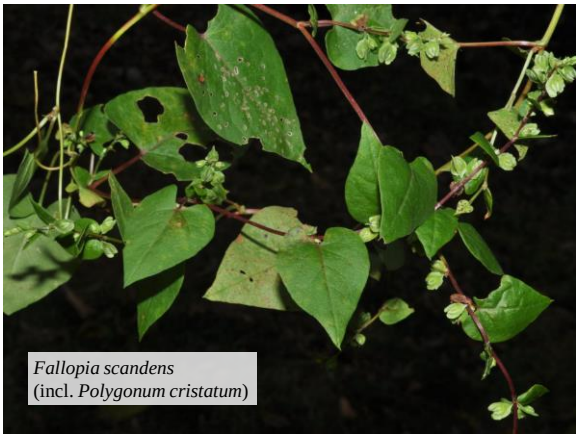

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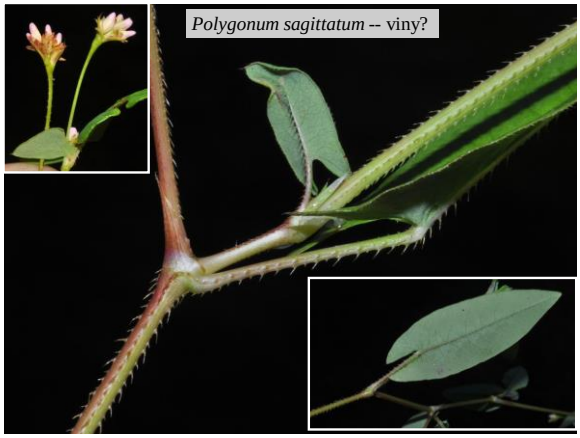

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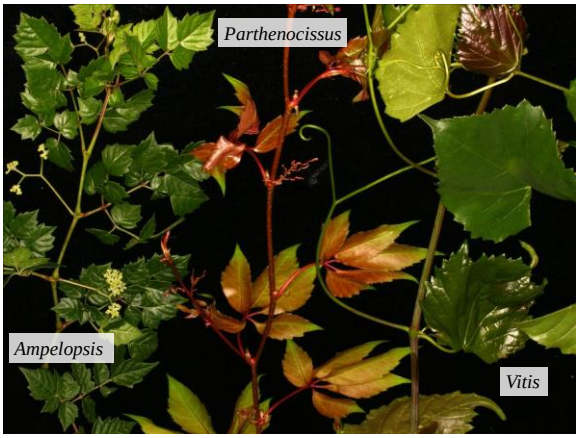

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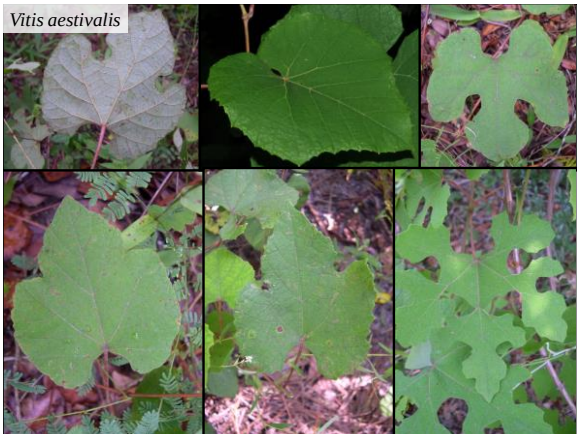

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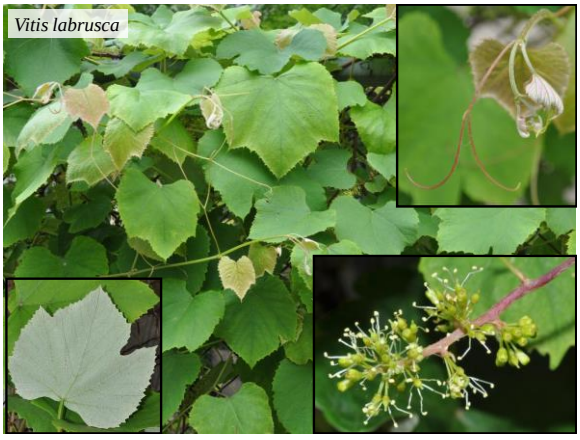

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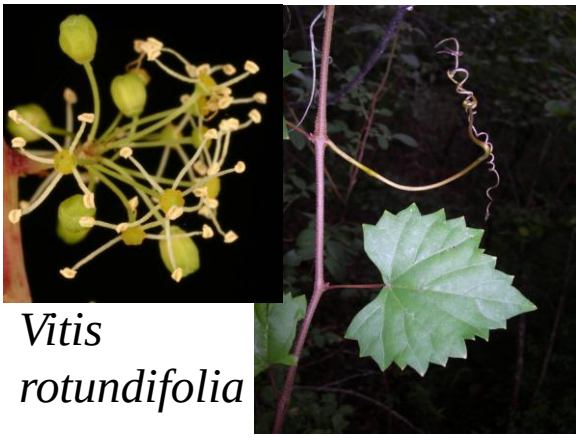

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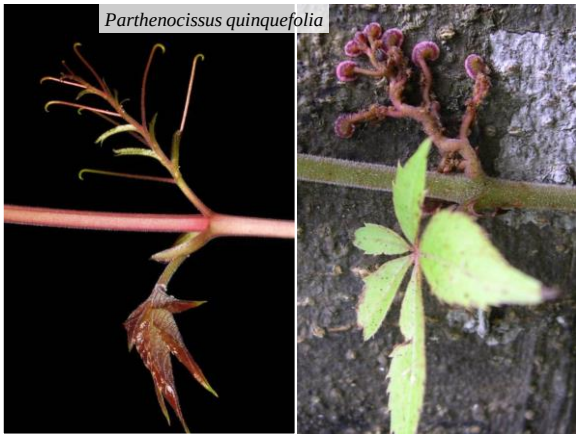

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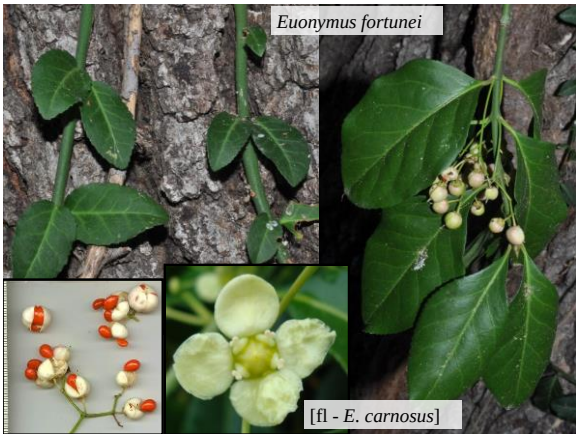

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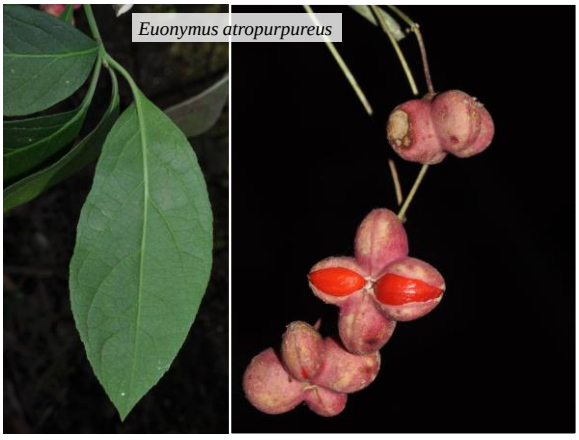

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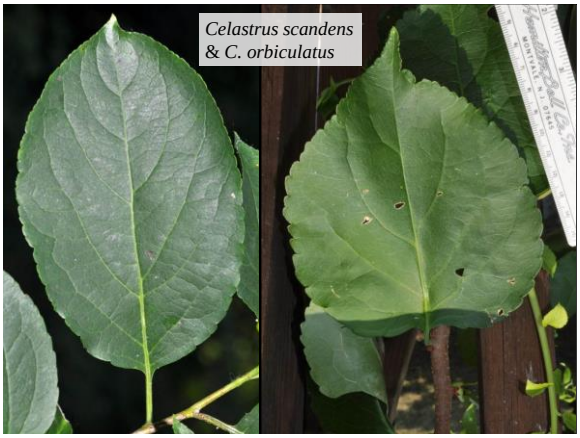

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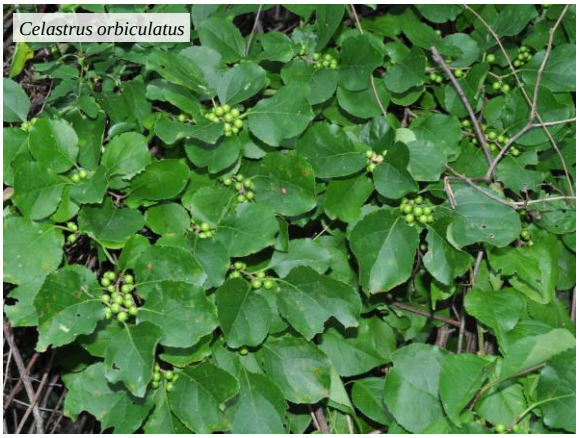

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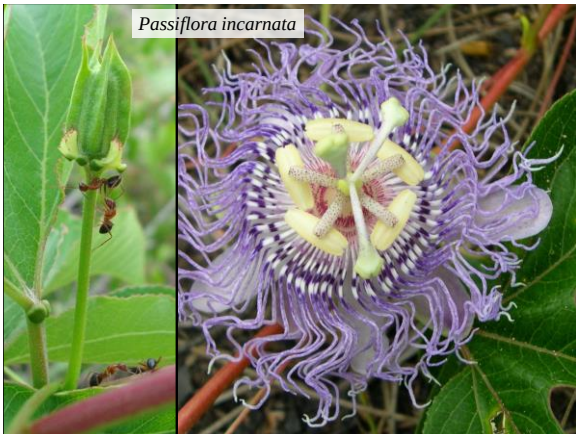

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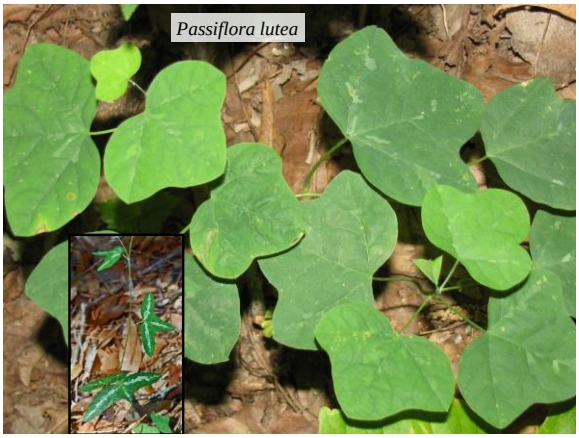

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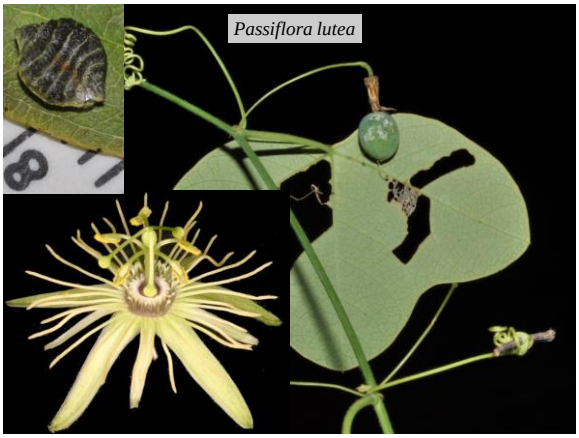

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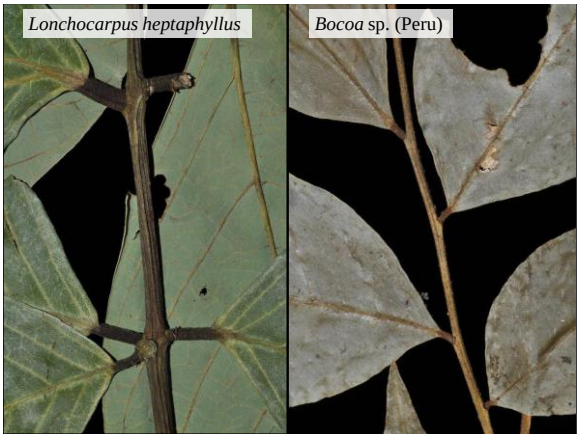

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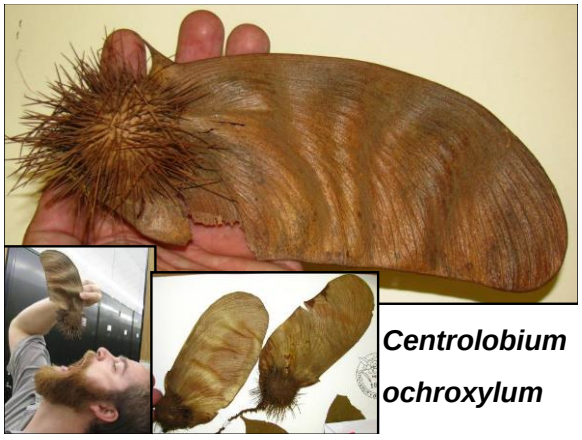

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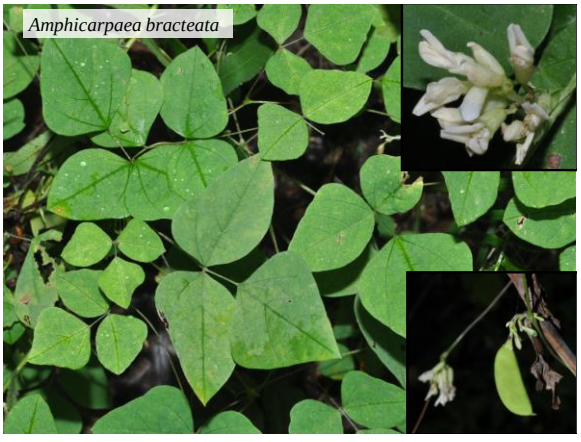

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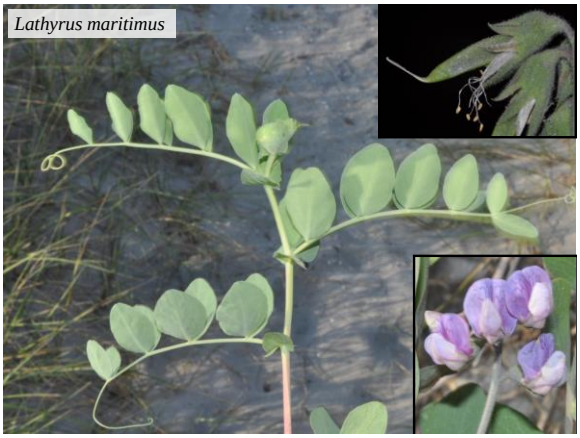

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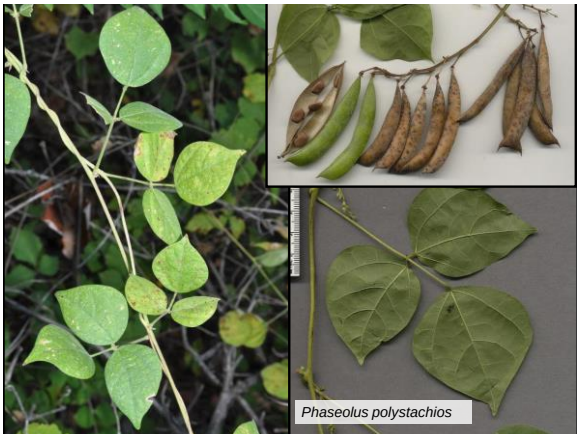

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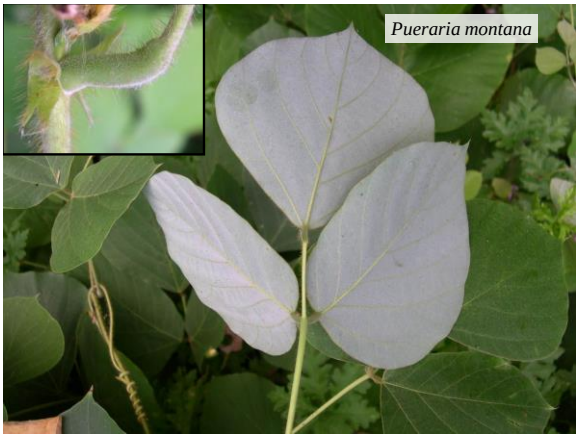

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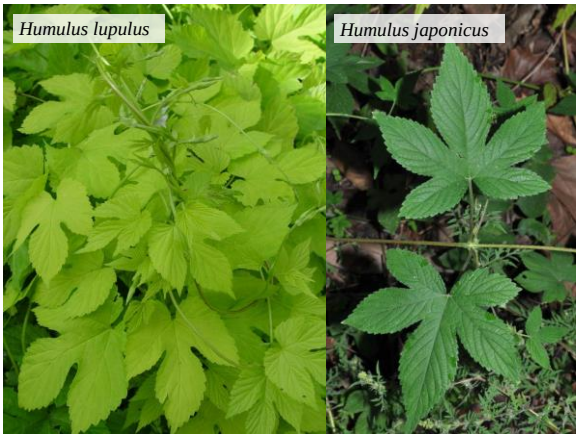

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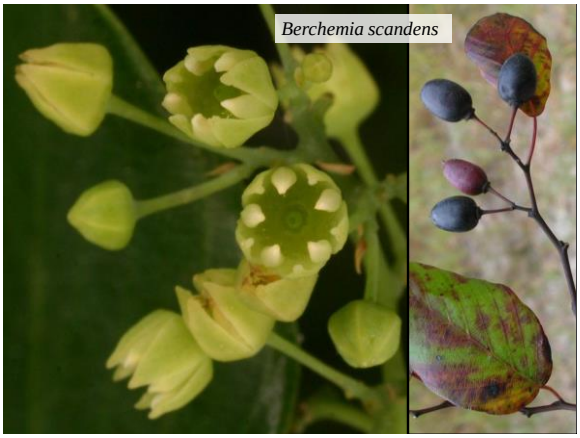

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Cucurbitaceae: tendril at right angle to petiole; 9 genera (5 native)

Cayaponia quinqueloba
Citrullus lanatus (watermelon)*
Coccinia grandis (ivy gourd)*
Cucumis melo (cantelope) & *C. sativus* (cucumber)*
Cucurbita foetidissima & *C. melopepo* (squashes)
Echinocystis lobata
Lagenaria siceraria (bottle gourd)*
Melothria pendula
Sicyos angulatus

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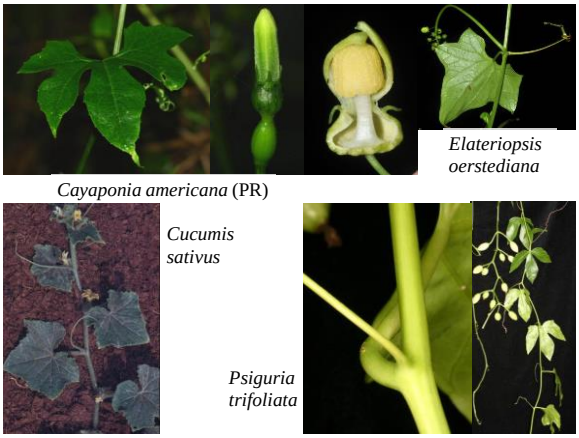

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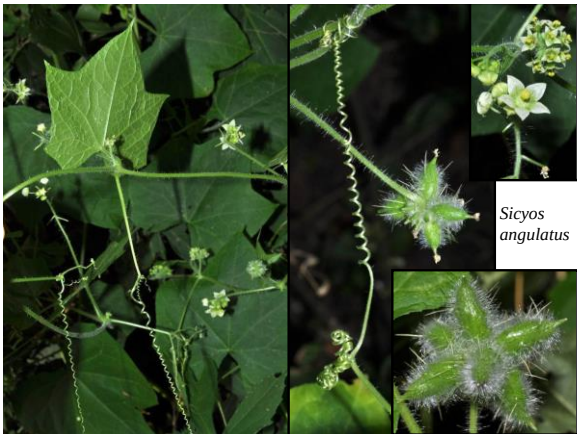

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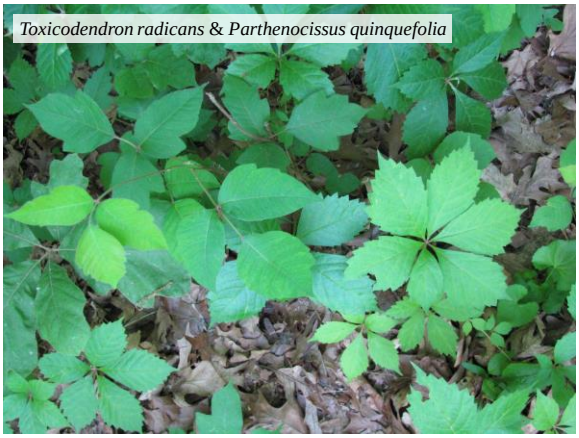

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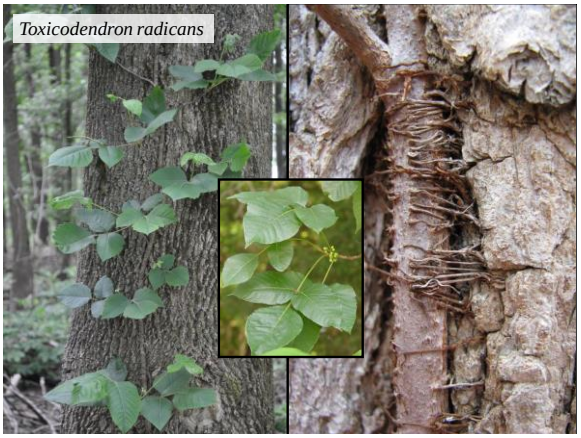

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Hydrangea (= *Decumaria*) *barbara*

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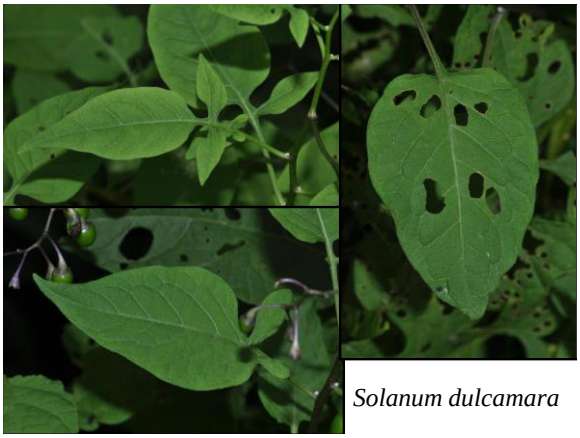

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Convolvulaceae: lvs alternate, mostly cordate, light milky sap

Calystegia: two bracts hiding calyx, 2 stigmas; 5 spp.

Convolvulus: 2 linear stigmas; 1 sp.

Cuscuta: orangish parasites; 12 spp.

Dichondra caroliniensis: tiny creeper, leaves reniform

Evolvulus: 2 styles; 2 spp.

Ipomoea: 1 stigma (s.t. 2 lobed); 11 spp.

Jacquemontia tamnifolia: dense head-like inf, 2 stigmas

Stylisma pickeringii: 1 stigma (2-lobed) or 2 styles; 1 sp.

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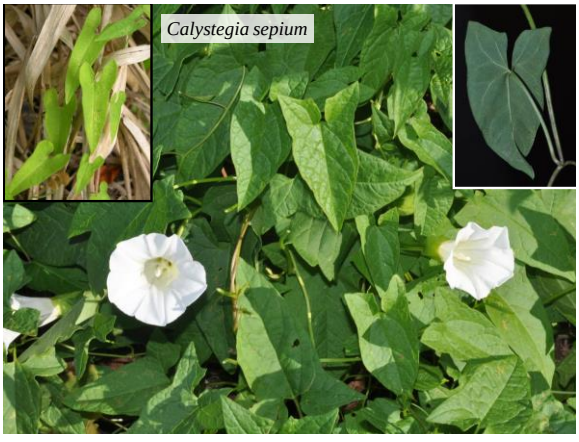

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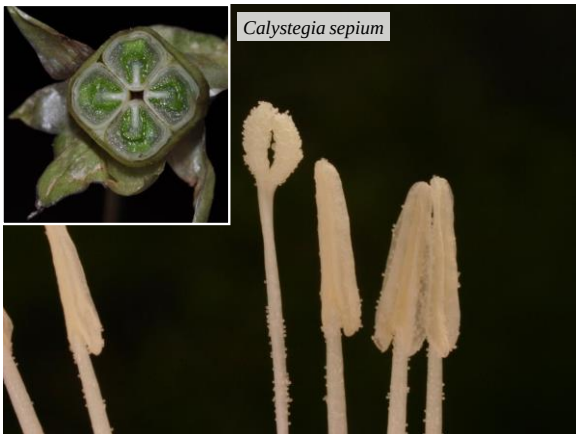

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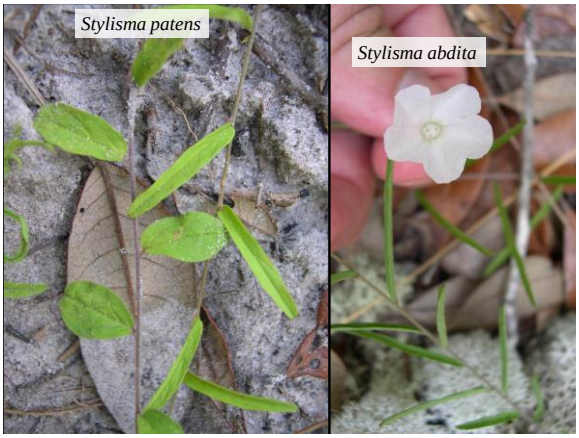

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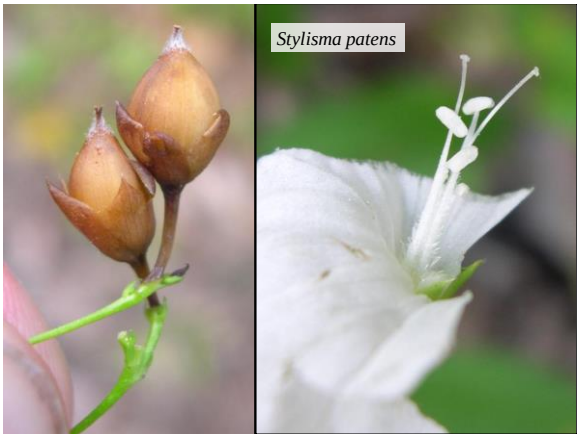

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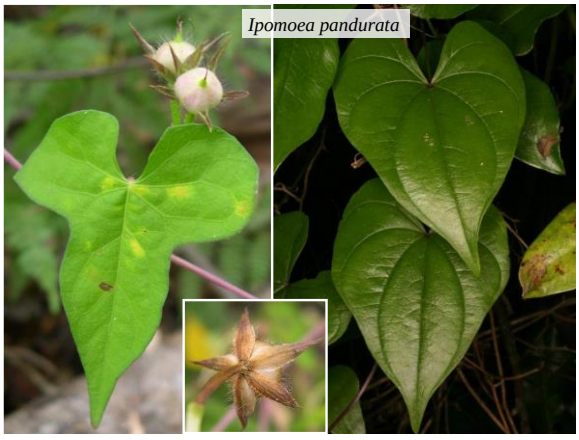

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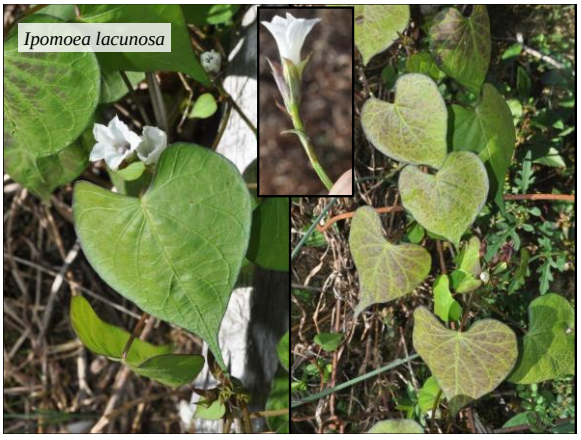

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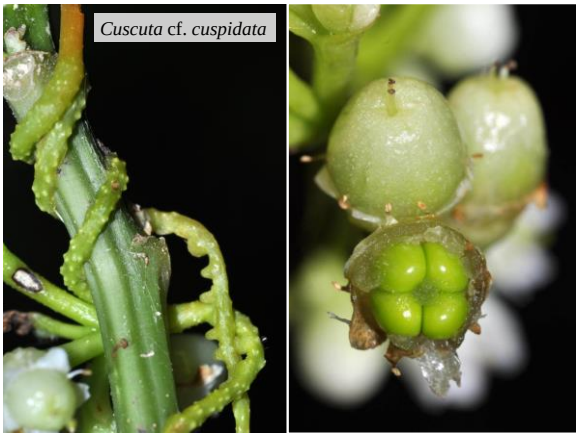

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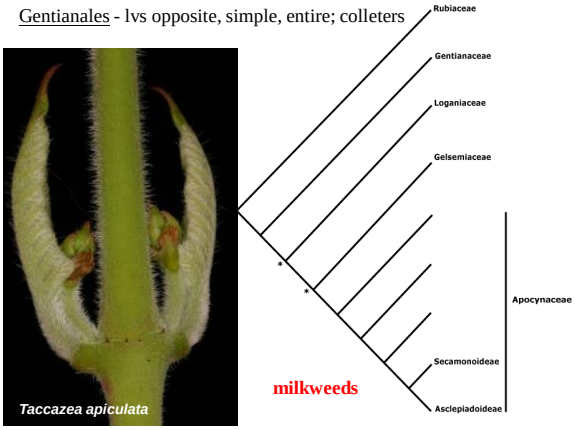
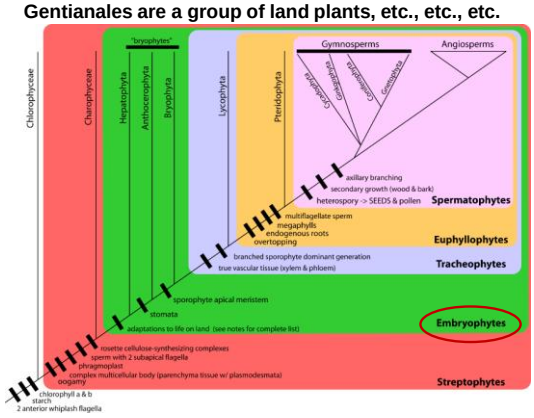
Gentianales - lvs opposite, simple, entire; colleters



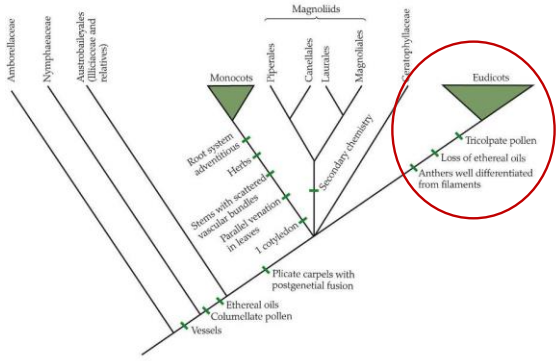
211

Gentianales are a group of land plants, etc., etc., etc.



212

Gentianales are a group of eudicots



ANGIOSPERMS – phylogenetic overview

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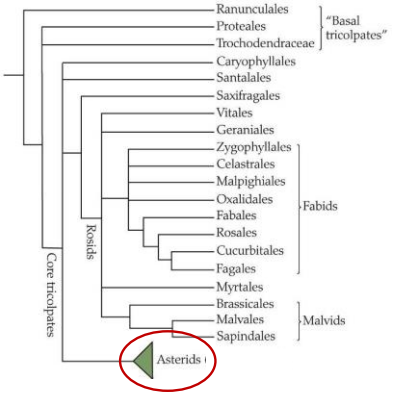
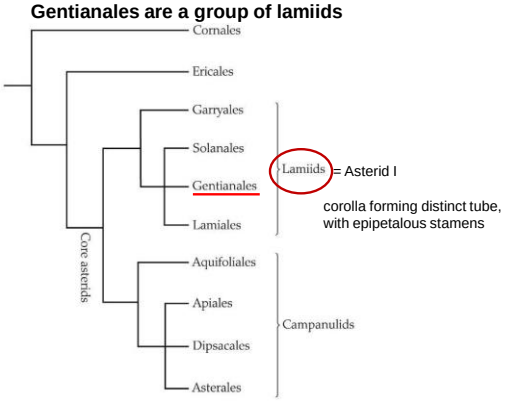
Gentianales are a group of asterids (sympetalous)



214

Gentianales are a group of lamiids



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Gentianales overview

leaves opposite, simple, entire

colleters often present

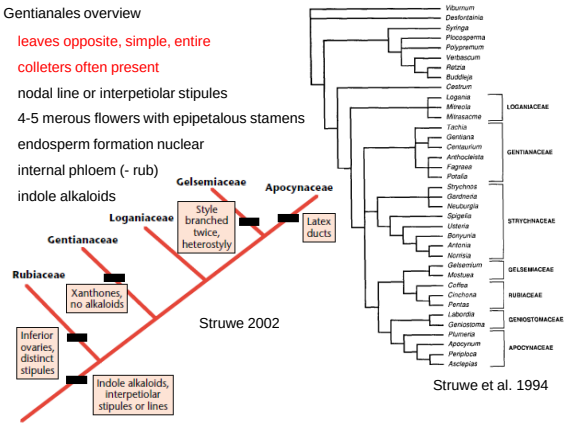
nodal line or interpetiolar stipules

4-5 merous flowers with epipetalous stamens

endosperm formation nuclear

internal phloem (- rub)

indole alkaloids



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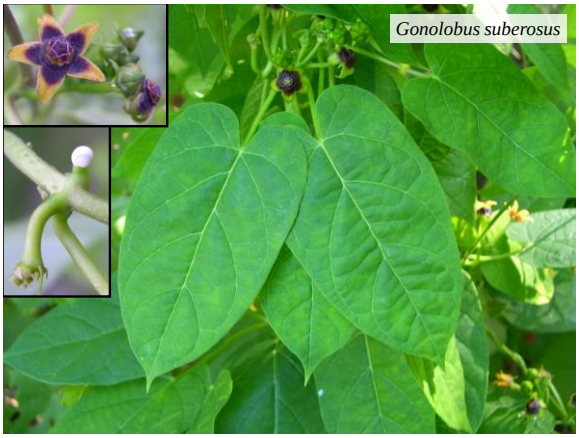

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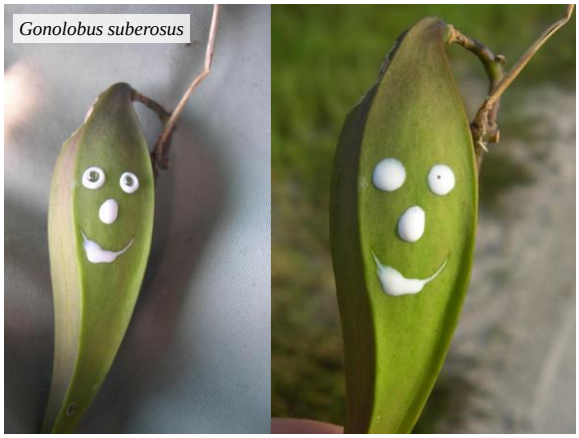

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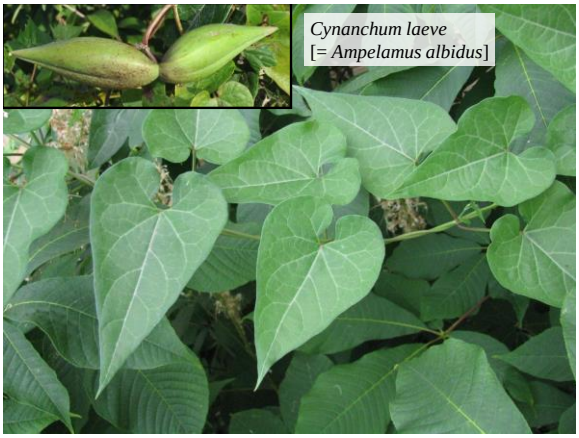

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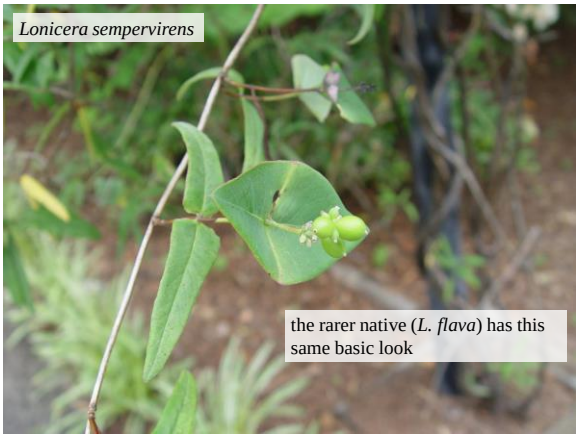

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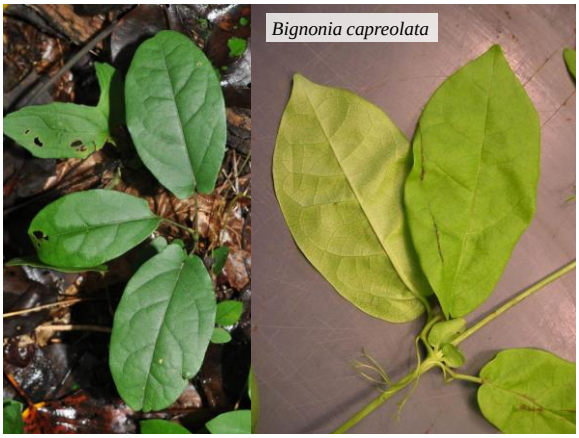

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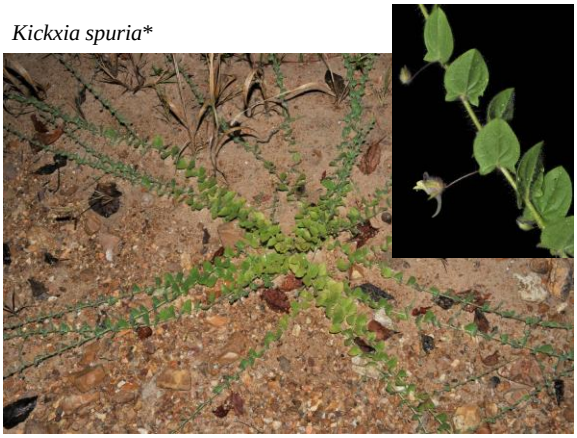

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knowing natural groups can be very useful

but, it is best learned in conjunction with imprinting 'difficult' species or groups & also learning "artificial motifs"

thank you!

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