

Plant Identification

Methods and Resources



Matt Jones

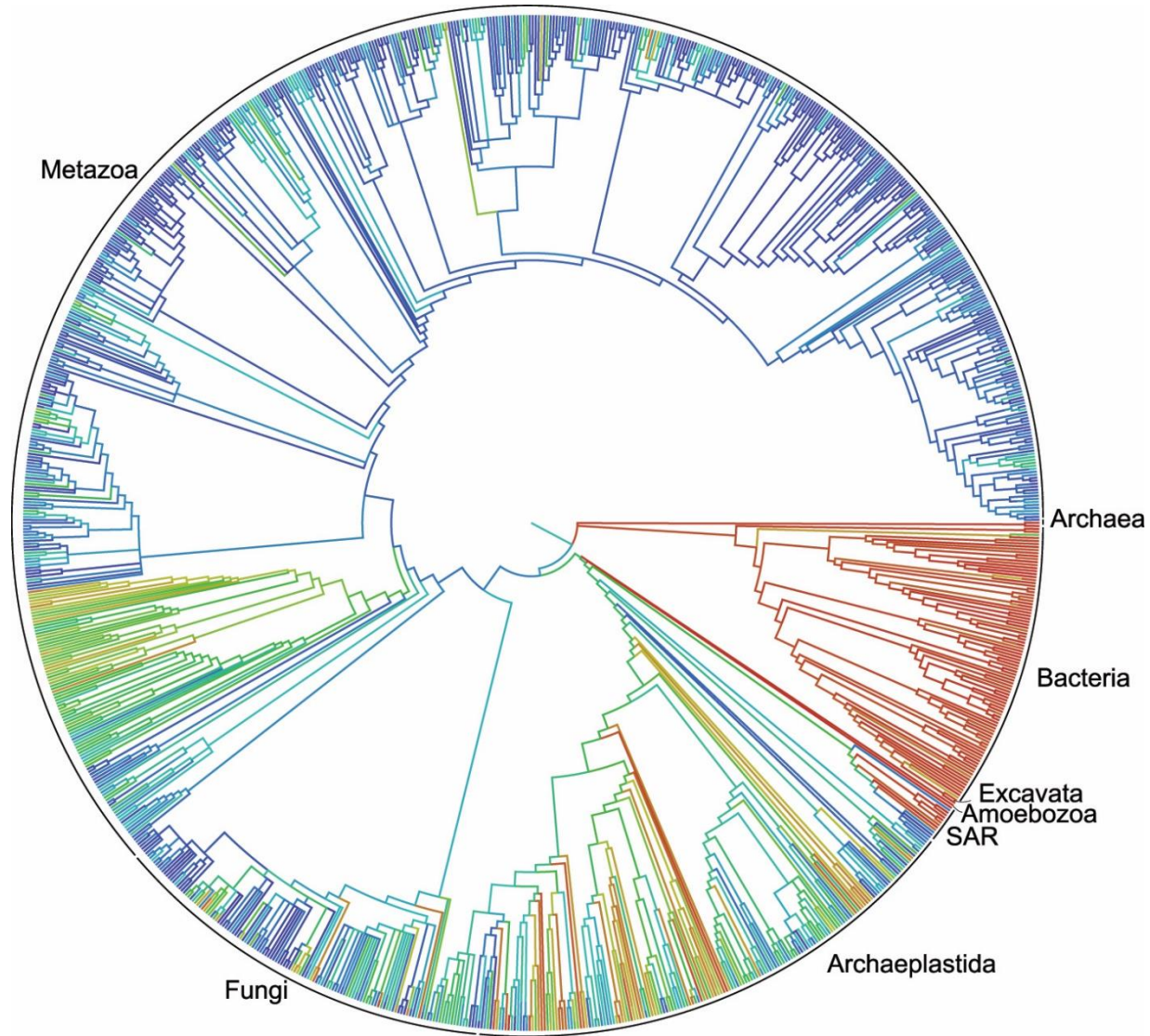
Horticulture Extension Agent
NCCE Chatham County Center

Part I

Outline

1. Systematics and Taxonomy
2. Morphological Features used in Plant ID
3. Tools and Resources for Plant ID
How to Use a Dichotomous Key
4. ID Demo with a Dichotomous Key

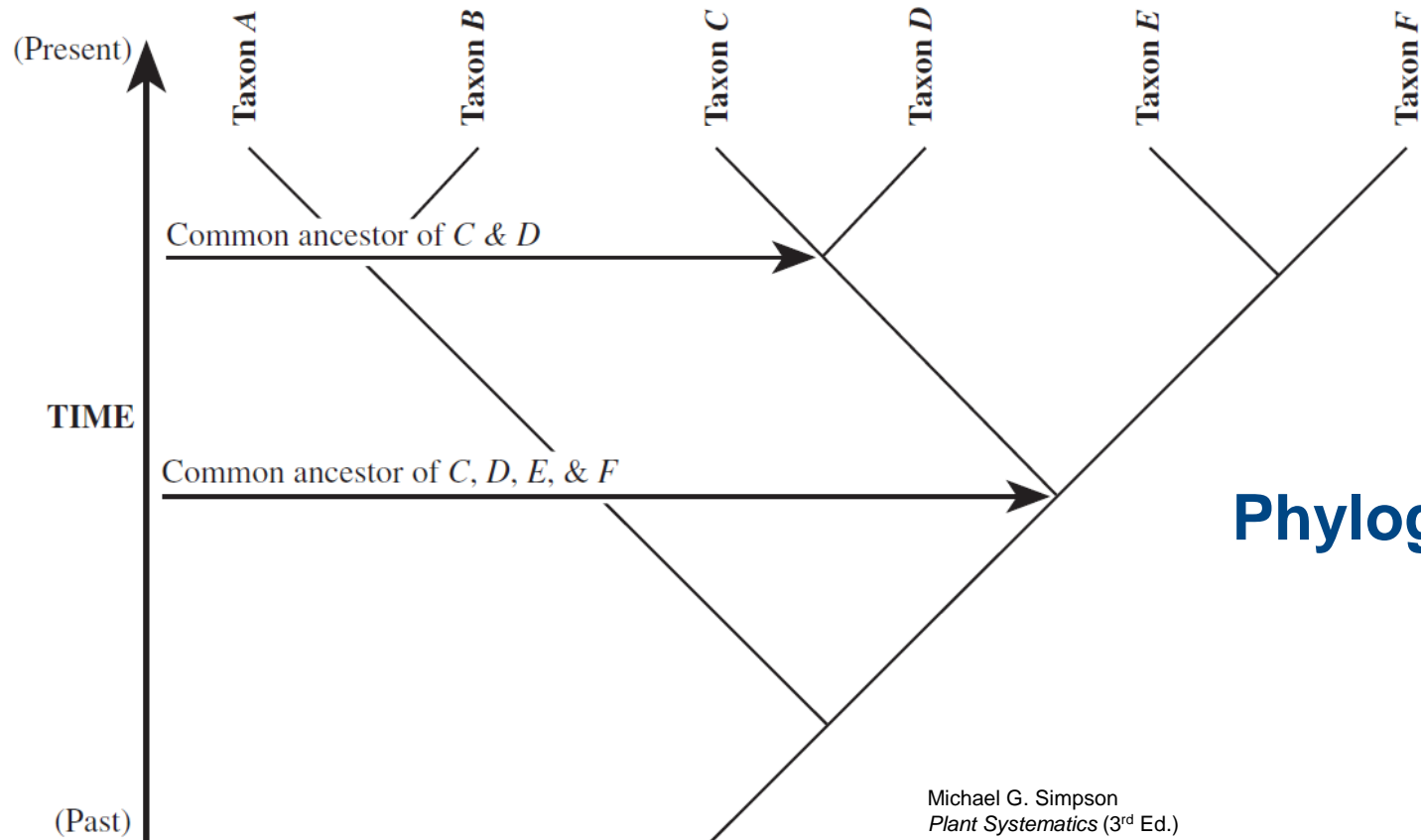
So many species...



Only 15% of 8.7 million species have been identified & classified

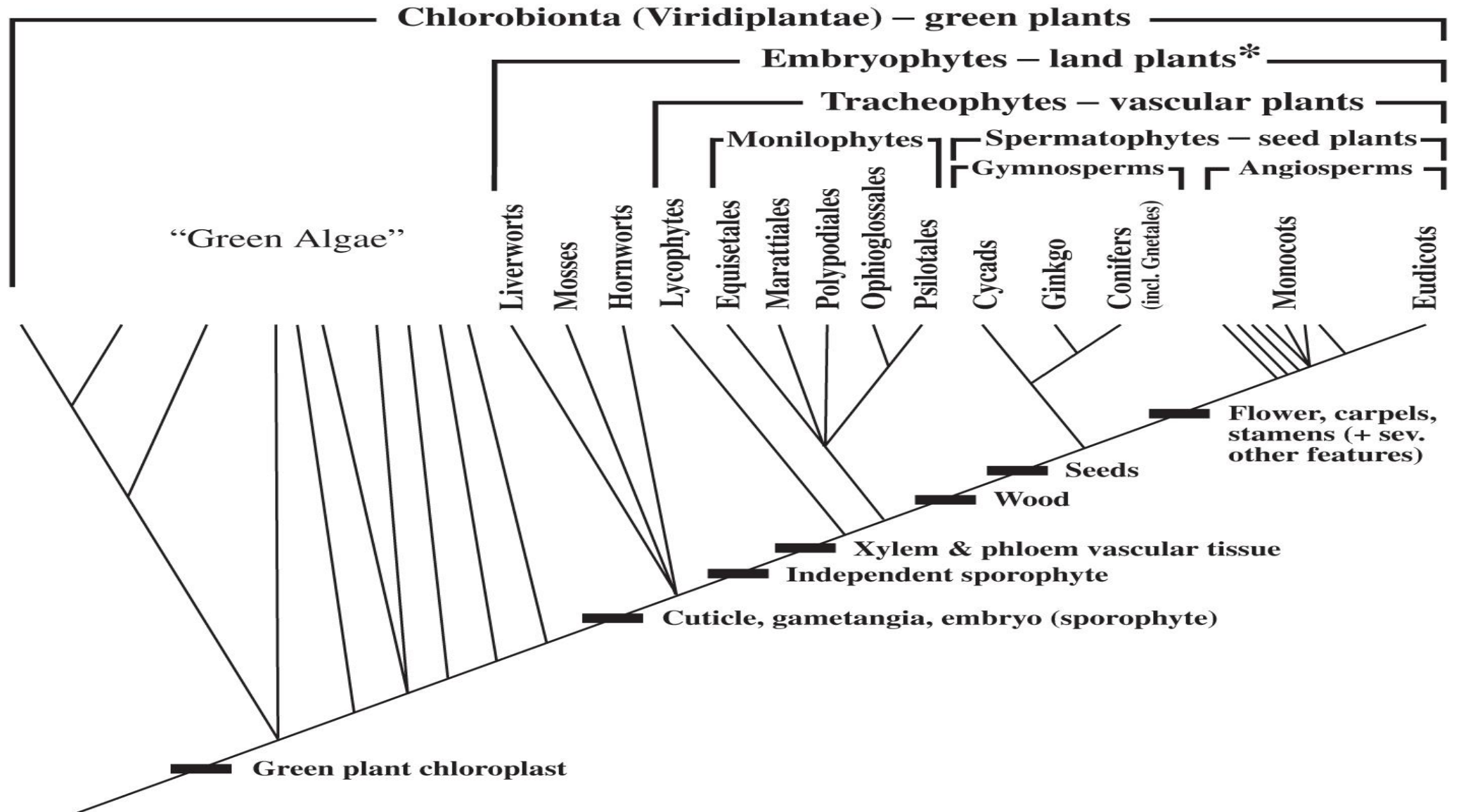
How Many Species Are There on Earth and in the Ocean? Mora, C., Tittensor, D. P., Adl, S., Simpson, A. G. B. & Worm, B. PLoS Biol. 9, e1001127 (2011)

Systematics: the science of naming and classifying organisms (taxonomy) that reconstruct the evolutionary relationships among organisms.



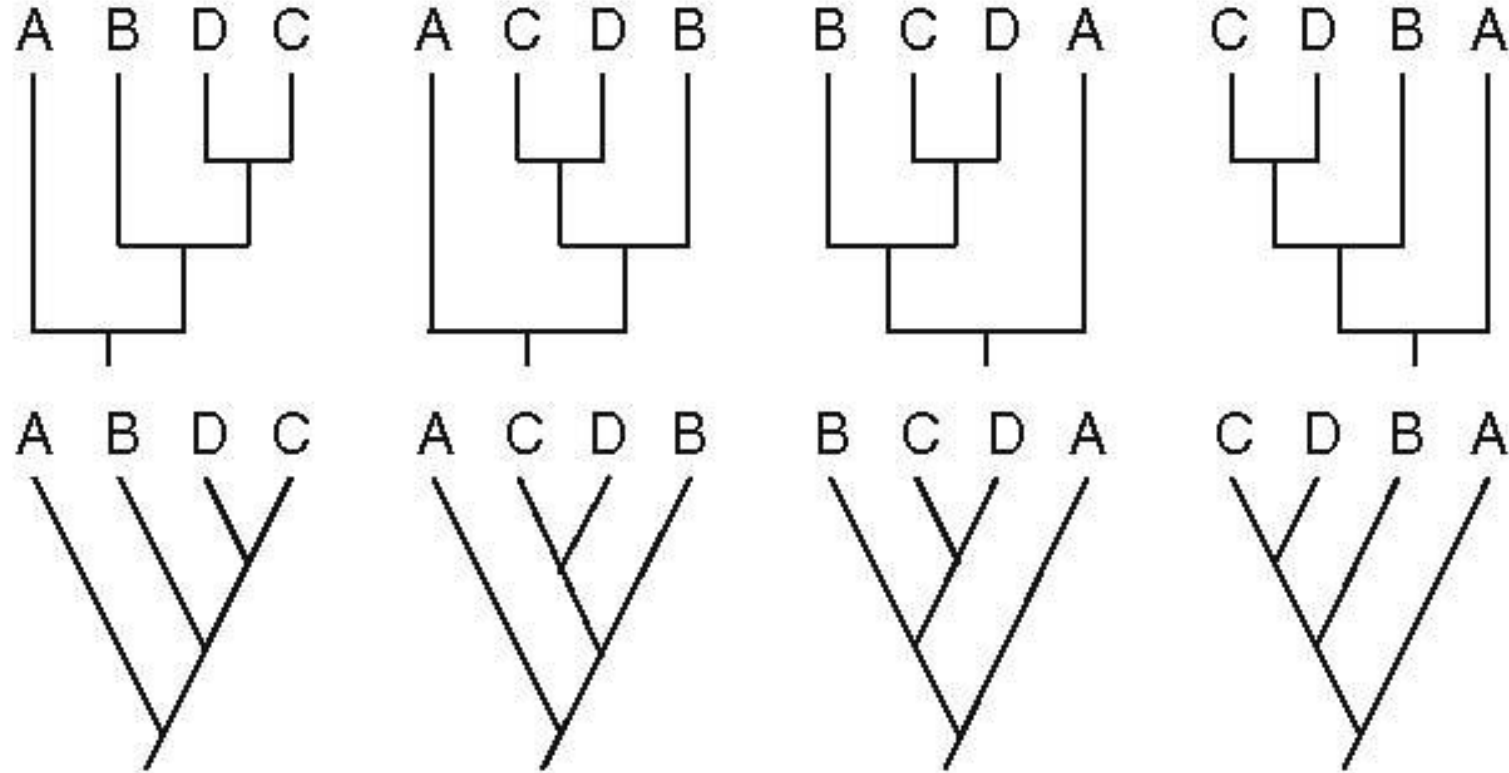
Phylogenetic Tree or Cladogram

Phylogeny of Plants



Interpreting Phylogenetic Trees

Image: *Principles of Biology*
David Rintoul and Robert Bear
OpenStax CNX
Creative Commons Attribution License 4.0



All of these cladograms depict the same relationships.

Taxonomy

- Description
- Identification
- Nomenclature
- Classification



family Sapotaceae genus Sideroxylon species **Sideroxylon macrocarpum**

Sideroxylon macrocarpum (Nuttall) J. R. Allison

Wayne J. Elisens, J. Matthew Jones

Sida 22: 245. 2006 .,

Common names: Large-fruited bully.

Basionym: *Bumelia macrocarpa* Nuttall N. Amer. Sylva 3: 34. 1849.

Treatment appears in FNA [Volume 8](#). Treatment on page 241. Mentioned on page 238.

Shrubs, to 1 m. **Stems** armed, tomentose, glabrescent. **Leaves** deciduous; petiole 0.5–5 mm, pilosulous; blade (dull dark green adaxially), broadly elliptic, oblanceolate, obovate, or spatulate, 3–52 × 2–21 mm, base acute to cuneate, margins plane, apex obtuse or rounded, sometimes retuse, abaxial surface sparsely strigose (hairs white to gray, rarely tawny), venation visible, adaxial surface glabrate, midrib flat, marginal vein absent. **Inflorescences** 2–18-flowered, sometimes flowers solitary. **Pedicels** 1–5.5 mm, sparsely strigose. **Flowers:** calyx 2–2.8 mm diam.; sepals (4–)5(–6), 2.1–3 × 0.8–1.2 mm, glabrate to tomentose; petals (4–)5(–6), white, median segment ovate to suborbiculate, 2.4–2.6 mm, lateral segments lanceolate to oblong, 2–2.3 mm; stamens (4–)5(–6), 2.1–3.5 mm; staminodes lanceolate to ovate, 1.3–2.1 mm, erose; anthers lanceolate to sagittate, 1.1–1.5 mm; pistil 5-carpellate; ovary 5-locular, 1–1.2 mm, glabrate or villous; style 1–1.5 mm. **Berries** purplish black, ellipsoid to subglobose, 9–14 mm, glabrous or glabrate. **Seeds** 7.3–9 mm.

Contents [\[hide\]](#)

[Distribution](#)
[Discussion](#)
[Selected References](#)
[Lower Taxa](#)

Identification



Holistic vs. Analytical

Analytical Identification

Taxonomic Keys

239. ANACARDIACEAE R. Brown 1818, nom. cons. (Cashew Family) [in SAPINDALES]

A family of about 70-81 genera and about 800-875 species, trees, shrubs, lianas, and rarely herbs, of tropical, subtropical, and temperate regions. Our representatives are all classed in subfamily Anacardioideae (Pell et al. 2011). References: Pell et al. in Kubitzki (2011); Barkley (1937).

- 1 Leaves simple *Cotinus*
- 1 Leaves compound.
 - 2 Leaves even-pinnate [*Pistacia*]
 - 2 Leaves odd-pinnate.
 - 3 Fruits both red and glabrous *Schinus*
 - 3 Fruits not simultaneously red and glabrous.
 - 4 Fruits red, glandular pubescent; foliage and stems lacking contact poisons; inflorescences dense, either terminal or lateral on last year's growth; sepal margins ciliate *Rhus*
 - 4 Fruits white or yellow, glabrous or puberulent (the hairs not glandular); foliage and stems containing contact poisons; inflorescences openly branched, axillary; sepal margins entire *Toxicodendron*

Analytical Identification

Written Comparison

Flora of North America

Search

family subfamily Malvaceae Malvaceae subfam. Malvoideae genus species Sida Sida spinosa

Sida spinosa Linnaeus Paul A. Fryxell†, Steven R. Hill

Sp. Pl. 2: 683. 1753.

Common names: False or Indian or prickly mallow, prickly sida.

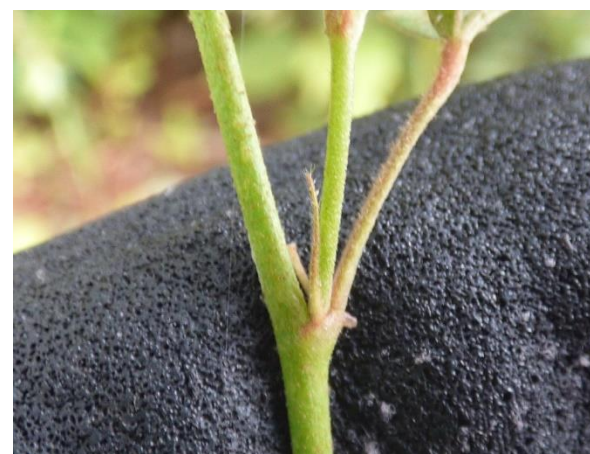
Synonyms: *Sida alba* Linnaeus, *S. alnifolia* Linnaeus, *S. angustifolia* Miller, *S. heterocarpa* Engelm.

Treatment appears in FNA Volume 6. Treatment on page 318. Mentioned on page 311.

Subshrubs or herbs, annual or perennial, 0.2–1 m, rarely taller. **Stems** erect, minutely stellate-hairy, hairs to 0.5 mm. **Leaves:** stipules free from petiole, 1-veined, subulate, 3–6 mm, 1/2 as long as petiole; petiole 5–15 mm, usually 1/4–1/2 length of blade, sometimes shorter, minutely stellate-hairy, hairs to 0.5 mm, usually with small spinelike tubercle on stem just below its attachment; blade ovate, lanceolate, or narrowly oblong, 2–6 cm, smaller apically, 2–5 times longer than wide, base subcordate, margins crenate-serrate to base, apex usually acute, surfaces stellate-tomentulose abaxially, glabrate adaxially.

Inflorescences axillary solitary or 2–4 clustered flowers. **Pedicels** 0.5–1 cm, subequal to calyx and subtending petiole. **Flowers:** calyx angulate, 5–7 mm, minutely tomentose, lobes triangular; petals yellow, rarely white, 5 mm; staminal column glabrous; style 5-branched. **Schizocarps** subconic, 4–5 mm diam., hairy; mericarps 5, 3–4 mm, somewhat rugose, apex spined, spines 1 mm, antrorsely hairy. **2n** = 14, 28.

Phenology: Flowering year-round in warmer areas, summer elsewhere.
Habitat: Roadsides, pastures, disturbed ground
Elevation: 0–1500 m



Ideal for verification

Analytical Identification Visual Comparison



86

Flowers bilateral; leaves simple, basal, toothed or lobed

Flowers bilateral; leaves deeply divided, alternate, segments entire



Viola primulifolia
VIOLACEAE | primrose-leaf violet

Mar–Jun, 2–10 in. Erect, creeping perennial of bogs, wet savannas, pocosins, and moist organic soils along small streams. Stemless; underground, horizontal rhizomes produce numerous stolons that terminate in crowns of leaves. Leaves petiolate, often with the tapering base of the blade continuing as petiole wings, elliptic-oblong to oval, 1/2–4 in. long, entire or shallowly toothed, smooth or hairy. Flowers solitary on slender, smooth stalks arising from leaf crown; each flower white with purple lines on lower petal(s), about 1/8 in. wide, with 5 unequal petals, the lowest with a backward-pointing spur. Fruit a green, narrowly oval capsule. JF



Baptisia albescens
FABACEAE | spiked wild indigo

May–Jul, 2–3 ft. Erect perennial of dry, open woodlands and woodland borders, pine flatwoods, and roadsides. Stems 1–several from a crown, stout, unbranched, blue-green to gray-purple and with a waxy coating, smooth. Leaves alternate, on petioles with small stipules at the base, divided into 3 elliptical leaflets with rounded tips, each 1/2–2 1/2 in. long. Flowers in 1–several long, erect, terminal spikes extending above foliage; each flower white or cream with yellow, less than 3/4 in. long, with typical pea-flower shape, including an erect banner petal. Fruit an erect, yellowish-brown and leathery, narrowly cylindrical seed pod. BAS



Galactia erecta
FABACEAE | erect milkpea

May–Jul, 8–16 in. Erect perennial of dry longleaf pinelands, especially where regularly burned. Stems slender, sparingly branched, sparsely hairy. Leaves few, alternate, long-petioled, divided into 3 narrow leaflets, each 1–2 in. long, smooth. Flowers in small clusters of 1–6 from leaf axils, white, turning red or maroon, about 1/2 in. long, with typical pea-flower shape. BAS



87

Flowers bilateral; leaves deeply divided, alternate, segments entire

Hyloidesmum glutinosum
(*Desmodium glutinosum*)
FABACEAE | clusterleaf tick-trefoil

Jun–Aug, 1–4 ft. Erect perennial of moist forests, especially nutrient-rich ones. Stems unbranched, sparsely to moderately hairy. Leaves alternate to almost whorled, long-petioled, divided into 3 broadly oval leaflets, the terminal one slightly larger at 2 1/2–5 1/2 in. long; leaflets green on both sides, often with stiff hairs above and soft-hairy beneath. Flowers in a terminal panicle above the leaves, white to purplish-rose, about 1/4 in. long, with typical pea-flower shape. Fruit a flattened pod divided into 1–4 U-shaped segments and covered with hooked hairs that suck to clothing and fur. AMC



Lespedeza angustifolia
FABACEAE | narrowleaf lespedeza

Aug–Oct, to 4 1/2 ft. Erect to ascending perennial of sandhill-pocosin ecotones, dry to moist savannas, and mountain bogs. Stems mostly unbranched, covered with thin, longitudinal lines and close-pressed hairs. Leaves on short petioles with linear stipules that soon drop, divided into 3 narrowly linear leaflets, each 1/2–1 1/2 in. long and often hairy. Flowers in dense cylindrical to spherical spikes (1/3–1 in. long), on stalks from upper leaf axils; each flower yellowish-white to cream, about 1/4 in. long, resembling pea-flower structure. Fruit a hairy, flattened, elliptical to oblong pod containing a single seed. BAS



Lespedeza capitata
FABACEAE | bush-clover

Aug–Oct, 1 1/2–5 ft. Erect perennial of woodlands and woodland borders, wet meadows, fens, prairies. Stems 1–several, stiff, smooth below, branched and covered with dense, close-pressed silvery hairs above. Leaves petiolate with needlelike stipules that soon drop, divided into 3 narrowly elliptical to oblong leaflets, each 3/4–1 1/4 in. long, blunt-tipped, usually silvery-hairy. Flowers in dense, nearly spherical racemes from upper leaf axis (the raceme stalks longer than leaves); each yellowish-white, less than 1/2 in. long, with typical pea-flower shape, the banner petal bearing a central purple spot. Fruit a hairy, flattened-elliptical pod with a short point and a single seed. BAS



Analytical Identification Visual Comparison



UNC Herbarium
<http://herbarium.unc.edu/>

NC State University Herbarium
<https://projects.ncsu.edu/cals/plantbiology/ncsc/>

Analytical Identification Visual Comparison

iNaturalist



- Submit photos for experts to ID
- Record your own observations
- Everyone should try it!
- Use as a tool, not a prosthesis.

The screenshot shows the iNaturalist website interface. At the top, there is a search bar and navigation links for Explore, Your Observations, Community, Identify, and More. A user profile for 'jmattjones9' is visible, with tabs for Home, Profile, Observations, Edit Observations, Calendar, IDs, Lists, Journal, Favorites, and Projects. Below the profile, there are tabs for All Updates, Your Content, Following, and Real Time Discussions. A green banner reads 'Let's Get Started by Posting Some Observations' and includes a tip: 'Need inspiration? Here's some organisms being observed nearby...' with four example photos: Mallard, Song Sparrow, Harris's Sparrow, and Savannah Sparrow. A text box below the photos says: 'Get outside, and observe an individual organism. Pick something wild and take a clear, full frame photo. If you already have a photo of something wild, add it now. You can also use the iNaturalist mobile apps to record observations.' To the right, there is a forum section with several posts, including 'How to access old "batch edit" options etc', 'Include lexicon in API Taxa all_names search', 'Most unexpected iNaturalist experience', 'Bookmarks in Profile and Under Bookmarks Tab Mismatch', 'Help with understanding Entomological terms', and 'Should the FAQ section be updated with relevant questions from the forum?'. At the bottom right, there is a 'Subscriptions' section with a gear icon.

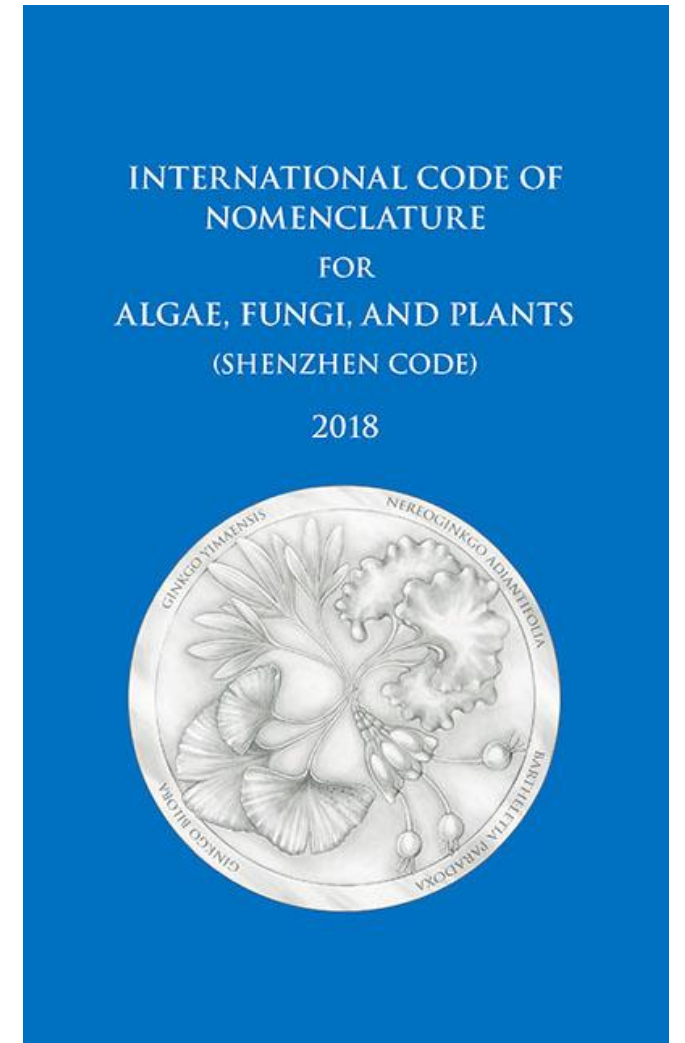
inaturalist.org

Scientific Names

- Latin or Latinized
- Binomial Nomenclature
- Italicized or Underlined
- Governed by scientific organizations
- Priority given to first valid published name

Common Names

- Vary greatly
- Synonyms
- Many lack common names



Scientific Names

Italicized or Underlined

Capitalized lowercase

Betula lenta Linnaeus *var. lenta*

Genus Specific Epithet Authorship

Variety
(or other lower rank)

Species Name

Classification

Arranging Taxa into Groups

Major Taxonomic Ranks

Taxa

Kingdom

Plantae

Phylum (“Division” also acceptable)

Magnoliophyta

Class

Liliopsida (Monocots)

Order

Arecales

Family

Arecaceae

Genus (plural: genera)

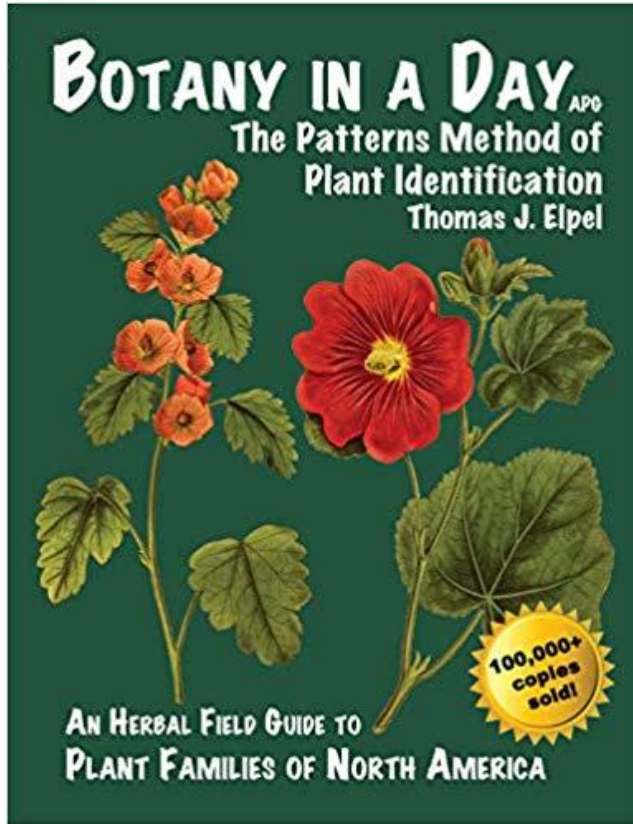
Cocos

Species (plural: species)

Cocos nucifera

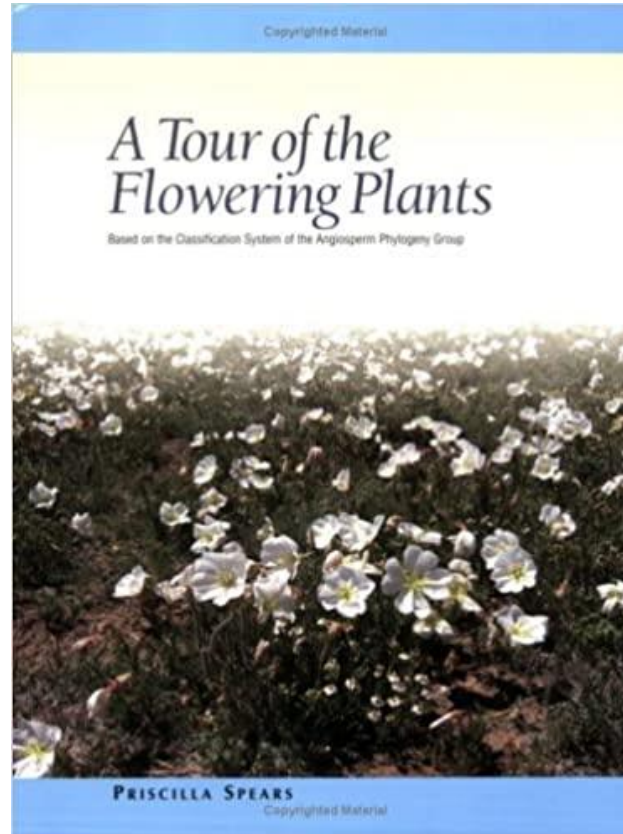
FAMILY important rank for starting analytical identification

Learning Major Plant Families



Botany in a Day
HOPS Press

http://www.hopspress.com/Books/Botany_in_a_Day.htm



A Tour of the Flowering Plants
MBG Press

<https://www.mbgpress.org/product-p/tour-of-flowering-plants.htm>

Field identification of
the 50 most common
plant families
in temperate regions

(including agricultural,
horticultural, and wild species)

by Lena Struwe

struwe@aesop.rutgers.edu

© 2009, All rights reserved.

RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY

Note: Listed characteristics are the most common characteristics, there might be exceptions in rare species. This compendium is available for download without cost at http://www.sci.sdsu.edu/plants/plantsystematics/studentresources/Struwe_50MajorTempPlantFamilies2016.pdf. Please send corrections and additions to the author.

Field ID of 50 Most Common...
Rutgers Univ. Extension - **Free Online**

http://www.sci.sdsu.edu/plants/plantsystematics/studentresources/Struwe_50MajorTempPlantFamilies2016.pdf

Phyletic

- Grouping by morphological similarity
- 18th c. – 1960s

Phenetic (Numerical Taxonomy)

- Huge numbers of characters
- Attempt at subjectivity
- 1960s-1980s

Cladistic (Phylogenetic)

- Comparing derived & ancestral character states
- Evolution of taxa
- Genetic and other data
- Complex tree constructing methods

American Journal of Botany 88(2): 348–361. 2001.

DISINTEGRATION OF THE SCROPHULARIACEAE¹

RICHARD G. OLMSTEAD,^{2,3} CLAUDE W. DEPAMPHILIS,⁴
ANDREA D. WOLFE,⁵ NELSON D. YOUNG,⁶ WAYNE J. ELISONS,⁷ AND
PATRICK A. REEVES³

¹Department of Botany, Box 355325, University of Washington, Seattle, Washington 98195 USA; ²Department of Biology, Life Sciences Consortium, and Institute of Molecular Evolutionary Genetics, Pennsylvania State University, 208 Mueller Lab, University Park, Pennsylvania 16802 USA; ³Department of Evolution, Ecology, and Organismal Biology, Ohio State University, 1735 Neil Avenue, Columbus, Ohio 43210 USA; ⁴Department of Biology, Trinity University, 715 Stadium Drive, San Antonio, Texas 78212 USA; and ⁵Department of Botany and Microbiology, University of Oklahoma, 770 Van Vleet Oval, Norman, Oklahoma 73019-6131 USA

A molecular systematic study of Scrophulariaceae sensu lato using DNA sequences of three plastid genes (*rbcL*, *ndhF*, and *rps2*) revealed at least five distinct monophyletic groups. Thirty-nine genera representing 24 tribes of the Scrophulariaceae s.l. (sensu lato) were analyzed along with representatives of 15 other families of Lamiales. The Scrophulariaceae s.s. (sensu stricto) include part or all of tribes Aptosimeae, Hemimerideae, Leucophylleae, Mamuleae, Selagineae, and Verbasceae (= Scrophularieae) and the conventional families Buddlejaceae and Myoporaceae. Veronicaceae includes all or part of tribes Angelonieae, Antirrhineae, Cheloneae, Digitaleae, and Gratioleae and the conventional families Callitrichaceae, Globulariaceae, Hippuridaceae, and Plantaginaceae. The Orobanchaceae include tribes Buchnereae, Rhinanthaeae, and the conventional Orobanchaceae. All sampled members of Orobanchaceae are parasitic, except *Lindenbergia*, which is sister to the rest of the family. Family Calceolariaceae Olmstead is newly erected herein to recognize the phylogenetic distinctiveness of tribe Calceolariae. The Calceolariaceae are close to the base of the Lamiales. The Stilbaceae are expanded by the inclusion of *Halleria*. *Mimulus* does not belong in any of these five groups.

Key words: Calceolariaceae; Lamiales; *ndhF*; Orobanchaceae; *rbcL*; *rps2*; Scrophulariaceae; Stilbaceae; Veronicaceae.