**Updates required to *Plant Systematics: A Phylogenetic Approach*, 4th edition, as a result of recent publications.** [Updated 20 May 2022]

As necessitated by recent publications, updates to the Fourth Edition of our textbook will be provided in this document. It is hoped that this list will facilitate the efficient incorporation of new systematic information into systematic courses in which our textbook is used. Plant systematics is a dynamic field, and new information on phylogenetic relationships and species circumscriptions are constantly being published. Thus, it is not surprising that even introductory texts require constant modification in order to stay current.

The updates are organized by chapter and page number. Some require only minor changes, as indicated below, while others will require more extensive modifications of the wording in the text or figures, and in such cases, we have presented here only a summary of the major changes needed. The eventual Fifth Edition will, of course, contain organizational changes not treated in this document.

Finally, at the end of this document are treatments for 14 families which will be added to an eventual Fifth Edition, i.e., Ochnaceae, Linaceae, Plumbaginaceae, Grossulariaceae, Pentaphylacaceae, Cunoniaceae, Symplocaceae, Styracaceae, Haloragaceae, Loganiaceae, Buxaceae, Pandanaceae, Santalaceae, and Monimiaceae.

**Cover pages (list of families):** Adoxaceae…….534 🡪 Viburnaceae……..534 [Also add the following 14 families, newly added to the textbook: Buxaceae, Cunoniaceae, Grossulariaceae, Haloragaceae, Linaceae, Loganiaceae, Monimiaceae, Ochnaceae, Pandanaceae, Pentaphylacaceae, Plumbaginaceae, Santalaceae, Styracaceae, and Symplocaceae. See treatments of these families at the end of this document. In addition comparable treatments of an additional 110 families will be added to the “Photo Gallery” website.]

**Acknowledgments**

Page xvi: add Peter Fritsch and Michael Moody to list of those thanked.

**Chapter 1.**

Page 10, Figure 1.9. Delete “*A. kilma*” and the line leading to it. This change will revert this figure to its form in the 3rd edition. This is based on the conclusions of Cron et al. (2016) that the recently described (and supposed diploid) *Adansonia kilma* is a synonym of *A. digitata* (and actually a tetraploid, as is *A. digitata*)! Also delete citation of Pettigrew et al. (2012) from figure caption.

Cron, G. V., N. Karimi, K. L. Glennon, C. A. Udeh, E. T. F. Witkowski, S. M. Venter, A. E. Assogbadjo, & D. A. Baum. 2016. One African baobab species or two? Synonymy of *Adansonia kilima* and *A*. *digitata*. *Taxon* 65: 1037-1049.

**Chapter 2.**

Page 39, column 1, line 12: …include *S. densum* and *S. leimanthoides*. 🡪 …include *S. densum, S, macrum, S. leimanthoides*, and *S. tennesseense*.

Page 39, column 1, line 13: four species 🡪 six species

Sorrie, B. A. and A. S. Weakley. 2017. *Stenanthium leimanthoides* and *S. densum* (Melanthiaceae) revisited, with the description of two new species. J. Bot. Res. Inst. Texas 11: 275-286.

**Chapter 4.**

Page 65, line 6 under Morphology: …beginnings of plant systematics. 🡪 …beginnings of plant systemataics (see Linnaeus’ *Philosophia Botanica*; translated by Freer 2001).

Freer, S. 2001. *Linnaeus’ Philosophia botanica*. Oxford University Press, Great Britain.

Page 73, column 2, add paragraph at end of section on Leaves, right before Floral Morphology:

**Aerial dispersal units** Vegetative structures, i.e., stems, buds, and leaves, are occasionally modified, forming specialized, asexial dispersal units, allowing the plant to complement (or even replace) sexual reproduction (Zona and Howard 2022). These units may be **plantlets** (small plants, attached to the parent), **bulbils** (small, aerial bulbs), **cormlets** (small, aerial corms, with scale leaves and an obvious axis of growth), **tubers** (small to large, aerial tubers, with axis or axes of growth difficult to determine), or **gemmae** (tiny, undifferentiated dispersal units). These may be borne on the stems (at the nodes), leaves, or inflorescences. Such structures are especially common in monocots, Begoniaceae, Crassulaceae, and Saxifragaceae. Vegetative reproduction and dispersal may also occur by fragmentation of the plant body.

Zona, S. and C. C. Howard. 2022. Aerial vegetative diasporrers of angiosperms: terminology, organography, and dispersal. *Flora* 287: doi.org/10.1016/j.flora.2021.151989.

Page 110, column 2, line 11: add Séguin 2021 to list of general chemistry references

Page 114: add to references under Morphology, the paper on nectaries (Erbar 2014).

Erbar, C. 2014. Nectar secretion and nectaries in basal angiosperms, magnoliids and non-core eudicots and a comparision with core eudicots. *Plant Divers. Evol*. 131/2: 63-143.

Séguin, M. 2021. The chemistry of plants: Perfumes, Pigments and Poisons, 2nd ed. Royal Society of Chemistry, U.K.

**Chapter 5.**

Add to references:

Cushman, K. R., M. B. Burgess, E. T. Doucette, G. A. Nelson, & C. S. Campbell. 2017. Species delimitation in tetraploid, apomictic *Amelanchier* (Rosaceae). *Syst. Bot*. 42: 234-256.

**Chapter 7.**

Page 196, column 2: Recent publications (Field et al., 2016; Burnard et al. 2016) provide information regarding phylogeny and generic limits in the Lycopodiaceae. Five genera seem reasonable: *Lycopodium*, *Lycopodiellia*, and the species lacking strobili can be divided into three genera – *Phlegmariurus* (epiphytic, lacking bulbils), *Huperzia* (terrestrial, with bulbils), and *Phylloglossum* (phenetically distinctive, reduced, with fertile shoot on leafless peduncle). *Phlegmariurus* has two major subclades, one in the Neotropics and the other in the Paleotropics.

Page 193: Update classification where necessary in order to agree with family limits as recognized in the classification of the Pteridophyte Phylogeny Group.

Page 195, Table 7.1: non-included families to be added to the list for Polypodiales include: Cystodiaceae, Desmophlebiaceae, Didymochlaenaceae, Hypodematiaceae, Lonchitidaceae, and Nephrolepidaceae.

Page 196, Lycopodiaceae. Update based on Chen et al. 2022: Taxon 71: 25-51.

Page 197: Update discussion of Selaginellaceae, citing Weststrand and Korall (2016a, b).

Page 198, column 1, add to references: Zhou and Zhang 2015. [And perhaps useful to note that subg. *Selaginella* is sister to remaining taxa.]

Page 200, column 2, Genera/species: 15 🡪 18

Page 201, column 1, line 19 in **Discussion**: New analysis by Christenhusz et al. (2019) indicates that *E*. *bogotense* is sister to the rest, and is placed in its own subgenus (add reference and modify wording here).

Page 202, column 1, Genera/species: 4/70-90 🡪 10/110. And under Major genera: *Botrychium* (45-60) 🡪 *Botrychium* (35); and *Ophioglossum* (25-30) 🡪 *Ophioglossum* (40)

Page 202, column 1, Figure 7.7: *Botrychium virginianum* 🡪 *Botrypus viriginianus*

Page 204, Plate 7.1: *Pleopeltis polypodioides* 🡪 *Pleopeltis michauxiana*

Page 205, column 2, Genera/species: 4/17-18 🡪 6/18.

Page 205, column 2, Genera: *Osmunda* (8-9 spp.) 🡪 *Osmunda* (4 spp.); also add to list of genera – *Plenasium* (4) and *Claytosmunda* (1).

Page 207, column 2, Genera/species: About 5/500. 🡪 3/640.

Page 207, column 2, Major genera: *Alsophila* (210 spp.) 🡪 *Alsophila* (275 spp.); and *Sphaeropteris* (120) 🡪 *Sphaeropteris* (100); and *Cyathia* (110) 🡪 *Cyathia* (265)

Page 208, column 1, line 1: about 20 families, 174 genera 🡪 26 families, about 250 genera [Also, would be useful to add a cladogram figure, showing relationships among major families of this order.]

Page 208, column 1, line 2: 7000-8500 species; 🡪 about 8700 species;

Page 208, column 2, line 1 – to list of non-covered families add: Didymochlaenaceae, Hypodematiaceae, Nephrolepidaceae, Cystodiaceae, Desmophlebiaceae, and Lonchitidaceae

Page 209, column 1, Genera/species: 11/170 🡪 10/265

Page 209, column 1, Major genera: *Dennstaedtia* (45 spp.) 🡪 *Dennstaedtia* (70); and add *Hypolepis* (80) and *Microlepia* (60).

Page 210, column 1, Genera/species (for Pteridaceae): ca. 50/950 🡪 53/1200

Page 210, column 1, Major genera: *Pteris* (200 spp.) 🡪 *Pteris* (250 spp.); and *Adiantum* (150) 🡪 *Adiantum* (225); and *Cheilanthes* (150) 🡪 *Cheilanthes* (100); and add the additional genera – *Jamesonia* (50), *Pityrogramma* (20), and *Pellaea* (40)

Page 210, column 1, line 12 in Discussion: could be recognized 🡪 are often recognized

Page 210, column 1, Additional references: add Schuettpelz et al. 2016

Page 210, column 1, Eupolyploids I: change to Polypodiineae (Eupolyploids I)

Page 210, column 1, line 4 under Eupolyploids I: six to eight 🡪 nine

Page 210, column 1, Genera/species (for Dryopteridaceae): 40-45/1700 🡪 26/2115

Page 210, column 1, Major genera: *Elaphoglossum* (500 spp.) 🡪 *Elaphoglossum* (600 spp.); and *Polystichum* (260) 🡪 *Polystichum* (500); and *Dryopteris* (225) 🡪 *Dryopteris* (400); and add the genera – *Megalastrum* (90), *Bolbitis* (80), and *Cyrtomium* (35)

Page 210, column 2, line 3: 260 🡪 500

Page 210, column 2, line 8: Add sentence: Three subfamilies are often recognized.

Page 211, column 1, Genera/species: ca. 56/1200 🡪 65/1650

Page 211, column 1, Major genera: *Grammitis* (400 spp.) 🡪 *Grammitis* (400 spp., but genus now often divided into several segregates, but additional study needed)

Page 211, column 1, Major genera: *Polypodium* (150) 🡪 *Polypodium* (50); and *Pleopeltis* (50) 🡪 *Pleopeltis* (90); and add the additional genera – *Pyrrosia* (50), *Aglaomorpha* (50)

Page 211, column 1, line 7 in **Discussion**: Within Polypodiaceae, 8 subfamilies are now recognized. Cite Wei & Zhang (2022)

Page 211, column 1, line 17: *Pleopeltis polypodioides* 🡪 *Pleopeltis michauxiana*

Page 211, column 2, Eupolyploids II: change to Aspleniineae (Eupolyploids II)

Page 211, column 2, line 5: one to ten families 🡪 one to eleven families [The additional family, Desmophlebiaceae will not be covered in the text.]

Page 212, column 2, Genera/species: 1-10/700 🡪 2/730

Page 212, column 2, Major genera: Major genera: *Asplenium* (700 spp.) 🡪 Genera: *Asplenium* (700 spp.), *Hymenasplenium* (30).

Page 213, column 1, Genera/species: 5-30/950 🡪 5-37/1030

Page 213, column 1, Major genera: *Thelypteris* (280) 🡪 *Thelypteris* (280, but perhaps as few as 50 if genus broken up; more study needed)

Page 213, column 1: Update phylogeny of Thelypteridaceae, and cite Fawcett et al. 2021.

Page 213, column 2: Update phylogeny of Woodsiaceae, and cite Lu et al. 2019.

Page 213, column 2, line 1: two genera 🡪 three genera

Page 213, column 2, line 2: with three species 🡪 with four species

Page 213, column 2, Genera/species: 1/35 🡪 1/39 [and change number of species of *Woodsia* to 39]

Page 214, column 2, Genera/species: 5/600 🡪 3/650

Page 214, column 2, Major genera (change to Genera: *Athyrium* (220 spp.) 🡪 *Athyrium* (230 spp.); and *Diplazium* (300-400) 🡪 *Diplazium* (350)

Page 215, column 1, line 3: to Additional references add: Kuo et al. 2018.

Page 215, column 1, Distribution and ecology: Replace the current paragraph with the following: Widespread from northern temperate to tropical and southern temperate regions. *Austroblechnum*, *Cranfillia*, *Diploblechnum*, *Doodia*, *Lomaria,* and *Oceaniopteris* are diverse in the southern hemisphere, while *Blechnum*, *Lomaridium,* *Lomariocycas, Parablechnum,* and *Telmatoblechnum* are mainly tropical. *Sadleria* is endemic to Hawaii. These genera grow mostly in wet forests, forest borders, swamps, thickets, and disturbed sites. *Anchistea*, *Lorinseria*, and *Woodwardia* are mainly north temperate, occurring in forests, along streams, swamps, and moist meadows, especially in mountainous regions.

Page 215, column 1, Figure 7.20: *Woodwardia areolata* 🡪 *Lorinseria areolata*

Page 215, column 2, line 3: ca. 9/200. 🡪 24/265.

Page 215, column 2, Major genera: *Blechnum* (175 spp.) 🡪 *Blechnum* (30 spp.); and add the genera – *Austroblechnum* (40), *Doodia* (20), *Lomaridium* (16), *Lomariocycas* (20), *Parablechnum* (65); add Vicent et al. 2017, Gasper et al. 2016, and Moran et al. 2018 to list of references.

Page 215, column 2, Discussion (of Blechnaceae): Replace the current paragraph with the following: The occurrence of the sori in chains or parallel rows and the nature of the indusia are distinctive features of the family. Their young leaves are often reddish (due to anthocyanins). Blechnaceae are sister to the Onocleaceae. Within Blechnaceae, the three major clades are often treated as subfamilies: Woodwardioideae contain the genera *Anchistea*, *Lorinseria*, and *Woodwardia*; Stenochlaenoideae also comprise three genera (*Salpichlaena*, *Stenochlaena*, *Telmatoblechnum*), while the remaining 18 genera (mainly segregates of *Blechnum* s.l.) belong to the Blechnoideae (Gasper et al. 2016).

Page 216: Gymnosperms. Update treatment and cite: Stull et al. 2021. Gene duplication and phylogenomic conflict underlie major pulses of phenotypic evolution in gymnosperms. *Nature Plants* 7: 1015-1025.

Page 220: Update position of *Stangeria*, to be within the *Ceratozamia* + *Zamia* + *Microcycas* clade (and cite Coiro et al. 2020). This has both morphological and molecular support.

Page 227, column 2, line 14 from bottom: *Juniperus* is sister 🡪 *Juniperus* probably is sister…

Page 227, column 2, line 11 from bottom: to *Callitropsis*. 🡪 to *Callitropsis* (or sometimes *Hesperocyparis*).

Page 228, column 1, Additional references: add Terry et al. 2018 and Qu et al. 2017.

Page 229, column 2, **Taxaceae**: Update treatment by inclusion of *Cephalotaxus* (formerly Cephalotaxaceae).

**New References for Chapter 7:**

Burnard, D., L. Shapherd, L. Perrie, and A. Munkaesi. 2016. Phylogenetic relationships in New Zealand Lycopodiaceae. *Plant Syst. Evol*. 302: 661-667.

Chen, D.-K., X.-M. Zhou, C. J. Rothfels, L. D. Shepherd, R. Knapp, L. Zhang, N. T. Lu, X.-P. Fan, X. Wan, X.-F. Gao, H. He, and L.-V. Zhang. 2022. A global phylogeny of Lycopodiaceae (Lycopodiales: lycophytes) with the description of a new genus, *Brownseya*, from Oceania. *Taxon* 71: 25-51.

Christenhusz, M. J. M., L. Bangiolo, M. W. Chase, M. F. Fay, C. Husby, M. Witkus, and J. Viruel. 2019. Phylogenetics, classification and typification of extant horsetails (*Equisetum*, Equisetaceae). *Bot*. *J. Linn. Soc*. 189: 311-352.

Coiro, N., N. Jelmini, H. Neuenschwander, M. A. Calonje, A. P. Vocides, J. E. Mickle, and M. Rosaria Barone Lumaga. Evolutionary signal of leaflet anatomy in the Zamiaceae. *Int. J. Plant Sci*. 181: 697-715.

Fawcett, S., A. R. Smith, M. Sundue, J. G. Burleigh, E. B. Sessa, L.-Y. Kuo, C.-W. Chen, W. L. Testo, M. Kessler, GoFlag Consortium, and D. S. Barrington. 2021. A global phylogenomic study of the Thelypteridaceae. *Syst. Bot*. 46: 891-915.

Field, A. R., W. Testo, P. D. Bostock, J. A. Holtum, and M. Waycott. 2016. Molecular phylogenetics and the morphology of the Lycopodiaceae subfamily Huperzioideae supports three genera: *Huperzia*, *Phlegmariurus* and *Phylloglossum*. *Mol. Phylog. Evol*. 94: 635-657.

Gasper, A. L. de, T. E. Almeida, V. A. de O. Dittrich, A. R. Smith, and A. Salino. 2016. Molecular phylogeny of the fern family Blechnaceae (Polypodiales) with a revised genus-level treatment. *Cladistics* doi: 10.1111/cla.12173.

Herting, J., T. Stützel, and K. V. Klaus. 2020. The ancestral conifer cone: What did it look like? A modern trait-evolution approach. *Int. J. Plant Sci*. 181: 871-886. [This should be cited; update discussion of cone synapomorphies.]

Kuo, L.-Y., A. Ebihara, T.-C. Hsu, G. Rouhan, Y.-M. Huang, C.-N. Wang, W.-L. Chiou, and M. Kato. 2018. Infrageneric Revision of the fern genus *Deparia* (Athyriaceae, Aspleniineae, Polypodiales). *Syst. Bot*. 43: 545-655.

Lu, N. T., X.-M. Zhou, L. Zhang, R. Knapp, C.-X. Li, X.-P. Fan, L. Zhou, H.-J. Wei, J.-M. Lu, B. Xu, Y.-L. Peng, X.-F. Gao, and L. B. Zhang. 2019. A global plastid phylogeny of the cliff fern family Woodsiaceae and a two-genus classification of Woodsiaceae with the description of x*Woodsimatium* nothogen. nov. *Taxon* 68: 1149-1172.

Moran, R. C., J. G. Hanks, & P. H. Labiak. 2018. Evolution of spore morphology in the Blechnaceae. Int. J. Plant Sci. 179: 712-729.

Mynssen, C. M., A. Vasco, R. C. Moran, L. S. Sylvestre, and G. Rouhan. 2016. Desmophlebiaceae and Desmophlebium: A new family and genus of Eupolypod II ferns. *Taxon* 65: 19-34.

Perrie, L. R., L. D. Shepherd, and P. J. Brownsey. 2015. An expanded phylogeny of the Dennstaedtiaceae ferns: *Oenotrichia* falls within a non-monophyletic *Dennstaedtia*, and *Saccoloma* is polyphyletic. *Aust. J.* *Bot*. 28: 256-264. [Cite under Dennstaedtiaceae]

Pteridophyte Phylogeny Group. 2016. A community-derived classification for extant lycophytes and ferns. *J. Syst. Evol*. 54: 563-603.

Qu, X.-J., J.-J. Jin, S.-M. Chaw, S.-Z. Li, and T.-S. Yi. 2017. Multiple measures could alleviate long- branch attraction in phylogenomic reconstruction of Cupressoideae (Cupressaceae). Sci. Rep. 7.41005. doi.org/10.1038/srep41005.

Schuettpelz, E., C.-W. Chen, M. Kessler, J. B. Pinson, G. Johnson, A. Davila, A. T. Cochran, L. Huiet and K. M. Pryer. 2016. A revised generic classification of vittarioid ferns (Pteridaceae) based on molecular, micromorphological, and geographic data. *Taxon* 65: 708-722. [Cite under Pteridaceae]

Terry, R.G., A.E. Schwarzbach, and J.A. Bertel. 2018. A molecular phylogeny of Old World cypresses (*Cupressus*: Cuprressaceae): Evidence from nuclear and chloroplast DNA sequences*. Pl. Syst. Evol.* 304: 1181-1197.

Vicent, M., J. M. Gabriel y Galán, and E. B. Sessa. 2017. Phylogenetics and historical biogeography of *Lomaridium* (Blechnaceae: Polypodiopsida). *Taxon* 66: 1304-1316.

Wei, R. and X.-C. Zhang. 2022. A revised subfamilial classification of Polypodiaceae based on plastome, nuclear ribosomal, and morphological evidence. Taxon 71: 288-306.

Weststrand, S. and P. Korall. 2016a. Phylogeny of Selaginellaceae: There is value in morphology after all! *Amer. J. Bot*. 103: 2136-2159.

Weststrand, S. and P. Korall. 2016b. A subgeneric classification of *Selaginella*. *Amer. J. Bot*. 103: 2160-2169.

Zhang, L., C. J. Rothfels, A. Ebihara, E. Schuettpelz, T. Le Péchon, P. Kamaw, H. He, X.-M. Zhou, J. Prado, A. Field, G. Yatskievych, X.-F. Gao, and L.-B. Zhang. 2015. A global plastid phylogeny of the brake fern genus *Pteris* (Pteridaceae) and related genera of the Pteridoideae. *Cladistics* 31: 406-423. [Cite under Pteridaceae]

Zhou, X.-M and L.-B. Zhang. 2015. A classification of *Selaginella* (Selaginellaceae) based on molecular (chloroplast and nuclear), macromorphological and spore features. *Taxon* 64: 1117-1140.

**Chapter 8.**

Page 237, lines 24 and 31: add Chen et al. 2016 and Gitzendanner et al. 2018 to references supporting monophyly of monocots and monophyly of eudicots

Page 238, column 1, last line: add Chen et al. 2016 and Li et al. 2019 and Gitzendanner et al. 2018 to references cited

Page 238, column 2, line 11: add citation of APG 2016

Page 238, Figure 8.1: add reference to Chen et al. 2016 and Gitzendanner et al. 2018 and Li et al. 2021 and Baker et al. 2022 to references

Page 239, Figure 8.2: (APG 1998, 2003, 2009) 🡪 (APG 1998, 2003, 2009, 2016) Also add Gitzendanner et al. 2018 anad Li et al. 2021 to cited references [And other minor updates throughout chapter based on publication of APG IV 2016.]

Page 239, column 1, line 8 from bottom: …and Doyle 2009). 🡪 …and Doyle 2009, 2015).

Page 239, column 2, line 8: [insert sentence] Their fine roots typically are thicker than those of eudicots (Valverde-Barrantes et al. 2016).

Page 240, Figure 8.3: Add APG 2016.

Page 241, Figure 8.4: Add APG 2016; Gitzendanner et al. 2018; Stull et al. 2020; Zhang et al. 2020.

Page 241: Move Aquifoliales to Lamiids, as a line parallel to the line going to Garryales. Also change base of cladogram so relationships among Cornales, Ericales, and Gentianidae are a trichotomy. Also add in line to Icacinales, sister to the Solanales + Gentianales + Lamialaes clade. Add in Bruniales as clade sister to Apiales + Dipsacales + Asterales.

Page 241, column 2, line 5: (1998, 2002, 2009) 🡪 (1998, 2002, 2009, 2016)

Page 241, column 2, line 7: Soltis et al. (2005) 🡪 Soltis et al. (2005, 2018) [Also make this change elsewhere where cited]

Page 241, column 2, line 11: 257,400 🡪 295,400

Page 241, column 2, line 12: (Thorne 1992, 2001) 🡪 (Christenhusz and Byng 2016; Thorne 1992, 2001)

Page 241, column 2, line 18: (2009) 413. 🡪 (2016) 416.

Page 243, Table 8.1, **Adoxaceae** 🡪 **Viburnaceae**

Pages 242-243, Table 8.1: in the 5th edition family treatments will be included for **Buxaceae**, **Cunoniaceae**, **Grossulariaceae**, **Haloragaceae**, **Linaceae**, **Loganiaceae**, **Monimiaceae**, **Ochnaceae**, **Pandanaceae**, **Pentaphylacaceae**, **Plumbaginaceae, Santalaceae, Styracaceae,** and **Symplocaceae**. Also add the following families (merely mentioned in text) so not bold: Atherospermataceae, Dichapetalaceae, Moringaceae, Bataceae, Themidaceae, Elaeocarpaceae, Staphyleaceae, Tamaracaceae, and Frankeniaceae. In addition, figures (line-art) will be included for Casuarinaceae (*Casuarina*), Hydrocharitaceae (*Limnobium*), and *Ribes* (Grossulariaceae). A color plate for Zingiberales will be included, and some of the other color plates expanded. The above listed families in Table 8.1 need to be in **bold** type.

Page 244, column 1, line 17: … 2009) 🡪 … 2009, 2016).

Page 244, column 1, line 18: add sentence – Ordinal descriptions (indicating putative shared derived characters) can be found in Soltis et al. (2018).

Page 244, column 2, line 15 in **Discussion**: Add Simmons 2016, Gitzendanner et al. 2018 and Li et al. 2019 to references.

Page 244, column 2, line 21 in **Discussion**: Add Goremykin et al. 2015 to references.

Page 244, column 2, line 26: insert the following new paragraph: Strangely, the mitochondria of *Amborella* have incorporated genes from a wide variety of other plant lineages (i.e., green algae, mosses and other angiosperms, such as Euphorbiaceae, Fagales, Oxalidales, Poaceae, and Santalales) through lateral gene transfer mediated by mitochondrial fusion (Rice et al. 2013).

Page 244, column 2, Additional references: add Gottsberger 2016

Page 245, column 1, line 11: Soltis et al. 2005, 2011, 🡪 Soltis et al. 2005, 2011, 2018

Page 245, column 1, line 10: add Li et al. 2019 to references

Page 246, column 1, line 23 in description: *placentation parietal (the ovules scattered on the partitions)* 🡪 **placentation parietal (the ovules scattered on the partitions)**

Page 246, column 2, line 8 in **Discussion**: … Taylor 2008). 🡪 … Taylor 2008), although its placement is unclear in analyses of Gruenstaendl et al. (2017).

Page 248, column 1, line 10 in description: *petaloid*. 🡪 *petaloid*, **each with a single vascular bundle.**

Page 250, column 1, line 8: Soltis et al. 2011 🡪 Soltis et al. 2011, 2018 [also add Li et al. 2019 and Massoni et al. 2014 and Li et al. 2021 to references]

Page 253, column 1, line 1: Chloroplast genes 🡪 Chloroplast and nuclear genes

Page 253, column 1, line 2: add Veltjen et al. (2022) to references supporting two clades within family

Page 253, column 2, line 4: *of berries*, 🡪 *of* **stalked** *berries*,

Page 253, column 2, line 12: 2300 🡪 2400

Page 253, column 2, line 12-13: *Guatteria* (250 spp.) 🡪 *Guattera* (180 spp.); *Xylopia* (150) 🡪 *Xylopia* (175); *Uvaria* (110) 🡪 *Uvaria* (200) [and move this genus to first in the list]

Page 254, column 2, line 1: Pirie et al. (2012)… 🡪 Pirie et al. (2012) and Guo et al. (2017)…

Page 254, column 2, line 8: to examples, add *Guatteria*

Page 254, column 2, line 9: … inaperaturate pollen. 🡪 … inaperaturate pollen (see also Xue et al. 2018).

Page 255, **Additional references**: add Chatrou et al. 2018

Page 255, column 1, line 6 from bottom: 17/370 🡪 20/475; also line 7: *Myristica* (70) 🡪 (175)

Page 256, column 1, line 16: In list of genera replace *Nectandra* with *Damburneya*.

Page 256-257, **Discussion** for Lauraceae: Delete information starting with “Lauraceae belong to the large order Laurales…” and ending at “… support a closer relationship with Monimiaceae.” This information is reworded and forms the new introduction to Laurales, which in the fifth edition will have two families receiving full coverage: Lauraceae and Monimiaceae.

The **Discussion** for Lauraceae will start with: Lauraceae clearly are monophyletic (see description, and Renner and Chanderbali 2000). 🡪 Lauraceae clearly are monophyletic (see description, and Chanderbali et al. 2001; Massoni et al. 2014; Renner 1999; Renner and Chanderbali 2000; Rohwer 2000; Song et al. 2020).

Page 257, column 1, lines 30-37: Delete paragraph – Chloranthaceae have sometimes … to magnoliids.

Page 257, column 1, lines 14-12 from bottom: reword last sentence of paragraph as follows: Rohwer and Rudolf (2005) and Li et al. (2016) suggest that *Hyphodaphnis*, the *Cryptocarya* group, *Caryodaphnopsis*, and *Cassytha* are successively sister to the rest of the family…

Page 257, column 2, line 7: add to references cited, the following: Trofimov et al. 2016 and Rohde et al. 2017.

Page 257, column 2, line 17: add to references – Trofimov et al. 2016 and Rohde et al. 2017 and Penagos Zuluaga et al. 2021. Also add to end of sentence: … and genera such as *Damburneya* and *Aiouea* are now recognized, but problems of non-monophyly (e.g., in *Ocotea*, *Licaria*) remain.

Page 258, column 1, line 25: 5/90 🡪 6/105

Page 258, column 1, line 7 from bottom: add Soltis et al. 2018

Page 258, column 2, lines 12-16: …stigma. *Tasmannia* may be sister to the above-mentioned genera, a hypothesis supported by ribosomal DNA sequences and by its low chromosome number. Finally, *Takhtajania* likely is sister to all other members of the family. 🡪 … stigma, and is likely sister to *Zygogynum* and relatives, as well as *Pseudowintera*. *Tasmannia* may be sister to the above-mentioned genera, a hypothesis supported by DNA sequences and by its low chromosome number. Finally, *Takhtajania* likely is sister to all other members of the family (Marquínez et al. 2009).

Page 258, column 2, line 8 under Piperales: add Soltis et al. 2018 and Li et al. 2019 and Massoni et al. 2014

Page 259, column 1, line 4 in description: **scattered**; *with spherical* 🡪 **scattered**, and with mucilage canals; *with spherical*

Page 259, column 2, line 7: **Fruit usually a drupe**; 🡪 **Fruit fleshy, usually a drupe**;

Page 259, column 2, line 1 in **Discussion**: In addition to Tucker et al. 1993, add the following references to monophyly of Piperaceae: Jaramillo et al. 2004, Massoni et al. 2014, and Neinhuis et al. 2005

Page 259, column 2, line 7 in **Discussion**: carpels, both plesiomorphies), although 🡪 carpels), although

Page 259, column 2, line 9 in Discussion: In addition to Tucker et al. 1993, add the following references to the monophyly of Saururaceae: Meng et al. 2003, Massoni et al. 2014, Jaramillo et al. 2004, and Neinhuis et al. 2005

Page 259, column 2, line 14 in Discussion: add Massoni et al. 2014 to references supporting *Verhuellia* sister to rest

Page 261, column 1, line 15 in description: filaments distinct, **slightly to strongly adnate to style**, 🡪 **slightly to strongly adnate to style**; **filaments ± absent**,

Page 262, column 1, line 9 in **Discussion**: (Nickrent et al. 2002). 🡪 (Nickrent et al. 2002; Massoni et al. 2014).

Page 262, column 2, last line: Soltis et al. 2001, 2011), 🡪 Soltis et al. 2001, 2011; Sun et al. 2016)

Page 263, column 1, line 2 – add at end of paragraph: *Pseudoasterophyllites* is an interesting Cretaceous fossil that is apparently intermediate between *Ceratophyllum* and Chloranthaceae (Kvacek et al. 2016). *Montsechia* is another Cretaceous fossil likely related to both *Ceratophyllum* and *Pseudoasterophyllites*; the clade containing *Ceratophyllum* was once much more diverse than it now is (Gomez et al. 2020). All three genera have orthotropous ovules with only one integument; they also lack stigmatic papillae.

Page 263, column 1, line 1 under MONOCOTS: The monocots are considered… 🡪 The monocots, some 74,300 spp., are considered…

Page 263, column 1, line 31 under MONOCOTS: add Soltis et al. 2018 and Gitzendanner et al. 2018 and Li et al. 2019, 2021

Page 263, column 2, line 2: …Graham et al. 2006). 🡪 …Graham et al. 2006), although Acoraceae are nested within Alismatales in the analysis of Petersen et al. (2016).

Page 263, column 2, line 9: … “sweet flag.” 🡪 … “sweet flag.” Finally nectaries in the septa of the ovary may be a synapomorphy for all monocots except for *Acorus*, although such nectaries have been lost repeatedly (Tobe et al. 2018).

Page 263, column 2, line 1 under Alismatales: Cladistic analysis of both nuclear and chloroplast… 🡪 Cladistic analysis of nuclear, mitochondrial, and chloroplast…

Page 263, column 2, line 4 under Alismatales: …Soltis et al. 2000, 2011) support… 🡪 … Soltis et al. 2000, 2001; Petersen et al. 2016; Li et al. 2019) support… [Also add Hertweck et al. 2015 to references supporting monophyly of Alismatales.]

Page 263, column 2, line 9 under Alismatales: The Araceae are sister to the remaining families of the order… 🡪 Either Araceae or Tofieldiaceae are sister to the remaining families of the order (Ross et al. 2016)…

Page 264, column 1, line 2 from bottom: placentation various; 🡪 placentation various; **locules with mucilage**;

Page 264, column 2, line 10: 109/2830 🡪 123/4300; also *Arisaema* (150) 🡪 (170); *Amorphophallus* (100) 🡪 (200); and add *Alocasia* (140) and *Xanthosoma* (200)

Page 266, column 1, line 3: …et al. 2011), and morphology… 🡪 …et al. 2011), phylogenomic analyses (Henriquez et al. 2014), and morphology…

Page 266, column 1, **Additional references**: add Mayo et al. 2013

Page 266, column 2, line 11 from bottom: add to references – Lehtonen 2009 and Ross et al. 2016

Page 266, column 2, line 10 from bottom: The genera with achenes … 🡪 Phylogenetic relationships within the clade are still rather unclear; the genera with achenes….

Page 268, column 1, line 3 in description: often rhizomatous; 🡪 often rhizomatous, **vessels absent**;

Page 268, column 2, line 16 in **Discussion**: (Chen et al. 2012b) 🡪 (Chen et al. 2012b; Ross et al. 2016)

Page 269, column 1, line 4 in **Discussion**: add Ross et al. 2016 to list of references here

Page 269, column 2, line 4: Add Givnish et al. 2016 and Li et al. 2019 and Hertweck et al. 2015 to the list of references supporting monophyly of Liliales. And add Givnish et al. reference also to Figure 8.14 legend.

Page 271, column 1, line 2 in Liliaceae description: saponins often present 🡪 saponins and tuliposides often present

Page 272, column 1, line 2 in **Discussion**: add Chase et al. 2000 and Kim & Kim 2018 to references for monophyly.

Page 272, column 1, line 5: form a clade… 🡪 form a basal grade…

Page 272, column 2, line 9: … Colchicaceae. The remaining genera of … 🡪 … Colchicaceae. Following Kim and Kim (2018) we place *Prosartes*, *Scoliopus*, *Streptopus*, and *Tricyrtis* in subfamily Streptopoideae, and *Calochortus* by itself in subfamily Calochortoideae. The remaining genera of …

Page 272, column 2, lines 9-15: reword text as follows: The remaining genera of … (*Fritillaria* type) 🡪 The remaining genera of Liliaceae constitute the Lilioideae + Medeoloideae clade (Givnish et al. 2016; Kim & Kim 2018), which is characterized by a megagametophyte developing from four megaspores (*Fritillaria* type). Medeoloideae (*Clintonia*, *Medeola*) have rhizomes, leaves with a network of veins, small tepals, and berry fruits, while their sister group, the Lilioideae (8 genera, e.g., *Amana*, *Erythronium*, *Fritillaria*, *Gagea*, *Lilium*, *Tulipa*) have bulbs with contractile roots, parallel veined leaves, large and showy tepals, and capsule fruits.

Page 272, column 2, lines 13-15: Delete this sentence: Monophyly of each … 2000).

Page 273, column 1, line 8 in **Discussion**: paraphyletic assemblage 🡪 non-monophyletic assemblage

Page 273, column 1 line 17 in **Discussion**: add to beginning of paragraph – The *Uvularia* + *Disporum* clade (i.e., Uvularioideae) are sister to the rest of Colchicaceae (Nguyen et al. 2013).

Page 273, column 1, line 18: (Vinnersten and Manning 2007) 🡪 (Colchicoideae; Vinnersten and Manning 2007)

Page 273, column 2, Genera/species: *Smilax* (310 spp.) 🡪 *Smilax* (310 spp., incl. *Heterosmilax*)

Page 273, column 2, line 4 from bottom: likely sister 🡪 possibly sister

Page 273, column 2, line 3 from bottom: … 2006). 🡪 … 2006; Qi et al. 2013), although *S. vitensis* is supported in this position in another analysis (Chen et al. 2006). The presence of prickles on the stem is likely ancestral (Qi et al. 2013) but has been lost multiple times within the genus.

Page 276, colulmn 1, line 1: 14/168 🡪 15/168

Page 276, column 1, line 3 in **Discussion**: add Kim et al. 2016 to references supporting monophyly

Pshr 276, column 1, line 28 in **Discussion**: add *Melanthium* to list of genera of Melanthieae

Page 276, column 2, line 5 under Asparagales: add Chen et al. 2013, Seberg et al. 2012, Hertweck et al. 2015, and Li et al. 2019 to references supporting monophyly

Page 276, column 2, line 12 from bottom: add sentence to end of paragraph – Like some Liliales, genomes are quite large in many members of this ordinal clade (Soltis et al. 2018).

Page 276, column 2, line 7 from bottom: Add Themidaceae to list of families in Asparagales.

Page 277: “Key to Families of Asparagales” Replace current couplet 10 with the following:

10. Inflorescence umbellate. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 11

10. Inflorescence with an obvious axis, i.e., racemose. . . . . . . . . . . . . . . . . . . . . . . . . . . **Hyacinthaceae**

11. Plants from a bulb, usually with an onion or garlic smell; inflorescence bracts 3, enveloping young inflorescence, and the individual flowers not bracteate. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **Alliaceae**

11. Plants from a corm, withoug an onion or garlic smell; inflorescence bracts 3 or more, not enveloping inflorescence, and each flower with a bract. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .Themidaceae

Modify first lead of couplet 9: Plants from a bulb; 🡪 Plants from a bulb or corm;

Renumber current couplets 11 and 12 as 12 and 13.

Page 280, column 2, line 13 in **Discussion**: add Chen et al. 2013 and Seberg et al. 2012 to references supporting monophyly of Asparagaceae

Page 280, column 2, line 19 in **Discussion**: (Fukuda et al. 2005) 🡪 (Fukuda et al. 2005; Kubota et al. 2012; Norup et al. 2015)

Page 282, column 1, line 7 in **Discussion**: add Chen et al. 2013 and Seberg et al. 2012 to references supporting monophyly of Ruscaceae

Page 282, column 1, Major genera: *Dracaena* (80 spp.) 🡪 *Dracaena* (130 spp. [And delete entry for *Sansevieria*]

Page 282, column 1, line 20 in **Discussion**: Lu and Morden 2014 🡪 Lu and Morden 2014; Zona et al. 2014; Takawira-Nyenya et al. 2018

Page 282, column 2, Additional references: add Chahinian 2005

Page 283, column 1, line 5 in **Discussion**: add Chen et al. 2013 and Seberg et al. 2012 and McKain et al. 2012 to references supporting monophyly of Agavaceae

Page 283, column 1, line 18 in **Discussion** – after the words “…also have a distinctive bimodal karyotype.” add the following: The haploid karyotype has the classical 25S + 5L form in *Hosta*, *Hesperaloe, Hesperoyucca, Yucca, Fucraea, Beschorneria, Prochnyanthes*, and *Agave* (incl. *Polianthes*, *Manfreda*), but is variously modified in *Schoenolirion, Hesperocallis, Hastingia, Chlorogalum*, and *Camassia*, e.g., with 12S + 3L in *Chlorogalum* and *Camassia* and 18S + 6L in *Hesperocallis*. These genera form the bimodal karyotype clade (likely associated with a paleopolyploid event). Molecular data (Chase et al. 1995a, 2000; Rudall et al. 1997b; McKain et al. 2016) also support a close relationship of this bimodal karyotype clade to *Anthericum*, *Chlorophytum* and relatives (which lack a bimodal karyotype and are usually placed in Anthericaceae), a group of rhizomatous herbs with leaves in a basal rosette, leading to a broadly delimited Agavaceae, which are not easily characterized.

Page 283, column 1, line 32 in **Discussion**: … both are monophyletic (Bogler and Simpson 1995, 1996). 🡪 both may be monophyletic (Bogler and Simpson 1995, 1996), but the monophyly of Yuccoideae is not supported in the molecular-based analysis of McKain et al. (2016).

Page 283, column 1, next to last line: genus *Tegeticula* 🡪 genera *Tegeticula* and *Parategeticula*

Page 283, column 2, line 5: add Flores-Abreu et al. 2019 to Additional referenes.

Page 284, column 1, line 5: add Chen et al. 2013 and Seberg et al. 2012

Page 284, column 1, lines 11-12 in Description: *by a few membranous spathelike bracts*, 🡪 *by 3, membranous, enveloping, spathelike bracts*,

Page 284, column 2, line 3 in **Discussion**: rbcL sequences (Fay and Chase 1996) and ITS sequences (Friesen et al. 2006). 🡪 DNA sequences (Chen et al. 2012; Fay and Chase 1996; Friesen et al. 2006; Seberg et al. 2012).

Page 284, column 2, line 22 in **Discussion**: from corms, and include 🡪 from corms, lack the sulfur-containing compounds, and include

Page 285, column 2, line 13: *Zephyranthes* (60) 🡪 *Zephyranthes* (170; incl. *Habranthus*)

Page 286, column 1, line 6 in **Discussion**: add Chen et al. 2013 and Seberg et al. 2012 to references supporting monophyly of Amaryllidaceae

Page 286, column 1, line 9 im **Discussion**: add Garcia et al. 2019 to references supporting tribal charaterizations

Page 286, column 1, line 12: *Eucharis*, *Habranthus*, *Zephranthes* 🡪 *Eucharis*, *Zephranthes*

Page 286, column 2, line 19: 22/750 🡪 22/900

Page 286, column 2, line 2 in **Discussion**: add Chen et al. 2013 and Seberg et al. 2012 to references

Page 287, column 1 line 12 from bottom: 67/1750 🡪 67/2120

Page 287, column 2, line 3: add Chen et al. 2013 to references

Page 288, column 1, line 2 in Economic plants and products: (incl. *Molineria*) 🡪 (incl. *Molineria*, *Sinocurculigo*)

Page 288, column 1, line 3 in **Discussion**: add Chen et al. 2013 and Liu et al. 2012 to references supporting monophyly

Page 289, column 1, line 4: 880.21,950 🡪 880/26,000

Page 290, column 1, line 2 in Discussion: add Pérez-Escobar et al. 2021 to references in support of family monophyly

Page 290, column 1, line 10 in **Discussion**: add Freudenstein and Chase 2015 to references

Page 293, column 1, line 5 under Commelinoid Monocots: add Barrett et al. 2016 to references.

Page 293, column 1, line 8 in description: *usually splitting in a pinnate to palmate fashion* 🡪 **usually splitting in a pinnate** *to palmate fashion*

Page 293, column 2, line 7: *usually sessile* 🡪 **usually sessile**

Page 293, column 2, line second from bottom: Add Comer et al. 2016 and Barrett et al. 2016 to list of references.

Page 295, column 2, line 5: Following “…and *Jubaea*.” Insert the sentence -- Within Cocoseae, those genera with fiber-spines, e.g., *Acrocomia*, *Astrocaryum*, and *Bactris*, form a clade – the subtribe Bacteridinae (Meerow et al. 2015).

Page 296, column 1, line 35: (Henderson 1986) 🡪 (Henderson 1986, 2002)

Page 296, column 1, line 4 from bottom: add Barrett et al. 2016 and Li et al. 2019 and Hertweck et al. 2015 and Zuntini et al. 2021 to list of references supporting ordinal monophyly

Page 297, column 2, line 3 in **Discussion**: add Zuntini et al. 2021 and Lee et al. 2022 to molecular references supportin gmonophyly of Commelinaceae

Page 298, column 1, line 2: add Zuntini et al. 2021 and Lee et al. 2022 to references supporting placement of *Cartonema*

Page 298, column 1, line 4: add Zuntini et al. 2021 and Lee et al. 2022 to references supporting tribal classification

Page 298, column 2, line 2 in **Discussion**: due to the presence 🡪 due to DNA sequences and the presence

Page 298, column 2, line 6 in **Discussion**: Morphology supports recognition … 🡪 Morphology and molecular data support recognition …

Page 298, column 2, line 8 in **Discussion**: (Simpson 1990). 🡪 (Simpson 1990; Aerne-Hains & Simpson 2017; Hooper et al. 2009; Zuntini et al. 2021).

Page 298, column 2, line 15: a nondeflexed style; and 🡪 a nondeflexed style, presence of tannin cells; and

Page 298, column 2, line 3 in description of Pontederiaceae: Leaves usually alternate and spiral, along stem or ± basal, ± differentiated into petiole and blade, … 🡪 **Leaves** alternate and spiral or 2-ranked, **dimorphic**, with initial leaves sessile, later leaves ± differentiated into a petiole and blade, with or without an indistinct upper pulvinus…

Page 298, column 2, line 7 in description: at base; stipules lacking, 🡪 at base, **with a ligule-like extension of sheath**; stipules lacking.

Page 298, column 2, line 8 in description: racemes or spikes, 🡪 racemes or spikes, **becoming deflexed in fruit**,

Page 300, column 1, line 2: *often tristylous*. 🡪 *often tristylous*, **with aerenchyma tissue in receptacle, perianth, and ovary wall**.

Page 300, column 1, line 2: …*showy*, 🡪 *showy*, **often blue to purple, with nectar guide**,

Page 300, column 1, line 17-18: 9/35 🡪 2/38; and change to – ***Genera***: *Pontederia* (26 spp.; incl. *Eichhornia* and *Monochoria*) and *Heteranthera* (12; incl. *Hydrothrix*, *Scholleropsis*). The family is represented in the continental United States and/or Canada by *Pontederia* and *Hetroanthera*.

Page 300, column 1, **Economic plants**: reword as follows – Some species of *Pontederia* (pickerel weed, water hyacinth) are used as aquatic ornamentals; *P. crassipes* is a very serious weed of still or slowly-flowing waters in the tropics and subtropics.

Page 300, column l, line 2 in **discussion**: add Pellegrini et al. 2018

Page 300, column 1, line 3 in **Discussion**: add Ness et al. 2011 and Zuntini et al. 2021 to references supporting family monophyly

Page 300, column 1, line 4-16 in **Discussion**: reword first paragraph (except initial sentence) as follows – *Heteranthera* is sister to an expanded *Pontederia* (with recognition of five subgenera, see Pellegrini et al. 2018). The two genera are easily distinguished, as *Pontederia* has its sessile leaves 2-ranked (vs. spiral in *Heteranthera*), the petiolate leaves with a pulvinus (vs. pulvinus absent) and a chartaceous to coriaceous blade (vs. membranous blade), flowers with six (vs. 1-3) stamens, and septal nectaries (vs. nectaries absent). The monophyly of *Heteranthera* is supported by numerous characters, including plants ±submerged, the lack of rhizomes, ligules 2 to several parted, obliquely inserted staminal filaments, and unevenly trilobed stigmas. Some species of *Heteranthera* have dimorphic stamens (fertile stamens and staminodes providing food for insects) (Eckenwalder and Barrett 1986). Monophyly of *Pontederia* is supported by 2-ranked sessile leaves, petiolate leaves with a pulvinus, tristylous flowers, the perianth with obtuse lobes, unusually curved staminal filaments, style J-shaped, and the perianth that is persistent, coiled and tightly enclosing the fruit, hardened and ornamented at maturity. *Pontederia* subg. *Pontederia* is distinct due to the apomorphies of a gynoecium with two locules aborting and the third containing only a single ovule, nut fruits, and relatively large, smooth seeds.

Page 300, column 1, line 13 in **Discussion**: *Eichhornia* is not monophyletic. 🡪 *Eichhornia* is not monophyletic (Ness et al. 2011; Pellegrini et al. 2018).

Page 300, column 2, line 2 under Poales: (Barrett et al. 2013; 🡪 (Barrett et al. 2013, 2016;

Page 300, column 2, line 4: add Li et al. 2019

Page 300, column 2, line 16 from bottom: *rbcL* 🡪 DNA

Page 300, column 2, line 15 from bottom: add to references – Hochbach et al. 2018

Page 302, Figure 8.29. Show relationship of Bromeliaceae and Tyhaceae as basal in order and unresolved (i.e., remove line showing them as a clade, as some analyses support this and others do not). Also add to references supporting this tree the following: Bouchenak-Khelladi et al. 2014; Hochbach et al. 2018; Givnish et al. 2010.

Page 302, column 1, line 18: add reference – Hochbach et al. 2018

Page 302, column 2, line 4 in description: and spiral, 🡪 and **spiral**,

Page 303, column 1, lines 2 and 4 from bottom: *Tillandsia* (450 spp.) 🡪 *Tillandsia* (650 spp.); *Guzmania* (120) 🡪 *Guzmania* (200)

Page 303, column 2, line 7: add *Alcantarea* to list of ornamentals

Page 303, column 2, line 3 in **Discussion**: add reference – Hochbach et al. 2018

Page 305, column 1, line 24: add reference – Hochbach et al. 2018

Page 305, column 1, line 8 from bottom, Additional references: add Gomes-da-Silva and Souza-Chies 2017

Page 305, column 2, line 3: *densely clustered flowers* 🡪 **densely clustered flowers**

Page 305, column 2, line 6: radial. 🡪 radial, **very small**.

Page 305, column 2, line 6 from bottom: Insert sentence at end of paragraph – Within *Typha*, *T. minima* and *T. elephantina* form a clade that is sister to the remaining species (Kim and Choi 2011; Zhou et al. 2018).

Page 307, column 1, line 2: add Ito et al. 2016 to references

Page 307, column 1, line 13 in description: *individually inconspicuous* 🡪 **individually inconspicuous**

Page 307, column 1, line 18 in description: *flowers)*, sometimes with 🡪 *flowers)*, **scarious**, sometimes with

Page 307, column 2, Additional references: add – Andrino et al. 2020

Page 307, column 2, line 24 in description: ± capitate 🡪 **± funnel-shaped**

Page 309, column 1, line 2 in description: *and solid*. 🡪 *and solid*, **with vascular bundles in rings**.

Page 309, column 2, line 5: Drábková 🡪 Zaveska Drábková

Page 309, column 2, line 5: add to references on non-monophyly of Juncaceae: Zaveska Drábková 2010 and Zaveska Drábková and Vlcek 200

Page 309, column 2, line 10: add sentence – *Juncus trifidus* and *J. monanthos* are sister to the rest of the family and should be recognized as the genus *Oreojuncus* (Zaveska Drábková and Kirschner 2013); their leaves have fimbriate-lacerate auricles.

Page 311, column 1, line 9 in **Discussion**: *rbcL* sequences 🡪 DNA sequences

Page 311, column 1, line 10: … Simpson et al. 2007). 🡪 … Simpson et al. 2007, 2009; Hinchcliff and Roalson 2013).

Page 311, column 1, line 13 in **Discussion**: (Global *Carex* group 2015). 🡪 (Global *Carex* group 2015, 2016). Also add the following sentence here: Cariceae are closely related to theDulichieae, Scirpeae, and Trichophoreae, and are sister to the Sumatroscirpeae (Léveillé-Bourret and Starr 2019).

Page 311, column 1, line 19: in *Carex* 🡪 in *Carex* and *Sumatroscirpus* (Léveillé-Bourret et al. 2018)

Page 311, column 2, line 9: *Flowers usually unisexual (plants dioecious)* 🡪 *Flowers usually unisexual* **(plants dioecious)**

Page 311, column 2, line 3 in **Discussion**: add reference – Hochbach et al. 2018

Page 311, column 2, last line: should 🡪 could

Page 312, column 1, line 4 in description of Poaceae: **ligule** 🡪 *ligule*

Page 312, column 2, lines 14-15: and 1 subapical to nearly basal amphitropous or hemianatropous ovule 🡪 **and 1** subapical to nearly basal amphitropous or **hemianatropous ovule**

Page 316, column 1, add this sentence to end of **Pooideae** paragraph: Hybridization has led to a highly reticulate phylogeny within many subclades of Pooideae (Tkach et al. 2020).

Page 317, column 1, Zingiberales: In edition 5 a color plate will be added, showing floral and vegetative variation within this ordinal clade. Plate will include the following: Cannaceae, *Canna* x *indica* (flowers); Costaceae, *Tapeinochilos ananassae* (leaves and inflorescence); Heliconiaceae, *Heliconia rostrata* (inflorescence); Marantaceae, *Cathalea lutea* (inflorescence); Musaceae, *Musa acuminata* ‘Red Iholene’ (habit); Musaceae, *Musa balbisiana* (fruit with seeds); Musaceae, *Musa ornata* (staminate and carpellate inflorescences and flowers); Strelitziaceae, *Strelitzia reginae* (inflorescence); Zingiberaceae, *Alpinia* *purpurea* (inflorescence); Zingiberaceae, *Hedychium coronatum* (leaves; flowers; 2 images); Zingiberaceae, *Hedychium gardnerianum* (fruits).

Page 317, column 1, line 4 under Zingiberales: (Barrett et al. 2013; 🡪 (Barrett et al. 2013, 2016; [also add Li et al. 2019 and Hertweck et al. 2015 to references]

Page 318, column 1, line 7 in **Distribution and ecology**: add Burgos-Hernández et al. 2019

Page 319, column 2, lines 13-14: *Nectaries 2; positioned atop the ovary*. 🡪 **Nectaries 2; positioned atop the ovary**.

Page 321, column 1, line 13 in **Discussion**: (Kress et al. 2002) 🡪 (Kress et al. 2002; Selvaraj et al. 2008)

Page 321, column 2, line 36: 30/450 🡪 31/550

Page 323, column 2, line 5: 1/19 🡪 1/22

Page 323, column 2, line 3 in **Discussion**: et al. 1993). 🡪 … et al. 1993; Prince 2010).

Page 323, column 2, line 3 in **Discussion**: add sentence at end of paragraph – *Canna flaccida* is sister to the remaining species.

Page 323, column 2, line 1 under EUDICOTS: This large group is considered… 🡪 This large group (ca. 210,000 spp.) is considered…

Page 323, column 2, line 9 under EUDICOTS: Add Sun et al. 2016 and Soltis et al. 2018 and Gitzendanner et al. 2018 and Li et al. 2019, 2021 to list of references supporting monophyly of Eudicots.

Page 324, column 1, line 4: Add Sun et al. 2016 and Lane et al. 2018 to list of references.

Page 324, column 2, line 21: (Hoot and Crane 1995; 🡪 (Hoot and Crane 1995; Hoot et al. 2015;

Page 324, Figure 8.40: add Hoot et al. 2015 and Lane et al. 2018 and Li et al. 2019 to cited references

Page 325, column 1, line 5: Hoot et al. 1999; 🡪 Hoot et al. 1999, 2015;

Page 325, column 1, line 11: Hoot et al. 1999; 🡪 Hoot et al. 1999, 2015;

Page 325, column 2, line 9 in description: *and entire* 🡪 **and entire**

Page 326, Plate 8.6: *Dicentra spectabilis* 🡪 *Lamprocapnos* *spectabilis*

Page 327, column 1, line 4 in Discussion: Ortiz et al. 2007 🡪 Ortiz et al. 2007, 2016

Page 327, column 2, line 3: Tinosporoideae 🡪 Chasmantheroideae

Page 327, column 2, line 3: add *Coscinium* to examples of genera in Chasmantheroideae

Page 327, column 2, line 11 in description: with short to elongate receptacle. 🡪 with **well-developed**, short to elongate **receptacle**.

Page 329, column 1, line 8: (Hoot 1995; Johansson and Jansen 1993). 🡪 (Hoot 1995; Johansson and Jansen 1993; Wang et al. 2005), although other in other analyses *Glaucidium* is sister to the rest, followed by Hydrastis (Hoot et al. 2015; Wang et al. 2009, 2016).

Page 329, column 1, line 36: (Hoot 1995;… 🡪 (Cossard et al. 2016; Hoot 1995; … And insert the following sentences immediately after – Thus, Cossard and associates adopt the following subfamilies: Claucidoideae (*Glaucidium*), Hydrastidoideae (*Hydrastis*), Coptidoideae (*Xanthorhiza, Coptis*), with the remaining taxa placed in an expanded Ranunculoideae (incl. “Thalictroideae”). Within the diverse subfamily Ranunculoideae, *Adonis* and *Trollius* (Adonideae) are sister to a clade including *Thalictrum*, *Isopyrum*, *Aquilegia* and relatives, while the remaining tribes, e.g., *Helleboreae, Caltheae, Nigelleae, Cimicifugeae, delphinieae, ranunclueae*, and *Anemoneae*, form a large clade.

Page 330, column 1, line 3 in **Discussion**: add Hsieh et al. 2022 to references supporting monophyly of family.

Page 330, column 2, line 7: (Stevens 2001, onward). 🡪 (Stevens 2001, onward; Wang et al. 2009).

Page 331, column 1, line 1: add Hsieh et al. 2022 to references regarding Berberidoideae.

Page 331, column 1, line 7 in description: **but often lobed or dissected**, 🡪 **but often lobed or dissected and with broad base**,

Page 331, column 2, line 3 in Discussion: add reference: Sauquet et al. 2015

Page 331, column 2, line 4 from bottom: Hoot et al. (1997) 🡪 Hoot et al. (1997, 2015)

Page 332, column 1, line 11: are sister to 🡪 are possibly sister to

Page 332, column 2, line 7: *Dicentra*, *Corydalis*, … 🡪 *Lamprocapnos*, *Dicentra*, *Corydalis*, …

Page 332, column 2, line 9: … stamens. 🡪 … stamens (and possibly also opaque latex).

Page 333, column 1, Key to families of Proteales and some phylogenetically adjacent eudicots: Buxaceae 🡪 **Buxaceae**

Page 333, column 1, Key to families…: fruit a capsule 🡪 fruit a capsule or drupe [correction on the lead to Buxaceae]

Page 333, column 2, line 11: …2011). 🡪 …2011; Cronk et al. 2015). [also add Li et al. 2019]

Page 333, column 2, line 17: with **Proteaceae**, **Platanaceae**, and Nelumbonaceae forming a clade 🡪 with **Proteaceae**, **Platanaceae**, Nelumbonaceae, and Sabiaceae forming a clade

Page 333, column 2, line 22: Gynoecia with one or two pendent ovules per carpel may be synapomorphic… 🡪 Gynoecia with one or two pendent ovules per carpel and seeds with an elongate embryo may be synapomorphic…

Page 333, column 2, line 12 in d escription: very reduced and inconspicuous 🡪 **very reduced and inconspicuous**

Page 334, column 1, lines 1-2: *with the connective prolonged into a peltate appendage*; 🡪 **with the connective prolonged into a peltate appendage**;

Page 334, column 1, line 9 in **Discussion**: …Pool 2003). 🡪 …Pool 2003). Evidence from fossils indicate that the family once was far more diverse in leaf form, e.g., species with pinnately or palmately compound leaves (or leaves with basal appendages) existed, and some had glandular, peltate hairs (Golovneva 2007; Huegele et al. 2022; Kavček and Manchester 2004; Kvaček et al. 2001).

Page 334, column 1, line 4 from bottom: entire to serrate; 🡪 entire to serrate, with pinnate venation;

Page 334, column 2, line 12 in **Discussion**: Weston 2007). 🡪 Weston 2007, 2014).

Page 334, column 2, line 16: (Hoot and Douglas 1998), 🡪 (Hoot and Douglas 1998; Weston 2014),

Page 333, column 2, line 17: with **Proteaceae**, **Platanaceae**, and Nelumbonaceae forming a clade 🡪 with **Proteaceae**, **Platanaceae**, Nelumbonaceae, and Sabiaceae forming a clade [and add APG 2016 to list of supportive references]

Page 335, column 1, line 4: Add Chen et al. 2016 and Li et al. 2019 to references

Page 335, column 1, line 2-3 under Saxifragales: put **Grossulariaceae** and **Haloragaceae** in bold

Page 335, column 1, line 9 under Saxifragales: add Sun et al. 2016 and Soltis et al. 2018 and Li et al. 2019 to references supporting monophyly of Saxifragales.

Page 335, column 1, line 3 from bottom: add Sun et al. 2016 to references.

Page 335, column 2, line 3 from bottom: 35/550 🡪 40/700; *Saxifraga* (325 spp.) 🡪 *Saxifraga* (400 spp.); *Chrysosplenium* (55) 🡪 *Chrysosplenium* (65); delete *Mitella* from list of large genera, and add *Micranthes* (80) to list of genera.

Page 336m column 1, add the following to genera in U.S. and Canada: *Darmera*, *Elmera*, *Conimitella*, *Mitella*, *Pectiantia*, *Brewerimitella*, *Ozomelis*

Page 337, Key to Families of Saxifragales: put **Grossulariaceae** and **Haloragaceae** in bold.

Page 337, column 1, line 16: *Saxifraga* s.l. 🡪 *Saxifraga*

Page 337, column 1, line 17: …remaining genera. 🡪 … remaining genera (i.e., the Heucheroideae) (Deng et al. 2015).

Page 338, Plate 8.7: expand plate by adding: Altingiaceae (*Liquidambar stryaciflua*: fruits), Grossulariaceae (*Ribes cereum*: flower, longitudinal section; *R. sanguinea*: flowers), Haloragaceae (*Proserpinaca palustris*: plant in bloom).

Page 338, column 1, line 9: *distinct to slightly connate at base* 🡪 **distinct to slightly connate at base**

Page 340, column 1, line 19: Mort et al. 2001 🡪 Mort et al. 2001, 2010

Page 340, column 1, line 24: of *Sedum* and some other genera. 🡪 of *Sedum* (Nikulin et al. 2016; Messerschmid et al. 2020) and some other genera.

Page 340, column 2, line 6 from bottom: add to references – Li 2008 and Chen et al. 2016

Page 342, column 2, line 13 in **Discussion**: and Wen 2006; 🡪 and Wen 2006, 2013;

Page 342, column 2, line 15 – add this sentence to end of paragraph: We note, however, that *Liquidambar* s.s. is monophyletic and sister to a monophyletic *Altingia* in the morphology-based phylogenetic analyses of Scharfstein et al. (2020) and Ickert-Bond et al. (2005, 2007). The species traditionally treated as *Semiliquidambar* (morphologically intermediate between *Altingia* and *Liquidambar*) are the result of hybridization between species traditionally treated in the two genera.

Page 342, column 2, line 5 under Rosid Clade: add Soltis et al. 2018, Gitzendanner et al. 2018 and Chen et al. 2016 and Li et al. 2019

Page 342, column 2, line 24 under Rosid Clade: add Soltis et al. 2018

Page 342, column 2, last line: (Sun et al. 2015) 🡪 (Sun et al. 2015; Soltis et al. 2018)

Page 343, column 1, lines 7-9 in descripton: *but usually appearing leaf-opposed due to growth of the axillary branch from the opposing leaf axil* 🡪 **but usually appearing leaf-opposed due to growth of the axillary branch from the opposing leaf axil**

Page 343, column 1, line 11 in description: *± connate* 🡪 **± connate**

Page 343, column 1, line 4 from bottom: Wen 2007). 🡪 Wen 2007; Ren et al. 2011; Zhang, Wen and Zimmer 2015).

Page 343, column 2, line 13 in description: Stamens 10-15 🡪 **Stamens 10** (-15), **usually in 2 whorls with the outer whorl opposite the petals**

Page 343, column 2, line 5 from bottom: 22/230 🡪 22/300

Page 345, column 2, line 3: *rbcL* and *trnL-F* sequences 🡪 DNA sequences

Page 345, column 2, line 4: add Sun et al. 2016 andd Godoy-Bürki et al. 2018 to references.

Page 345, column 2, lines 6-7: *Bulnesia* 🡪 *Bulnesia*, *Gonopterodendron*

Page 345, Plate 8.8: expand plate to include the following: Celastraceae (*Hippocratea volubilis*: fruit), Cunoniaceae (*Cunonia capensis*: branch with flowers; *Weinmannia pinnata*: flowers), and Geraniaceae (*Geranium himalayense*: flowers).

Page 347, column 1, line 9 in **Discussion**: Truncate paragraph at … Cunoniaceae and Cephalotaceae. [The following part of the paragraph is in a modified form transferred to the introduction paragraph to the Oxalidales.]

Page 347, column 1, last line: add Gardner et al. 2012 to references

Page 347, column 2, line 29: 89/1221 🡪 94/1410

Page 347, column 2, line 33: add *Mortonia* to continental genera

Page 347, column 2, line 13 from bottom: *Catha*. 🡪 *Catha edulis*.

Pages 348-349, Key to Major Families of Malpighiales: Ochnaceae 🡪 **Ochnaceae** [Also **Linaceae** will be added to key; see revised key.]

Page 348, column 1, line 11: (Zhang and Simmons 2006), and 🡪 (Bacon et al. 2016; Li et al. 2019; Zhang and Simmons 2006), and

Page 348, column 2, line 4 under Malpighiales: add Sun et al. 2016 and Li et al. 2019 and Folk et al. 2018 to references supporting monophyly of the order.

Page 348, column 2, line 4: Wang et al. 2011 🡪 Wang et al. 2009

Page 348m Key to Major Families of Malpighiales [box]: Insert a new couplet 6, and make the current couplet six couplet 7, and renumber other couplets accordingly. The new couplet #6 to be inserted is below:

6. Inflorescences epiphyllous, the flowers borne on the petiole; petals with apex deeply 2-lobed. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Dichapetalaceae

6. Inflorescences various, but not epiphyllous; petals not bifid. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 7

Page 349, column 1, line 3: (Cronquist 1981, 1988; Thorne … 🡪 (Cronquist 1981, 1988; Endress et al. 2013; Thorne …

Page 249, column 1, line 9: Ochnaceae 🡪 **Ochnaceae** [and add **Linaceae** to list of major families]

Page 349, column 2, line 4: stipules, conduplicate 🡪 stipules, colleters, conduplicate

Page 349, column 2, line 5: conduplicate petals enwrapping the stamens in bud 🡪 conduplicate petals, postgenitally connected, enwrapping the stamens in bud

Page 349, column 2, line 8: (Matthews and Endress 2011) 🡪 (Matthews and Endress 2011; Thiebaut and Hoffman 2005)

Page 349, column 2, line 12: (Davis et al. 2007). 🡪 (Davis et al. 2007; Sun et al. 2016), and may not be monophyletic, even when restrictively delimited

Page 349, column 2, line 1 in description: *perennial herbs*. 🡪 *perennial herbs*; occasionally with laticifers (sap clear, reddish, or white).

Page 349, Key to Major Families of Malpighiales [box]: insert additional families, Linaceae and Erythroxlaceae.

Insert new couplet 12:

12. Leaves usually with 2 faint to pronounced fold-lines, one on each side of midvein; stem with cortical vascular bundles; petals with an adaxial, ± bilobed appendage (forming a corona). . . . . Erythroxylaceae

12. Leaves not as above; stems without cortical vascular bundles; petals various but lacking basal-adaxial appendage (so corona absent) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .13

Second lead of former couplet 12, now couplet 13, changed to the following (and first lead unchanged):

13. Leaves alternate or opposite; stipules lateral or absent; petals not fringed or hairy and not enclosing a single stamen or group of stamens; plants not of mangrove habitats. . . . . . . . . . . . . . . . . . . . . . . . . . . . .14

Then insert new couplet 14, relabeling current couplets 13-15 as 15-17:

14. Leaves alternate, usually serrate, the venation ochnoid, i.e., with secondary and tertiary veins well developed and veins ± parallel; flowers with stamens distinct, lacking nectar glands. . . . . . . . **Ochnaceae**

14. Leaves alternate or opposite, entire, the venation not ochnoid; flowers with staminal filaments connate, forming a tube, and nectar glands outside of staminal tube. . . . . . . . . . . . . . . . . . . . . . . .**Linaceae**

Page 350, plate 8.9: *Mascagnia macroptera* 🡪 *Callaeum macropterum*

Page 351, Plate 8.9: expand plate through addition of: Ochnaceae (*Ochna thomasiana*: flowers and fruits), Linaceae (*Reinwardtia indica*: flowers and leaves), anad Chrysobalanaceae (*Chrysobalanus icaco*: flowers, fruits: 2 images).

Page 351, column 1, lines 15-16: megagametophyte usually 16-nucleate 🡪 **megagametophyte usually 16-nucleate**

Page 351, column 2, line 8: replace *Janusia* with *Cottsia*

Page 353, column 1, line 4: add reference – Vega et al. 2002; Pace et al. 2019

Page. 353, column 2, line 4: …still rather unclear. 🡪 …still rather unclear, although *Kostermanthus* may be sister to the remaining genera, followed by an early-diverging clade comprised of *Neocarya* and *Parinari* (Bardon et al. 2016).

Page 353, column 1, line 1 under Genera/species: *Licania* (170 spp.) 🡪 *Licania* (100 spp.)

Page 353, column 1, line 2 under Genera/species: *Licania* and *Chrysobalanus* occur… 🡪 *Chrysobalanus* and *Geobalanus* occur…

Page 353, column 2, line 7: …*Licania* may be polyphyletic. 🡪 … *Licania* is clearly polyphyletic (Sothers et al. 2016).

Page 353, column 2, line 13 from bottom: 222/6100 🡪 222/6300

Page 356, column 1, line 27 in **Discussion**: add *Tetracoccus* to listed genera of Picrodendraceae

Page 356, column 2, line 21 (add sentence to end of paragraph). Finally, the small subfamily Cheilosoideae (*Cheilosa*, *Neoscortechinia*) may be sister to the rest of the clade.

Page 356, column 2, line 9 in description of Phyllanthaceae: Sepals usually 5… 🡪 Sepals usually 3-5,

Page 357, column 1, Floral formula: K 5 (surrounded by dashed line) 🡪 K 3-5 (surrounded by dashed line)

Page 357, column 1, line 2 in Genera/species: incl. *Breynia*, *Glochidion*), 🡪 incl. *Breynia*, *Glochidion*, *Sauropus*),

Page 357, column 2, line 4: To Samuel et al. and Wurdack et al., add the following: Hoffman et al. 2006.

Page 357, column 2, line 4: at end of this paragraph add the sentence: The large genus *Phyllanthus* is not monophyletic, and it has been suggested that it be divided into ten genera (see Bouman et al. 2021, 2022).

Page 357, column 2: Additional references: add – Gama et al. 2016, and Van Welzen et al. 2015, and Hidalgo et al. 2020.

Page 358, column 1, line 7: Ruhfel et al. 2011, 2013 🡪 Ruhfel et al. 2011, 2013, 2016

Page 358, column 1, line 9 from bottom: *Clusia* is noteworthy… 🡪 Within Clusiaceae, the Clusieae (e.g., *Clusia*, *Tovomita*; fruits capsular, androecium not fasciculate, seeds arillate) is sister to the Symphonieae + Garcinieae clade (e.g., *Symphonia*, *Platonia*, *Garcinia*; fruits fleshy, indehiscent) (Ruhfel et al. 2016). *Clusia* is notworthy…

Page 358, column 1, line 6 from bottom: add the following sentence at the end of this paragraph: Most species of *Clusia* are dioecious and it can be difficult to match concpecific staminate and carpellate individuals (Luján 2019).

Page 358, column 1, last line: (e.g., *Mammea, Calophyllum, Garcinia*) 🡪 (e.g., *Garcinia, Symphonia*)

Page 358, column 2, line 10 from bottom: Calophyllaceae have only… 🡪 ***Discussion***: Calophyllaceae have only…

Page 358, column 2, line 7 from bottom: add Ruhfel et al. 2016 to references

Page 359, column 2, line 1: distinct or slightly connate. 🡪 distinct or slightly connate, **often fasciculate**.

Page 360, column 1, line 3 in **Discussion**: add Ruhfel et al. 2016

Page 360, column 1, line 20 in **Discussion**: add Meseguer et al. 2013, 2015

Page 360, column 2, line 11: 15/149 🡪 16/149

Page 362, column 1, line 6 from bottom: 22/950. 🡪 34/985.

Page 362, column 2, line 13 in description of Passifloraceae: …to slightly connate, *often petal-like*. 🡪 …to slightly connate, occasionally adnate to hypanthium (some *Turnera*), *often petal-like*.

Page 363, column 2, line 1 in Genera/species: 27 🡪 28

Page 365, column 1, line 5 in **Discussion**: … and relatives. *Malesherbia* … 🡪 …and relatives, and both the corona and hypanthium in *Pibiria*. Molecular data also support the family’s monophyly (Tokuoka 2012). *Malesherbia*…

Page 365, column 1, line 7 in **Discussion**: (Turneroideae + Passifloroideae clade, characterized ... with pinnate venation. Passifloroideae… 🡪 … (Turneroideae + Pibirioideae + Passifloroideae clade, characterized by extrafloral nectaries on the leaves, but only gland-headed hairs in *Pibiria*) and *Malesherbia* is dinctinctive in havint a v alvate (vs. imbricate) calyx and corolla. Turneroideae (i.e., *Turnera*, *Piriquetia* and relatives) have solitary flowers with a contorted and deliquescent corolla; they also have lost the corona and have leaves with pinnate venation. Pibiroideae (oly *Pibiria*) have flowers with a petal-like calyx (as in Passifloroideae) but lack a corona and hypanthium. They have pinnate-veined leaves, yellow flowers, and have lost the androgynophore (like Turneroideae); their flowers are in cymes (not solitary as in Turneroideae) (Maas et al. 2019). Passifloroideae…

Page 365, column 1, line 30 in Discussion: Add sentence -- …the seeds. 🡪 …the seeds. However, the capsular species with white arils (e.g., *Turnera*) are usually ant-dispersed.

Page 365, column 1, Additional references: Add – Arbo et al. 2015.

Page 367, column 1, line 3: …*Casearia*. 🡪 …*Casearia* (Thadeo et al. 2014).

Page 367, column 1, line 9: add Liu et al. 2016 to references

Page 367, column 1, line 23: …are still poorly understood, but *Casearia* (Plate 8.9C) may be sister to… 🡪 …are still incompletely understood, but *Casearia* (Plate 8.9C), *Lunania*, and relatives (i.e., Samydeae, having theoid teeth, not salicoid teeth) likely are sister to the remaining genera. Samydeae usually have pellucid dots to lines in their leaves and flowers with seven to twelve stamens (Mestier et al. 2022).

Page 367, column 2, add to references: Cronk et al. 2015.

Page 367, column 2, line 4 under Fabales: add Sun et al. 2016 and Li et al. 2019 and Folk et al. 2018 to references supporting monophyly of order.

Page 368, column 1, line 13: radial to bilateral 🡪 radial to **bilateral**

Page 370, column 2, line 1: 751 🡪 765

Page 371, column 1, line 1: delete *Caesalpinia* (120) from list of large genera.

Page 372: Table 8.2: Needs major revision, expand to two pages. See draft at end of page by page correction part of this document.

Page 373, column 1, line 28: *Caesalpinia, Pterogyne* 🡪 *Caesalpinia, Guilandina, Pterogyne*

Page 373, column 2, Additional references: Add – Gagnon et al. 2013, 2016

Page 367, column 2 – Fabaceae: Extensively revise treatment of family in order to bring it in line with new subfamily classification of the family published in Taxon (66: 44-77). Subfamily “Caesalpinioideae” split into **Cercidoideae**, **Detarioideae**, **Dialioideae** and an expanded **Caesalpinioideae** (including the mimosoids); no changes in circumscription of **Faboideae/Papilionoideae**. Briefly characterize each of these major clades (including mimosoids), and add a new figure showing phylogenetic structure within family. See The Legume Phylogeny Working Group 2017; Zimmerman et al. 2017. Also cite updated phylogenetic analysis: Zhang et al. 2020.

Page 368, Plate 8.10: add photos of Fabaceae: Fabaceae, Cercidoideae (*Bauhinia acuminata*: flower and leaves), Fabaceae, Deterioideae (*Amherstia nobilis*: flower), Fabaceae Deterioideae (*Saraca indica*: node showing intrapetiolar stipules). Also change the following: Fabales: Fabaceae, Mimosoideae *Albizia*… 🡪 Fabales: Fabaceae, Caesalpinioideae (Mimoseae) *Albizia*…

Page 375, column 1, line 3: *the abaxial one often boat-shaped* 🡪 **the abaxial one often boat-shaped**

Page 375, column 1, line 14: sometimes arillate; 🡪 sometimes arillate; **seed coat with many layers, the inner layer of the testa ± palisade, U-thickened**

Page 375, column 1, line 4 in **Discussion**: (Persson 2001). 🡪 (Mota et al. 2019; Persson 2001; Pastore et al. 2017).

Page 357, column 1, line 17 in **Discussion**: *Badiera, Polygaloides*, 🡪 *Badiera, Bredemeyera, Polygaloides,*

Page 375, column 2, Additional references: add Pastore et al. 2019

Page 375, column 2, line 4 under Rosales: add Sun et al. 2016 and Li et al. 2019 and Folk et al. 2018 to references supporting monophyly of order.

Page 376, Fig. 8.62: Delete “Incurved stamens” from the synapomorphies of Urticaceae, and add this character as a synapomorphy of Urticaceae + Moraceae clade.

Page 376, Rosaceae: add in a cladogram for this family, showing relationships of the subfamilies, and especially relationships within the complex Amygdaloideae (see end of this document).

Page 376, column 2, line 22: Add at end of the paragraph this sentence – Inflexed stamens are likely also synapomorphic for the Urticaceae + Moraceae clade, although they have been lost in *Cecropia* and relatives within Urticaceae, and lost multiple times (i.e., giving rise to straight stamens) repeatedly within Moraceae, possibly associated with shifts from wind to animal pollination (Gardner et al. 2021b).

Page 376, column 2, line 15 from bottom: add Elaeagnaceae to list of major families of Rosales

Page 376, column 2, line 9 from bottom: thorns sometimes present; 🡪 thorns sometimes present; **cork cambium deep-seated**;

Page 381, column 1, line 4: … basis of fruit type. 🡪 …basis of fruit type (Potter et al. 2007; Xiang et al. 2017).

Page 382, column 1, line 3: Five tribes 🡪 Six tribes

Page 382, column 1, line 9: … respectively. 🡪 … respectively. *Filipendula* (Ulmarieae) is probably sister to the remaining tribes, followed by *Rubus*, Colurieae, and *Rosa*.

Page 382, column 1, line 3 from bottom: Osmaronieae 🡪 Exochordeae

Page 382, column 2, line 1: Osmaronieae 🡪 Exochordeae

Page 382, column 2, line 6 and 7: *Lyonothamnus* is not closely related to any other group within the Amygdaloideae. 🡪 *Lyonothamnus* may be most closely related to Amygdaleae, although they are morphologically quite different.

Page 385, column 2, line 16: each locule; stigmas 🡪 each locule; **style usually with longitudinal canals**; stigmas

Page 385, column 2, line 19: *often with a conspicuous subbasal rim* 🡪 **with a conspicuous subbasal** (to apical) **rim**

Page 385, Genera/species: *Zizyphus* (100) 🡪 *Ziziphus* (70); *Rhamnus* (70) 🡪 *Rhamnus* (70, incl. *Oreoherzogia*, *Ventia*); and add to the list – *Sarcomphalus* (33).

Page 385, Genera/species: Add to the list of genera occurring in the United States: *Pseudoziziphus* and *Sarcomphalus*. [*Ziziphus* is kept in the list, but now represented only by introduced species.]

Page 385, line 9 in Discussion: …Richardson et al. (2000a, b). 🡪 … Richardson et al. (2000a, b) and Hauenschild et al. (2016a, b).

Page 386, column 1, line 4: *Berchemia*, and *Reynosia* 🡪 *Berchemia*, *Condalia*, *Pseudoziziphus*, and *Reynosia*

Page 386, column 1, line 10: *Ziziphus*, *Ceanothus* 🡪 *Ziziphus*, *Sarcomphalus*, *Ceanothus*

Page 386, column 1, references: add Islam and Guralnick 2015, and Huang et al. 2021

Page 386, column 2, line 13 in description: **4- to 6-porate** 🡪 **4- to 7-porate**

Page 388, column 1, line 9: *Ampelocera* and *Holoptelea* are sister… 🡪 *Ampelopcera*, *Holoptelea* and *Phyllostylon* are sister…

Page 388, lines 12 and 14: replace “section” with “suhgenus” in both lines

Page 388, line 16: and usually non-ciliate margined… 🡪 and non-ciliate margined…

Page 388, line 18: …(Wiegrefe et al. 1994). 🡪 … (Wiegrefe et al. 1994; Whittenmore et al. 2021). The Himalayan species, *U. villosa* (flowers and fruits sessile, fruits ciliate) is placed in its own subgenus (subg. *Indoptelea*). Within *Ulmus*, subg. *Oreoptelea* is sister to the subg. *Indoptelea* + subg. *Ulmus* clade.

Page 390, column 1, line 2 in Genera/species: add – *Artocarpus* (70)

Page 390, column 1 line 13 in discussion: rbcL, ndhF, and 26S sequences 🡪 nuclear and chloroplast sequences

Page 390, column 1, 14: to references add: Williams et al. 2017

Page 390, column 1-2, line 5 from bottom in column 1 to 2 from top in column 2: The earliest lineages… (Clement and Weiblen 2009). Replace this text with the following. Molecular data support recognition of six tribes within Moraceae. These belong to two major clades, the first of which includes Artocarpeae (*Artocarpus*, *Clarisia*, and *Batocarpus*; staminate flowers usually with only a single stamen), which are related to Chlorophoreae (only *Maclura*; thorns and globose pistillate inflorescences) and Moreae (*Morus*, *Sorocea*, *Paratrophis*, and relatives; unisexual inflorescences, filaments curved or straight, and stipules not membranous). The second major clade includes the remaining four tribes, i.e., Parartocarpeae (*Parartocarpus*, *Hullettia;* unisexual inflorescences, stamens straight, and monoecious), Dorstenieae (*Dorstenia*, *Brosimum*, *Broussonetia*, *Fatoua*, and relatives; morphologically variable, but inflorescences usually bisexual), Olmedieae (*Castilla*, *Antiaropsis*, *Olmedia*, and relatives; inflorescences discoid and with multiple, layers of imbricate bracts), and Ficeae (only *Ficus*; inflorescences cup-shaped, with bracts around the small opening) (Clement and Weiblen 2009; Gardner et al. 2021a, b; Zerega and Gardner 2019).

Page 390, column 2, line 30: … fungus). 🡪 … fungus) (Gardner et al. 2018).

Page 390, column 2, Additional references: add – Gardner & Zerega 2021, and Gardner et al. 2021c.

Page 392, column 1, line 1: **laticifers restricted** 🡪 **laticifers usually restricted**

Page 393, column 1, line 8: **incurved in bud** 🡪 *incurved in bud*

Page 393, column 1, Major genera: *Pilea* (600 spp.) 🡪 *Pilea* (710 spp.)

Page 393, column 1, line 10 in **Discussion**: (Sytsma et al. 2002). 🡪 (Sytsma et al. 2002; Treibler et al. 2016; Wu et al. 2013).

Page 393, column 1, line 4 from bottom, insert sentence: The major clade corresponding to the old Cecropiaceae is now recognized as Cecropieae, and includes *Cecropia* (probably including *Musanga*), *Myrianthus*, *Pourouma*, and *Coussapoa*.

Page 393, column 2, Additional references: add Fu et al. 2022

Page 393, column 2, line 12 under Cucurbitales: add Sun et al. 2016 and Soltis et al. 2018 and Li et al. 2019 and Folk et al. 2018 to references supporting monophyly of order.

Page 393, column 2, immediately following Cucurbitales introduction insert “Key to Major Families of Cucurbitales”:

**Key to the Major Families of Cucurbitales**

1. Vines, usually with a tendril attached ± laterally at each node; petals connate; stamens variously connate and modified; fruit usually a berry with a hard to leathery rind; seeds flattened, without a lid. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .**Cucurbitaceae**

1. Non-vine herbs, without tendrils; petals absent or distinct, or perianth of colorful, distinct tepals; stamens distinct; fruit usually a capsule; seeds not flattened, with a lid (i.e., operculate). . . . . . . . . . . . . . .2

2. Leaf venation palmate, the blade asymmetrical; plants not N-fixing; perianth usually of petaloid tepals; staminal filaments obvious; stigmas spirally twisted, yellow; placentation axile; capsule usually 3-winged. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **Begoniaceae**

2. Leaf venation pinnate, the blade symmetrical; plants with N-fixing nodules on roots; perianth of connate sepals and petals absent; staminal filaments very short; stigmas not twisted, greenish to white; placentation parietal; capsule not winged. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Datiscaceae

Page 395, column 1, line 1: often in 2 concentric rings 🡪 **often in 2 concentric rings**

Page 395, column 1, line 3: with calcified walls 🡪 **with calcified walls**

Page 395, column 2, last line in Economic plants and products: Add – For more information on the evolution and domestication of crop species see Chomicki et al. 2020.

Page 395, column 2, line 2 in **Discussion**: Two subfamilies … features. 🡪 Two subfamilies are often recognized (Jeffrey 1967, 1980, 1990a, b; Kocyan et al. 2007). However, “Nhandiroboideae,” (characterized by separate styles and pendulous ovules) has been shown to be non-monophyletic, and consists of a basal grade (e.g., Gomphogyneae, Triceratieae, Zanonieae), containing genera with numerous plesiomorphic features (Renner and Schaefer 2016; Schaefer and Renner 2011).

Page 395, column 2, line 2 in description: with large water-storage cells in leaf hypodermis 🡪 **with large water-storage cells in leaf hypodermis**

Page 395, column 2, line 7: *stipules present, often large, persistent* 🡪 **stipules present, often large, persistent**

Page 397, column 1, line 7: (919 spp.) 🡪 (1870 spp.)

Page 397, column 1, line 7: 2/920 🡪 2/1871

Page 397, column 1, line 9 in Discussion: … paraphyletic. 🡪 …paraphyletic, and 70 sections are now recognized within this large genus (Moonlight et al. 2018).

Page 397, column 1, 10 from bottom, additional references: add Wilde 2011

Page 397, column 2, line 5: add Sun et al. 2016 and Li et al. 2019 and Folk et al. 2018 to references supporting monophyly of order.

Page 397, column 2, line 16: add Cook and Crisp 2005 and Yang et al. 2021 to references supporting phylogenetic pattern within Fagales

Page 398, Fig. 8.73: Add Yang et al. 2021 to references supporting cladogram

Page 398, column 1, line 12-13: *matK* and *rbcL* sequences 🡪 DNA sequences

Page 398, column 1, line 13: (Manos and Steele 1997). 🡪 (Manos and Steele 1997; Chen et al. 2016; Xiang et al. 2014).

Page 398, column 1, line 14: that recent analyses 🡪 that other recent analyses

Page 398, column 1, line 15: (Li et al. 2004, Soltis et al. 2011) 🡪 (Herbert et al; 2006, Li et al. 2004; Soltis et al. 2011)

Page 398, column 1, line 18: add sentence at end of paragraph: The families of Fagales can be distinguished by characteristics of their wood anatomy (Wheeler et al. 2022).

Page 398, column 2, line 13: …aborting. 🡪 …aborting, with 1 integument.

Page 398, column 2, line next to last: 9/900 🡪 8/900

Page 400, column 1, line 3 in **Discussion**: add Xiang et al. 2014 and Yang et al. 2021 to nucleotide sequences references

Page 400, column 1, line 8: … other genera of Quercoideae. 🡪 … other genera of Quercoideae, which all have seeds that retain the cotyledons.

Page 400, column 1, lines 8-12 in **Discussion**, replace sentence – The North American *Notholithocarpus* … Oh and Manos 2006, 2008). – with the following:

Among these genera, the North American *Notholithocarpus* *densiflorus* (usually treated in *Lithocarpus*) is sister to *Quercus*, and the *Notholithocarpus* + *Quercus* clade is likely sister to the *Lithocarpus* (Asian species) + *Chrysolepsis*. This *Quercus* + *Notholithocarpus* + *Lithocarpus* + *Chrysolepsis* clade is supported by acorn fruits, i.e., a single nut surrounded by an unlobed cupule. All these genera are insect pollinated, while wind pollination (with dangling catkins of staminate flowers) is a derived character of *Quercus*. This *Quercus* + *Notholithocarpus* + *Lithocarpus* + *Chrysolepsis* clade is sister to the *Castanea* + *Castanopsis* clade (see Oh and Manos 2006, 2008; Zhou et al. 2022).

Page 400, column 1, line 14 in **Discussion**: plesiomorphic morphological characters: bisexual inflorescences, 🡪 plesiomorphic morphological characters: insect pollination, bisexual inflorescences,

Page 400, column 1, line 18 in **Discussion**: replace sentence “*Quercus* is considered to be monophyletic….” with the following:

*Quercus* is considered monophyletic based on its dangling catkins (indicating wind pollination; Zhou et al. 2022) and several floral characters, especially the large size of the style relative to the ovary at pollination (Deng et al. 2008). Acorn fruits diagnose a slightly more inclusive clade (i.e., *Quercus* + *Notholithocarpus* + *Lithocarpus* + *Chrysolepsis*).

Page 400, column 1, line 24 in **Discussion**: add to references supporting monophyly of *Quercus*: Hipp et al. 2017 and Denk et al. 2017 and Deng et al. 2018 and Zhou et al. 2022

Page 400, column 1, line 26: … (Plate 8.12C). 🡪 … (Plate 8.12C), also likely synapomorphic.

Page 400, column 1 line 26 to end of column: Replace paragraph Two major phenetic groups … Manos 2008). With the following:

*Quercus* is comprised to two major clades (Zhou et al. 2022): subg. *Cerris* (pollen usually with visible rugulate; including sects. *Cyclobalanopsis*, *Cerris* and *Ilex*) and subg. *Quercus* (pollen ± verrucate; including sects. *Quercus*, *Virentes*, *Ponticae*, *Protobalanus*, and *Lobatae*). Section *Cyclobalanopsis* (incl. ca. 90 species) is phenetically distinctive because it has cyclically arranged cupule scales, while all the other sections have imbricate cupule scales. The red oaks (sect. *Lobatae*, incl. ca. 120 spp.) are characterized by leaves often with bristle tips; flowers with elongate, linear-spathulate styles, and usually retuse anthers; aborted ovules near the apex of the nut; and usually biennial fruits with a pubescent inner fruit wall and cupule scales membranous, with broad-angled tips). In contrast, the white oaks (sect. *Quercus*, incl. ca. 150 spp.) have leaves without bristle tips; flowers with short, abruptly dilated styles and usually apiculate anthers; aborted ovules at the base of the nut; and annual fruits with a glabrous inner fruit wall and cupule scales triangular, thin to corky. The live oaks (section *Virentes*, seven species) are very similar to the white oaks (and have often been included in that section), but they are consistently evergreen, have a cotyledonary tube, and distinctive seedling development. A fourth, smaller group, section *Protobalanus*, is also similar to section *Quercus*, but differs in its biennial (vs. annual) fruits, clearly pubescent (vs. glabrous) inner fruit wall (Nixon et al. 1995; Denk et al. 2017), and pollen sculpturing (Denk and Grimm 2009). DNA analyses support the segregation of *Q. cerris*, *Q. suber*, and *Q. ilex*, and their relatives from section *Quercus* (Denk and Grimm 2010; Denk et al. 2017; Manos et al. 1999, 2001; Oh and Manos 2008), and their recognition either in section *Cerris* (10 spp.) or section *Ilex* (35 spp.). These sister sections (of Europe and Asia) are phenetically quite similar but can be distinguished morphologically: section *Cerris* (plants deciduous, flowers with pointed styles, fruits annual with cupule scales elongated, the tips recurved), section *Ilex* (plants evergreen, flowers with blunt styles, fruits annual or biennial with cupule scales thin, triangular, the tips recurved or not). Interestingly the monophyly of *Quercus* is not supported in the plastid-based analysis of Yang et al. (2021) as a likely result of hybridization (chloroplast capture)*,* but its monophyly is strongly supported by nuclear genes (Zhou et al. 2022).

Page 400, column 2, **Additional references**: add Hauser et al. 2017.

Page 401, column 2, line 6 in **Discussion**: (Li et al. 2004) 🡪 (Li et al. 2004; Yang et al. 2019; Xiang et al. 2014; Yang et al. 2021)

Page 401, column 2, line 18 in **Discussion**: … Chen et al. 1999). 🡪 … Chen et al. 1999; Yang et al. 2019, 2021).

Page 401, column 2, line 26 in **Discussion**: *rbcL* 🡪 chloroplast

Page 401, column 2, line 28: add Yang et al. 2021 to references supporting monophyly of subfamilies. Also add sentence at end of paragraph: The monophyly of both *Carpinus* and *Ostrya* is in need of clarification (Yang et al. 2021).

Page 401, column 2, line 31 in Discussion: (Abbe 1935, 1974) 🡪 (Abbe 1935, 1974; Zhu et al. 2018)

Page 403, column 2, lines 3-4 in **Discussion**: *rbcL* and *matK* sequences (Sogo et al. 2001; Steane et al. 2003). 🡪 DNA sequences (Sogo et al. 2001; Steane et al. 2003; Xiang et al. 2014; Yang et al. 2021).

Page 404, column 1, line 28 in description: *Fruit a drupe* 🡪 **Fruit a drupe**

Page 404, column 2, line 4 in **Discussion**: add Xiang et al. 2014 and Yang et al. 2021 to molecular references

Page 407, column 1, line 3: 8/59 🡪 7/59

Page 407, column 1, line 4 in **Discussion**: add Xiang et al. 2014 to references

Page 407, column 1, line 7 in **Discussion**: add Mu et al. 2020 and Yang et al. 2021 to references listed

Page 409, column 1, line 2): add Sun et al. 2016 to references supporting monophyly of order.

Page 409, column 1, line 15: add Zhang et al. 2015 to references

Page 409, column 1, line 22: (Price and Palmer 1993) 🡪 (Price and Palmer 1993; Zhang et al. 2015)

Page 409, column 1, last line: Add Berger et al. 2016 and Sun et al. 2016 and Li et al. 2019 and Maurin et al. 2021 and Folk et al. 2018 to list of references for monophyly of order.

Page 409, column 2, line 28: …sequences, and Soltis et al. (2011) who… 🡪 … sequences, Berger et al. (2016) who used *rbcL, ndhF, matK, matR*, 18S and 26S sequences, and Soltis et al. (2011) who…

Page 410, Figure 8.81: Remove the line in cladogram connecting Combretaceae with theLythraceae + Onagraceae clade. Instead should be a trichotomy at base of cladogram, Also add the following the references cited in the figurre caption: Soltis et al. 2011, Berger et al. 2016, Maurin et al. 2021.

Page 410, Key to Major Families of Myrtales: Add a new couplet 1 (see below) and renumber current couplets 1-5 as 2-6:

1. Hypanthium absent; calyx with a nectar spur; stamen 1. . . . . . . . . . . . . . . . . . . . . . . . Vochysiaceae

1. Hypanthium present, short to elongate; calyx without nectar spur; stamens 4 to numerous. . . . . . . 2

Page 413, column 1, line 4 in **Discussion**: (Graham et al. 2005) 🡪 (Graham et al. 2005; Maurin et al. 2021)

Page 413, column 1, line 15 in **Discussion**: *Lythrum, Pemphis*, and 🡪 *Lythrum, Pemphis, Rotala*, and

Page 413, column 2, line 14: or biporate; 🡪 or biporate; **and lacking pseudocolpi**

Page 414, column 1, line 3: Levin et al. 2003 🡪 Levin et al. 2003, 2004

Page 414, column 1, line 5: …2007). 🡪 …2004), and genomic data (Maurin et al. 2021).

Page 415, column 2, line 3 in **Discussion**: Maurin et al. 2010 🡪 Maurin et al. 2010, 2017, 2021

Page 416, column 2, line 6: with furrows fused 🡪 **with furrows fused in polar region and lacking pseudocolpi**

Page 417, column 1, line 12: 144/4630 🡪 142/5900

Page 417, column 1, line 13: *Myrcia* (300) 🡪 *Myrcia* (400, including *Calyptranthes*)

Page 417, column 1, line 14-15: *Psidium* (100), and *Calyptranthes* (100). 🡪 and *Psidium* (100).

Page 417, column 1, line 15: All of the above (except *Myrcia*), 🡪 All of the above,

Page 417, column 1, line 4-6 in **Description**: Add Biffin et al. 2010, Maurin et al. 2021 to references on phylogeny of family.

Page 417, column 2, line 7: *Calyptranthes* 🡪 *Myrcia*

Page 417, column 2, line 9: delete *Calyptranthes* [as it is now included in *Myrcia*, also listed]

Page 417, column 2, line 9: myrtoid clade 🡪 Myrteae

Page 417, column 2, line 11: and *Rhodomyrtus*) 🡪 and *Rhodomyrtus*; see Vasconcelos et al. 2017, 2019; Lucas et al. 2019)

Pshr 417, column 2, line 11: *Acmena* group 🡪 Syzygieae

Page 417, column 2, line 35: Lucas et al. 2007 🡪 Lucas et al. 2007, 2008

Page 417, column 2, line 36: Wilson 1960d 🡪 Wilson 1960d, 2011 [also add Flickinger et al. 2020 to list of references]

Page 417, column 2, description of Melastomataceae, line 5: *Leaves opposite*, entire… 🡪 *leaves opposite*, simple, entire…

Page 417, column 2, description of Melastomataceae, lines 6-9: *with usually 2-8 subparallel secondary veins diverging from the base and converging toward the apex, these usually connected*… 🡪 **with usually 2-8 subparallel secondary veins diverging from the base and converging toward the apex**, *these usually connected*…

Page 417, column 2, description of Melasstomataceae, line 9: stipules lacking. 🡪 stipules usually lacking.

Page 417, column 2, description of Melastomataceae, line 15: projections. 🡪 projections (*calyx teeth*).

Page 417, column 2, description of Melastomataceae, lines 15-16: *convolute*. 🡪 **convolute**.

Page 419, column 1, description of Melastomataceae, line 2: *anthers* sometimes unilocular 🡪 anthers usually bilocular, but sometimes unilocular or multilocular

Page 419, column 1, description of Melastomataceae, line 3: *at base, sometimes*… 🡪 *at base, sometimes greatly elongated below anther, sometimes*

Page 419, column 1, description of Melastomataceae, line 12: *numerous and small*; endosperm 🡪*numerous and small*, but occasionally larger, few to 1, often with a hylar operculum; endosperm

Page 419, column 1, 188/5100 🡪 177/5750

Page 419, column 1, last line in Major genera. …only by *Rhexia* and *Miconia*. 🡪 … only by *Rhexia* and *Miconia*, although *Acisanthera* and *Melastoma* are naturalized in Florida.

Page 419, column 1, Major genera: change list of large genera to: *Miconia* (1900 spp.), *Memecylon* (400), *Medinilla* (360), *Blakea* (190), *Microlicia* (165), *Pleroma* (161), *Sonerila* (160), *Meriania* (121), and *Chaetogastra* (117).

Page 419, column 1, Economic plants and products: *Tibouchina* (princess flower) 🡪 *Pleroma* and *Tibouchina* (princess flowers)

Page 419, column 1, line 2 in **Discussion**: two subfamilies 🡪 two large subfamilies

Page 419, column 1, line 3 in **Discussion**: sclereids in leaves, anther with… 🡪 sclereids and stomatal crypts in leaves, anther with…

Page 419, column 1, line 7 in **Discussion**: bilateral, stems… 🡪 bilateral, indothecium poorly developed, not fibrous, anthers usually with pores, seeds with a hylar operculum, stems usually…

Page 419, column 1, line 12 in **Discussion**: add Goldenberg et al. 2015 and Wurdack and Michelangeli 2019 and Penneys et al. 2020 and Maurin et al. 2021 and Clausing & Renner 2001.

Page 419, column 1, line 14: Delete sentence: *Pternandra* probably is … Renner 2001). Add instead: *Pternandra* is of uncertain position, either sister to Olisbeoideae or to Melastomatoideae; it is placed in its own subfamily (Kibessioideae). [Place this sentence at the end of discussion of Melastomatoideae, i.e., column 2, line 14.]

Page 419, column 1, line 20 in **Discussion**: into several tribes. 🡪 into several tribes (Bacci et al. 2019; Kartonegoro et al. 2021; Penneys et al. 2020).

Page 419, column 2, line 3: … Michelangeli et al. 2008). 🡪 … Michelangeli et al. 2008) and recently all these genera have been subsumed within *Miconia* s.l. (Michelangeli et al. 2019).

Page 419, column 2, line 4: Dissochaeteae/Sonerileae complex 🡪 Sonerileae

Page 419, column 2, line 9: Rhexieae have thee additional apomorphies of unilocular anthers and snail-shapaed seeds. 🡪 Rhexieae have the apomorphies of seeds that are snail-shaped and have multicellular tuberculae.

Page 419, column 2, line 14: and may be closely related to *Rhexia*. 🡪 and is related to Rhexieae (e.g., *Rhexia*), Microlicieae (e.g., *Microlicia*, *Lavoisiera*, *Trembleya;* see Fritsch et al. 2004), and the recently described Marcetieae (e.g., *Aciotis, Acisanthera, Comolia, Marcetia, Nepsera;* see Da Rocha et al. 2018). The latter tribe lacks a setose ovary apex and has snail-shaped, to ellipsoid or tear-shaped seeds.

Page 419, column 2, line 26: (e.g., *Tococa*) 🡪 (e.g. some *Miconia*; see Michelangeli 2010)

Page 419, column 2, Additional references: add Basso-Alves et al. 2017 and Bochorny et al. 2019.

Page 419, column 2, line 16: …2000b). 🡪 …2000b; Sun et al. 2016; Cardinal-McTeague 2016; Li et al. 2019; Edger et al. 2018; Folk et al. 2018).

Page 420, Fig. 8.86: add Cardinal-McTeague 2016 and Edger et al. 2018 to supporting references; show Tovariaceae and Residaceae as a polytomy coming of same line as Capparaceae + Cleomaceae + Brassicaceae clade. Also, along with 4-merous flowers, etc. add indolic glucosinolates as an additional synapomorphy

Page 422, immediately after introduction of Brassicales, insert: **Key to the Major Families of Brassicales**:

1. Flowers 5-merous. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2

1. Flowers 4-merous. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 4

2. Herbs, prostrate or climbing; flowers bilateral, with a pronounced hypanthium-spur; placentation axile; fruit a schizocarp. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Tropaeolaceae

2. Thick-trrunked trees or shrubs; flowers radial or bilateral, lacking a spur; placentation parietal; fruit a capsule or berry. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 3

3. Leaves 2- to 3-times pinnately compound; sap not milky; flowers radial or bilateral, bisexual, with a hypanthium; fruit an elongated capsule; seeds winged. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Moringaceae

3. Leaves simple and palmately lobed or palmately compound; sap ± milky; flowers radial, mostly unisexual, lacking a hypanthium; fruit a berry; seeds non-winged. . . . . . . . . . . . . . . . . . . . . . . Caricaceae

4. Flowers unisexual and densely clustered in cone-like spikes; perianth of tepals in staminate flowers and lacking in carpellate flowers; fruit a cluster of drupes. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Bataceae

4. Flowers bisexual; inflorescences not as above; perianth of a calyx and corolla; fruit usually a capsule (with or without a replum) or silique. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5

5. Plants trees or shrubs; fruit lacking a replum. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **Capparaceae**

5. Plants ± herbaceous; fruit with a replum, i.e., a thickened rim to which the seeds are attached. . . . . . . 6

6. Leaves palmately compound; flowers usually bilateral; gynophore elongated; fruit usually a capsule, lacking a false septum. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **Cleomaceae**

6. Leaves simple, often pinnately dissected or lobed; flowers usually radial; gynophore usually short; fruit a silique, with a false septum, i.e., thin partition lacking vascular tissue. . . . . . . . . . . . . . . . . **Brassicaceae**

Page 422, column 1, line 6 in description: stipules absent 🡪 **stipules absent**

Page 422, column 1, line 27 of description: **embryo folded**; 🡪 **embryo folded, the radicle not in pocket formed by testa;**

Page 422, column 1, line 10 from bottom: add *Boechera* (110)

Page 422, column 1, line 5 from bottom: *Erysimum* and *Thelypodium*

Page 422, column 2, line 17 in **Discussion**: 25-48 🡪 52

Page 422, column 2, line 19 in **Discussion**: et al. 2006); 🡪 et al. 2006; Huang et al. 2015; Nikolov et al. 2019);

Page 424, column 1, line 3: *embryo curved*; 🡪 *embryo curved, the radicle in pocket formed by testa*;

Page 424, column 1, line 4 in **Discussion**: add two references in connection with problematic generic limits – Barrett et al. 2017 and Roalson & Hall 2017

Page 424, column 2, line 10: *embryo curved*; 🡪 *embryo curved, the radicle in pocket formed by testa*;

Page 424, column 2, line 40: add Tamboli et al. 2018 to Additional references.

Page 425, column 1, line 3: add Sun et al. 2016 and Le Péchon and Gigord 2014 and Folk et al. 2018 and Li et al. 2019 to references supporting monophyly of order.

Page 425, column 1, lines 2-3 in description: *but usually stellate hairs or peltate scales* 🡪 **but usually stellate hairs or peltate scales**

Page 425, column 2, line 10 from bottom: add to list of continental genera *Anoda, Ayenia, Melochia, Modiola, Malvella*, and *Meximalva*

Page 427, column 1, line 1: add reference – Hernández-Gutiérrerz et al. 2021.

Page 428, Fig. 8.90: add Le Péchon and Gigord 2014 and Cvetković et al. 2021 and Hernández-Gutiérrez et al. 2021 to references supporting topology of figure. Also add “separate carpels” to synapomorphies of Brownlowioideae, and add *Mortoniodendron* as a genus of Tilioideae. Add to synapomorphy of Malvoideae: spiny pollen with numerous pores. Add to synapomorphies of Dombeyoideae: staminodes formina short tube, and cotyledons bifid. Indicate that Malvoideae + Bombacoideae form the Malvatheca. Alter structure of cladogram to remove the Byttnerioideae + Grewioideae clade, and extend the lines to these two subfamilies down to the lower horizontal line.

Page 428, column 2, line 6 from bottom: *Hibiscus*); 🡪 *Hibiscus*; Areces-Berazain & Ackerman 2017);

Page 429, column 1, line 21, in Additional references: -- add the following: McCarthy and Mason-Gamer 2020

Page 429, column 2, line 7: … and Chase 2003). 🡪 … Chase 2003), and Cistaceae may, in fact, be sister to *Pakaraimaea*, a genus traditionally placed in Dipterocarpaceae (Heckenhauer et al. 2017).

Page 429, column 2, line 12: (Arrington and Kubitzki 2003). 🡪 (Arrington and Kubitzki 2003; Aparicio et al. 3017).

Page 429, column 2, line 3 from bottom: 17/550 🡪 17/680

Page 429, column 2, linw 3 from bottom: *Shorea* (195 spp.) 🡪 *Shorea* (195 spp.; paraphyletic group, with recognition of segregates, such as *Rubroshorea*, *Richetia*, *Anthoshorea*, possibly required)

Page 430, column 1, line 4 in **Discussion**: add Heckenbauer et al. 2017 to references supporting monophyly of family; and add to end of sentence the following: , with the exception of the Pakaraimoideae, which are likely sister to Cistaceae.

Page 430, column 1, line 5 in **Discussion**: The family is divided 🡪 The family traditionally has been divided…

Page 430, column 1, line 24 in **Discussion**: add Heckenhauer et al. 2017, 2018, 2019 and Cvetković et al. 2022 to papers investigating phylogeny of Diperocarpoideae

Page 430, column 2 line 3 in **Discussion**: add Sun et al. 2016 to references

Page 431, column 1, line 8: add Sun et al. 2016 and Li et al. 2019 and Folk et al. 2018 to references supporting monophyly of order.

Page 431, column 1, line 12: add to cited references supporting monophyly of Anacardiaceae + Burseraceae: Muellner-Riehl et al. 2016.

Page 432, Fig. 8.91: Add to references in figure caption: Muellner-Riehl et al. 2016.

Page 432, column 1, line 3: 155/930 🡪 161/2085

Page 432, column 1, line 8: add *Choisya* and *Thamnosma* to list of continental genera

Page 432, column 2, lines 3-5: add Sun et al. 2016 and Chen et al. 2016 and Appelhans et al. 2021 to references And change cpDNA to DNA and delete “and nuclear (*Xdh*) sequences”. Thus, list all molecular references together.

Page 432, column 2, lines 16 and 17: *Eremocitrus*, and *Microcitrus* 🡪 *Eremocitrus*, *Microcitrus*, and *Oxanthera*; and also include additional reference on line 17 – Schwartz et al. 2016

Page 432, column 2, line 17: A recircumscribed Amyridoideae (formerly Toddalioideae; … (Morton and Telmer 2014). 🡪 The large Zanthoxyloideae (formerly Toddalioideae p.p; including *Casimiroa*, *Zanthoxylum*, *Phellodendron*, *Ptelea, Skimmia, Tetradium, Toddalia*, *Correa*, *Choisya*, and relatives) also is monophyletic, and these plants are characterized by fruits with a fibrous endocarp, usually forming follicles, capsules, or drupes, with from one to several pits (Morton 2015; Morton and Telmer 2014; Appelhaus et al. 2021).

Page 432, column 2, line 25: *Ruta* and *Chloroxylon* together constitute the small subfamily Rutoideae. 🡪 *Ruta*, *Chloroxylon* and relatives constitute the small subfamily Rutoideae and are mainly herbs to subshrubs with 4-12 ovules per locule. Another small subfamily, Amyridoideae (*Amyris*, and 2 others), are distinctive in having unicarpellate flowers. Finally, the Cneoroideae (*Cneorum* and relatives) are sister to the clade comprising all of the above subfamilies; they have entirely lost pellucid dots, or have these restricted to the leaf margins.

Page 432, column 2, line 24: add Morton 2015

Page 432, column 2, line 25: …Rutoideae. 🡪 …Rutoideae. Finally, Cneorum, Harrisonia, Spathelia and relatives (subfam. Cneoroideae) are sister to the rest of the familial clade.

Page 435, column 1, line 13: add Kubitzki et al. 2011 to general references

Page 435, column 1, line 5 from bottom: 51/550 🡪 56/640

Page 435, column 2, line 4 from bottom: *Dysoxylum* (61), and *Guarea* (35) 🡪 *Chisocheton* (53), *Guarea* (35), and *Dysoxylum* (28)

Page 435, column 2, line 3 in **Discussion**: Muellner et al. 2003 🡪 Muellner et al. 2003, 2006

Page 435, column 2, line 6 in **Discussion**: Swietenioideae 🡪 Cedreloideae

Page 435, column 2, line 9 in **Discussion**: …1975). Swietenioideae, containing… 🡪 …1975; Atkinson 2020; Mabberley 2011). Cedreloideae, containing

Page 435, column 2, line 2 in description of Simaroubaceae: cells often present 🡪 cells or canals often present

Page 435, column 2, line 2 in description: leaves and bark 🡪 leaves, twigs, and bark

Page 435, column 2, line 4 in description: Hairs usually simple. 🡪 Hairs ususally simple, sometimes glandular.

Page 435, column 2, line 6: (Plate 8.15F); 🡪 (Plate 8.15F), sometimes with nectar glands;

Page 436, column 2, line 3: 21/100 🡪 22/120

Page 437, column 1, line 3: add Sun et al. 2016 and Majure et al. 2021a-c

Page 437, column 1, line 8: *Castela* and *Picrasma* are sister taxa, forming a clade that is sister… 🡪 *Castela* (incl. *Holacantha*) forms a clade that is sister…

Page 437, column 1, line 10: among wich *Ailanthus* was the first to diverge 🡪 among which *Picrasma*, followed by *Ailanthus*, were the first to diverge

Page 437, column 1, line 11: et al. 2007). 🡪 et al. 2007; Clayton 2011; Majure et al. 2021a, b).

Page 437, column 1, line 11: at end of this paragraph add the following sentence: Seemingly simple (but actually unifoliolate) leaves have evolved numerous times, and are characteristic of *Amaroria*, *Castela*, *Leitneria*, *Samadera*, and some species of *Soulamea*.

Page 437, column 1, line 24: …while the drupes of *Simarouba* are bird-dispersed. 🡪 …while the drupes of *Simarouba* are bird dispersed, and those of *Leitneria* water dispersed. Dispersal by fish and rodents also occurs.

Page 437, column 1, Additional references: add – Pirani et al. 2021

Page 437, column 1, line 3 from bottom: **fertile carpel**. 🡪 **fertile carpel, with elongate funicle**.

Page 437, column 1, last line: *asymmetrical drupe*; 🡪 *asymmetrical drupe*, occasionally a samara;

Page 437, column 2, Floral formula: add samara to second formula: drupe 🡪 drupe, samara

Page 437, column 2, line 8: 70/600 🡪 80/870

Page 437, column 2, line 12: *Metopium, Rhus* 🡪 *Metopium, Pistacia, Rhus*

Page 437, column 2, line 7 in **Discussion**: add Pell 2004, Pell et al. 2011, Chen et al. 2016, and Weeks et al. 2014 to references

Page 437, column 2, line 16 in **Discussion**: is often considered to be paraphyletic 🡪 may be paraphyletic

Page 437, column 2, line 17 in **Discussion**: add Weeks et al. 2014 to references

Page 439, column 1, line 10: at end of paragraph add: Those with samaras (e.g., *Loxopterygium*, *Schinopsis*) are dispersed by wind; *Astronium* and *Myracrodruon*, which have wings that develop from the accrescent calyx, are also wind dispersed.

Page 439, column 1, line 12 in description: usually imbricate 🡪 **usually valvate**

Page 439, column 1, line 9 from bottom: 17/500 🡪 19/755

Page 439, column 2, line 3: add Weeks et al. 2014 to references

Page 439, column 2, line 15, Additional references: add Daly et al. 2011

Page 439, column 2, line 18 in description: … orthotropous; 🡪 … orthotropous, **the outer integument thicker than the inner**;

Page 439, column 2, line 26 in description: *seeds often with an aril-like coat*; 🡪 *seeds often with an aril or a fleshy seed coat*;

Page 442, column 1, line 5: add Acevedo-Rodríguez et al. 2011 and Sun et al. 2016 to references supporting family monophyly

Page 443, column 1, line 14 in **Discussion**: ITS plus chloroplast sequences 🡪 DNA sequences

Page 443, column 1, line 14: (Buerki et al. 2010a, b 🡪 (Buerki et al. 2010a, b; 2021

Page 442, column 2, line 24: add Feng et al. 2019 to additional references

Page 442, column 2, first line under Caryophyllales: add APG 2016

Page 442, column 2, line 7 under Caryophyllales: Heubl et al. 2006). 🡪 Heubl et al. 2006; Hernández et al. 2015; Li et al. 2019; Yang et al. 2015; Smith et al. 2017; Yao et al. 2019; Walker et al. 2018).

Page 442, column 2, line 8 from bottom: … are found in Caryophyllaceae); 🡪 …are found in Caryophyllaceae, Limeaceae, and Molluginaceae; see also Soltis et al. 2018);

Page 442, column 2, last line: add to references – Walker et al. 2018 and Yu et al. 2018

Page 443, column 1, line 7: … 2001). 🡪 … 2011, 2018; Yang et al. 2015).

Page 443, column 1, line 10 from bottom: 27 families 🡪 28 families

Page 443, column 1, line 6 from bottom: add Molluginaceae to list of major families. Also change Rivinaceae to Petiveriaceae

Page 443, column 1, last line: add Hernández et al. 2015, Yang et al. 2015, 2017, Smith et al. 2017, and Walker et al. 2018 to references cited in support of phylogenetic relationships within Caryophyllineae.

Page 443, Figure 8.97: add Hernández et al. 2015, Yang et al. 2015, 2017, Smith et al. 2017, Walker et al. 2018 and Yao et al. 2019 to references in figure caption. Also move “Pollen spinulose” to line representing stem species of Caryophyllinae. Also include a clade comprised of the two families Tamaracaceae and Frankeniaceae; this clade is positioned as sister to the Polygonaceae + Plumbaginaceae clade. Synapomorphies for the Polygonaceae + Plumbaginaceae + Tamaracaceae + Frankeniaceae clade are ovary 1-locular and salt glands. Synapomorphies for the Ramaracaceae + Frankeniaceae clade are small leaves and petals with adaxial appendages.

Page 444, column 1, line 3: Plumbaginaceae 🡪 **Plumbaginaceae**

Page 444, column 1, line 3: add mention of Tamaracaceae and Frankeniaceae

Page 444, Key to Major Families of Caryophyllineae: Rivinaceae 🡪 Petiveriaceae

Page 446, column 1, line 3 in description: **Leaves opposite** 🡪 *Leaves opposite*

Page 446, column 1, line 34: 86/2200 🡪 101/2200

Page 446, column 1, line 40: add *Eremogone* to list of continental genera

Page 446, column 2, line 28: (*Arenaria* subg. *Eremogone*) 🡪 (*Arenaria* subg. *Eremogone*, *Minuartia*, in part)

Page 446, column 2, line 29: (*Arenaria* subg. *Arenaria* and *Moehringia*) 🡪 (*Arenaria* subg. *Arenaria*, *Moehringia*, and *Leiosperma*)

Page 448, column 1, line 9: add to references – Dillenberger and Kadereit 2014; Sadeghian et al. 2016; Sharples and Tripp 2019

Page 449, column 1, line 2 in **Discussion**: At the end of the first sentence of this paragraph add the following: Phylogenetic relationships within the major genus, *Phytolacca*, have been investigated by Ali et al. (2015).

Page 449, column 1, line 6 in **Discussion**: add Ronse de Craene 2013 to references supporting polyphyletic assemblage that is difficult to characterize

Page 449, column 1, line 8 in **Discussion**: drupes 🡪 berries

Page 449, column 1, line 9 in **Discussion**: …*Trichostigma*). 🡪 …*Trichostigma*) (Brockington et al. 2009; Yang et al. 2015, 2017).

Page 449, column 2, line 12: 31/350 🡪 32/400

Page 449, column 2, line 12-13: *Neea* (80 spp.), *Guapira* (60), 🡪 *Guapira* (140 spp., incl. *Neea*),

Page 449, column 2, line 14: All but *Neea*, along with… 🡪 All these, along with…

Page 449, column 2, last line: add Rossetto et al. 2019 to **Additional references**.

Page 450, column 1, line 2 in description: **with concentric rings of vascular bundles** 🡪 *with concentric rings of vascular bundles*

Page 452, column 1, line 3: 169/2360 🡪 185/2360

Page 452, column 1, line 11: and *Suaeda*. 🡪 *Suaeda* and *Tidestromia*. Also add *Chenopodiastrum*, *Cycloloma, Dysphania, Blitum, Bassia, Kochia*

Page 452, column 1, line 10 in **Discussion**: add Walker et al. 2018 to references

Page 452, column 1, last line: add *Blitum* to list of genera with fleshy tepals

Page 452, column 2: under **Additional references** add: Waselkov et al. 2018 and Sukhorukov et al. 2018 and Steffen et al. 2015 and Piirainen et al. 2017

Page 453, column 1, line 2 in **Discussion**: Klak et al. (2003) 🡪 Klak et al. (2003, 2017)

Page 453, column 1, lines 13-16 in **Discussion**: *Sesuvium* and relatives … other members of the family 🡪 The monophyly of Sesuvioideae is supported by DNA sequences; these plants lack showy staminodes and have a perianth of tepals that are petaloid adaxially and sepaloid abaxially. The subfamily is comprised of two tribes, the Sesuvieae (*Sesuvium* and relatives) have circumscissile capsules and arillate seeds, while the Anisostigmateae (*Anisostigma* and *Tribulocarpus*) have woody fruits with papery wings or stiff spines, and it is sister to the other members of the family.

Page 453, column 2, line 8 in Discussion: remaining genera, and … 🡪 remaining genera (Hanckck et al. 2018), and …

Page 454, column 1, line 13 in description: *± inferior* 🡪 **± partially inferior**

Page 454, column 1, line 7 from bottom: add Walker et al. 2018 to references

Page 456, column 1, Genera/ species: 111/1400 🡪 139/1860

Page 456, column 1, line: 12 from bottom: add to continental genera *Coryphantha*, *Echinomastus*, *Escobaria*, and *Peniocereus*

Page 456, column 2, line 6: add Guerrero et al. 2018

Page 456, column 2, line 18: characterized by stem stomata 🡪 characterized bt reduced leaves, stem stomata

Page 456, column 2, line 31: After “…Majure et al. 2012).” Insert the following sentence: Expanded leaves have re-evolved in *Pereskiopsis* and *Quiabentia* of the Opuntioideae (Majure et al. 2019).

Page 459, column 1, line 5 in description: *forming a snap trap* 🡪 *forming a snap trap with trigger hairs*

Page 459, column 2, line 24: add Fleischmann et al. 2018 to Additional references.

Page 459, column 2, line 2 in description of Polygonaceae: often with oxalic acid 🡪 often with oxalic acid; **vessel elements with vestured pits**

Page 459, Key to Major Families of Polygonineae: Plumbaginaceae 🡪 **Plumbaginaceae**

Also: add two couplets to key, a new couplet 3, he current couplet 3 becomes couplet 4, and add a new couplet 5:

1. No change

1. No change

2. No change

2. No change

3. Fruits indehiscent; ovary with 1 basal ovule; petals not appendaged. . . . . . . . . . . . . . . . . . . . . . . . . . 4

3. Fruits dehiscent (capsular); ovary with 2 to many ovules on each placenta; petals with basal-adaxial appendages. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5

4. Current couplet 3a]

4. Current couplet 3b]

5. Leaves alternate; seeds with hairs. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Tamaracaceae

5. Leaves opposite; seeds without hairs. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Frankeniaceae

Page 461, column 1, line 10 in **Discussion**: …2011). 🡪 …2011, 2015).

Page 461, column 2, line 9 under Santalales: add Soltis et al. 2018 and Gitzendanner et al. 2018 and Li et al. 2019

Page 461, column 2, line 19 under Santalales: Nickrent et al. 2010 🡪 Nickrent 2020; Nickrent et al. 2010, 2019

Page 461, column 2, line 28: Santalaceae 🡪 **Santalaceae**

Page 462, Key to major families of Santalales: Santalaceae 🡪 **Santalaceae**

Page 463, column 1, line 3: 2005, 2008). 🡪 … 2005, 2008; Liu et al. 2018).

Page 463, column 1, last line: add sentence – Loranthaceae are most closely related to Schoepfiaceae (e.g., *Quinchamalium*, *Schoepfia*) and Misodendraceae (*Misodendrum*).

Page 463, column 2, line 4 in description: **Leaves opposite and decussate** 🡪 *Leaves opposite and decussate*

Page 463, column 2, last line: racemes of 3-flowered cymes. 🡪 racemes.

Page 465, column 1, line 2: Tepals 3-4, erect or closed, valvate 🡪 *Tepals 3-4*, erect or closed, *valvate*,

Page 465, column 1, line 3: Stamens usually 3, opposite tepals 🡪 *Stamens usually 3, opposite tepals*

Page 465, column 1, line 4: without filaments 🡪 *without filaments*

Page 465, column 1, line 8: … placenta. Fruit… 🡪 … placenta. Nectary absent. Fruit…

Page 465, column 1, floral formula: in both staminate and carpellate flowers change:

K 3-5 , C 0 🡪 K 0 , C 3-5

Page 465, column 2, line 8 under Asterid Clade: add Soltis et al. 2018 and Chen et al. 2016 and Li et al. 2019

Page 465, column 2, line 11 under Asterid Clade: could also be synapomorphic. 🡪 could also be synapomorphic (Stull et al. 2018).

Page 465, column 2, line 15 under Asterid Clade: core asterids 🡪 core asterids (Gentianidae)

Page 465, column 2, 26 under Asterid Clade: 2003) 🡪 2003, 2009, 2016)

Page 465, column 2, line 3 under Cornales: add Li et al. 2019 and Thomas et al. 2021 to references supporting monophyly of order

Page 466, column 1, line 11: many botanists recognize Nyssaceae as distinct from Cornaceae (Xiang et al. 2002). 🡪 many botanists place Nyssaceae within the Cornaceae.

Page 466, column 2, line 15: 17/220/ 🡪 9/250.

Page 466, column 2, line 16: *Hydrangea* (30) 🡪 *Hydrangea* (95). Also delete *Decumaria* from list of genera occurring in the U.S.

Page 466, column 2, line 3 in **Discussion**: add Kim et al. 2015 and Thomas et al. 2021 to references

Page 466, column 2, line 15 in **Discussion**: (*Hydrangea*, *Decumaria*, *Schizophragma*, and relatives) 🡪 (*Hydrangea* s.l., including *Decumaria*, *Dichroa*, *Schizophragma*, and others)

Page 466, column 2, line 19 in **Discussion**: 2001). 🡪 2001; De Smet et al. 2015; Kim et al. 2015).

Page 466, column 2, line 24 in **Discussion**: The genus *Hydrangea* definitely is nonmonophyletic. 🡪 The genus *Hydrangea* is large and diverse, with 16 recognized sections.

Page 468, column 1, line 4: 14/280 🡪 20/280

Page 468, column 1, line 5: *Loasa* (75) 🡪 *Loasa* (65)

Page 468, column 1, line 4 in **Discussion**: … and relatives). 🡪 … and relatives) and DNA sequences (Thomas et al. 2021).

Page 468, column 1, line 14 in **Discussion**: add Castillo et al. 2019 to references

Page 468, column 2, line 3 in **Discussion**: add Thomas et al. 2021 to references supporting family monophyly

Page 468, column 2, line 3 in **Discussion**: add Thomas et al. 2021 to references supporting family monophyly

Page 468, column 2, line 19: … turn black at maturity). 🡪 …turn black at maturigy), but this dichotomy is not supported in the analysis of Thomas et al. (2021).

Page 470, column 1, line 3 in discussion: add Thomas et al. 2021 to references supporting family monophyly

Page 470, column 2, line 6 in **Discussion**, to references supporting infrafamilial relationships add: Chen et al. 2016 and Thomas et al. 2021

Page 470, column 2, line 3 under Ericales: add Chen et al. 2016 and Rose et al. 2018 and Li et al. 2019 to references for monophyly of order

Page 470, column 2, line 7 from bottom: … that includes Balsaminaceae. 🡪 … that includes Balsaminaceae and Marcgraviaceae.

Page 471, Key to Major Families of Ericales: **Pentaphylaceae**, **Styracaceae**, and **Symplocaceae** all should be put in bold; also add a new couplet #1, and renumber couplets 1-16 as 2-17:

1. Floral bract (and sometimes also associated pedicel) modified, enlarged and nectar-producing. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Marcgraviaceae

1. Flora pedicel and bract not modified as above. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2

Page 472, Figure 8.108: Add Löfstrand and Schönenberger 2015 and Zhang et al. 2020 to references in figure caption. Also add the following synapomorphies for the Sarraceniaceae + Actinidiaceae clade: proximally thick to massive petals, numerous stamens.

Page 472, Figure 8.108: Change the long line leading to Balsaminaceae to a line leading to a pair of branches, one leading to Balsaminaceae and the other to Marcgraviaceae. Add the following putative synapomorphies of the Balsaminaceae + Marcgraviaceae to this line: raphide crystals; staminal filaments ± flattened; anthers with small filaments entangling pollen; mucilage inside gynoecium. Move Pentaphylacaceae to a line parallel to the Theaceae line.

Page 472, column 2, lines 1-3 from bottom: Put **Pentaphylacaceae**, **Styracaceae**, and **Symplocaceae** in bold and add Marcgraviaceae to listed families.

Page 473, column 1, line 4 in **Discussion**: Add “Ruchisansakun et al. 2015” to listed references

Page 473, column 1, lines 8-10: Such grains are characteristic of *Hydrocera* and a few species of *Impatiens*, such as *I. omeiana* (of China), which is sister to the remaining species of *Impatiens*. 🡪 Such grains are characteristic of *Hydrocera* and a few species of *Impatiens*, i.e., subg. *Clavicarpa*, such as *I*. *omeiana* (of China), which are sister to the remaining species of *Impatiens*, i.e., subg. *Impatiens*. Species of *Impatiens* subg. *Clavicarpa* have 4-carpellate gynoecia while those of subg. *Impatiens,* a much larger clade, have 5-carpellate gynoecia (and oblong pollen grains) (Yu et al. 2016).

Page 475: **Plate 8.19**. Expand plate of Ericales to 1.5 pages, and include photos of Balsaminaceae (*Impatiens balsamina*: flower, side view showing spur), Styracaceae (*Halesia diptera*: flowers, fruits), Symplocaceae (*Symplocos hartwegii*: flower), Pentaphylacaceae (*Ternstroemia* *gymnanthera*: flower, fruits; 2 images).

Page 476, column 1 line 4 in **Discussion**: add De-Nova et al. 2018 and Mori et al. 2016 to references

Page 476, column 1, line 7 in **Discussion**: diagnosable clades 🡪 diagnosable groups

Page 476, column 2, line 3 from bottom of description of Lecythidaceae: forming a wing; 🡪 forming a wing; **seed coat with vascular bundles**;

Page 477, column 1, line 1 in **Discussion**: cpDNA 🡪 DNA

Page 477, column 1, line 2 in **Discussion**: add Rose et al. 2018 to references

Page 477, column 2, line second from bottom: add Rose et al. 2018 to references in support of monophyly

Page 479, column 1, Additional reference: Add – Kümpers et al. 2016.

Page 479, column 1, line 3 of description: cyanogenic. 🡪 cyanogenic; **sclereids present**.

Page 479, column 1, last line of description: thin testa 🡪 thin, **vascularized testa**

Page 480, column 2, line 3: delete *Glaux* from generic list. [*Glaux* is within *Lysimachia*; *Anagallis* may be as well, but more phylogenetic work is needed.]

Page 481, column 1, line 7: add Rose et al. 2018 to references cited

Page 481, column 1, line 32: delete *Glaux*

Page 481, column 2, line 21 in description: **embryo large**; endosperm… 🡪 **embryo large**, straight; endosperm…

Page 481, column 2, line 4 from bottom: *rbcL* and *matK* sequences 🡪 DNA sequences

Page 481, column 2, line 3 from bottom: add Yu et al. 2017 and Rose et al. 2018 to references

Page 482, column 1, line 4: add Yuet al. 2017 and Li et al. 2013 to references

Page 483, column 1, line 12: style 1 🡪 style 1, **not divided**

Page 483, column 1, last line: *rbcL*, *matK*, and 18S rDNA 🡪 DNA

Page 483, column 2, first line: add Rose et al. 2018 to references

Page 483, column 2, line 7: …in the raphe (references). 🡪 …in the raphe, and roots with ericoid mycorrhizal association, i.e., hyphae restricted to epidermal layer. [And add “Freudenstein et al. 2016” to list of references]

Page 483, column 2, line 15: including *Rhododendron* and *Menziesia*. 🡪 including *Therorodion* and *Rhododendron* (incl. *Menziesia* and *Ledum*).

Page 483, column 2, lines 10-13 from bottom: Reword sentence as follows: In contrast, *Enkianthus*, Monotropoideae, Pyroloideae, and Arbutoideae (see below) represent earlier divergent clades within the family. They have late-inverting anthers.

Page 484, Fig. 8.113: Modify cladogram to show that Arbutoideae and Monotropoideae are sister groups, which in turn are sister to Pyroloideae. Add Freudenstein et al. (2016) and Schwery et al. (2015) to cited references in figure legend.

Page 484, column 2, first line: add Lu et al. 2019 and Khan et al. 2021 to Ericaceae references

Page 484, column 2, line 6 in description: *usually solitary on a scape* 🡪 **usually solitary on a scape**

Page 484, column 2, line 8 in description: often petaloid 🡪 **often petaloid**

Page 486, column 1, line 8: …(Neyland and Merchant 2006). 🡪 …(Neyland and Merchant 2006; Ellison et al. 2012; Rose et al. 2018).

Page 486, column 1, line 8 under “Core Asterids”: Soltis et al. 2011). 🡪 Soltis et al. 2011, 2018; Stull et al. 2015, 2020; Zhang et al. 2020).

Page 486, column 1, end of paragraph on Core Asterids – add sentence: There are a few inconsistent placements resulting from plastid vs. nuclear data, for example, Aquifoliales is placed either within the lamiid clade or campanulid clade (Stull et al. 2020).

Page 487: place treatment of Aquifoliales immediately after Garryales and before Solanales.

Page 487, column 1, line 7: …is less clear. 🡪 is less clear (Burge 2011).

Page 487, column 1, line 8: are insect pollinated, 🡪 are pollinated by fungus gnats,

Page 487, column 1, line 18 under Solanales: or just Solanales (Chase et al. 1993; Moore et al. 2011… 🡪 or just Solanales (Chase et al. 1993; Hasenstab-Lehman 2017; Moore et al. 2011 …

Page 487, column 1, line 18 under Solanales: at end of paragraph and sentence add – or just Gentianales (Stull et al. 2015).

Page 487, column 2, line 20 in description: oriented obliquely to the median plane of the flower 🡪 oriented obliquely

Page 487, column 2, line 25: megasporangium 🡪 megasporangium, **campylotropous**

Page 487, column 2, line 5 from bottom: add *Chamaesaracha*

Page 488, column 1, line 13: tomorrow), *Cestrum*… 🡪 tomorrow), *Calibrachoa*, *Cestrum*…

Page 488, column 1, line 11 in **Discussion**: … *ndhF* sequences. 🡪 … *ndhF* sequences, and Särkinen et al. (2013) based on seven nuclear and plastid genes.

Page 488, column 2, line 6: (2005) demonstrated 🡺 (2005), and Särkinen et al. (2013) demonstrated

Page 488, column 2, line 10: cpDNA 🡪 DNA

Page 490, Plate 8.20: *Merremia dissecta* 🡪 *Distimake dissectus*

Page 491, column 1, line 1, Additional references: Add – Barboza et al. 2016,

Page 491, column 1, line 1 in Genera/species: 55/1930 🡪 50/1930; *Ipomoea* (600 spp.) 🡪 *Ipomoea* (800 spp.)

Page 491, column 1, line 6 in Genera/species: *Merremia* 🡪 *Distimake*

Page 491, column 2, line 20: problematic. 🡪 problematic (see Muñoz-Rodríguez et al. 2019; Wood et al. 2020).

Page 491, column 2, line 20: add this sentence at the end of the paragraph – Generic boundaries are also confused around *Merremia*.

Page 491, column 2, line 28: Austin 1979 🡪 Austin 1879, 1998

Page 494, column 1, lines 4-5: *Heliotropium* (260) 🡪 *Heliotropium* (300 spp.); and delete “*Tournefortia* (150)”; also include *Euploca* (100). Also: *Cordia* (320 spp.) 🡪 *Cordia* (250), and add *Verronia* (100).

Page 494, column 1, line 11: add *Myriopus, Tiquilia, Oreocarya, Johnstonella, Verronia*

Page 494, column 1, line 6 in **Discussion**: add Hasenstab-Lehamn 2017

Page 494, column 1, line 4-5 from bottom: which includes *Heliotropium*, *Tournefortia*, and *Argusia*, 🡪 which includes *Heliotropium*, *Euploca*, *Myriopus*, and *Ixorhea*,

Page 494, column 2, line 4: (Plate 8.20F) 🡪 (Plate 8.20F; see also Weigend et al. 2013)

Page 494, column 2, line 8: (Weigend et al. 2014). 🡪 (Boraginales Working Group 2016; Weigend et al. 2014).

Page 494, column 2, line 17: add Boraginales Working Group 2016 and Hasenstab-Lehman 2017

Page 494, column 2, line 26; add sentence at end of paragraph: These plants are sometimes divided into 11 families, of which the largest are Cordiaceae, Ehretiaceae, Heliotropiaceae, Hydrophyllaceae, and Boraginaceae s.s. (Boraginales Working Group 2016).

Page 494, column 2, line 38: The corky nutlets of *Argusia* 🡪 The corky nutlets of *Heliotropium* *gnaphaloides*

Page 494, column 2, last line: to additional references, add: Chacón et al. 2016 and Hilger & Diane 2003 and Leubert et al. 2011 and Miller and Gottschling 2007.

Page 495, column 1, line 5: insert into references cited – Judkevich et al. 2017; Ribeiro et al. 2017

Page 495, column 1, line 14: add Li et al. 2019 and Yang et al. 2016 and Antonelli et al. 2021 to references supporting monophyly of order

Page 495, column 1, line 20: Loganiaceae 🡪 **Loganiaceae**

Page 495, column 1, Key to major families of Gentianales: Loganiaceae 🡪 **Loganiaceae**

Page 495, column 2, line 6: … Gentianaceae, and *Buddleja* and … 🡪 … Gentianaceae, *Polypremum* to the Tetrachondraceae, and *Buddleja* and

Page 495, column 2, line 13 to line 19: delete text between “containing two major subclades … (Struwe et al. 1994). So sentence ends: … constitute a monophyletic group. [Note: this information is moved to discussion under the new family treatment for Loganiaceae.]

Oage 495, column 2, line 21: add Yang et al. 2016 and Antonelli et al. 2021 to references supporting two major clades in the order

Page 497, Fig. 8.119: add Refulio-Rodriguez and Olmstead 2014 and Yang et al. 2016 and Antonelli et al. 2021 to references. Also modify cladogram so Apocynaceae, Gelsemiaceae, Gentianaceae and Loganiaceae form a polytomy, and delete the apomorphy “Included phloem”.

Page 497, column 1, Major genera: *Psychotria* (1500 spp.) 🡪 *Psychotria* (1250 spp.) … and *Palicourea* (250) 🡪 *Palicourea* (600)

Page 497, column 2, line 2: add Chen et al. 2016 and Antonelli et al. 2021 to references supporting monophyly of family

Page 497, column 2, line 26: add sentence at end of paragraph: Recently, however, mitochondrial sequence and nuclear data has called the monophyly of both Cinchinoideae and Ixoroideae into question, possibly as a result of ancient hybridization (Rydin et al. 2017; Antonelli et al. 2021), and these are sometimes merged into an expanded Cinchinoideae (see Antonelli et al. 2021).

Page 499, column 1, line 37: 91/1600 🡪 99/1740

Page 499, column 1, line 38-39: delete *Sebaea* (60) from list

Page 499, column 1, line 39: (except *Sebaea* and *Exacum*) 🡪 (except *Exacum*)

Page 499, column 1, line 41: replace *Centaurium* with *Gyrandra* and *Zeltnera*

Page 499, column 2, line 1: add Struwe (2014) and Struwe and Pringle (2018) and Antonelli et al. 2021 to references

Page 499, column 2, line 4: add Soltis et al. 200, 2011 to references

Page 499, column 2, line 24: (Struwe et al. 2002). 🡪 (Struwe 2014; Struwe et al. 2002).

Page 499, column 2, line 25-26: The colorful flowers of Gentianaceae are pollinated mainly by bees and butterflies. 🡪 The colorful flowers of Gentianaceae are pollinated by bees, flies, beetles, butterflies, and moths, although some are hummingbird pollinated.

Page 501, column 1, line 9: 384/4550 🡪 378/5350

Page 501, column 1, line 16: add *Mandevilla* and *Funastrum* to list of genera; and delete *Sarcostemma*

Page 501, column 1, line 5 in **Discussion**: *rbcL* and *matK* sequences 🡪 DNA sequences; and also add Chen et al. 2016 and Fishbein et al. 2018 and Endress et al. 2018 and Antonelli et al. 2021 to references

Page 501, column 2, line 19: add Fishbein et al. 2018 to references

Page 503, Fig. 8.123: add Fishbein et al. 2018 to references supporting figure

Page 503, column 1. line 17 under Lamiales: add Soltis et al. 2018 and Li et al. 2019 and Luna et al. 2019

Page 504, Figure 8.124: Add to references in figure legend – Luna et al. 2019 and Zhang et al. 2020. Also, modify tree topology so that (1) Oleaceae branches first, followed by Tetrachondraceae (instead of a trichotomy), and (2) show Gesneriaceae and Calceolariaceae as sister taxa. [Phrymaceae (incl. *Mimulus*) 🡪 Mazaceae – corrected in third printing of fourth edition]

Page 504, column 2, line 2 of description: glycosides; glycosides, **and distinctive iridoids**;

Page 507, column 2, line 2: *Fraxinus* (60) 🡪 *Fraxinus* (45)

Page 508, Key to major families of Lamiales: Add new couplet # 3 (see below) and renumber existing couplets 3-15 as 4-16:

3. Flowers with 4 sepals and appearing to have 2 petals (but actually actually 4); corolla bilateral, usually with hooded to slipper-shaped lower lip; stamens 2. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .Calceolariaceae

3. Flowers not as above, i.e., either radial and with 4 sepals and petals, or bilateral and with 5 sepals and petals, the lower corolla lip not hooded to slipper-shaped; stamens 2-5. . . . . . . . . . . . . . . . . . . . . . . . . . . 4

Page 508, column 1, line 5: *rps16* and *trnL-F* sequences – DNA sequences

Page 508, column 1, line 6: add Chen et al. 2016 to references supporting monophyly

Page 508, column 2, line 12: Wallander 2008). 🡪 Wallander 2008, 2013).

Page 509, Key to major families of Lamiales (continued), second lead of couplet 9: anthers usually distinct 🡪 anthers distinct or sticking together in pairs

Page 509, Key to major families of Lamiales (continued), replace current couplet #13 with the one below, and add in new couplet #14 (see below), and then renumber current couplets 14 and 15 as 15 and 16:

13. Stigma lobes not or only slightly expanded, not sensitive. . . . . . . . . . . . . . . . . . . . . . . **Plantaginaceae**

13. Stigma lobes slightly to clearly expanded, usually sensitive. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .14

14. Seeds with ruminate endosperm; anthers sticking together in pairs or distinct; seeds numerous in each locule. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Linderniaceae

14. Seeds without ruminate endosperm; anthers distinct; seeds numerous in each locule or on each placenta but in *Phryma* solitary. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **Phyrmaceae**

Page 510, column 1, line 2 in **Discussion**: *ndhF* sequences 🡪 DNA sequences

Page 510, column 1, line 3 in **Discussion**: add Möller and Clark 2013 and Weber et al. 2013 to references

Page 510, column 1, line 3: Most genera belong to one of two large… 🡪 The morphologically distinctive genus *Sanango*, which lacks anthers sticking together as well as parietal placentation, is sister to the remaining genera, which belong to one to two large…

Page 510, column 1, add to references: Nishii et al. 2015.

Page 510, column 2, line 25: replace *Maurandya* with *Epixiphium* and *Maurandella*; also add *Stemodia* to list of continental genera; also add *Sairocarpus* and *Keckiella*

Page 510, column w, line 20-21: *Penstemon* (250) 🡪 *Penstemon* (280) and *Gratiola* (20) 🡪 *Gratiola* (30)

Page 512, column 1, line 25: add Chen et al. 2016 to references supporting monophyly

Page 512, column 1, line 36: add sentence to end of paragraph: Carnivory has evolved in *Philcoxia* (Scatigna et al. 2018) independently of that in the Lentibulariaceae.

Page 512, column 2, line 22: 52/1680 🡪 60/1680

Page 512, column 2, line 25: add *Emorya*, *Capraria*, and *Myosporum* to continental genera

Page 513, column 1, line 5: sister to the remaining members of the… 🡪 sister to the remaining members, i.e., Myoporeae (Fowler et al. 2021), of the…

Page 513, column 1, line 4 from bottom: 99/2060 🡪 97/2060

Page 513, column 2, line 3: add *Boschniakia*, *Bellardia*, *Cordylanthus, Kopsiopsis, Odontites,* and *Triphysaria* to continental genera

Page 513, column 2, line 5-6 in **Discussion**: add McNeal et al. 2013 and Latvis et al. 2017 and Tang et al. 2019 and Nickrent 2020 to references

Page 513, column 2, line 32 in **Discussion**: within Orobanchaceae. 🡪 … within Orobanchaceae (McNeal et al. 2013).

Page 513, column 2, line 33 in **Discussion**: include the abaxial lobes of the corolla outside the abaxial, 🡪 include the lateral lobes of the abaxial corolla lip placed externally in bud (i.e., rhinanthoid corolla aestivation),

Page 513, column 2, line 5 from bottom: …and some include *Rehmannia* (Chinese foxglove) within it. 🡪 …and some include *Rehmannia* (Chinese foxglove) and *Triaenophora* within it; these genera also have rhinanthoid corolla aestivation (which is synapomorphic for the broadened family circumscription).

Page 515, column 1, line 4 in **Discussion**: add reference – Luna et al. 2019 and Liu et al. 2019

Page 515, column 1, line 6 in **Discussion**: (Whipple 1972), and the traditional… 🡪 (Whipple 1972), *Cyrtandromoea*, and the traditional…

Pshr 515, column 1, line 12 in **Discussion**: add reference – Nesom et al. 2019

Page 515, column 1, line 13 in **Discussion**: four major clades 🡪 five major clades

Page 515, column 1, line 19 in **Discussion**: … North America. 🡪 … North America, and (5) the southeast Asian genus Cyrtandromoea, which is distinctive in having an accrescent, urn-shaped calyx surrounding the fruit.

Page 515, column 1, line 22 in **Discussion**: add to references – Chase et al. 2017.

Page 515, column 2, line 20 in Discussion: rest of the family. 🡪 rest of the family (Olmstead et al. 2009; Ragsac et al. 2019).

Page 517. column 1, line 3 from bottom: 202 🡪 220

Page 517, column 2, line 7 in **Discussion**: add Tripp and McDade 2014 and Manzitto-Tripp et al. 2022 to references supporting family monophyly

Page 517, column 2, line 21 and line 36 in **Discussion**: add Tripp and McDade 2013 to references

Page 517, column 2, line 36: subfamily Avicennioideae; 🡪 subfamily Avicennioideae, placed sister to Thunbergioideae;

Page 519, column 2, line 2 in **Discussion**: *rbcL* and *matK* sequences 🡪 DNA sequences

Page 519, column 2, line 3 in **Discussion**: (Muller et al. 2000) 🡪 (Müller 2002, 2004, 2006; Silva et al. 2018)

Page 519, column 2, line 15 in **Discussion**: add Müller et al. 2004 and Silva et al. 2018

Page 521, column 2, line 2: add sentence – Generic limits are problematic within Lantaneae (Lu-Irving et al. 2021).

Page 521, column 2, line 3 from bottom: 252/7100 🡪 241/7200

Page 521, column 2, line 2 from bottom: *Hyptis* (400) 🡪 *Hyptis* (144); note: also move this genus to the numerically appropriate position in the list of genera.

Page 522, column 1, line 5: to the list of U.S. genera add *Cantinoa* and *Condea*

Page 523, column 1, line 2: *Rosmarinus* (rosemary), Salvia (sage), 🡪 *Salvia* (sage, rosemary),

Page 523, column 1, line 3 in **Discussion**: *rbcL*, and *ndhF* sequences 🡪 DNA sequences

Page 523, column 1, line 5 in **Discussion**: add to references – Chen et al. 2016

Page 523, column 1, line 19 in **Discussion**: add to references cited – Li et al. 2016

Page 523, column 1, line 30 in **Discussion**: Analyses of *rbcL* and … 🡪 Analyses of DNA sequences

Page 523, column 1, line 34 in **Discussion**: … 1998). 🡪 … 1998), sister to a large clade comprising the rest of the family (Chen et al. 2016), or unresolved within a clade also containing Viticoideae, Ajugoideae, Scutellarioideae, and Lamioideae, among others (Li et al., 2016).

Page 523, column 2, line 3: … are usually placed within the polyphyletic “Viticoideae,” 🡪 …are usually placed within the polyphyletic “Viticoideae,” but recently (Li et al. 2016) this subfamily has been dismembered, with *Gmelina*, *Premna*, and *Cornutia* placed in Premnoideae, *Vitex* and close relatives in Viticoideae s.s., and *Callicarpa* unplaced to subfamily and positioned sister to Prostantheroideae. *Callicarpa* + Prostantheroideae (*Prostanthera*, *Westringia*, and relatives) are likely sister to the remaining members of the family.

Page 523, column 2, first line: Scheen et al, 2010). 🡪 Scheen et al. 2010; Bendiksby et al. 2011).

Page 523, column 2, line 6: *Tectona* … also polyphyletic. 🡪 *Tectona* … phylogenetically isolated and sister to the clade comprising Ajugoideae, Scutellarioideae, Lamioideae, and several small subfamilies (Li et al. 2016).

Page 525, column 1, line 13: beverage *maté*. 🡪 …beverage *mate*; and those of *I. guayusa*, a species of Ecuador, Peru, and Colombia, are similarly used.

Page 525, column 1, line 5 in **Discussion**: add Yao et al. 2020 to references

Page 525, column 1, line 7 in Discussion: … 2010). Aquifoliaceae are 🡪 … 2010). The group probably originated in eastern Asia, and *Ilex sinica* and relatives may be sister to the remaining species. Red fruits and serrate leaves are likely ancestral in *Ilex,* with black fruits and spiny leaves evolving several times (Yao et al. 2020). Aquifoliaceae are

Page 525, column 1, in Additional References: Add – Loizeau et al. 2016.

Page 525, column 2, line 4: add Soltis et al. 2018 and Li et al. 2019 and Zhang et al. 2020

Page 527, column 1, line 1: Nectar produced on sides of ovary 🡪 **Nectar produced on sides of ovary**

Page 527, column 1, line 3 in **Discussion**: 3007 🡪 2007

Page 527, column 1, line 9: …sticky resin. 🡪 …sticky resin (produced by glandular hairs in the septal region within the fruit).

Page 527, column 1, line 11 in **Discussion**: … resinous-piney odor. 🡪 … resinous-piney odor (see also Carolin and Bittrich 2018).

Page 527, column 2, line 6: *very reduced* 🡪 **very reduced**

Page 527, column 2, line 24: 434/3780 🡪 466/3820

Page 527, column 2, line 31: add *Cymopterus* to list of N Amer. genera

Page 527, column 2, line 3 in Discussion: add Clarkson et al. 2021 to references supporting monophyly of family

Page 530, column 1, line 10 from bottom: after …2000, 2010). Insert the following sentence: Apioideae have vittae running longitudinally between the vascular bundles on the dorsal fruit surface (i.e., vallecular oil ducts) and also on the inner surface adjacent to the carpophore; Saniculoidese lack vallecular ducts but have rib oil ducts (Plunkett et al. 2018a).

Page 530, column 1, last line: add sentence – The Australian genus *Platysace* is probably sister to all other genera of Apiaceae.

Page 532, column 1, line 1: 1450 🡪 1900

Page 532, column 1, line 1: *Shefflera* (600 spp.) 🡪 *Schefflera* (600 spp.; but including several non-sister clades deserving of generic recognition, e.g., *Sciadaphyllum*, *Didymopanax*, and *Crepinella*, in the New World, and *Heptapleurum* and *Schefflera* s.s. in the Old World)

Page 532, column 1, line 22 in **Discussion**: (Plunkett et al. 2004). 🡪 (Plunkett et al. 2004, 2018b, 2019).

Page 532, column 1, line 1 under Dipsacales: **Adoxaceae** 🡪 **Viburnaceae**

Page 532, column 1, last line: add Li et al. 2019 and Lee et al. 2021 to references supporting monophyly of Dipsacales

Page 532, column 2, Key to Families of Dipsacales: **Adoxaceae** 🡪 **Viburnaceae**

Page 533, Figure8.136: Adoxaceae 🡪 Virurnaceae

Page 533, Figurre 8.136: Add to figure legend Wang et al. 2020 and Lee et al. 2021; also indicate subfamily names along with generic groupings along cladogram, i.e., Diervilloideae, Caprifolioideae, Linnaeoideae, Valerianoideae, and Dipsacoideae

Page 533, column 1, line 1: Adoxaceae 🡪 Viburnaceae

Page 533, column 1, line 8: add Wang et al. 2020 and Lee et al. 2021 to references

Page 533, column 1, line 9: Adoxaceae 🡪 Viburnaceae

Page 533, column 2, line 1: The monophyly of this clade is… 🡪 The monophyly of this clade, i.e., the Linnina, is…

Page 533, column 2, line 12: constitute a monophyletic group, 🡪 constitute a monophyletic group (Diervilloideae)

Page 533, column 2, line 18: probably form a clade 🡪 probably form a clade (Caprifolioideae)

Page 533, column 2, last line: add to references Wang et al. 2015

Page 534, column 1, line 1: **Adoxaceae** E. Meyer 🡪 **Viburnaceae** Rafinesque

Page 534, column 1, line 2: (Moschatel or Elderberry Family) 🡪 (Viburnum or Elderberry Family)

Page 534, column 2, last line: *Petals 4-5*, 🡪 *Petals 3-5,*

Page 535, Plate 8.24: Under (A) (B) and (G) change Adoxaceae to Viburnaceae.

Page 536, column 1, line 5: *Carpels 3-5* 🡪 *Carpels 2-5*

Page 536, column 2, line 1 in **Discussion**: Adoxaceae 🡪 Viburnaceae

Page 536, column 2, line 2 in **Discussion**: delete “(*rbcL* and ITS)”

Page 536, column 2, line 3 in **Discussion**: add Moore and Donoghue 2007 and Lee et al. 2021 and Soltis et al. 2011 and Wang et al. 2020 to references

Page 536, column 2, line 4 in **Discussion**: Opuloideae 🡪 Viburneae

Page 536, column 2, line 5 in **Discussion**: Adoxoideae 🡪 Adoxeae

Page 536, Figure 8.136: Adoxaceae 🡪 Viburnaceae

Page 537, column 1, line 11: (Clement et al. 2014). 🡪 (Clement et al. 2014; Landis et al. 2021), and the genus exhibits fascinating variation in fruit color, nutrient composition of pulp, and endocarp form (Clement et al. 2021; Jacobs et al. 2008).

Page 537, column 2, line 1: bees, wasps, and flies. 🡪 bees, wasps, moths, beetles, and flies. Inflorrescences with showy and sterile marginal flowers have evolved four times in Viburnum (Park and Donoghue 2021).

Page 537, column 2, line 2: drupes are dispersed by birds. 🡪 drupes of *Sambucus* and *Viburnum* are dispersed by birds; those of *Adoxa* are eaten by snails.

Page 537, column 2, in Additional references: Add – Backlund and Bittrich 2016 and Sinnott-Armstrong et al. 2020.

Page 537, column 2, last line: add Li et al. 2019 and Zhang et al. 2020 to references supporting Asterales monophyly

Page 538, column 1, line 7 in description of Campanulaceae: *to bilateral*, 🡪 to **bilateral**,

Page 538, column 1, line 14: *anthers distinct but pressed together around the style* 🡪 *anthers distinct* **but pressed together around the style**

Page 538, column 2, line 4: add Crowl et al. 2016 to references supporting the monophyly of Campanulaceae.

Page 538, column 2, lines 4-7: Three subfamilies – Campanuloideae, “Cyphioideae,” and Lobelioideae – are often distinguished and may be recognized at the family level (Lammers 1992). 🡪 The family contains five subclades (often recognized as subfamilies): Campanuloideae, Cyphioideae, Nemacladoideae, Cyphocarpoideae, and Lobelioideae (Crowl et al. 2016); The two largest, i.e., Campanuloideae (1000 spp.) and Lobelioideae (1200 spp.) are each often recognized at the family level (Lammers 1992).

Page 538, column 2, lines 7-10: The Campanuloideae, with radially symmetrical flowers and nonconnate anthers, are considered monophyletic on the basis of invaginating hairs on the upper portion of the style, and molecular data (Haberle et al. 2009). 🡪 The Campanuloideae, widely distributed in northern temperate regions, are considered monophyletic on the basis of radially symmetrical flowers and invaginating hairs on the upper portion of the style, and also molecular data (Haberle et al. 2009; Crowl et al. 2016).

Page 538, column 2, line 11: The Lobelioideae constitute a clade… 🡪 The more tropical Lobelioideae constitute a clade based on their connate anthers, resupinate flowers with a variously developed slit in the upper lobe (developmentally adaxial, but abaxial when flower is resupinate); they have retained bilaterally symmetrical flowers (and these have 1- or 2-lips) similar to those seen in the three small subfamilies.

Page 538, column 2, line 15: Analyses of *rbcL* and ITS sequence variation also support the monophyly of both subfamilies (Cosner et al. 1994; Eddie et al. 2003). 🡪 Analyses of DNA sequences support the monophyly of all five subfamilies (Cosner et al. 1994; Eddie et al. 2003; Crowl et al. 2016; Kagame et al. 2021), with Cyphioideae sister to Campanulaceae, and Nemacladoideae and Cyphocarpoideae related to Lobelioideae (Crowl et al. 2016).

Page 541, column 1, Additional references: add – Chen et al. 2016 and Sylvester et al. 2016

Page 541, column 1, line 7 from bottom: 12/440 🡪 8/440

Page 541, column 1, line 7 from bottom: *Goodenia* (190 spp.) 🡪 *Goodenia* (251 spp.)

Page 541, column 2, line 12: … diverse). Within the second clade… 🡪 …diverse). Within the first clade, i.e., *Goodenia*, *Scaevola*, *Selliera*, *Velleia*, and relatives, generic limits are unclear, and *Goodenia* clearly is non-monophyletic (Gardner et al. 2016), and *Selliera*, *Velleia*, *Verveauxia*, and *Pentaptilon* are now included within an expanded *Goodenia* (Shepherd et al. 2020). Within the second clade…

Page 542, column 2, line 10: endosperm scanty or lacking 🡪 **endosperm scanty or lacking**

Page 543, column 2, line 1: 23,600 🡪 25,000

Page 544, column 1, line 11: replace *Prenanthes* with *Nabalus* in list of North American widespread genera; also add *Chaetopappa,* *Gutierrezia, Heterotheca, Melapodium, Palafoxia, Parthenium, Pectis, Ratibida, Stephanomeria, Xanthium,* and *Perityle*.

Page 546, Table 8.4: Entry #3: Cardueae (=Cynareae) (Thistles and related Dicomeae, Tarchonanthese, and Oldenburgieae) 🡪 Cardueae (=Cynaree) (Thistles) Also delete *Dicoma* from list of genera.

Page 546, Table8.4: Entry #5, 6, and 7: Cichorioideae 🡪 Vernonioideae

Page 548, column 1, line 1: twelve subfamilies 🡪 12 to 16 subfamilies

Page 548, column 1, line 2: Panero and Funk 2008 🡪 Panero and Funk 2008; Panero et al. 2014; Funk et al. 2009; Susanna et al. 2020

Page 548, column 1, line 15: add Panero et al. 2014

Page 548, Fig. 8.144: add Panero et al. 2014 to references supporting figure; also could note that several small subfamilies are omitted for purposes of clarity, but Famatinanthoideae (second branch to diverge, right after Barnadesioideae) should be added to cladogram. Also make the following changes: (1) Remove Dicomeae from branch with Cardueae, and replace with two parallel lines on cladogram, one ending in Carduoideae, and the other ending in Dicomoideae. (2) Remove Cichorieae from the clade with Vernonieae, Liabeae, and Arctoteae. Relabel this clade, now with just three tribes, as Vernonioideae, and add in a line ending in Cichorioideae, in a trichotomy with the Veronioideae and Asteroideae. See redrawn image of this cladogram.

Page 549, column 2, in **Additional references**: Add Ackerfield et al. 2020 and Smissen et al. 2020 and Spellenburg and Zucker 2019

Page 549, add to Suggested Readings: Van Balgooy et al. 2015. Also add Mabberley 2017, APG IV. 2016, Soltis et al. 2018, and Christenhusz et al. 2017.

Page 612, column 3, lines 19 and 21: 1993-2015. 🡪 1993-2016. And: Vols. 1-8, 19-28. 🡪 Vols. 1-8, 12, 19-28.

**New references for Chapter 8:**

Acevedo-Rodríguez, P., P. C. van Welzen, F. Adema, and R. W. J. M. van der Ham. 2011. Sapindaceae. In *The families and genera of vascular plants*. Vol. 10. 357-405. Springer-Verlag, Berlin.

Ackerfield, J., A. Susanna, V. Funk, D. Kelch, D. S. Park, A. H. Thornhill, B. Yildiz, T. Arabaci, and T. Dirmenci. 2020. A prickly puzzle: Generic delimitations in the *Carduus*-*Cirsium* group (Compositae: Cardueae: Carduinae). *Taxon* 69: 715-738.

Aerne-Hains, L. & M. G. Simpson. 2017. Vegetative anatomy of the Haemodoraceae and its phylogenetic significance*. Int. J. Plant Sci.* 178: 117-156.

Albach, D. C., K. Yan, S. R. Jensen, and H.-Q. Li. 2009. Phylogenetic placement of *Triaenophora* (formerly Scrophulariaceae) with some implications for the phylogeny of Lamiales. *Taxon* 58: 749-756.

Ali, M/. J. Lee, S.-Y. Kim, S.-H. Park, and F. Al-Hemaid. 2015. Molecular phylogenetic analyses of internal transcribed spacer (ITS) sequences of nuclear ribosomal DNA indicate monophyly of the genus *Phytolacca* (Phytolaccaceae). *Bangladesh J. Plant Sci*. 22: 1-8.

Andrino, C. O., P. T. Sano, P. W. Inglis, N. Hensold, F. N. Costa, and M. F. Simon. 2020. Phylogenetics of *Paepalanthus* Mart. (Eriocaulaceae), a diverse, Neotropical, monocot lineage. *Bot. J. Linn.* *Soc*. doi 10.1093/botlinnean/boaa070.

Angiosperm Phylogeny Group. 2016. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. *Bot. J. Linn. Soc*. 181: 1-20.

Antonelli, A., J. J. Claarkson, K. Kainulainen, O. Maurin, G. E. Brewer, A. P. Davis, N. Epitawalange, D. J. Goyder, T. Livshults, C. Persson, L. Pokorny, S. C. A. Straub, L. Strue, A. R. Zuntini, F. Forest, and W. J. Baker. 2021. Settling a family feud: a high-level phylogenetic framework for the Gentianales based on 353 nuclear genes and partial plastomes. *Amer. J. Bot*. 108: 1143-1165.

Aparicio, A., S. Martín-Hernanz, C. Parejo-Farnés, J. Arroyo, S. Lavergne, E. B. Yeşilyurt, M.-Y. Zhang, E. Rubio, and R. G. Albaladejo. 2017. Phylogenetic reconstruction of the genus *Helianthemum* (Cistaceae) using plastid and nuclear DNA-sequences: Systematic and evolutionary inferences. *Taxon* 66: 868-885.

Appelhans, M. S., M. J. Bayly, M. M. Heslewood, M. Groppo, G. A. Verboom, P. L. Forster, J. A. Kallunki, and M. F. Duretto. 2021. A new subfamily classification of the *Citrus* family (Rutaceae) based on six unclear and plastid markers. *Taxon* 70: 1035-1061.

Arbo, M. M., A. M. Gonzalez, and S. M. Sede. 2015. Phylogenetic relationships within Turneraceae based on morphological characters with emphasis on seed micromorphology. *Plant Syst. Evol*. 301: 1907-1926.

Areces-Berazain, F. and J. D. Ackerman. 2017. Diversification and fruit evolution in eumalvoids (Malvaceae). *Bot. J. Linn. Soc*. 184: 401-417.

Atkinson, B. A. 2020. Fossil evidence for a Cretaceous rise of the mahagony family. *Amer. J. Bot.* 107: 139-147.

Austin, D. F. 1998. Parallel and convergent evolution in the Convolvulaceae. In *Diversity and taxonomy of tropical flowering plants*. P. Mathew and M. Sivadasan (eds.). 201-234 pp. Mentor Books, India.

Bacci, L. F., F. A. Michelangeli, & R. Goldenberg. 2019. Revisiting the classification of Melastomataceae: Implications for habit and fruit evolution. *Bot. J. Linn. Soc*. 190: 1-24.

Backlund, A. and V. Bittrich. 2016. Adoxaceae. In *The Families and Genera of Vascular Plants*, Vol. 14. K. Kubitzki (ed.). 19-29. Springer Verlag, Berlin.

Bacon, C. D., M. P. Simmons, R. H. Archer, L.-C. Zhao, and J. Andriantiana. 2016. Biogeography of the Malagasy Celastraceae: Multiple independent origins followed by widespread dispersal of genera from Madagascar. *Mol. Phylog. Evol*. 94: 365-382.

Baker, W. J., and 30 others. 2022. A comprehensive phylogenetic platform for exploring angiosperm trees of life. *Syst. Biol*. 76: 301-319. [Accessed Kew Tree of Life Explorer, 3 Mar 2022]

Barboza, G. E., A. T. Hunziker, G. Bernardello, A. A. Cocucci, A. E. Moscone, C. Carrizo García, V. Fuentes, M. O. Dillon, V. Bittrich, M. T. Cosa, R. Subils, A. Romanutti, S. Arroyo, and A. Anton. 2016. Solanaceae. In *The Families and Genera of Vascular Plants*, K. Kubitzki (ed.). 295-357.

Bardon, L., C. Sothers, G. T. Prance, P.-J. G. Malé, Z.-X. Xi, C. C. Davis, J. Murienne, R. García-Villacorta, E. Coissac, S. Lavergne, and J. Chave. 2016. Unraveling the biogeographical history of Chrysobalanaceae from plastid genomes. *Amer. J. Bot*. 103: 1089-1102.

Barrett, C. F., W. J. Baker, J. R. Comer, J. G. Conran, S. C. Lahmeyer, J. H. Leebens-Mack, J. Li, G. S. Lim, D. R. Mayfield-Jones, L. Perez, J. Medina, J. C. Pires, C. Santos, D. W. Stevenson, W. B. Zomlefer, and J. I. Davis. 2016. Plastid genomes reveal support for deep phylogenetic relationships and extensive rate variation among palms and other commelinids monocots. *New* *Phytol*. 209: 855-870.

Barrett, R. L., E. H. Roalson, K. Ottenwell, M. Byrne, S. P. Govindwar, S. R. Yadav, A. S. Tamboli, and A. R. Gholave. 2017. Resolving generic boundaries in Indian-Australasian Cleomaceae: Circumscription of *Arecleome*, *Arivela*, and *Coryandra* as distinct genera. *Syst. Bot*. 42: 694-708.

Basso-Alves, J. P., R. Goldenberg, and S. P. Teixeira. 2017. Ontogeny elucidates the double calyx of *Leandra melastomoides* (Miconieae, Melastomataceae). *Int. J. Plant Sci*. 178: 740-752.

Benkiksby, M., L. Thorbek, A.-C. Scheen, C. Lindqvist, and O. Ryding. 2011. An updated phylogeny and classification of Lamiaceae subfamily Lamioideae. *Taxon* 60: 471-484.

Berger, B. A., R. Kriebel, D. Spalink, and K. J. Sytsma. 2016. Divergence times, historical biogeography, and shifts in speciation rates of Myrtales. *Mol. Phylog. Evol*. 95: 116-136.

Biffin, E., E. J. Lucas, L. A. Craven, I. Ribeiro da Costa, M. G. Harrington, and M. D. Crisp. 2010. Evolution of exceptional species richness among lineages of fleshy-fruited Myrtaceae. *Ann. Bot*. 106: 79-93.

Bochorny, T., F. A. Michelangeli, F. Almeda, and R. Goldenberg. 2019. Phylogenetics, morphology and circumscription of Cambessedesieae: A new Neotropical tribe of Melastomataceae. *Bot. J. Linn. Soc*. 190: 281-302.

Boraginales Working Group. 2016. Familial classification of the Boraginales. *Taxon* 65: 502-522.

Boouchenak-Khelladi, Y., M. A. Musaya, & P. H. Linder. 2014. A revised ecolutionary history of Poales: Origins and diversification. *Bot. J. Linn. Soc*. 175: 4-16.

Bouman, R. W., P. J. A. Kessler, I. R. H. Telford, J. J. Bruhl, J. S. Strijk, R. M. K. Saunders, & P. C. van Welzen. 2021. Moleculaar phylogenetics of *Phyllanthus* sensu lato (Phyllanthaceae): towards coherent monophyletic taxa. *Taxon* 70: 72-98.

Bouman, R. W., P. J. A. Kessler, I. R. H. Telford, J. J. Bruhl, J. J. Strijk, R. M. K. Saunders, H. J. Esser, B. Falcón-Hidalgo, P. C. van Welzen. 2022. A revised phylogenetic classification of tribe Phyllantheae (Phyllanthaceae). *Phytotaxa* 540: 1-100.

Buerki, S., M. W. Callmander, P. Acevedo-Rodriguez, P. P. Lowry II, J. Munzinger, P. Bailey, D. Maurin, G. E. Brewer, N. Epitawalage, W. J. Baker, and F. Forest. 2021. An updated infrafamilial classification of Sapindaceae based on targeted enrichment data. *Amer. J. Bot*. 108: 1234-1251.

Burge, D. O. 2011. Molecular phylogenetics of *Garrya* (Garryaceae). *Madroño* 58: 249-255.

Burgos-Hernándes, M., C. Pozo, and D. González. 2018. Evolutionary history of Musaceae: Ancient distribution and the rise of modern lineages. *Bot. J. Linn. Soc*. 189: 23-35. 2019.

Carolin, R. C. and V. Bittrich. 2018. Pittosporaceae. In *The families and genera of vascular plants*. Vol. 15. K. Kubitzki (ed.). 539-547. Springer-Verlag, Berlin.

Castillo, R. A., F. Luebert, T. Henning, and M. Weigend. 2019. Major lineages of Loasaceae subfam. Loasoideae diversified during the Andean uplift. *Mol. Phylog. Evol*. 141: 106616.

Chacón, J., F. Luebert, H.H. Hilger, S. Ovchinnikova, F. Selvi, L. Cecchi, C.M. Guilliams, K. Hasenstab-Lehman, K. Sutory, M.G. Simpson, and M. Weigend. 2016. The borage family (Boraginaceae s. str.): A revised infrafamilial classification based on new phylogenetic evidence, with emphasis on the placement of some enigmatic genera. *Taxon* 65: 523-546.

Chahinian, B. J. 2005. The splendid Sansevieria: An account of the species. Published by the author. Buenos Aires.

Chase, M. A., S. Stankowski, and M. A. Streisfeld. 2017. Genomewide variation provides insight into evolutionary relationships in a monkeyflower species complex (*Mimulus* sect. *Diplacus*). *Amer. J. Bot*. 104: 1510-1521.

Chatrou, L. W., I. M. Turner, B. B. Klitguaard, P. J. M. Maas, and T. M. A. Utteridge. 2018. A linear sequence to facilitate curation of herbarium specimens of Annonaceae. *Kew Bull*. 73: 39. https://doi.prg/10.1007/s12225-018-9764-3.

Chen, L.-Y., Q.-F. Wang, and S. S. Renner. 2016. East Asian Lobelioideae and ancient divergence of a giant rosette *Lobelia* in Himalayan Bhutan. *Taxon* 65: 293-304.

Chen, Y.-P., B. T. Drew, B. Li, D. E. Soltis, P. S. Soltis, and C.-L. Xiang. 2016. Resolving the phylogenetic position of *Ombrocharis* (Lamiaceae), with reference to the molecular phylogeny of tribe Elsholtzieae. *Taxon* 65: 123-136.

Chen, Z.-D. and 46 others. 2016. Tree of life for the genera of Chinese vascular plants*. J. Syst. Evol*. 54: 277-306.

Chomicki, G., H. Schaefer, and S. S. Renner. 2020. Origin and domestication of Cucurbitaceae crops: Insights from phylogenies, genomics and archaeology. *New Phytologist* 226: 1240-1255.

Christenhusz, M. J. M. and J. W. Byng. 2016. The number of known plant species in the world and its annual increase. *Phytotaxa* 261: 201-217.

Christenhusz, M. J. M., M. F. Fay, and M. W. Chase. 2017. Plants of the world: An illustrated encyclopedia of vascular plants. Kew Publishing, Royal Botanic Gardens, Kew, and The University of Chicago Press, Chicago.

Clarkson, J. J., A. R. Zuntini, O. Maurin, S. R. Downie, G. M. Plunkett, A. N. Nicolas, J. F. Smith, M. A. E. Feist, K. Gutierrrez, P. Malakasi, P. Bailey, G. E. Brrewer, N. Epitawalage, S. Zmarzty, F. Forest, and W. J. Baker. 2021. A higher-level phylogenomic study of the carrot family (Apiaceae). *Amer. J. Bot*. 108: 1252-1269.

Clayton, J. W. 2011. Simaroubaceae. In *The families and genera of vascular plants*. Vol. 10. K. Kubitzki (ed.) 408-423. Springer-Verlag, Berlin.

Clement, W. L., T. J. Stammer, A. Goble, P. Gallagher, and M. J. Donoghue. 2021. Parallelism in endocarp form sheds light on fruit syndrome evolution in *Viburnum*. *Syst. Bot*. 46: 504-517.

Comer, J. R., W. B. Zomlefer, C. F. Barrett, D. W. Stevenson, K. Heyduk, and J. H. Leebens-Mack. 2016. Nuclear phylogenomics of the palm subfamily Arecoideae (Arecaceae). *Mol. Phylog. Evol*. 97: 32-42.

Cossard, G., J. Sannier, H. Saauquet, C. Damerval, L. Ronse de Craene, F. Jabbour, and S. Nadot. 2016. Subfamial and tribal relationships of Ranunculaceae: Evidence from eight molecular markers. *Plant Syst. Evol*. 302: 419-431.

Cronk, Q. C. B., I. Needham, and P. J. Rudall. 2015. Evolution of catkins: Inflorescence morphology of selected Salicaceae in an evolutionary and developmental context. *Front. Plant. Sci*. 6: 1030.

Crowl, A. A., N. W. Miles, C. J. Bisger, K. Hansen, T. Ayers, R. Haberle, and N. Cellinese. 2016. A global perspective on Campanulaceae: Biogeographic, genomic, and floral evolution. *Amer. J. Bot.* 103: 233-245.

Cvetković, T., F. Areces-Berazain, D. H. Hinsinger, D. C. Thomas, J. J. Wieringa, S. K. Ganesan, & J. S. Strijk. 2021. Phylogenomics resolves deep subfamilial relationships in Malvaceae. *G3*. Doi: 10.1093/g3journal/jkap136.

Cvetković, T., D. D. Hinsinger, D. C. Thomas, J. J. Wieringa, E. Velautham, and J. S. Strijk. 2022. Phylogenomics and a revised tribal classification of subfamily Dipterocarpoideae (Dipterocarpaceae). *Taxon* 71: 85-103.

Daly, D. C., M. M. Harley, M.-C. Martínez-Habibe, and A. Weeks. 2011. Burseraceae. In *The Families and Genera of vascular plants.* Vol. 10. K. Kubitzki (ed.). 76-104. Springer-Verlag, Berlin.

Da Rocha, M. J. R., P. J. F. Guimarães, F. A. Michelangeli, and J. A. Nogueira Batista. 2018. Taxonomy of Marcetieae: A new Neotropical tribe of Melastomataceae. *Int. J. Plant Sci.* 179: 50-74.

Deng, J.-B., B. T. Drew, E. V. Mavrodiev, M. A. Gitzendanner, P. S. Soltis, and D. E. Soltis. 2015. Phylogeny, divergence times, and historical biogeography of the angiosperm family Saxifragaceae. *Mol. Phylog. Evol*. 83: 86-98.

De-Nova, J. A., L. L. Sánchez-Reyes, L. E. Equiarte and S. Magallón. 2018. Recent r adiation and dispersal of an ancient lineage: The case of *Fouquieria* (Fouquieriaceae, Ericales) in North American deserts. *Mol. Phyl. Evol*. 126: 92-104.

De Smet, Y., C. G. Mendoza, S. Wanke, P. Goetghebeur, and M.-S. Samain. 2015. Molecular phylogenetic and new (infra)generic classification to alleviate polyphyly in tribe Hydrangeeae (Cornales: Hydrangeaceae). *Taxon* 64: 741-753.

Denk, T., G. W. Grimm, P. S. Manos, M. Deng, and A. L. Hipp. 2017. An updated infrageneric classification of the oaks: Review of previous taxonomic schemes and synthesis of evolutionary patterns. Pp. 12-38. In: E. Gil-Pelegrín, J. Peguero-Pina, O. Sancho-Knapik, eds. Oaks Physiological Ecology. Exploring the functional diversity of the genus *Quercus* L., *Tree Physiology*, vol. 7. Springer-Verlag.

Deng, M., X.-L. Jiang, A. L. Hipp, P. S. Manos, and M. Hahn. 2018. Phylogeny and biogeography of East Asian evergreen oaks (*Quercus* section *Cyclobalanopsis*; Fagaceae): Insights into the Cenozoic history of evergreen broad-leaved forests in subtropical Asia. *Mol. Phylog. Evol*. 170-181.

Dillenberger, M. S. and J. W. Kadereit. 2014. Maximum polyphyly: Multiple origins and delimitation with plesiomorphic characters require a new circumscription of *Minuartia* (Caryophyllaceae). *Taxon* 63: 64-88.

Edger, P. P., J. C. Hall, A. Harkess, M. Tang, J. Coombs, S. Mohammadin, M. E. Schranz, Z. Xiong, J. Leebens-Mack, B. C. Meyers, K. J. Sytsma, M. A. Koch, I. A. Al-Shehbaz, and J. C. Piers. 2018. Brassicales phylogeny inferred from 72 plastid genes: A reanalysis of the phylogenetic localization of two paleopolyploid events and origin of novel chemical defenses. *Amer. J. Bot*. 105: 463-469.

Ellison, A. M., E. D. Butler, E. J. Hicks, R. F. C. Naczi, P. J. Calie, C. D. Bell, and C. C. Davis. 2012. Phylogeny and biogeography of the carnivorous plant family Sarraceniaceae. *PLOS One* 716: e39291.doi:10.1371/journal. Pone. 0039291.

Endress, M. E., U. Meve, D. J. Middleton, and S. Liede-Schumann. 2018. Apocynaceae. In *The families and genera of vascular plants*. Vol. 15. K. Kubitzki (ed.). 207-411. Springer-Verlag, Berlin.

Endress, P. K. and J. A. Doyle. 2015. Ancestral traits and specializations in the flowers of the basal grade of living angiosperms. *Taxon* 64: 1093-1116.

Endress, P. K., C. C. Davis, and M. L. Matthews. 2013. Advances in the floral structural characterization of the major subclades of Malpighiales, one of the largest orders of flowering plants. *Ann. Bot*. 111: 969-985.

Feng, Y., H. P. Comes, X.-P. Zhou, and Y.-X. Qiu. 2019. Phylogenomics recovers monophyly and early tertiary diversification of *Dipteronia* (Sapindaceae). *Mol. Phylog. Evol*. 130: 9-17.

Fishbein, M., T. Livshultz, S. C. K. Straub, A. O. Simões, J. Boutte, A. McDonnell, and A. Foote. 2018. Evolution on the backbone: Apocynaceae phylogenomics and new perspectives on growth forms, flowers, and fruits. *Amer. J. Bot*. 105: 495-513.

Fleischmann, A., A. T. Cross, R. Gibson, P. M. Gonella, and K. W. Dixon. 2018. Systematics and evolution of Droseraceae. In *Carnivorous Plants*. A. M. Ellison and L. Adamec (eds.). Pp. 43-57. Oxford University Press, Oxford.

Flickinger, J. A., B. Jestrow, R. Oviedo Prieto, E. Santiago-Valentín, J. Sustache, F. Jiménez-Rodriguez, K. C. st. E. Campbell, and J. Francisco-Ortega. 2020. A phylogenetic survey of Myrtaceae in the Greater Antilles with nomenclatural changes for some endemic species. *Taxon* 69: 448-480.

Flores-Abreu, I. N., R. E. Trejo-Salazar, L. L. Sánchez-Reyes, S. V. Good, S. Magallón, A. García-Mendoza, and L. E. Eguiarte. 2019. Tempo and mode in coevolution of *Agave* sensu lato (Agavoideae, Asparagaceae) and its bat pollinators, Glossophaginae (Phyllostomidae). *Mol*. *Phylog. Evol.* 133: 176-188.

Folk, R. A., R. L. Stubbs, N. J. Engle-Wrye, D. E. Soltis, and Y. Okuyama. 2021. Biogeography and habitat evolution of Saxifragaceae, with a revision of generic limits and a new tribal system. *Taxon* 70: 263-285.

Folk, R. A., M. Sun, P. S. Soltis, S. A. Smith, D. E. Soltis, and R. P. Guralnick. 2018. Chaallenges of comprehensive taxon sampling: Wrestling with rosids. *Amer. J. Bot*. 105: 433-445.

Fowler, R. M., D. J. Murphy.T. G. B. McLay, B. J. Buirchell, R. J. Chinnock, and M. J. Bayly. 2021. Molecular phylogeny of tribe Myoporeae (Scrophulariaceae) using nucler ribosomal DNA: Generic relationships and evidence for major clades. *Taxon* 70: 570-588.

Freudenstein, J. V. and M. W. Chase. 2015. Phylogenetic relationships in Epidendroideae (Orchidaceae), one of the great flowering plant radiations: progressive specialization and diversification. *Ann*. *Bot*. 115: 665-681.

Freudenstein, J. V., M. B. Broe, and E. R. Feldenkris. 2016. Phylogenetic relationships at the base of Ericaceae: Implications for vegetative and mycorrhizal evolution. *Taxon* 65: 794-804.

Fritsch, P. W., F. Almeda, S. S. Renner, A. B. Martins, and B. C. Cruz. 2004. Phylogeny and circumscription of the near-endemic Brazilian tribe Microlicieae (Melastomataceae). *Amer. J. Bot.* 91: 1105-1114.

Fu, L.-F., F. Wen, O. Maurin, M. Rodda, E. M. Gardner, Z.-B. Xin, Y.-G. Wei, and A. K. Monro. 2022. A revised delimitation of the species-rich genus *Pilea* (Urticaceaae) supports the resurrection of *Achudemia* and a new infrageneric classification. *Taxon* pp. 1-18. Doi.org/10.1002/tax.12711.

Gagnon, E., G. P. Lewis, J. Solange Sotuyo, C. E. Hughes, and A. Bruneau. 2013. A molecular phylogeny of *Caesalpinia* sensu lato: Increased sampling reveals new insights and more genera than expected. *S. Afr. J. Bot*. 89: 111-127.

Gagnon, E., A. Bruneau, C. E. Hughes, L. de Queroz, and G. P. Lewis. 2016. A new generic system for the pantropical *Caesalpinia* group (Leguminosae). *PhytoKeys* 2016 (71): 1-160.

Gama, T. S. S., I. Cordeiro, and D. Demarco. 2016. Floral structure and development reveal presence of petals in *Phyllanthus* L. (Phyllanthaceae*). Int. J. Plant Sci*. 177: 749-759.

Garcia, N., A. W. Meerow, S. Arroyo-Leuenberger, R. S. Oliveira, J. H. Dutilh, P. S. Soltis, and W. S. Judd. 2019. Generic classification of Amaryllidaceae strib Hippeastreae. *Taxon* 68: 481-498.

Gardner, A. G., M. Vaio, N. Guerra, and E. Emshwiller. 2012. Diversification of the American bulb-bearing *Oxalis* (Oxalidaceae): Dispersal to North America and modification of the tristylous breeding system. *Amer. J. Bot*. 99: 152-164.

Gardner, A. G., E. B. Sessa, P. Michener, E. Johnson, K. A. Shepherd, D. G. Howarth and R. S. Jabaily. 2016. Utilizing next generation sequencing to resolve the backbone of core Goodeniaceae and inform future taxonomic and floral form studies. *Mol. Phylog. Evol*. 94: 605-617.

Gardner, E. M. and N. J. C. Zerega. 2021. Taxonomic updates to Artocarpus subfenus Artocarpus (Moraceae) and allied taxa with a particular focus on the species native to Singapore. *Gard. Bull. Singapore* 73: 307-374.

Gardner, E. M., R. J. Gagné, P. E. Kendra, W. S. Montgomery, R. A. Raguso, T. T. McNeil, and N. J. C. Zerega. 2018. A flower in fruit’s clothing: Pollination of jackfruit (*Artocarpus heterophyllus*, Moraceae) by a new species of gall midge, *Clinodiplosis ultracrepidata* sp. nov. (Diptera: Cecidomyiidae). *Int. J. Plant Sci*. 179: 350-367.

Gardner, E. M., L. Audi, Q. Zhang, H. Sauquet, A. K. Monro, and N. J. C. Zerega. 2021a. Phylogenomics of *Brosimum* (Moraceae) and allied genera, including a revised subgeneric system. *Taxon* 70: 778-792.

Gardner, E. M., M. Gardner, R. Cowan, S. Dodsworth, N. Epitawalage, D. Arifiani, W. J. Baker, F. Forest, O. Maurin, N. J. C. Zerega, A. K. Monro, and A. L. Hipp. 2021b. Repeated parallel losses of inflexed stamens in Moraceae: Phylogenomics and generic revision of the tribe Moreae and the reinstatement of the tribe Olmedieae (Moraceae). *Taxon* 70: 946-988.

Gardner, E. M., M. G. Johnson, J. T. Pereira, A. Shafrenna Ahmad Puad, D. Arifiani, Sahromi, N. J. Wickett, & N. J. C. Zerega. 2021c. Paralogs and off-target sequences improve phylogenetic resolution in a densely sampled study of the breadfruit genus (*Artocarpus*, Moraceae). *Syst. Biol*. 70: 558-575.

Gitzendanner, M. A., P. S. Soltis, G. K. S. Wong, B. R. Ruhfel, & D. E. Soltis. 2018. Plastid phylogenetic analysis of green plants: A billion years of evolutionary history. *Amer. J. Bot*. 105: 291-301.

Givnish, T. J., A. Zuluaga, I. Marques, V. K. Y. Lam, M. Soto Gomez, W. J. D. Iles, M. Ames, D. Spalink, J. R. Moeller, B. G. Briggs, S. P. Lion, D. W. Stevenson, W. Zomlefer, and S. W. Graham. 2016. Phylogenomics and historical biogeography of the monocot order Liliales: Out of Australia and through Antarctica. *Cladistics* doi: 10.1111/cla.12153.

Global Carex Group. 2016. Megaphylogenetic specimen-level approaches to the *Carex* (Cyperaceae) phylogeny using ITS, ETS, and matK sequences: Implications for classification. *Syst. Bot*. 41: 500-518.

Godoy-Bürki, A. C., J. M. Acosta, and L. Aagesen. 2018. Phylogenetic relationships within the New World subfamily Larreoideae (Zygophyllaceae) confirm polyphyly of the disjunct genus *Bulnesia*. *Syst. Biodiv*. 2018: 1-16. doi: 10.1080/14772000.2018.1451406.

Goldenberg, R., F. Almeda, K. Sosa, R. C. Ribeiro, and F. A. Michelangeli. 2015. *Rupestrea*: A new Brazilian Genus of Melastomataceae, with anomalous seeds and dry indehiscent fruits. *Syst. Bot*. 40: 561-571.

Golovneva, L. B. 2007. Occurrence of *Sapindopsis* (Platanaceae) in the Cretaceous of Eurasia. *Paleont*. *Jour*. 43: 1077-1090.

Gomes-da-Silva, J. and T. T. Souza-Chies. 2017. What actually is *Vriesea*? A total evidence approach in a polyphyletic genus of Tillandsoideae (Bromeliaceae, Poales). *Cladistics* doi.org/10.1111/cla.12200

Gomez, B., V. Daviero-Gomez, C. Coiffard, A. Barral, C. Martín-Closas, and D. L. Dilcher. 2020. *Montsechia vidalii* from the arremian of Spain, the earliest known submerged aquatic angiosperm, and its systematic relationship to *Ceratophyllum*. *Taxon* 69: 1273-1292.

Goremykin, V. V., S. V. Nikiforova, D. Cavalieri, M. Pindo, and P. Lockart. 2015. The root of flowering plants and total evidence. *Syst. Biol*. 64: 879-891.

Gruenstaendl, M., L. Nauheimer and T. Borsch. 2017. Plastid genome structure and phylogenomics of Nymphaeales: Conserved gene order and new insights into relationships. *Pl. Syst. Evol*. 303: 1251-1270.

Guerrero, P. C., L. C. Majure, A. Cornejo-Romero, and T. Hernández-Hernández. 2018. Phylogenetic relationships and evolutionary trends in the cactus family. *J. Heredity* 2018, 1-18. Doi: 10.1093/jhered/esy064.

Guo, X., C. C. Tang, D. C. Thomas, T. L. P. Couvreur, and R. M. K. Saunders. 2017. A mega-phylogeny of the Annonaceae: taxonomic placement of five enigmatic genera and support for a new tribe, Phoenicantheae. *Sci. Rep*. 7: 7323.

Hancock, L. P., F. Obbens, A. J. Moore, K. Thiele, J. M. de Vos, J. West, J. A. M. Holtum, and E. J. Edwards. 2018. Phylogeny, evolution, and biogeographic history of *Calandrinia* (Montiaceae). *Amer. J. Bot*. 105: 1021-1034.

Hasenstab-Lehman, K. E. 2017. Phylogenetics of the borage family: Delimiting Boraginales and assessing closest relatives. *Aliso* 35: 41-49.

Hauenschild, F., S. Matuszak, A. N. Muellner-Riehl, and A. Favre. 2016. Phylogenetic relationships within the cosmopolitan buckthorn family (Rhamnaceae) support the resurrection of *Sarcomphalus* and the description of *Pseudoziziphus* gen. nov. *Taxon* 65: 47-64.

Hauenschild, F., A. Favre, G. A. Salazar, and A. N. Muellner-Riehl. 2016. Analysis of the cosmopolitan buckthorn genera *Frangula* and *Rhamnus* s.l. supports the description of a new genus, *Ventia*. *Taxon* 65: 65-78.

Hauser, D. A., A. Keuter, J. D. McVay, A. L. Hipp, and P. S. Manos. 2017. The evolution and diversification of the red oaks of the California Floristic Provence (*Quercus* section *Lobatae*, series *Agrifoliae*). *Amer. J. Bot*. 104: 1581-1595.

Heckenhauer, J., R. Samuel, P. S. Ashton, B. Turner, M. H. J. Barfuss, T.-S. Jang, E. M. Temsch, J. Mccann, K. Abu Salim, A. M. Achala, S. Attanayake, and M. W. Chase. 2017. Phylogenetic analyses of plastid DNA suggests a different interpretation of morphological evolution than those used as the basis for previous classifications of Dipterocarpaceae (Malvales). *Bot. J. Linnean Soc*. 185: 1-26.

Heckenhauer, J., R. Samuel, P. S. Ashton, K. A. Salim, and O. Paun. 2018. Phylogenomics resolves evolutionary relationships and provides insights into floral evolution in the tribe Shoreae (Dipterocarpaceae). *Mol. Phylog. Evol*. 127: 1-13.

Heckenhauer, J., O. Paun, M. W. Chase, P. S. Ashton, A. S. Kamariah, and R. Samuel. 2019. Molecular phylogenetics of the tribe Shoreeae (Dipterocarpaceae) using whole plastid genomes. *Ann. Bot*. 123: 857-865.

Henderson, A. 2002. *Evolution and ecology of palms*. New York Bot. Gard. Press, New York.

Hernández, P., W. G. Berendsohn, T. Borsch, S. von Mering, H. Akhani, S. Arias, I. Castañeda, U. Eggli, R. Eriksson, H. Flores, S. Fuentes, G. Kadereit, C. Klak, N. Korotkova, R. Nyffeler, G. Ocampo, H. Ochoterena, B. Oxelman, R. K. Rabeler, A. Sanchez, B. O. Schlumpberger, and P. Uotila. 2015. A taxonomic backbone in the angiosperm order Caryophyllales. *Willdenowia* 45: 281-383.

Henriquez, C. L., T. arias, J. C. Pires, T. B. Croat, and B. A. Schaal. 2014. Phylogenomics of the plant family Araceae. *Mol. Phylog. Evol.* 75: 91-102.

Hertweck, K. L., M. S. Kinney, S. A. Stuart, O. Maurin, S. Mathews, M. W. Chase, M. A. Gandolfo, & J. C. Pires. 2015. Phylogenetics, divergence times and diversification from three genomic partitions in monocots. *Bot. J. Linn. Soc*. 178: 375-393.

Hidalgo, B. F., S. Fuentes Bazan, R. Berazaín Iturralde, and T. Borsch. 2020. Phylogenetic relationships and character evolution in Neotropical *Phyllanthus* (Phyllanthaceae), with a focus on the Cuban and Caribbean taxa. *Int. J. Plant Sci*. 181:284-305.

Hilger, H. H. and N. Diane. 2003. A systematic analysis of Heliotropiaceae (Boraginales) based on *trnL* and ITS1 sequence data. *Bot. Jahrb. Syst*. 125: 19-51.

Hinchcliff, C. E. and E. H. Roalson. 2013. Using supermatrices for phylogenetic enquiry: An example using the sedges. *Syst. Bot*. 62: 205-219.

Hipp, A. L., P. S. Manos, A. González-Rodríguez, M. Hahn, M. Kaproth, J. D. McVay, S. V. Avalos, and J. Cavender-Bares. 2017. *New Phytol*. dol:10.1111/nph.14773.

Hochbach, A., H. P. Linder, & M. Röser. 2018. Nuclear genes, *matK* and the phylogeny of the Poales. *Taxon* 67: 531-536.

Hoffman, P., H. Kathriarachchi, and K. J. Wurdack. 2006. A phylogenetic classification of Phyllanthaceae (Malpighiales; Euphorbiaceae *sensu lato*). *Kew Bull*. 61: 37-53.

Hoot, S. B., K. M. Wefferling, and J. A. Wulff. 2015. Phylogeny and character evolution of Papaveraceae s.l. (Ranunculales). *Syst. Bot*. 40: 474-488.

Hopper, S. D., R. J. Smith, M. F. Fay, J. C. Manning, and M. F. Chase. 2009. Molecular phylogenetics of Haemodoraceae in the Greater Cape and Southwest Australian floristic regions. *Mol. Phyl. Evol*. 51: 19-30.

Hsieh, C.-L., C.-C. Yu, Y.-L. Huang, and K.-F. Chung. 2022. *Front. Plant Sci*. doi.org/10.3389/gpls.2021.720171.

Huang, C.-H., R. Sun, Y. Hu, L. Zeng, N. Zhang, L. Cai, Q. Zhang, M. A. Koch, I. Al-Shehbaz, P. P. Edger, J. C. Pires, D.-Y. Tan, Y. Zhong, and H. Ma. 2015. Resolution of Brassicaceae phylogeny using nuclear genes uncovers nested radiations and suggests convergent morphological evolution. *Mol. Bio. Evol*. doi:10.1093/molbev/msv226.

Huang, X., T. Deng, S. Chen, J. B. Landis, N. Lin, Y. Yang, G. Hu, Z. Zhou, Y. Want, H. Wang, K. Sh. Tojibaev, and H. Sun. 2021. Western Tethys origin, tropical Asia and tropical America disjunction in *Berchemia* and reinstatement of *Phyllogeiton* (Rhamneae, Rhamnaceae). *Taxon* 70: 515-525.

Huegele, I. B., H. Zhu, Y.-F. Wang, and S. R. Manchester. 2022. Trans-beringial distribution of *Platimeliphyllum* (Platanaceae) in the Eocene of eastern Asia and western North America. *Int. J. Plant Sci.* 183: 139-153.

Ito, Y., N. Tanaka, C. Kim, R. B. Kaul, and D. C. Albach. 2016. Phylogeny of *Sparganium* (Typhaceae) revisited: Non-monophyletic nature of *S. emersum* sensu lato and resurrection of *S. acaule*. *Pl*. *Syst. Evol*. 302: 129-135.

Jacobs, B., M. J. Donoghue, F. Bouman, S. Huysmans, and E. Smets. 2008. Evolution and phylogenetic importance of endocarp and seed characters in *Viburnum* (Adoxaceae). *Int. J. Plant Sci*. 169: 409-431.

Judkevich, M. D., R. M. Salas, and A. M. Gonzalez. 2017. Colleters in American Spermacoceae genera (Rubiaceae): Morphoanatomical and evolutionary aspects. *Int. J. Plant Sci*. 178: 378-397.

Kagame, S. P., A. W. Gichira, L.-Y. Chen, and Q.-F. Wang. 2021. Systematics of Lobelioideae (Campanulaceae): review, phylogenetic and biogeographic analyses. *PhytoKeys* 174: 13-45.

Kartonegoro, A., M. C. Veranso-Libalah, G. Kadereit, A. Frenger, D. S. Penneys, S. Mota de Oliveira, and P. C. Van Welzen. 2021. Molecular phylogenetics of the *Dissochaeta* alliance (Melastomataceaea): Rredefining tribe Dissochaeteae. *Taxon* 70: 793-825.

Khan, G., J. Nolzen, H. Schepker, and D. C. Albach. 2021. Incongruent phylogenies and their implications for the study of diversification, taxonomy, and genome size evolution in *Rhododendron*. Amer. J. Bot. 108: 1957-1981.

Kim, J. S. and J.-H. Kim. 2018. Updated molecular phylogenetic analysis, dating and biogeographical history of the lily family (Liliaceae: Liliales). *Bot. J. Linnean Soc*. 187: 579-593.

Kim, K. and H.-K. Choi. 2011. Molecular systematics and character evolution of *Typha* (Typhaceae) inferred from nuclear and plastid DNA sequence data. *Taxon* 60: 1417-1428.

Kim, S.-C., J. S. Kim, M. W. Chase, M. F. Fay, and J. H. Kim. 2016. Molecular phylogenetic relationships of Melanthiaceae (Liliales) based on plastid DNA sequences. *Bot. J. Linn. Soc*. 181: 567-584.

Klak, C, P. Hanáček, and P. V. Bruyns. 2017. Disentangling the Aizooideae: New Generic concepts and a new subfamily in Aizoaceae. *Taxon* 66: 1147-1170.

Kubitzki, K., J. A. Kallunki, and M. Duretto with P. G. Wilson. 2011. Rutaceae. In *The families and genera of vascular plants.* Vol. 10. K. Kubitzki (ed.) 276-356. Springer-Verlag, Berlin.

Kubota, S., I. Konno, and A. Kanno. 2012. Molecular plylogeny of the genus *Asparagus* (Asparagaceae) explains interspecific crossability between the garden asparagus (*A. officinalis*) and other *Asparagus* species. *Theor. Appl. Genetics* 124: 345-354.

Kümpers, B. M. C., J. E. Richardson, A. A. Anderberg, P. Wilkie, and L. P. Ronse De Craene. 2016. The significance of meristic changes in the flowers of Sapotaceae. *Bot. J. Linn. Soc*. 180: 161-192.

Kvaček, J., J. D. Doyle, P. K. Endress, V. Daviero-Gomez, B. Gomez, and M. Tekleva. 2016. *Pseudoasterophyllites cretaceus* from the Cenomanian (Cretaceous) of the Czech Republic: A possible link between Chloranthaceae and *Ceratophyllum*. *Taxon* 65: 1345-1373.

Kvaček, Z. and S. R. Manchester. 2004. Vegetative and reproductive structure of the extinct *Platanus* *neptuni* from the Tertiary of Europe and relationships within the Platanaceae. *Plant Syst. Evol*. 244: 1-29.

Kvaček, Z., S. R. Manchester, and S.-K. Guo. 2001. Trifolliolate leaves of *Platanus bella* (Heer) comb. n. from the Paleocene of North America, Greenland, and Asia and their relationships among extinct and extant Platanaceae. *Int. J. Plant Sci*. 162: 441-458.

Landis, M. J., D. A. R. Eaton, W. L. Clement, B. Park, E. L. Spriggs, P. W. Sweeney, E. J. Edwards, and M. J. Donoghue. 2021. Joint phylogenetic estimation of geographic movements and biome shiftsduring the global diversification of *Viburnum*. *Syst. Biol*. 70: 67-85.

Lane, A. K., M. M. Augustin, S. Ayyampalayam, A. Plant, S. Gleissberg, V. S. Di Stilio, C. W. Depamphilis, G. K.-S. Wong, T. M. Kutchan, J. H. Leebens-Mack. 2018. Phylogenomic analysis of Ranunculales resolves branching events across the order. *Bot. J. Linnean Soc*. 187: 157-166.

Latvis, M., S. J. Jacobs, S. M. E. Mortimer, M. Richards, P. D. Blischak, S. Mathews, and D. C. Tank. 2017. Primers for *Castilleja* and their utility across Orobanchaceae. II. Single-copy nuclear loci. *Appl. Plant Sci*. 5: 1700038.

Lee, A. K., I. S. Gilman, M. Srivastav, A. D. Lerner, M. J. Donoghue, and W. L. Clement. 2021. Reconstructing Dipascales phylogeny using Angiosperms353: issues and insights. *Amer. J. Bot*. 108: 1122-1142.

Lee, C.-K., S. Fuse, M. Poopath, R. Pooma, M. N. Tamura. 2022. Phylogenetic and infrafamilial classification of Commelinaceae (Commelinales). *Bot. J. Linn. Soc*. 198: 117-130.

Lehtonen, S. 2009. Systematics of the Alismataceae – a morphological evaluation. *Aquatic Bot*. 91: 279-290.

Legume Phylogeny Working Group. 2017. A new subfamily classification of the Leguminosae based on a taxonomically comprehensive phylogeny. *Taxon* 66: 44-77.

Leubert, F., G. Brokamp, J. Wen, M. Weigend, and H. H. Hilger. 2011. Phylogenetic relationships and morphological diversity in Neotropical *Heliotropium* (Heliotropiaceae). Taxon 60: 663-680.

Léveillé-Bourret, E., J. R. Starr, and B. A. Ford. 2018. A revision of *Sumatroscirpus* (Sumatroscirpeae, Cyperaceae) with discussions on southeast Asian biogeography, general collecting, and homologues with Carex (Cariceae, Cyperaceae). *Syst. Bot*. 43: 510-531.

Léveillé-Bourret, E. and J. R. Starr. 2019. Molecular and morphological data reveal three new tribes within the Scirpo-Caricoid Clade (Cyperoideae, Cyperaceae). *Taxon* 68: 218-245.

Levin, R. A., W. L. Wagner, P. C. Hoch, W. J. Hahn, A. Rodriguez, D. A. Baum, L. Katinas, E. A. Zimmer, and K. J. Sytsma. 2004. Paraphyly in tribe Onagreae: Insights into phylogenetic relationships of Onagraceae based on nuclear and chloroplast sequence data. *Syst. Bot*. 29: 147-164.

Li, B., P. D. Cantino, R. G. Olmstead, G. L. C. Bramley, C.-L. Xiang, Z.-H. Ma, Y.-H. Tan, and D.-X. Zhang. 2016. A large-scale chloroplast phylogeny of the Lamiaceae sheds new light on its subfamilial classification. *Scientific Reports* 6: 34343. DOI: 10.1038/srep34343.

Li, H.-T. and 22 others. 2019. Origin of angiosperms and the puzzle of the Jurassic gap. *Nature Plants* 5: 461-470.

Li, H. T. and 22 others. 2021. Plastid phylogenomic insights into relationships of all flowering plant families. *BMC Biol*. 19: 232.

Li, J. 2008. Molecular phylogenetics of Hamamelidaceae: Evidence from DNA sequences of nuclear and chloroplast genomes. Pp. 227-250 in A. K. Sharma and A. Sharma, eds. *Plant genome biodiversity and evolution.* Vol. 1. Part E. Phanerogams – Angiosperm. Science Publishers, Delhi.

Li, L. S. Madriñan and J. Li. 2016. Phylogeny and biogeography of *Caryodaphnopsis* (Lauraceae) inferred from low-copy nuclear gene and ITS sequences. *Taxon* 65: 433-443.

Li, M.-M., J.-H. Li, P. Del Tredici, J. Corajod, and C.-X. Fu. 2013. Phylogenetics and biogeography of Theaceae based on sequences of plastid genes. *J. Syst. Evol*. 396-404.

Liu, B., C. T. Le, R. L. Barrett, D. L. Nickrent, Z. Chen, L. Lu, R. Vidal-Russell. 2018. Historical biogeography of Loranthaceae (Santalales): Diversification agrees with emergence of tropical forests and radiation of songbirds. *Mol. Phylog. Evol*. 124: 199-212.

Liu, B., Y.-H. Tan, S. Liu, R. G. Olmstead, D.-Z. Min, Z.-D. Chen, N. Joshee, B. N. Vaidya, R. C. K. Chung, and B. Li. 2020. Phylogenetic relationsips of *Crytandromoea* and *Wrightia* revisited: A new tribe in Phrymaceae and a new family in Lamiales. *J. Syst. Evol*. 58: 1-17. doi 10.1111/jse.12513.

Liu, K.-W., G.-C. Xie, L.-J. Chen, X.-J. Xiao, Y.-Y. Zheng, J. Cai, J.-W. Zhai, G.-Q. Zhang, and Z.-J. Liu. 2012. *Sinocurculigo*, a new genus of Hypoxidaceae from China based on molecular and morphological evidence. *PLoS ONE* 7(6): e38880. https://doi.org/10.1371/journal.pone.0038880.

Liu, X., Z.-S. Wang, D.-S. Wang, and J.-G. Zhang. 2016. Phylogeny of Populus-Salix (Salicaceae) and their relative genera using molecular datasets. *Biochem. Syst. Ecol*. 68: 210-215.

Loizeau, P.-A., V. Savolainen, S. Andrews, G. Barriera, and R. Spichiger. 2016. Aquifoliaceae. In *The Families and Genera of Vascular Plants*, K. Kubitzki (ed.). 31-36. Springer-Verlag, Berlin.

Löfstrand, S. D. and J. Schönenberger. 2015. Molecular phylogenetics and floral evolution in the sarracenioid clade (Actinidiaceae, Roridulaceae and Sarraceniaceae) of Ericales. *Taxon* 64: 1209-1224.

Lu, L., P. W. Fritsch, N. J. Matzke, H. Wang, J. A. Kron, D.-Z. Li, and J. J. Wiens. 2019. Why is fruit color so variable> Phylogenetic analyses reveal relationships between fruit-color evolution, biogeography and diversification. *Global Ecol. Biogeogr*. 28: 891-903.

Lu-Irving, P., A. M. Bedoya, F. R. G. Salimena, T. R. dos Santos Silva, L. F. Viccini, C. Bitencourt, V. A. Thude, P. H. Cardoso, N. O’Leary, and R. G. Olmstead. 2021. Phylogeny of *Lantana*, *Lippia*, and related genera (Lantaneae: Verbenaceae). *Amer. J. Bot*. 108: 1354-1373.

Lucas, E. J., B. S. Amorim, D. F. Lima, A. R. Lima-Lourenço, E. M. Nic Lughadha, C. E. B. Proença, P. O. Rosa, A. S. Rosário, L. L. Santos, M. F. Santos, M. C. Souza, V. G. Staggemeier, T. N. C. Vasconcelos, and M. Sobral. 2018. A new infra-generic classification of the species-rich Neotropical genus *Myrcia* s.l. *Kew Bull*. 73: 1-12.

Lucas, E. J., B. Holst, M. Sobral, F. F. Mazine, E. M. Nic Lughadha, C. E. Barnes Proença, I. Ribeiro da Costa, and T. N. C. Vasconcelos. 2019. A new subtribal classification of Tribe Myrteae (Myrtaceae). *Syst. Bot*. 44: 560-569.

Luján, M. 2019. Playing the taxonomic cupid: matching pistillate and staminate conspecifics in dioecious *Clusia* (Clusiaceae). *Syst. Bot*. 44: 548-559.

Luna, J. A., J. E. Richardson, K. Nishii, J. L. Clark, and M. Möller. 2019. The family placement of *Cyrtandromoea*. *Syst. Bot*. 44: 616-630.

Maas, P. J. M., P. Baas, M. J. M. Christenhusz, J. J. Clarkson, J. Koek-Noorman, A. M. W. Mennega, T. Tokuoka, M. Van Der Bank, R. W. J. M. Van Der Ham, E.-J. Van Marle, L. Y. T. H. Westra, and M. W. Chase. 2019. ‘Unknown Yellow’: *Pibiria*, a new genus of Passifloraceae with a mixture of features found in Passifloroideae and Turneroideae. *Bot. J. Linn. Soc*. 189: 397-407.

Mabberley, D. J. 2011. Meliaceae. In *The families and genera of vascular plants*. Vol. 10. K. Kubitzki (ed.) 185-211. Springer-Verlag, Berlin.

Mabberley, D. J. 2017. *Mabberley’s plant book: A portable dictionary of plants, their classification and uses*, 4th ed. Cambridge University Press, Cambridge.

Majure, L. C., M. C. Baker, M. Cloud-Hughes, A. Salywon, and K. M. Neubig. 2019. Phylogenomics in Cactaceae: A case study using the chollas sensu lato (Cylindropuntieae, Opuntioideae) reveals a common pattern out of the Chihuahuan and Sonoran deserts. *Amer. J. Bot*. 106: 1-19.

Majure, L. C., T. Clase, A. Blankenship, and A. Noa-Monzón. 2021a. A new species of *Picrasmia*, *P*. *nanophylla* (Simaroubaceae), from the Dominican Republic. *Brittonia* doi.org/10.1007/s12228-021-09656-x.

Majure, L. C., A. Blankenship, A. Grinage, and A. Noa-Monzón. 2021b. *Castela* (Simaroubaceae), an impressive New World radiation of thorny shrubs destined for edaphically dry habitats. *Brazilian J. Bot.* doi.org/10.1007/s40415-021-00742-8.

Majure, L. C., K. Pham, and T. Clase. 2021c. *Castela senticosa* (Simaroubaceae: Sapindales), a new species from the Caribbean clade endemic to seasonally dry tropical forest on Hispaniola. *Systematic Botany* 46: 1033-1041.

Manzitto-Tripp, E. A., I. Darbyshire, T. F. Daniel, C. A. Kiel, and L. A. McDade. 2022. Revised classification of Acanthaceae and worldwide dichotomous keys. *Taxon* 71: 103-153.

Massoni, J., F. Forest, and H. Sauquet. 2014. Increased sampling of both genes and taxa improves resolution of phylogenetic relationships within Magnoliidae, a large and early-diverging clade of angiosperms. *Mol. Phyl. Evol*. 70: 84-93.

Marquínex, X., L. G. Lohmann, M. L. F. Salatino, A. Salatino, F. González. 2009. Generic relationships and dating of lineages in Winteraceae based on nuclear (ITS) and plastid (*rpS*16 and *psbA-trnH*) sequence data. *Mol. Phyl. Evol*. 53: 435-449.

Massoni, J., F. Forest, and H. Sauquet. 2014. Increased sampling of both genes and taxa improves resolution of phylogenetic relationships within Magnoliidae, a large and early-diverging clade of angiosperms. *Mol. Phylog. Evol*. 70: 84-93.

Maurin, O., J. Gere, M. van der Bank, and J. S. Boatwright. 2017. The inclusion of *Anogeissus*, *Buchenavia* and *Pteleopsis* in *Terminalia* (Combretaceae: Terminaliinae). *Bot. J. Linn. Soc*. 184: 312-325.

Maurin, O, A. Anest, S. Bellot, E. Biffin, G. Brewer, T. Charles-Dominique, R.S. Cowan, S. Dodsworth, N. Epitawalage, B. Gallego, A. Giaretta, R. Goldenberg, D.J.P. Gonçalves, S. Graham, P. Hoch, F. Mazine, Y.W. Low, C. McGinnie, F.A. Michelangeli, S. Morris, D.S. Penneys, O. A. Pérez Escobar, Y. Pinnon, L. Pokorny, G. Shimizu, V.G. Staggemeier, A. Thornhill, K.W. Tomlinson, I.M. Turner, T. Vasconcelos, P.G. Wilson, A.R. Zuntini, W.J. Baker, F. Forest, G. Lucas. 2021. A nuclear phylogenomic study of the angiosperm order Myrtales, exploring the potential and limitations of the universal Angiosperms353 probe set. *Amer. J. Bot.* 108:1-23.

Mayo, S. J., J. Bogner, and N. Cusimano. 2013. Recent progress in the phylogenetics and classification of Araceae. Pp. 208-242. In P. Wilkin and S. J. Mayo (eds), *Early events in monocot evolution*. Cambridge University Press, Cambridge.

McCarthy, D. M. and R. J. Mason-Gamer. 2020. Morphological variation in North American *Tilia* and its value in species delineation. *Int. J. Plant Sci.* 181: 175-195.

McKain, M. R., N. Wickett, Y. Zhang, S. Ayyampalayam, W. R. McCombie, M. W. Chase, J. C. Pires, C. W. de Pamphilis, and J. Leebens-Mack. 2012. Phylogenomic analysis of transcriptome data elucidates co-occurrence of a paleopolyploid event and the origin of bimodal karyotypes in Agavoideae (Asparagaceae). *Amer. J. Bot*. 99: 397-406.

McKain, M. R., J. R. McNeal, P. R. Kellar, L. E. Eguiarte, J. C. Pires, and J. Leebens-Mack. 2016. Timing of rapid diversification and convergent origins of active pollination within Agavoideae (Asparagaceae). *Amer. J. Bot*. 103: 1717-1729.

McNeal, J. R., J. R. Bennett, A. D. Wolfe, and S. Mathews. 2013. Phylogeny and origins of holoparasitism in Orobanchaceae. *Amer. J. Bot*. 100: 971-983.

Meerow, A. W., L. Noblick, D. E. Salas-Leiva, V. Sanchez, J. Francisco-Ortega, B. Jestrow, and K. Nakamura. 2015. Phylogeny and historical biogeography of the cocosoid palms (Arecaceae, Arecoideae, Cocoseae) inferred from sequences of six WRKY gene family loci. *Cladistics* 31: 509-534.

Meng, S.-W., A. W. Douglas, D.-Z. Li, Z.-D. Chen, H.-X. Liang, and J.-B. Yang. 2003. Phylogeny of Saururaceae based on morphology and five regions from three plant genomes. *Ann. Missouri Bot. Gard*. 90: 592-602.

Meseguer, A. S., J. J. Aldasoro, and I. Sanmartín. 2013. Bayesian inference of phylogeny, morphology and range evolution reveals a complex evolutionary history in St. John’s wort (*Hypericum*). *Mol*. *Phylog. Evol*. 67: 379-403.

Meseguer, A. S., J. M. Lobo, R. Ree, D. J. Beerling, and I. Sanmartín. 2015. Integrating fossils, phylogenies, and niche models into biogeography to reveal ancient evolutionary history: The case of *Hypericum* (Hypericaceae). *Syst. Biol*. 64: 215-232.

Messerschmid, T. F. E., J. T. Klein, G. Kadereit, and J. W. Kadereit. 2020. Linnaeus’s folly – phylogeny, ecolution and classification of *Sedum* (Crassulaceae) and Crassulaceae subfamily Sempervivoideae. *Taxon* 69: 892-926.

Mestier, A. de, G. Brokamp, M. Celis, B. Falcén-Hidalgo, J. Gutiérrez, and T. Borsch. 2022. Character evolution and biogeography of *Casearia* (Salicaceae): Evidence for the South American origin of a pantropical genus and for multiple migrations to the Caribbean islands. *Taxon* 71: 321-347.

Michelangeli, F. A. 2010. Neotropical myrmecophilous Melastomataceae: An annotated list and key. *Proc. California Acad. Sci.* 61: 409-449.

Michelangeli, F. A., R. Goldenberg, F. A. Almeda, W. S. Judd, E. R. Bécquer, G. Ocampo, G. M. Ionta, J. D. Skean, Jr., L. C. Majure, and D. S. Penneys. 2019. Nomenclatural novelties in *Miconia* (Melastomataceae: Miconieae). *Brittonia* 71: 82-121.

Miller, J. S. and M. Gottschling. 2007. Generic classification in the Cordiaceae (Boraginales): Resurrection of the genus *Varronia* P. Br. *Taxon* 56: 163-169.

Möller, M. and J. L. Clark. 2013. The state of molecular studies in the family Gesneriaceae: A review. *Selbyana* 31: 95-125.

Moonlight, P. W., and 28 others. 2018. Dividing and conquering the fastest-growing genus: Towards a natural sectional classification of the mega-diverse genus *Begonia* (Begoniaceae). *Taxon* 67: 267-323.

Mori, S. A., E. A. Kiernan, N. P. Smith, L. M. Kelly, Y.-Y. Huang, G. T. Prance, and B. Thiers. 2016. Observations on the phytogeography of the Lecythidaceae clade (Brazil nut family). *Phytoneuron* 2017-30: 1-85.

Mort, M. E., T. R. O’Leary, P. Carillo-Reyes, T. Nowell, J. K. Archibald, and C. Randle. 2010. Phylogeny and evolution of Crassulaceae: Past, present and future. *Schumannia* 6: 69-86.

Morton, C. M. 2015. Phylogenetic relationships of *Zieria* (Rutaceae) inferred from chloroplast, nuclear, and morphological data. *PhytoKeys* 44: 15-38.

Mota, M., J. R. Abbott, R. M. Salas, K. M. Neubig, and J. I. B. Pastore. 2019. Three lonely Argentines: Towards a new generic delimitation in Polygalaceae. *Taxon* 68: 522-536.

Mu, X.-Y., L. Tong, M. Sun, Y.-X. Zhu, J. Wen, Q.-W. Lin, and B. Liu. 2020. Phylogeny and divergence time estimation of the walnut family (Juglandaceae) based on nuclear RAD-Seq and chloroplast genomic data. *Mol. Phylog. Evol*. 147: 106802. doi.org/10.1016/j.ympev.2020.106802.

Muellner, A. N., V. Savolainen, R. Samuel, and M. W. Chase. 2006. The mahogany family “out of Africa”: Divergence time estimation, global biogeographic patterns inferred from plastid rbcL DNA sequences, extant, and fossil distribution of diversity. *Mol. Phyl. Evol*. 40: 236-250.

Muellner-Riehl, A. N., A. Weeks, J. W. Clayton, S. Buerki, L. Nauheimer, Y.-C. Chiang, S. Cody, and S. K. Pell. 2016. Molecular phylogenetics and molecular clock dating of Sapindales based on plastid *rbcL*, *atpB* and *trnL-trnF* DNA sequences. *Taxon* 65: 1019-1036.

Muñoz-Rodríguez, P., T. Cavruthers, J. R. I. Wood, B. R. M. Williams, K. Weitemier, B. Kronmiller, Z. Goodwin, A. Sumadijaya, N. L. Anglin, D. Filer, D. Harris, M. D. Rausher, S. Kelly, A. Liston, and R. W. Scotland. 2019. A taxonomic monograph of *Ipomoea* integrated across phylogenetic scales. *Nature, Plants* 5: 1136-1154.

Nesom, G. L., N. S. Fraga, W. R. Barker, P. M. Beardsley, D. C. Tank, B. G. Baldwin, and R. G. Olmstead. 2019. Response to “The case for the continued use of the genus name *Mimulus* for all monkeyflowers.” *Taxon* 68: 624-627.

Ness, R. W., S. W. Graham, and S. C. H. Barrett. 2011. Reconciling gene and genome duplication events: using multiple gene families to infer the phylogeny of the aquatic plant family Pontederiaceae. *Molec. Biol. Evol*. 28: 3009-3018.

Nguyen, T. P. A., J. S. Kim, and J.-H. Kim. 2013. Molecular phylogenetic relationships and implications for the circumscription of Colchicaceae (Liliales). *Bot. J. Linn. Soc*. 172: 255-269.

Nickrent, D. L. 2020. Parasitic angiosperms: How often and how many? *Taxon* 69: 5-27.

Nickrent, D. L., F. Anderson, and J. Kuijt. 2019. Inflorescence evolution in Santalales: Integrating morphological characters and molecular phylogenetics. *Amer. J. Bot.* 106: 402-414.

Nikolov, L. A., P. Shushkov, B. Nevado, X.-C. Gan, I. A. Al-Shehbaz, D. Filatov, C. D. Bailey, and M. Tsiantis. 2019. Resolving the backbone of the Brassicaceae phylogeny for investigating trait diversity. *New Phytologist* 222: 1638-1651.

Nikulin, V. Y., S. B. Grontcharova, R. Stephenson, and A. A. Gontcharov. 2016. Phylogenetic relationships between *Sedum* L. and related genera (Crassulaceae) based on ITS rDNA sequence comparisions. *Flora* 224: 218-229.

Nishii, K., M. Hughes, M. Briggs, E. Haston, F. Christie, M. J DeVilliers, T. Hanekom, W. G. Roos, D. U. Bellstedt and N. Möller. 2015. *Streptocarpus* redefined to include all Afro-Malagasy Gesneriaceae: Molecular phylogenies prove congruent with geographical distribution and basic chromosome numbers and uncover remarkable morphological homoplasies. *Taxon* 64: 1243-1274.

Norup, M. F., G. Petersen, S. Burrows, Y. Bouchenak-Khelladi, J. Leebens-Mack, J. C. Pires, H. P. Linder, and O. Seberg. 2015. Evolution of *Asparagus* L. (Asparagaceae): Out-of-South-Africa and multiple origins of sexual dimorphism. *Mol. Phylog. Evol*. 92: 25-44.

Ortiz, R. del, W. Wang, F. M. B. Jacques, and Z. Chen. 2016. Phylogeny and a revised tribal classification of Menispermaceae (moonseed family) based on molecular and morphological data. *Taxon* 65: 1288-1312.

Pace, M. R., I. L. Cunha Neto, L. N. N. Santos-Silva, G. P. A. Melo-de-Pinna, P. Acevedo-Rodríguez, R. F. Almeida, A. M. Amorim, and V. Angyalossy. 2019. First report of laticifers in lianas of Malpighiaceae and their phylogenetic implications. *Amer. J. Bot*. 106: 1156-1172.

Park, B. and M. J. Donoghue. 2021. Phylogenomic insights into the independent origins of sterile marginal flowers in *Viburnum*. *Int. J. Plant Sci*. 182: 591-608.

Pastore, J. F. B., J. R. Abbott, K. M. Neubig, W. M. Whitten, R. B. Mascarenhas, M. C. Almeida Mota, and C. van den Berg. 2017. A molecular phylogeny and taxonomic notes in *Caamembeca* (Polygalaceae). *Syst. Bot*. 42: 54-62.

Pastore, J. F. B., J. R. Abbott, L. M. Neubig, C. Van Den Berg, M. Mota, A. Cabral, and W. M. Whitten. 2019. Phylogeny and biogeography of *Polygala* (Polygalaceae). *Taxon* 68: 673-691.

Pell, S. K. 2004. *Molecular systematics of the cashew family (Anacardiaceae).* Ph.D. dissertation, Louisiana State University, Baton Rouge.

Pell, S. K., J. D. Mitchell, A. J. Miller, and T. A. Lobova. 2011. Anacardiaceae. In *The families and genera of vascular plants*. Vol. 10. K. Kubitzki (ed.). 7-50. Springer-Verlag, Berlin.

Pellegrini, M. O. O., C. N. Horn, and R. F. Almeida. 2018. Total evidence phylogeny of Pontederiaceae (Commelinales) sheds light on the necessity of its recircumscription and synopsis of *Pontederia* L. *PhytoKeys* 108: 25-83.

Penneys, D. S. et al. 2020. Lithobieae and Eriocnemeae: Two new Neotropical tribes of Melastomataceae. *Phytotaxa* 453: 157-178.

Penagos Zuluaga, J. C., H. van der Werff, B. Park, D. A. R. Eaton, L. S. Comida, S. A. Queenborough, & M. J. Donoghue. 2021. Resolved phylogenetic relationships in the *Ocotea* complex (Supraocotea) facilitate phylogenetic classification and studies of character evolution. *Amer. J. Bot*. 108: 664-679.

Prez-Escobar, O. A. and 21 others. 2021. Hundreds of nuclear and plastid loci yield novel insights into orchid relationships. *Amer. J. Bot*. 108: 1166-1180.

Petersen, G., O. Seberg, A. Cuenca, D. W. Stevenson, M. Thadeo, J. I. Davis, S. Graham, and T. G. Ross. 2016. Phylogeny of the Alismatales (Monocotyledons) and the relationships of *Acorus* (Acorales?). *Cladistics* 32: 141-159.

Pirainen, M., O. Liebisch, and G. Kaereit. 2017. Phylogeny, biogeography, systematics and taxonomy of Salicornioideae (Amaranthaceae/Chenopodiaceae) – a cosmopolitan, highly specialized hygrohalophyte lineage dating back to the Oigocene. *Taxon* 66: 109-132.

Pirani, J. R., L. C. Majure, & M. F. Devecchi. 2021. An updated account of Simaroubaceae with emphasis on American taxa. *Brazilian J. Bot*. doi.org/10.1007/s40415-021-00731-x.

Plunkett, G. M., M. G. Pimenov, J.-P. Reduron, E. V. Kljuykov, B.-E. van Wyk, T. A. Ostroumova, M. J. Henwood, P. M. Tilney, K. Spalik, N. F. Watson, B.-Y. Lee, F.-D. Pu, C. J. Webb, J. M. Hart, A. D. Mitchell, and B. Muckensturm. 2018a. Apiaceae. In *The families and genera of vascular plants*. Vol. 15. K. Kubitzki (ed.). 9-206. Springer-Verlag, Berlin.

Plunkett, G. M., J. Wen, P. P. Lowry II, A. D. Mitchell, M. J. Henwood, and P. Fiaschi. 2018b. Araliaceae. In *The families and genera of vascular plants*. Vol. 15. K. Kubitzki (ed.). 413-446. Springer-Verlag, Berlin.

Plunkett, G. M., P. P. Lowry II, P. Fiaschi, D. G. Frodin, and A. N. Nicolas. 2019. Phylogeny, biogeography, and morphological evolution among and within the Neotropical and Asian clades of *Schefflera* (Araliaceae). Taxon 68: 1278-1313.

Prince, L. 2010. Phylogenetic relationships and species delimitation in *Canna* (Cannaceae). Pp. 307-331 in O. Seberg, G. Petersen, A. S. Barfod, and J. I. Davis, eds. *Diversity, phylogeny and evolution in the Monocotyledons*. Aarhus University Press, Aarhus.

Qi, Z.-C., K. M. Cameron, P. Li, Y.-P. Zhao, S.-C. Chen, G. Chen, and C.-X. Fu. 2013. Phylogenetics, character evolution, and distribution patterns of the greenbriers, Smilacaceae (Liliales), a near-cosmopolitan family of monocots. *Bot. J. Linn. Soc*. 173: 535-548.

Ragsac, A. C., R. Farias-Singer, L. B. Freitas, L. G. Lohmann, and R. G. Olmstead. 2019. Phylogeny of the Neotropical tribe Jacarandeae (Bignoniaceae). *Amer. J. Bot*. 106: 1589-1601.

Ren, H., L.-M. Lu, A. Soejima, Q. Luke, D.-X. Zhan, Z.-D. Chen, and J. Wen. 2011. Phylogenetic analysis of the grape family (Vitaceae) based on the noncoding plastid *trnC-petN*, *trnH-psbA*, and *trnL-F* sequences. *Taxon* 60: 629-637.

Renner, S. S. and H. Schaefer. 2016. Phylogeny an evolution of the Cucurbitaceae. In *Genetics and genomics of Cucurbitaceae. Plant Genetics and Genomics: Crops and models*. Vol. 20. K. N. Grumet R. and J. Garcia-Mas (eds.). Springer, Cham.

Ribeiro, J. C., M. J. P. Ferreira, and D. Demarco. 2017. Colleters in Asclepiadoideae (Apocynaceae): Protection of meristems against desiccation and new functions assigned. *Int. J. Plant Sci*. 178: 465-477.

Rice, D. W., A. J. Alverson, A. O. Richardson, G. J. Young, M. V. Sanchez-Puerta, J. Munzinger, K. Barry, J. L. Boore, Y. Zhang, C. W. de Pamphilis, E. B. Knox, and J. D. Palmer. 2013. Horizontal transfer of entire genomes via mitochondrial fusion in the angiosperm *Amborella*. *Science* 342: 1468-1472.

Roalson, E. H., and J. C. Hall. 2017. New generic concepts for African Cleomaceae. *Syst. Bot*. 42: 925-942.

Rohde, R., B. Rudolph, K. Ruthe, F. G. Lorea-Hernández, P. L. R. de Moraes, J. Li, and J. G. Rohwer. 2017. Neither *Phoebe* nor *Cinnamomum* – the tetrasporangiate species of *Aiouea* (Lauraceae). *Taxon* 66: 1085-1111.

Rose, J. P., T. J. Kleist, S. D. Lefstrand, B. T. Drew, J. Schönenberger and K. J. Sytsma. 2018. Phylogeny, historical biogeography, and diversification of angiosperm order Ericales suggest ancient Neotropical and East Asian connections. *Mol. Phyl. Evol*. 122: 59-79.

Ross, T. G., C. F. Barrett, M. S. Gomez, V. K. Y. Lam, C. L. Henriquez, D. H. Les, J. I. Davis, A. Cuenca, G. Petersen, O. Seberg, M. Thadeo, T. J. Givnish, J. Conran, D. W. Stevenson, and S. W. Graham. 2016. Plastid phylogenomics and molecular evolution of Alismatales. *Cladistics*. 32: 160-178.

Rossetto, E. P. S., A. D. de Faria, P. M. Ruas, C. De Fátima Ruas, N. A. Douglas, and J. E. L. Da Silva Riberio. 2019. Clarifying generic delimitation in Nyctaginaceae tribe Pisonieae after more than a century of taxonomic confusion. *Bot. J. Linn. Soc*. 189: 378-396.

Ruchisansakun, S., T. van der Niet, S. B. Janssens, P. Triboun, J. Techaprasan, T. Jenjittikul, and P. Suksathan. 2015. Phylogenetic analyses of molecular data and reconstruction of morphological character evolution in Asian *Impatiens* section *Semeiocardium* (Balsaminaceae). *Syst. Bot*. 40: 1063-1074.

Rydin C., N. Wikström, and B. Bremer. 2017. Conflicting results from mitochondrial genomic data challenge current views of Rubiaceae phylogeny. *Amer. J. Bot*. 104: 1522-1532.

Sadeghian, S., S. Zarre, R. K. Rabeler, and G. Heubl. 2015. Molecular phylogenetic analysis of *Arenaria* (Caryophyllaceae: tribe Arenarieae) and its allies inferred from nuclear DNA internal transcribed spacer and plastid DNA *rpl16* sequences. *Bot. J. Linn. Soc*. 178: 648-669.

Särkinen, T., L. Bohs, R. G. Olmstead, and S. Knapp. 2013. A phylogenetic framework for evolutionary study of the nightshades (Solanaceae): a dated 1000-tip tree. *BMC Evol. Biol*. 13: 214. https://doi.org/10.1186/1471-2148-13-214.

Sauquet, H., L. Carrive, N. Poullain, J. Sannieer, C. Damerval, and S. Nadot. 2015. Zygomorphy evolved from dissymmetry in Fumarioideae (Papaveraceae, Ranunculales): New evidence from an expanded molecular phylogenetic framework. *Ann. Bot*. 115: 895-914.

Scatinga, A. V., P. W. Fritsch, V. C. Souza, and A. O. Simões. 2018. Phylogenetic relationships and morphological evolution in the carnivorous genus *Philcoxia* (Plantaginaceae, Gratioleae). *Syst*. *Bot*. 43: 910-919.

Schaefer, H. and S. S. Renner. 2011. Cucurbitaceae. In *The families and genera of vascular plants*. Vol. 10. K. Kubitzki (ed.). 112-174. Springer-Verlag, Berlin.

Scharfstein, A. R., R. A. Stockey, and G. W. Rothwell. 2020. Evolution and phylogeny of Altingiaceae: Anatomically preserved infructescences from Late Cretaceous deposits of Vancouver Island, British Columbia, Canada. *Int. J. Plant Sci*. 181: 452-463.

Schuster, T. M., J. L. reveal, M. J. Bayly, and K. A. Kron. 2015. An updated molecular phylogeny of Polygonoideae (Polygonaceae): Relationships of *Oxygonum*, *Pteroxygonum*, and *Rumex*, and a new circumscription of *Koenigia*. *Taxon* 64: 1188-1208.

Schwartz, T., S. Nylinder, C. Ramadugu, A. Antonelli, and B. E. Pfeil. 2016. The origin of oranges: a multi-locus phylogeny of Rutaceae subfamily Aurantioideae. *Syst. Bot*. 40: 1053-1062.

Schwery, O., R. E. Onstein, Y. Bouchenak-Khelladi, Y. Xing, R. J. Carter, & H. P. Linder. 2015. As old as the mountains: The radiations of the Ericaceae. *New Phytol*. 207: 355-367.

Selvaraj, D., R. K. Sarma, and R. Sathishkumar. 2008. Phylogenetic analysis of chloroplast *matK* gene from Zingiberaceae for plant DNA barcoding. *Bioinformation* 3: 24-27.

Sharples, M. T. and E. A. Tripp. 2019. Phylogenetic relationships within and delimitation of the cosmopolitan flowering plant genus *Stellaria* (Caryophyllaceae): Core stars and fallen stars. *Syst*. *Bot*. 44: 857-876.

Shepherd, K. A., B. J. Lepschi, E. A. Johnson, A. G. Gardner, E. B. Sessa, and R. S. Jabaily. 2020. The concluding chapter: Recircumscription of *Goodenia* (Goodeniaceae) to include four allied genera with an updated infrageneric classification. *PhytoKeys* 152: 27-104.

Silva, S. R., R. Gibson, L. Adamec, Y. Domínguez, and V. F. O. Miranda. 2018. Molecular phylogeny of bladderworts: A wide approach of *Utricularia* (Lentibulariaceae) species relationships based on six plastidal and nuclear DNA sequences. *Mol. Phylog. Evol*. 118: 244-264.

Simmons, M. P. 2016. Mutually exclusive phylogenomic inferences at the root of the angiosperms: *Amborella* is supported as sister and Observed Variability is biased. *Cladistics* doi: 10.1111/cla.12177.

Simpson, D. A. and 18 others. 2008. Phylogeny of Cyperaceae based on DNA sequence data – a new rbcL analysis. Pp. 72-83 in J. T. Columbus, E. A. Friar, J. M. Porter, L. M. Prince, and M. G. Simpson, eds. *Monocots: Comparative biology and evolution. Poales*. Rancho Santa Ana Bot. Gard., California [*Aliso* 23: 72-83].

Smith, S. A., J. W. Brown, Y. Yang, R. Bruenn, C. P. Drummond, S. F. Brockington, J. F. Walker, N. Last, N. A. Douglas, and M. J. Moore. 2017. Disparity, diversity and duplications in the Caryophyllales. *New Phytol*. Doi:10.1111/nph.14772.

Sinnott-Armstrong, M. A., C. Lee, W. L. Clement, and M. J. Donoghue. 2020. Fruit syndromes in Viburnum: Correlated evolution of color, nutritional content, and morphology in burd-dispersed fleshy fruits. *BMC Evol. Biol*. 20: 7. https://doi.org/10.1186/s12862-019-1546-5.

Smissen, R. D., R. J. Bayer, N. G. Bergh, I. Breitwieser, S. E. Freire, M. Galbany-Casals, A. N. Schmidt-Lebuhn, and J. M. Ward. 2020. A revised subtribal classification of Gnaphalieae (Asteraceae). *Taxon* 69: 778-806.

Soltis, D., P. Soltis, P. Endress, M. Chase, S. Manchester, W. Judd, L. Majure, and E. Mavrodiev. 2018. *Phylogeny and evolution of the angiosperms: Revised & updated edition*. University of Chicago Press, Chicago.

Song, Y., W.-B. Yu, Y.-H. Tan, J.-J. Jin, B. Wang, J.-B. Yang, B. Liu, R. T. Corlett. 2020. Plastid phylogenomics improve phylogenetic resolution in the Lauraceae. *J. Syst. Evol*. 58: 423-439.

Sothers, C. A., G. T. Prance, and M. W. Chase. 2016. Towards a monophyletic *Licania*: a new generic classification of the polyphyletic Neotropical genus *Licania* (Chrysobalanaceae). *Kew Bull.* 71: 58. Doi: 10.1007/S12226-016-9664-3.

Spellenberg, R. and N. Zucker. 2019. The sunflower family: A guide to the family Asteraceae in the contiguous United States. *BRIT Press Bot. Miscellany* No. 52: 1-574.

Steffen, S., P. Ball, L. Mucina, and G. Kadereit. 2015. Phylogeny, biogeography and ecological diversification of *Sarcocornia* (Salicornioideae, Amaranthaceae). *Ann. Bot*. 115: 353-368.

Struwe, L. and J. S. Pringle. 2018. Gentianaceae. In *The families and genera of vascular plants*. Vol. 15. K. Kubitzki (ed.). 453-503. Springer-Verlag, Berlin.

Stull, G. W., R. D. de Stefano, D. E. Soltis, and P. S. Soltis. 2015. Resolving basal lamiid phylogeny and the circumscription of Icacinaceae with a plastome-scale data set. *Amer. J. Bot*. 102: 1794-1813.

Stull, G. W., M. Schori, D. E. Soltis, and P. S. Soltis. 2018. Character evolution and missing (morphological) data across Asteridae. *Amer. J. Bot*. 105: 470-479.

Sukhorukov, A. P., M. V. Nilova, A. A. Krinitsina, M. A. Zaika, A. S. Erst, and K. A. Shepherd. 2018. Molecular phylogenetic data and seed coat anatomy resolve the generic position of some critical Chenopodioideae (Chenopodiaceae – Amaranthaceae) with reduced perianth segments. *Phytokeys* 109: 103-128.

Sun, M., R. Naeem, J.-X. Su, Z.-Y. Cao, J. G. Burley, P. S. Soltis, D. E. Soltis, and Z.-D. Chen. 2016. Phylogeny of the Rosidae: A dense taxon sampling analysis. *J. Syst. Evol*. 54: 363-391.

Sun, Y., M. J. Moore, S.-J. Zhang, P. S. Soltis, D. E. Soltis, T.-T. Zhao, A.-P. Meng, X.-D. Li, J.-Q. Li, and H.-C. Wang. 2016. Phylogenomic and structural analyses of 18 complete plastomes across nearly all families of early-diverging eudicots, including an angiosperm-wide analysis of IR gene content evolution. *Mol. Phyl. Evol*. 96: 93-101.

Susanna, A., B. G. Baldwin, R. J. Bayer, J. M. Bonifacino, N. Garcia-Jacas, S. C. Keeley, J. R. Mandel, S. Ortiz, H. Robinson, and T. F. Stuessy. 2020. The classification of the Compositae: A tribute to Vicki Ann Funk (1947-2019). *Taxon* 69: 807-814.

Sylvester, S. P., D. Quandt, L. Ammann, and M. Kessler. 2016. The world’s smallest Campanulaceae: *Lysipomia mitsyae* sp. nov. *Taxon* 65: 305-314.

Takawira-Nyenya, R., L. Mucina, W. M. Caradinal-McTeague, and K. R. Thiele. 2018. *Sansevieria* (Asparagaceae, Nolinoideae) is a herbaceous clade within *Dracaena*: Inference from non-coding plastid and nuclear DNA sequence data. *Phytotaxa* 376: 254-276.

Tamboli, A. S., P. B. Yadav, A. A. Gothe, S. R. Yadav, and S. P. Govindwar. 2018. Molecular phylogeny and genetic diversity of genus *Capparis* (Capparaceae) based on plastid DNA sequences and ISSR markers. *Plant Syst. Evol*. 304: 205-217.

Tang, G.-D., J.-F. Liu, L. Huang, C.-M. Zhu, L.-H. Liu, C. P. Randle, and W.-B. Yu. 2019. Molecular and morphological analyses support the transfer of *Gleadovia kwangtungensis* to *Christisonia* (Orobanchaceae). *Syst. Bot*. 44: 74-82.

Thadeo, M., A. A. Azevedo, R. M. S. A. Meira. 2014. Foliar anatomy of Neotropical Salicaceae: Potentially useful characters for taxonomy. *Plant Syst. Evol*. 300: 2073-2089.

Thiebaut, L. F. and P. Hoffman. 2005. Occurrence of colleters in Erythroxylaceae. *Kew Bull*. 60: 455-459.

Thomas, S. K., X. Liu, Z.-Y. Du, Y. Dong, A. Cummings, L. Pokorny, Q.-Y. Xiang, aand J. H. Lebens-Mack. 2021. Comprehending Cornales: Phylogenetic reconstruction of the order using angiosperm 353 probe set. *Amer. J. Bot*. 108: 1112-1121.

Thulin, M., A. J. Moore, H. El-Seedi, A. Larsson, P.-A. Christin, and E. J. Edwards. 2016. Phylogeny and generic delimitation in Molluginaceae, new pigment data in Caryophyllales, and the new family Corbichoniaceae. *Taxon* 65: 775-793.

Tkach, N., J. Schneider, E. Döring, A. Wölk, A. Hochbach, J. Nissen, G. Winterfeld, S. Meyer, J. Gabriel, M. H. Hoffmann, and M. Röser. 2020. Phylogenetic lineages and the role of hybridization as driving force of evolution in grass supertribe Poodae. *Taxon* 69: 234-277.

Tobe, H., Y.-L. Huang, T. Kadukawa, and M. N. Tamura. 2018. Floral structure and development in Nartheciaceae (Dioscoreales), with special reference to ovary position and septal nectaries. *J. Plant Res*. 131: 411-428.

Tokuoka, T. 2012. Molecular phylogenetic analysis of Passifloraceae sensu lato: A review and perspectives. *J. Plant Res*. 108: 97-106.

Treiber, E. L., A. L. Gaglioti, S. Romaniuc-Neto, S. Madriñán, and G. D. Weiblen. 3016. Phylogeny of the Cecropieae (Urticaceae) and the evolution of an ant-plant mutualism. *Syst. Bot*. 41: 56-66.

Tripp, E. A. and L. A. McDade. 2013. Time-calibrated phylogenies of hummingbirds and hummingbird-pollinated plants reject a hypothesis of diffuse co-evolution. *Aliso* 31: 89-103.

Tripp, E. A. and L. A. McDade. 2014. A rich fossil record yields calibrated phylogeny for Acanthaceae (Lamiales) and evidence for marked biases in timing and directionality of intercontinental disjunctions. *Syst. Biol*. 64: 660-684.

Trofimov, D., B. Rudolph, and J. G. Rohwer. 2016. Phylogenetic study of the genus *Nectandra* (Lauraceae), and reinstatement of *Damburneya*. *Taxon* 65: 980-996.

Valverde-Barrantes, O. J., A. L. Horning, K. A. Smemo, and C. B. Blackwood. 2016. Phylogenetically structured traits in root systems influence arbuscular mycorrhizal colonization in woody angiosperms. *Plant Soil* doi: 10.1007/s11104-016-2820-6.

Van Balgooy, M. M. J., Y. W. Low, and K. M. Wong. 2015. *Spot-characters for the identification of Malesian seed plants: A guide*. Natural History Publications (Borneo) Sdn. Bhd, Kota Kinabalu, Malaysia.

Van Welzen, P. C., K. Pruesapan, I. R. H. Telford, H.-J. Esser, and J. J. Bruhl. 2014. Phylogenetic reconstruction prompts taxonomic changes in *Sauropus*, *Synostemon* and *Bryenia* (Phyllanthaceae tribe Phyllantheae). *Blumea* 59: 77-94.

Vasconcelos, T. N. C., C. E. B. Proença, B. Ahmad, D. S. Aquilar, R. Aguilar, B. S. Amorim, J. Campbell, I. R. Costa, P. S. De-Carvalho, J. E. Q. Faria, A. Giaretta, P. W. Kooij, D. F. Lima, F. F. Mazine, B. Peguera, G. Prenner, M. F. Santos, J. Soewarto, A. Wingler, and E. J. Lucas. 2017. Myrteae phylogeny, calibration, biogeography and diversification patterns: Increased understanding in the most species rich tribe of Myrtaceae. *Mol. Phylog. Evol*. 109: 113-137.

Vasconcelos, T. N. C., G. Prenner, and E. J. Lucas. 2019. A systematic overview of the floral diversity in Myrteae (Myrtaceae). *Syst. Bot*. 44: 570-591.

Vega, A. S., M. A. Castro, and W. R. Anderson. 2002. Occurrence and phylogenetic significance of latex in the Malpighiaceae. *Amer. J. Bot*. 89: 1725-1729.

Veltjen, E., E. Testé, A. P. Bejerano, P. Asselman, M. H. Rodrígues, L. R. G. Torres, L. W. Chatrou, P. Goetghebeur, I. Larridon, and M.-S. Samain. 2022. The evolutionary history of the Caribbean magnolas (Magnoliaceae): Testing species delimitation and biogeographical hypotheses using molecular data. *Mol. Phylog. Evol*. 167: doi.org/10.1016/y.ympev.2021.107359.

Walker, J. F., Y. Yang, T. Feng, A. Timoneda, J. Mikenas, V. Hutchson, C. Edwards, N. Wang, S. Ahluwalia, J. Oliveri, N. Walker-Hale, L. C. Majure, R. Puente, G. Kadereit, M. Lauterbach, U. Eggli, H. Flores-Olvera, H. Ochoterena, S. F. Brockington, M. J. Moore, & S. A. Smith. 2018. From cacti to carnivores: Improved phylotranscriptomic sampling and hierarchical homology inference provide further insight into the evolution of Caryophyllales. *Amer. J. Bot*. 105: 1-17.

Wallander, E. 2013. Systematics and floral evolution in *Fraxinus* (Oleaceae). *Belgische Dendrologie Belge* 2012: 38-58.

Wang, H.-F., S. Landrein, W.-P. Dong, Z.-L. Nie, K. Kondo, T. Funamoto, and J. Wen. 2015. Molecular phylogeny and biogeographic diversification of Linnaeoideae (Caprifoliaceae s.l.) disjunctly distributed in Eurasia, North America and Mexico. *PLoS ONE* 10(3): e0116485. <https://doi.org/10.1371/journal.pone.0116485>.

Wang, H.-F., H. Liu, M. J. Moore, S. Landrein, B. Liu, Z.-X. Zhu, and H.-F. Wang. 2020. Plastid phylogenomic insights into the evolution of the Caprifoliaceae s.l. (Dipacales). *Mol. Phylog*. *Evol*. 142: 106641. https://doi.org/10.1016/j.ympev.2019.106641.

Waselkov, K. E., A. S. Boleda, & K. M. Olsen. 2018. A phylogeny of the genus *Amaranthus* (Amaranthaceae) based on several low-copy nuclear loci and chloroplast regions. *Syst. Bot*. 43: 439-458.

Weber, A., J. L. Clark, and M. Möller. 2013. A new formal classification of the Gesneriaceae. *Selbyana* 31: 68-94.

Weeks, A., F. Zapata, S. K. Pell, D. C. Daly, J. Mitchell, and P. V. Fine. 2014. To move or evolve: Contrasting patterns of intercontinental connectivity and climatic niche evolution in “Terebinthaceae” (Anacardiaceae and Burseraceae). *Front. Genet*. 5: 409.

Weigend, M., F. Luebert, F. Selvi, G. Brokamp, and H. H. Hilger. 2013. Multiple origins for Hound’s tongues (*Cynoglossum* L.) and Navel seeds (*Omphalodes* Mill.) – The phylogeny of the borage family (Boraginaceae s. str.). *Mol. Phylog. Evol*. 68: 604-618.

Weston, P. H. 2014. What has molecular systematics contributed to our knowledge of the plant family Proteaceae? Pp. 365-397 in P. Besse, ed. *Molecular plant taxonomy methods and protocols*. Humana Press, Springer. New York.

Wheeler, E. A., P. Baas, and S. R. Manchester. 2022. Wood anatomy of modern and fossil Fagales in rrelation to phylogenetic hypotheses, familial classification, and patterns of character evolution. *Int. J. Plant Sci.* 183: 61-86.

Whittemore, A. T., R. S. Fuller, B. H. Brown, M. Hahn, L. Gog, J. A. Weber, and A. L. Hipp. 2021. Phylogeny, biogeography, and classification of the elms (*Ulmus*). *Syst. Bot*. 46: 711-727.

Wilde, J. J. F. E. de. 2011. Begoniaceae. In *The families and genera of vascular plants*, vol. 10. K. Kubitzki (ed.). 56-71.Sprinter-Verlag, Berlin.

Williams, E. W., E. M. Gardner, R. Harris III, A. Chaveerach, J. T. Pereira, and N. J. C. Zerega. 2017. Out of Borneo: Biogeography, phylogeny, and divergence date estimates of *Artocarpus* (Moraceae). *Ann. Bot*. 119: 611-627.

Wilson, P. G. 2011. Myrtaceae. In *The Families and genera of vascular plants*, Vol. 10, K. Kubitzki (ed.), 212-271. Springer-Verlag, Berlin.

Wood, J. R. I., P. Muñoz-Rodríguez, B. R. M. Williams, and R. W. Scotland. 2020. A foundation monograph of *Ipomoea* (Convolvulaceae) in the New World. *PhytoKeys* 143: 1-823.

Wu, Z-Y., A. K. Monro, R. I. Milne, H. Wang, T.-S. Yi, J. Liu, and D.-Z. Li. 2013. Molecular phylogeny of the nettle family (Urticaceae) inferred from multiple loci of three genomes and extensive generic sampling. *Mol. Phyl. Evol*. 69: 812-827.

Wurdack, K. J. and F. A. Michelangeli. 2019. Systematics and relationships of *Tryssophyton* (Melastomataceae), with a second species from the Pakaraima Mountains of Guyana. *PhytoKeys* 136: 1-21.

Xiang, X. G., W. Wang, R.-Q. Li, L. Lin, Y. Liu, Z.-K. Zhou, Z.-Y. Li, and Z.-D. Chen. 2014. Large-scale phylogenetic analyses reveal fagalean diversification promoted by the interplay of diaspores and environments in the Paleogene. *Persp. Plant Ecol. Evol. Syst*. 16: 101-110.

Xiang, Y., C.-H. Huang, Y. Hu, J. Wen, S. Li, Y. Yi, H. Chen, J. Xiang, and H. Ma. 2017. Evolution of Rosaceae fruit types based on nuclear phylogeny in the context of geological times and genomic evolution. *Mol. Biol. & Evol*. 34: 262-281.

Xue, B., Y.-H. Tan, D. C. Thomas, T. Chaowasku, X.-L. Hou & R. M. K. Saundeers. 2018. A new Annonaceae genus, *Wuodendron*, provides support for a post-boreotropical origin of he Asian-Neotropical disjunction in the tribe Miliuseae. *Taxon* 67: 250-266.

Yang, X.-Y., Z.-F. Wang, W.-C. Luo, X.-Y. Guo, C.-H. Zhang, J.-Q. Liu, and G.-P. Ren. 2019. Plastomes of Betulaceae and phylogenetic implications. *J. Syst. Evol*. 57: 508-518.

Yang, Y.-Y., X.-J. Qu, R. Zhang, G. W. Stull, and T.-S. Yi. 2021. Plastid phylogenomic analyses of Fagales reveal signatures of conflict and ancient chloroplast capture. *Mol. Phylog. Evol*. 163: doi.org/10.1016/y.ympev.2021.107232.

Yang, Y., M. J. Moore, S. F. Brockington, D. E. Soltis, G.K.-S. Wong, E. J. Carpenter, Y. Zhang, I. Chen, R. F. Sage, S. Coughoff, J. M. Hibberd, M. N. Nelson, and S. A. Smith. 2015. Dissecting molecular evolution in the highly diverse plant clade Caryophyllales using transcriptome sequencing. *Mol. Biol. Evol*. 32: 2001-2014.

Yao, G., J.-J. Jin, H.-T. Li, J.-B. Yang, V. S. Mandala, M. Croley, R. Mostow, N. A. Douglas, M. W. Chase, M. J. M. Christenhusz, D. E. Soltis, P. S. Soltis, S. A. Smith, S. F. Brockington, M. J. Moore, T.-S. Yi, and D.-Z. Li. 2019. Plastid phylogenomic insights into the evolution of Caryophyllales. *Mol. Phylog. Evol*. 134: 74-86.

Yao, X., Y. Song, J.-B. Yang, Y.-H. Tan, R. T. Corlett. 2020. Phylogeny and biogeography of the hollies (Ilex L., Aquifoliaceae). *J. Syst. Evol*. Doi. 10.1111/jse.12567.

Yu, S.-X., S. B. Janssens, X.-Y. Zhu, M. Lidén, T.-G. Gao, and W. Wang. 2016. Phylogeny of *Impatiens* (Balsaminaceae): Integrating molecular and morphological evidence into a new classification. *Cladistics* 32: 179-197.

Yu, X.-Q., L.-M. Gao, D. E. Soltis, P. S. Soltis, J.-B. Yang, L. Fang, S.-X. Yang, and D.-Z. Li. 2017. Insights into the historical assembly of East Asian subtropical evergreen broadleaves forests revealed by the temporal history of the tea family. *New Phytol*. 215: 1235-1248.

Yu, Y., A. H. Wortley, L. Lu, D.-Z. Li, H. Wang, and S. Blackmore. 2018. Evolution of angiosperm pollen. 5. Early diverging Superasteridae (Berberidopsidales, Caryophyllales, Cornales, Ericales, and Santalales) plus Dilleniales. *Ann. Missouri Bot. Gard*. 103: 106-161.

Zaveska Drábková, L. 2010. Phylogenetic relationships within Juncaceae: Evidence from five regions of plstid, mitochondrial and nuclear ribosomal DNA, with notes on morphology. Pp. 389-416 in O. Seberg, G. Petersen, A. S. Barfod, and J. I. Davis, eds. *Diversity, phylogeny and evolution in the Monocotyledonae.* Aarhus University Press, Aarhus.

Zaveska Drábková, L. and C. Vlcek. 2009. DNA variation within Juncaceae: Comparison of impact of organelle regions on phylogeny. *Plant Syst. Evol*. 278: 169-186.

Zaveska Drábková, L. and J. Kirschner. 2013. *Oreojuncus*, a new genus in the Juncaceae. *Preslia* 85: 438-503.

Zerega, N. J. C. and E. M. Gardner. 2019. Delimitation of the new tribe Parartocarpeae (Moraceae) is supported by a 333-gene phylogeny and resolved tribal level Moraceae taxonomy. *Phytotaxa* 388: 235-265.

Zhang, J., T. A. Ruhlmann, J. Saber, J. C. Blazier, and R. K. Jensen. 2015. Coordinated rates of evolution between interacting plastid and nuclear genes in Geraniaceae. *Plant Cell* 27: 563-573.

Zhang, N., J. Wen, and E. A. Zimmer. 2015. Congruent deep relationships in the grape family (Vitaceae) based on sequences of chloroplast genomes and mitochondrial genes via genome skimming. *Plos* *One* 10(12): e0144701.

Zhang, R., Y.-H. Wang, J.-J. Jin, G. W. Stull, A. Bruneau, D. Cardoso, L. P. de Queiroz, M. J. Moore, S.-D. Zhang, S.-Y. Chen, J. Wang, D.-Z. Li, and T.-S. Yi. 2020. Exploration of plastid phylogenomics conflict yields new insights into the deep relationships of Leguminosae. *Syst*. *Biol*. 69: 613-622.

Zhou, B.-B., T.-Y. Tu, F.-J. Kong, J. Wen, and X.-W. Xu. 2018. Revised phylogeny and historical biogeography of the cosmopolitan aquatic plant genus *Typha* (Typhaceae). Sci. Rep. 8: 8813. https://doi.org/10.1038/s41598-018-27279-3.

Zhou, B.-F., S. Yuan, A. A. Crowl, Y.-Y. Liang, Y. Shi, X.-Y. Chen, Q.-Q. An, M. Kang, P. S. Manos, and B. Wang. 2022. Phylogenomic analyses highlight innovation and introgression in the continental radiaations of Fagaceae across the Northern Hemisphere. *Nature Comm*. doi.org/10.1038/s41467-022-28917-1.

Zhu, J.-Y., L.-F. Zhang, B.-Q. Ren, M. Chen, R.-Q. Li, Y. Zhou, Y. Liang, J.-H. Li, and Z.-D. Chen. 2018. Comparative flower and inflorescence organogenesis among genera of Betulaceae: Implications for phylogenetic relationships. *Bot. Rev*. 84: 79-98.

Zimmerman, E., P. S. Herendeen, G. P. Lewis, and A. Bruneau. 2017. Floral evolution and phylogeny of the Dialioideae, a diverse subfamily of tropical legumes. *Amer. J. Bot*. 104: 1019-1041.

Zona, S., A. A. de Zayas, R. Orellana, R. Oviedo, B. Jestrow, and J. Francisco-Ortega. 2014. *Dracaena* L. (Asparagaceae) in the New World: Its history and botany. *Vieraea* 42: 219-240.

Zuntini, A. R., L. P. Frankel, L. Pokorny, F. Forest, and W. J. Baker. 2021. A comprehensive phylogenomic study of the monocot order Commelinales, with a new classification of Commelinaceae. *Amer. J. Bot*. 108: 1066-1086.

**Appendix One:**

Page 589, line 7: add Turland et al. 2018 (the current code)

Page 594, column 1, line 8: Table 3. 🡪 …Table 3 (Harris et al. 2017; Zhu and Manchester 2020).

Page 597, column 1, line 1 under “Requirements for Naming a New Species of Vascular Plants”: Add the following as the first sentence of this paragraph: About 2000 species of plants are described each year (Christenhusz and Byng 2016).

Page 597, column 1, line 9, of #4. … description. A very useful… 🡪 …description. A description is an analytic statement listing the features that characterize the species in question, including morphological, anatomical, biochemical, karyological, and even molecular aspects (see Hassemer et al. 2020).

Page 597, column 2, line 2: add the following at the end of paragraph – When describing a new species one should carefully document that the taxonomic recognition of the species is supported by the species concept (or concepts) being used (and these concepts/definitions should be explicitly stated). The code recommends that an illustration of the species be provided, and photographs of the plant in living condition and geographical distribution maps are also useful. Finally, the species should be compared with potential close relatives (or phenetically similar species), and if possible, it should be included in a phylogenetic analysis, allowing detailed comparison with its close relatives. Usually complete material, i.e., specimens with flowers and fruits, in addition to vegetative characters, is required, but incompletely known species can be described if their phylogenetic relationships are well understood. Examples of published new species treatments can be found in most botanical journals – a few are listed here: *Adenocalymma fistulosum* (Henrique et al. 2019), *Antiphytum brevicalyx* (Mendoza-Díaz et al. 2020), *Castela senticosa* (Majure et al. 2021c), *Chamaecrista oligandra* (da Silva et al. 2019), *Conradina cygniflora* (Edwards et al. 2009), *Dicerandra christmanii* (Huck et al. 1989), *Henriettea uniflora* (Judd et al. 2008), *Miconia abscondita* (Judd et al. 2015), *Miconia clasei* (Majure et al. 2018), *Miconia howardiana* (Judd et al. 1995), *Picrasma nanophylla* (Majure et al. 2021), *Saccharum intermedium* (Welker et al. 2017), *Salvia paryskii* (Skean and Judd 1988), *Tolmiea diplomenziesii* (Judd et al. 2007), and *Trillium delicatum* (Schilling et al. 2019).

Include the following figures in connection with this paragraph: 1) illustration of *Dicerandra christmanii*, 2) photo of holotype of *Dicerandra christmanii*, 3) photo of living plant of *Miconia howardiana*, 4) photo of living plant of *Conradina cygniflora*.

On page 597, give the description of *Dicerandra christmanii*, from the protologue.

Page 599, column 1, line 8-9 from bottom: 2008 🡪 2017; and ed. 3 🡪 ed. 4

Page 599, column 3: add reference Turland, N. J. and 15 others, 2018

**Additions to Literature Cited:**

Christenhusz, M. J. M. and J. W. Byng. 2016. The number of known plant species in the world and its annual increase. *Phytotaxa* 261: 201-217.

Da Silva, M. J., A. O. de Souza, and A. A. Alonso. 2019. A new species for the legume genus *Chamaecrista* (Fabaceae, Caesalpinioideae) supported by molecular, morphological, and anatomical data. *Pl. Syst. Evol*. doi.org/10.1007/500606-019-01569-3.

Edwards, C. E., W. S. Judd, G. M. Ionta, and B. Herring. 2009. Using population genetic data as a tool to identify new species: *Conradina cygniflora* (Lamiaceae), a new, endangered species from Florida. *Syst. Bot*. 34: 747-759.

Harris, A. J., Y.-S. Chen, R. T. Olsen, S. Lutz, and J. Wen. 2017. On merging *Acer* sections *Rubra* and *Hyptiocarpa*: Molecular and morphological evidence. *PhytoKeys* 86: 9-42.

Hassemer, G., J. Prade, and R. M. Baldini. 2020. Diagnoses and descriptions in plant taxonomy: Are we making proper use of them? *Taxon* 69: 1-4.

Henrique, L., M. Fonseca, and L. G. Lohmann. 2019. A new species of *Adenocalymma* (Bignonieae, Bignoniaceae) from Minas Gerais, Brazil. *Brittonia* 71: 183-189.

Huck, R. B., W. S. Judd, W. M. Whitten, J. D. Skean, Jr., R. P. Wunderlin, and K. R. Delaney. 1989. A new *Dicerandra* (Labiatae) from the Lake Wales Ridge of Florida, with a cladistic analysis and discussion of endemism. *Syst. Bot*. 14: 197-213.

Judd, W. S., V. T. Salzman, and J. D. Skean, Jr. 1995. Taxonomic studies in the Miconieae (Melastomataceae). VII. *Miconia howardiana*, a new species from Hispaniola. *Brittonia* 47: 414-421.

Judd, W. S., D. S. Soltis, P. S. Soltis, and G. Ionta. 2007. *Tolmiea diplomenziesii*: A new species from the Pacific Northwest and the diploid sister taxon of the autotetraploid *T. menziesii* (Saxifragaceae). *Brittonia* 59: 217-225.

Judd, W. S., J. D. Skean, Jr., D. S. Penneys, and F. A. Michelangeli. 2008. A new species of *Henriettea* (Melastomataceae) from the Sierra de Baoruco, the Dominican Republic. *Brittonia* 60: 217-227.

Judd, W. S., L. C. Majure, J. D. Skean, Jr., and K. M. Neubig. 2015. *Miconia abscondita* (Melastomataceae: Miconieae), a new species from the Massif de la Hotte, Haiti: Rediscovered I herbaria after being hidden for nearly nine decades. *Rhodora* 117: 317-341.

Majure, L. C., J. D. Skean, Jr., K. M. Neubig, and W. S. Judd. 2018. *Miconia clasei*, a new species of *Miconia* sect. *Calycodomatia* (Miconieae: Melastomataceae) from the Sierra de Bahoruco, Dominican Republic and a closer look at species relationships in the Sandpaper Clade. *Syst. Bot*. 43: 430-438.

Majure, L. C., T. Clase, A. Blankenship, and A. Noa-Monzón. 2021. A new species of *Picrasma*, *P*. *nanophylla* (Simaroubaceae), from the Dominican Republic. *Brittonia* 73: 334-342. doi.org/10.1007/s12228-021-09656-x.

Majure, L. C., K. Pham and T. Clase. 2021c. *Castela senticosa* (Simaroubaceae: Sapindales), a new species from the Caribbean clade endemic to seasonally dry tropical forest on Hispaniola. *Syst*. *Bot*. 46: 1033-1041.

Mendoza-Díaz, N., H. Ochoterena, M. J. Moore, and H. Flores-Olvera. 2020. Molecular and morphological evidence reveals a new species of *Antiphytum* (Echiochiloideae, Boraginaceae) from Guerrero, Mexico. *Syst. Bot*. 45: 190-199.

Schilling, E. E., A. Floden, J. Lampley, T. S. Patrick, and S. B. Farmer. A new species of *Trillium* (Melanthiaceae) from central Georgia and its phylogenetic position in subgenus *Sessilium*. *Syst*. *Bot*. 44: 107-114.

Skean, J. D., Jr. and W. S. Judd. 1988. A new *Salvia* (Labiatae) from Hispaniola. *Brittonia* 40: 16-21.

Turland, N. J. and 15 others (eds.). 2018. *International code of nomenclature of algae, fungi, and plants (Shenzhen Code)* (Regnum Vegetabile, vol. 159), Koeltz Botanical Books, Glashütten, Germany.

Welker, C. A. D., T. T. Souza-Chies, M. C. Peichoto, R. P. Oliveira, L. C. Carvalho, V. B. S. Muccillo, E. A. Kellogg, and E. Kaltchuk-Santos. 2017. A new allopolyploid species of *Saccharum* (Poaceae— Andropogonoideae) from South America, with notes on its cytogenetics. *Syst. Bot*. 42: 507-515.

Zhu, H. and S. R. Manchester. 2020. Red and silver maples in the Neogene of western North America: fossil leaves and samaras of *Acer* section *Rubra*. *Int. J. Plant Sci*. 181: 542-556.

**Appendix Two:**

Page 601, line 6: … fruiting times. 🡪 … fruiting times (see also Heberling & Isaac 2017).

Page 601, line 13 under Collecting Plants: may be needed to document the observed pattern of variation adequately. 🡪 may be needed to adequately document the observed pattern of populational variation and/or species life history stages (Anderson 1941; Heberling 2022; Utech et al. 1984).

Page 602, column 1, line 23 – add the following to the end of the paragraph: In such plants a color photograph is a useful complement to the pressed and dried specimen, especially for species that are large, such as a palm tree or cycad, that may upon drying lose morphological traits important for identification, e.g., shape or color of the flowers. The photo or photos can be mounted along with the specimen (see below; Gómez-Bellver et al. 2019).

Page 604, column 2, line 3: …sheet. The specimen… 🡪 …sheet. Any photos can be attached as well. The specimen…

Page 608, column 1, line 8 under “Floras and Monographs”: …standardized as follows. 🡪 … standardized as follows, largely following “the order of growth” (see p. 279, Freer 2001).

Page 608, column 2, line 3 from bottom: 1993-2014 🡪 1993-2016

Page 209, column 1, line 7: … and illustrations. 🡪 … and illustrations (see Marhold and Stuessy 2013).

Page 609, column 2, line 32: … sites. Here … 🡪 [insert the following sentence]: We have found the numerous digitized images of herbarium specimens now available on-line to be extremely useful (see also Soltis 2017).

Page 609: Add reference to the website “Go Botany: New England Wild Flower Society”; nice interactive keys. Also add “Plants of the World Online”, Kew Science (2015, onward) and Palms of the World Online (2019 onward).

Page 612, column 2, line 3: public service, teaching, or research. 🡪 …public service, teaching, or research (Thiers 2020). The specimens in herbaria document the taxonomic concepts of specialists, provide material for morphological measurements (allowing the production of accurate keys and descriptions in floras, taxonomic revisions, and monographs), data on geographical distribution, habitats, blooming and fruiting times, etc., a repository for voucher and type specimens, and material for DNA extraction, anatomical, micromorphological, and palynological study (see also Funk 2003; Heberling 2022; Heberling et al. 2019).

Page 612, In Literature Cited, column 2, line 26: 1972-2012 🡪 1972-2017

Page 612, column 2, line 27: and 6 🡪 6, and 7

Page 612, column 3, line 19: 1993-2015. 🡪 1993-2021

Page 612, column 3, line 20: 1-8, 19-28 🡪 1-10, 12, 17, 19-28

Page 613, column 1, line 10: 1-7 🡪 1-8

Page 613, column 1, line 46: 1-18 🡪 1-24 [and date becomes 1992-2019]

Page 614, column 1, line 17: 2000 🡪 2000-2019 [and add A.R. Franck to authors]

Page 614, column 1, line 18: Vol. 1 🡪 Vols. 1-7

**Added references (Floras)**:

Allred, K. W. 2012. *Flora Neomexicana* *I-IIIa* (and *III* co-authored with R. D. Ivey). Published by the author. Las Cruces, New Mexico.

Chadde, S. W. 2012. *Wetland plants of the northern Great Plains*. Create Space Independent Publishing.

Chadde, S. W. 2013. *Wisconsin flora: an illustrated guide to the vascular plants of Wisconsin*. Create Space Independent Publishing.

Chadde, S. W. 2017. *Minnesota flora: An illustrated guide to the vascular plants of Minnesota*. Version 1.15. Create Space Independent Publishing. Lexington, Kentucky.

Chadde, S. W. 2016. *Michigan flora: Upper Peninsula*, ed. 2. Create Space Independent Publishing.

Chadde, S. W. 2019. *Wetland plants of the upper Midwest: A field g uide to the aquatic and wetland plants of Michigan, Minnesota and Wisconsin*. Create Space Independent Publishing.

Gilman, A. V. 2015. New flora of Vermont. *Mem. N. Y. Bot. Gard*. 110. N.Y. Bot. Gard., Bronx, New York.

Gómez-Bellver, C., N. Ibáñez, J. López-Pujol, N. Nualart, and A. Susanna. 2019. How photographs can be a complement of herbarium vouchers: A proposal for standardization. *Taxon* 68: 1321-1326.

Hall, D. W. 2019. *Grasses of Florida*. University Press of Florida. Gainesville, Florida.

Les, D. H. 2018. *Aquatic dicotyledons of North America: Ecology, life history, and systematics*. CRC Press, Boca Raton, Florida.

Lesica, P. 2013. *Manual of Montana vascular plants*. Bot. Res. Inst. Texas Press. Fort Worth, Texas.

MarholdK. And T. Stuessy. 2013. The future of botanical monography: Report from an international workshop, 12-16 March 2012m Smolenice, Slovak Republic. *Taxon* 62: 4-20.

Meyers, S. C., T. Jaster, K. E. Mitchell, and L. K. Hardison. 2015. *Flora of Oregon*. Vol. 1. Botanical Research Institute of Texas, Fort Worth, Texas, U.S.A.

Pell, S. K. and B. Angell. 2016. *A botanist’s vocabulary: 1300 terms explained and illustrated*. Timber Press, Portland, Oregon.

Powell, A. M. and R. D. Worthington. 2018. Flowering plants of Trans-Pecos Texas and adjacent areas. *Sida, Bot. Misc*. 49. Botanical Research Institute of Texas, Fort Worth, Texas, U.S.A.

Smith, W. R. 2018. *Sedges and rushes of Minnesota: The complete guide to species identification*. University of Minnesota Press, Minneapolis.

Soltis, P. S. 2017. Digitization of herbaria enables novel research. *Amer. J. Bot*. 104: 1281-1284.

Tennessee Flora Committee. 2015. *Guide to the Vascular Plants of Tennessee*. University of Tennessee Press, Knoxville.

**Added references (other):**

Anderson, E. 1941. The technique and use of mass collections in plant taxonomy. *Ann. Missouri Bot. Gard.* 28: 287-292.

Freer, S. 2001. *Linnaeus’ philosophia botanica*. Oxford University Press, Great Britain.

Funk, V. A. 2003. 100 uses for an herbarium: well at least 72. *American Society of Plant Taxonomists Newsletter* 17: 17-19.

Heberling, J. M. 2022. Herbaria as big data sources of plant traits. *Int. J. Plant Sci*. 183: 87-118.

Heberling, J. M. and B. L. Isaac. 2017. Herbarium specimens as exaptations: New uses for old collections. *Amer. J. Bot*. 104: 963-965.

Heberling, J. M., A. Prather, and S. J. Tonsor. 2019. The changing uses of herbarium data in an era of global change: An overview using automated content analysis. *BioScience* 69: 812-822.

Palmweb. 2019. *Palmweb: Palms of the World Online*. Published on the internet. http://palmweb.org.

Rabeler, R. K., H. T. Svoboda, B. Thiers, L. A. Prather, J. A. Macklin, L. P. Lagomarsino, L. C. Majure, and C. J. Ferguson. 2019. Herbarium practices and ethics, III. *Syst. Bot*. 44: 7-13.

Smith, J. P., Jr. 2017. *North America floras, manuals, and checklist: A bibliography*. Botanical Studies. 4. <http://digitalcommons.humboldt.edu/botany_jps/4>.

Thiers, B. M. 2020. *Herbarium: The quest to preserve and classify the world’s plants*. Timber Press, Portland, Oregon.

Utech, F. H., S. Kawano, and M. Ohaara. 1984. Voucher specimens from life history studies: its significance and necessity of conservation. *J. Phytogeogr. Taxon*. 32: 14-18.

Table 8.2

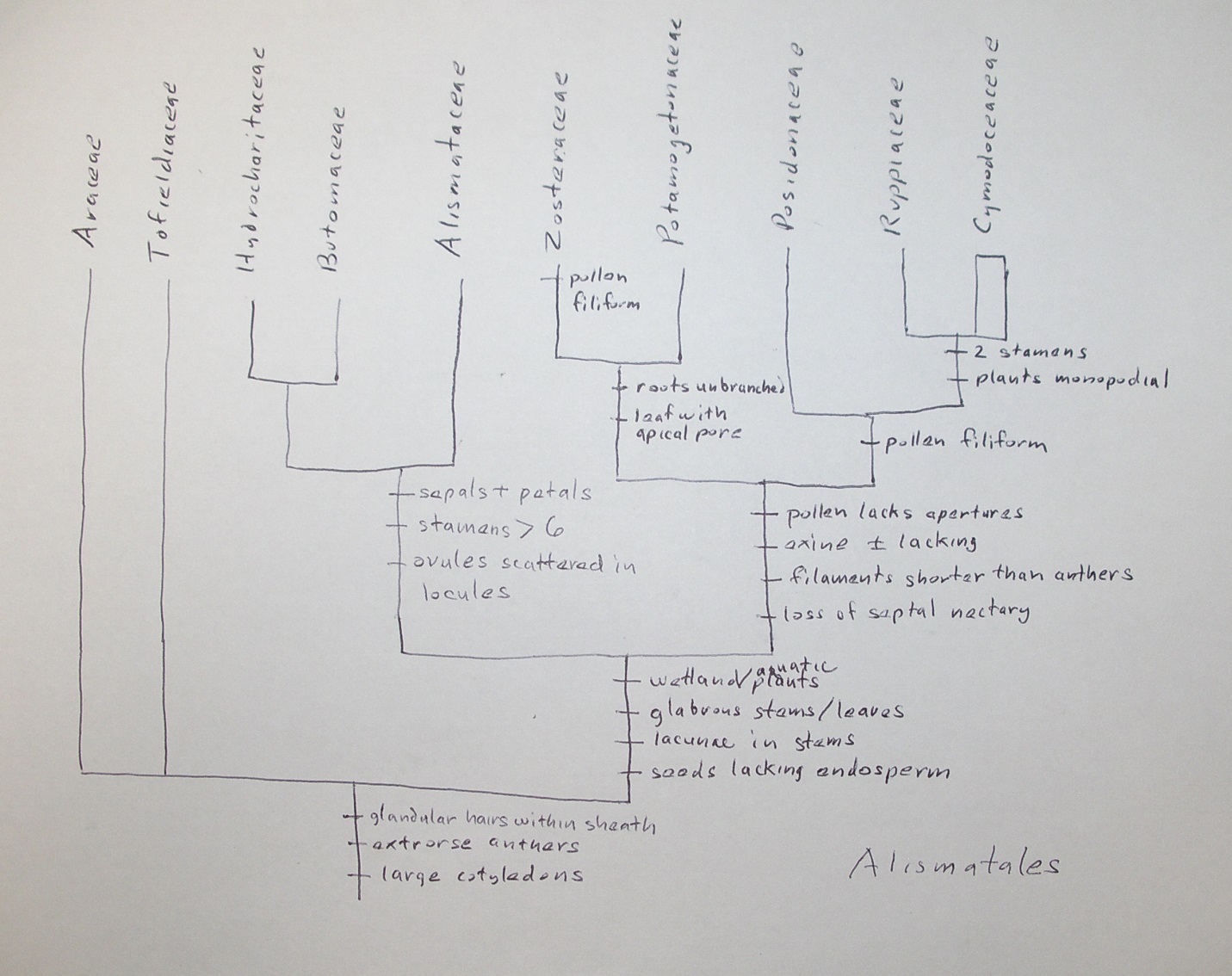
Diagnostic features for subfamilies of the Fabaceae (=Leguminosae)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Cercidoideae** | **Detarioideae** | **Dialioideae** |
| Genera/species | 12/335 | 84/760 | 17/85 |
| Representative genera | *Bauhinia, Cercis, Schnellia* | *Amherstia, Brownea, Detarium, Hymenaea, Macrolobium, Saraca, Tamarindus* | *Dialium* |
| Habit | Trees, shrubs, or lianas (with tendrils) | Trees or shrubs | Trees or shrubs |
| Leaves | Unifoliolate or bifoliolate | Pinnately compound (even); often with extrafloral nectaries (abaxial surface of leaflets) | Pinnately compound (odd) |
| Stipules | Lateral, distinct | Intrapetiolar (i.e., positioned on petiole base, adaxially, between leaf and stem), distinct or connate | Lateral, distinct (or absent) |
| Inflorescence | Lax, flowers opening sequentially; raceme or appearing so | Lax, flowers opening sequentially; raceme or panicle | Lax, flowers opening sequentially; branched thyrsoid cyme |
| Bracteoles | Large to minute | Large, often petaloid, ± enclosing bud | Small or absent |
| Corolla | Slightly to strongly bilateral | Radial to strongly bilateral | Radial to strongly bilateral |
| Petals | Imbricate, the adaxial (upper) petal innermost, frequently differentiated [diagram] | Imbricate, the adaxial petal usually innermost, large, with others smaller to rudimentary [diagram] | Imbricate, the adaxial petal innermost, all ± equal [diagram] |
| Stamens | 10, with filaments fused or distinct; not showy | 10, with filaments fused or distinct; not showy | 5 (or fewer); filaments free; not showy |
| Pollen | Monads (i.e., released as individual grains) | monads | Monads |
| Fruit | Legume, samara-like | Legume, indehiscent pod, samara-like, berry | Drupes, samara-like |
| Seed | Pleurogram absent; hilum crescent-shaped; aril absent | Pleurogram absent, but occasionally with pseudopleurogram; occasionally arillate | Pleurogram absent; aril absent |

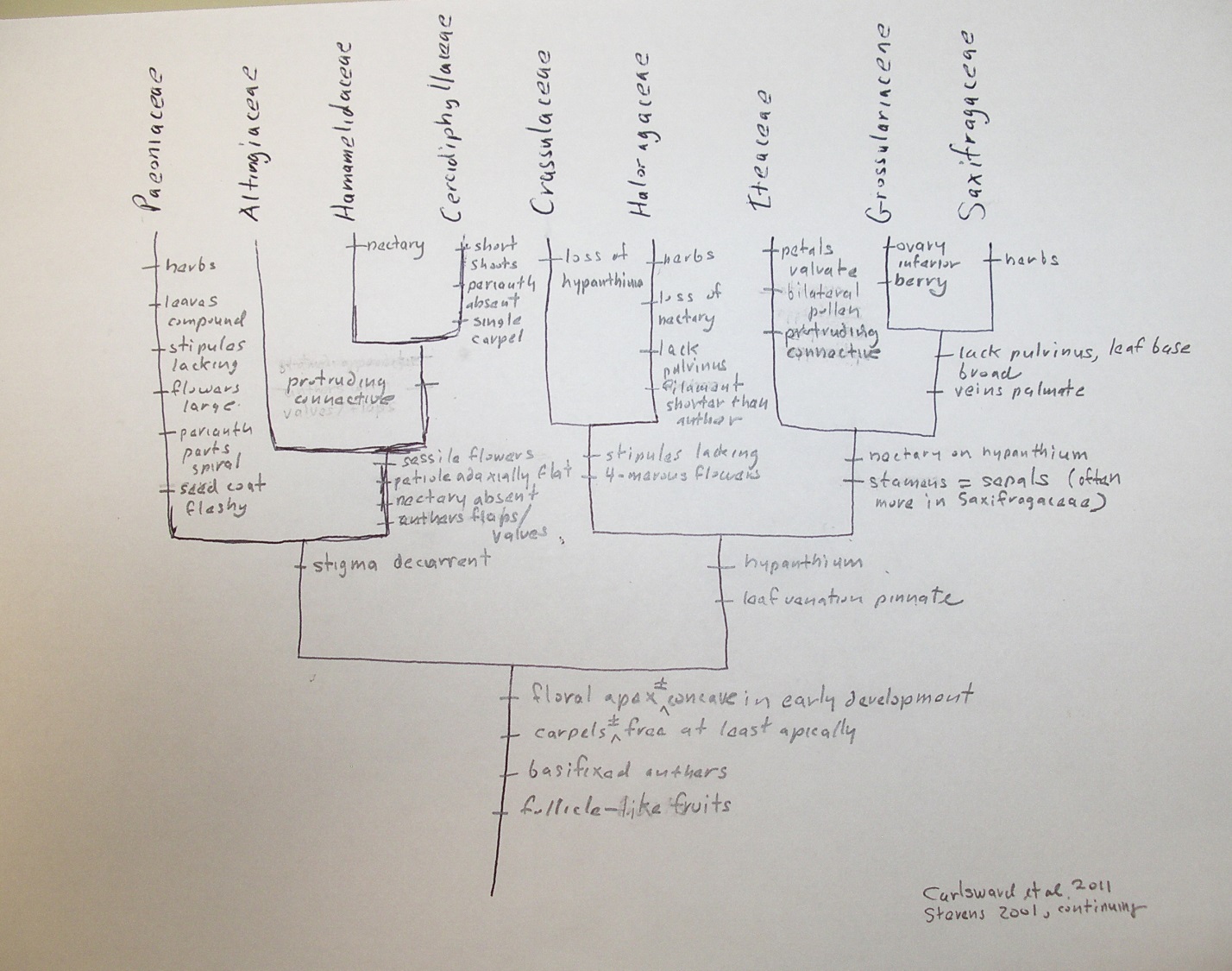
Table 8.2 continued

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Caesalpinioideae** (non-mimosoid clades) | **Caesalpinioideae** (mimosoid clade) | **Faboideae** (=Papilionoideae) |
| Genera/species | 62/1520 | 86/2500 | 503/14,000 |
| Representative genera | *Caesalpinia, Ceratonia, Cassia, Chamaecrista, Delonix, Gleditsia, Guilandina, Gymnocladus, Hematoxylum, Parkinsonia, Peltophorum, Senna* | *Acacia, Albizia, Archidendron, Calliandra, Desmanthus, Dichrostachys, Entada, Entrolobium, Inga, Leucaena, Mimosa, Neptunia, Parkia, Pithecellobium, Prosopis, Senegalia, Vachellia* | *Abrus, Arachis, Astragalus, Baptisia, Crotalaria, Dalbergia, Desmodium, Erythrina, Glycine, Indigofera, Lathyrus, Lotus, Lonchocarpus, Lupinus, Melilotus, Phaseolus, Pisum, Robinia, Tephrosia, Trifolium, Vicia, Wisteria* |
| Habit | Trees to shrubs, occasionally herbs | Trees to shrubs, occasionally herbs | Herbs, vines, shrubs or trees |
| Leaves | Pinnately compound (even) or twice pinnately compound; often with extrafloral nectar glands on petiole or leaf axes | Usually twice pinnately compound; often with extrafloral nectar glands on petiole or leaf axes | Pinnately compound (even or odd), palmately compound, trifoliolate, occ. unifoliolate; nectar glands absent on petiole or leaf axes, but occ. on stipules |
| Stipules | Lateral, distinct | Lateral, distinct | Lateral, distinct (but may be adnate to petiole) |
| Inflorescence | ± Lax, flowers opening sequentially; panicles, racemes, fascicles | Dense, flowers opening simultaneously; globose heads or spikes, these sometimes in branched clusters | ± Lax, flowers opening sequentially; racemes, or appearing so, cymes, heads, spikes, or flowers solitary |
| Bracteoles | Small or absent | Small or absent | Mostly small |
| Corolla | Usually bilateral (but some radial) | Radial | Bilateral |
| Petals | Imbricate, with adaxial (upper) petal innermost (often differentiated)  [diagram] | Valvate (but partly imbricate in *Parkia*)  [diagram] | Imbricate, with adaxial petal outermost, two basal petals connate or coherent at apex, i.e., papilionate [diagram] |
| Stamens | 10-1; filaments distinct to connate; not showy | 3 – numerous; filaments distinct to connate; more showy than the petals | 10; filaments distinct to connate; usually 9 connate and 1 distinct |
| Pollen | monads | Monads, tetrads, polyads | monads |
| Fruit | Legume, indehiscent pod | Legume, indehiscent pod, loment | Legume, indehiscent pod, loment, samara, drupe, achene |
| Seed (U-shaped line = pleurogram) | Pleurogram present or absent; aril present or absent | Pleurogram present; aril present or absent | Pleurogram absent; aril absent or occasionally present |

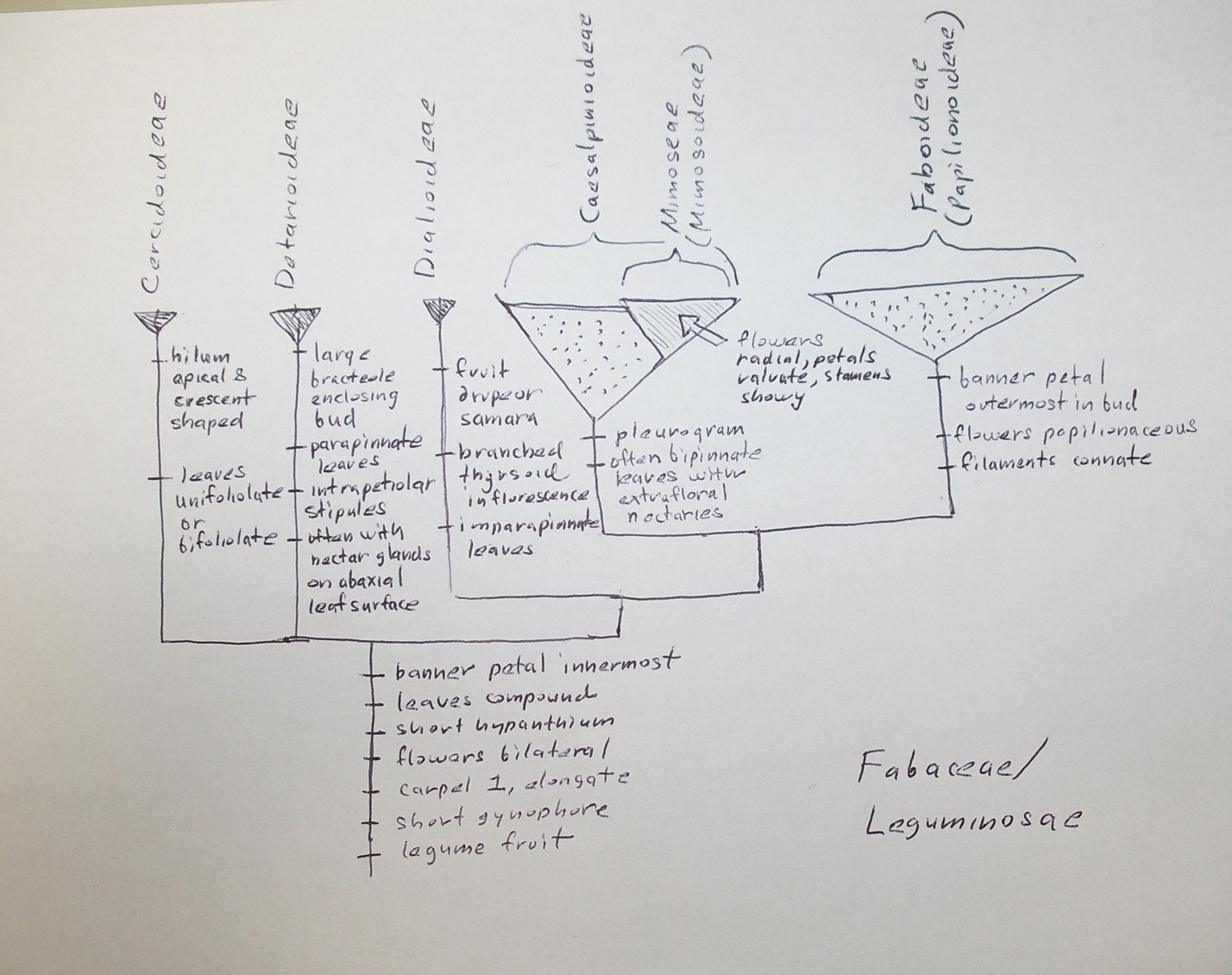
\* Duparquetioideae (a single species) omitted; fls. with 4 unequal free sepals, 5 glandular petals.



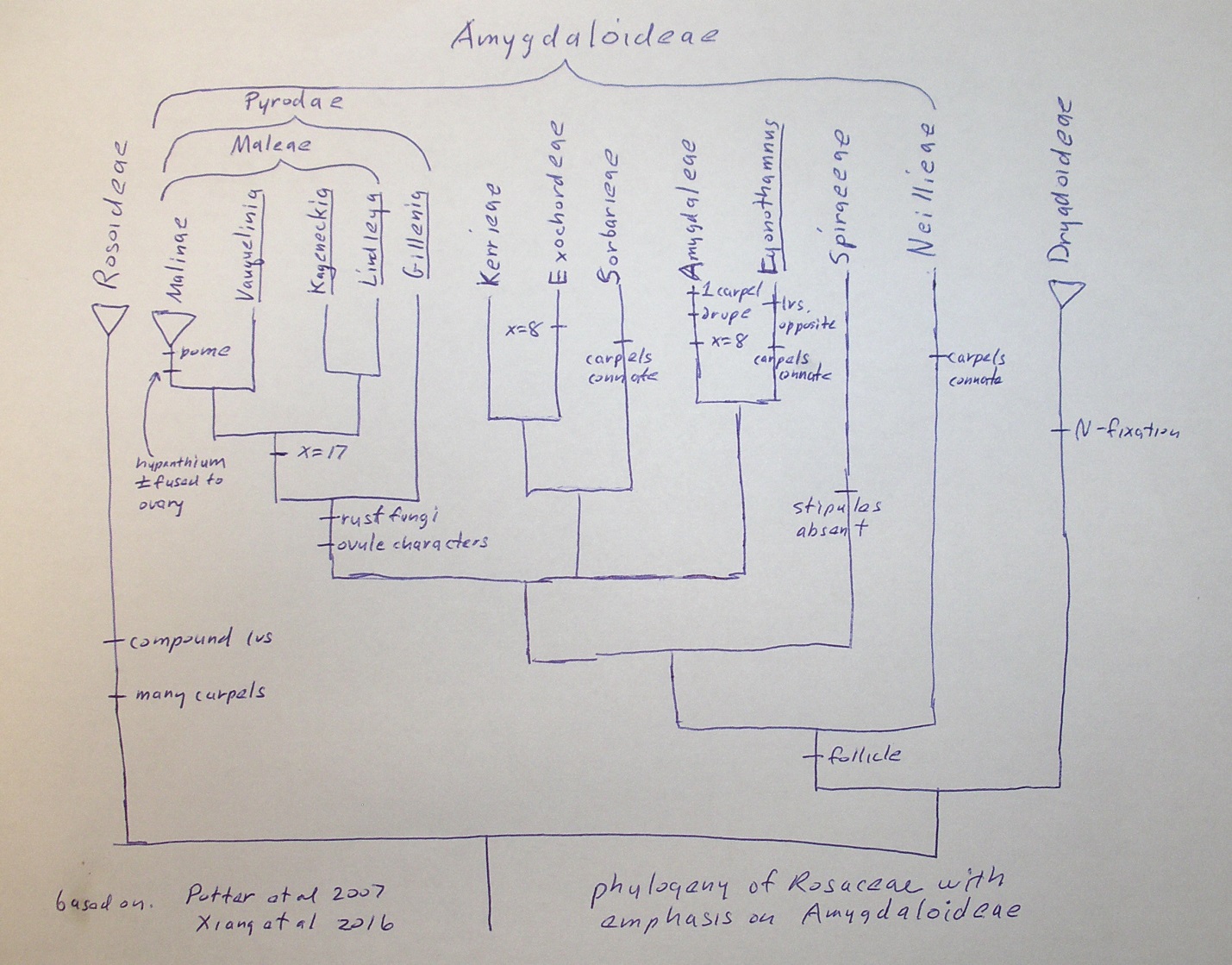
Alismatales phylogeny



Saxifragales phylogeny



Fabaceae phylogeny



Rosaceae phylogeny

**Families to be added in the 5th edition:**

*Malpighiales: Insert this family immediately after Hypericaceae:*

**Ochnaceae** de Candolle

(Mickey Mouse-plant Family)

Trees, shrubs, lianas, or rarely herbs, *usually with cortical vascular bundles in the stems*, occasionally with mucilage canals. Hairs simple, eglandular or glandular. *Leaves alternate and 2-ranked* *or spiral*, opposite and decussate, or whorled, *usually simple*, rarely pinnately compound, *usually serrate, with pinnate venation*, **and the venation ochnoid, i.e., with secondary and tertiary veins well developed and veins ± parallel**; stipules usually present, sometimes interpetiolar. Inflorescences determinate or indeterminate, sometimes reduced to a solitary flower, terminal or axillary. *Flowers usually bisexual, radial,* or sometimes bilateral (due to androecium). Sepals usually 5, usually distinct, imbricate, deciduous or more commonly *persistent, then often becoming attractive in fruit*, sometimes unequal in size. *Petals usually 5, distinct, convolute* or imbricate, *often clawed*. *Stamens 5 to numerous* (and then the outermost developing before the innermost), *distinct*, and often borne on a short to expanded androgynophore; *filaments usually shorter than the anthers;* anthers opening by longitudinal slits or apical pores; pollen grains tricolporate (porate in *Medusagyne*); staminodia sometimes present outside the fertile stamens, these often petaloid, and free or fused, then sometimes forming a tube or lobed disk. *Carpels 2 to numerous, connate; ovary superior*, with basal, axile or parietal placentation, *often deeply lobed* (*so carpels appearing distinct*); *style usually 1,* sometimes apically divided, or occasionally as many as the carpels, terminal or *gynobasic*; stigma(s) lobed to capitate. Ovules 1 to many in each locule, with a thin megasporangium, often with a single integument (due to fusion). *Nectary absent*. *Fruit a cluster of drupes, these contrasting in color with the enlarged receptacle/gynophore and persistent sepals, a septicidal capsule* (with or without a central column)*,* a nut (with associated, wing-like sepals), or a fleshy, berry-like capsule. Seeds winged or not, sometimes hairy, without an aril; endosperm present or absent.

***Floral formula***: \* K 5 , C 5 , A 5-numerous, G 2-numerous; cluster of drupes, septicidal capsule

[circle the “2-numerous” carpels; use infinity symbol for “numerous”]

***Distribution***: Pantropical.

***Genera/species***: 33/550. ***Major genera***: *Ouratea* (200 spp.), *Ochna* (85), *Campylospermum* (50), and *Sauvagesia* (40). *Ochna* is naturalized in the continental United States (southern Florida).

***Economic plants and products***: A few species of *Ochna* are used as ornamentals because of their yellow flowers and striking clusters of blue fruits, contrasting with the associated red, expanded receptacle and persistent sepals, which suggest the stylized head of the Mickey Mouse cartoon character. The seed oil of *Lophira alata* is used for cooking and soap production.

***Discussion***: The monophyly of Ochnaceae and relationships within the clade are supported by DNA sequences and morphology (Bissiengou et al. 2014; Fay et al. 1997; Matthews et al. 2012; Schneider et al. 2014, 2021, 2022; Schneider and Zizka 2017; Shah et al. 2021; Soltis et al. 2011; Stevens 2001 ongoing; Wurdack and Davis 2009). Synapomorphies for the family include vestured pits and the characteristic ochnoid venation (see description). The familial clade is divided into three subfamilies, with a species-rich Ochnoideae (leaves alternate) sister to the much smaller Medusagynoideae + Quiinoideae clade (leaves opposite or whorled). Species of Ochnoideae are easily diagnosed by their 2-ranked leaves, showy flowers with staminal filaments shorter than the usually porose anthers, and stems with cortical vascular bundles. Most Ochnoideae belong to one of two large tribes: Ochneae (ovary deeply lobed, with one ovule per carpel, each ovule with only a single integument, style gynobasic, fruits a cluster of drupes associated with an enlarged receptacle; e.g., *Brackenridgea*, *Campylospermum, Ochna, Ouratea*) and Sauvagesieae (stamens 5 or 10, usually associated with staminodes; e.g., *Cespedesia, Sauvagesia, Tyleria*). The Sauvagesieae have unlobed ovaries, few to several ovules per carpel, a terminal style, and usually have capsular fruits. Medusagynoideae consist only of the very rare *Medusagyne oppositifolia* of the Seychelles that has flowers with the multicarpellate gynoecium adnate to a massive central axis and distinctive fruits with the capsule valves at maturity connected only to the top of the column and diverging like the ribs of an umbrella and opening ventrally to release the winged seeds. Finally, Quiinoideae are a small group (mainly the genus *Quiina*) with berry-like capsules, producing few non-winged seeds, and with the outer fruit wall having numerous internal cavities. The early evolutionary diversification of the familial clade occurred mainly in the Neotropics (Schneider et al. 2022).

Nearly all members of Ochnaceae are bee pollinated, and these plants show the characteristics of buzz pollination, i.e., having either anthers that open by pores or a “poricidal system” – that is, having flowers with a pore formed by the more or less connate staminodes (Kubitzki and Amaral 1991). Additionally, nectaries are absent and the pollen diameter is small. The species with winged seeds (several genera, e.g., *Cespedesia, Luxemburgia*, *Medusagyne, Rhytidanthera*) or a nut associated with wing-like sepals (i.e., *Lophira*) are wind dispersed. Some have floating seeds or fruits, and are water dispersed, e.g., *Wallacea* and *Elvasia*. The species with white or red drupes contrasting with dark red sepals (*Euthemis*) or blue drupes that contrast with an expanded red receptacle and associated calyx (e.g., *Brakenridgea, Campylospermum, Euthemis, Ochna, Ouratea*) are, of course, bird dispersed.

***Additional references***: Amaral and Bittrich 2014; Dickinson 1990a, b; Furness 2013.

*Add these references to literature cited at end of Chapter 8*:

Amaral, M. C. E. and V. Bittrich. 2014. Ochnaceae. In *The families and genera of vascular plants*, vol. 11. K. Kubitzki (ed.). 253-268. Springer-Verlag, Berlin.

Dickinson, W. C. 1990a. The morphology and relationships of *Medusagyne* (Medusagynaceae). *Pl. Syst. Evol.* 171: 27-55.

Dickinson, W. C. 1990b. An additional note on the floral morphology and affinities of *Medusagyne* *oppositifolia* (Medusagynaceae). *Brittonia* 42: 191-196.

Fay, M. F., S. M. Swensen, and M. W. Chase. 1997. Taxonomic affinities of *Medusagyne oppositifolia* (Medusagynaceae). *Kew Bull*. 52: 111-120.

Furness, C. A. 2013. Evolution of pollen and tapetal characters in Ochnaceae (Malpighiales). *Int. J. Plant* *Sci*. 174: 1134-1152.

Matthews, M. L., M. C. E. Amaral, and P. K. Endress. 2012. Comparative floral structure and systematics in Ochnaceae s.l. (Ochnaceae, Quiinaceae and Medusagynaceae; Malpighiales). *Bot. J. Linn. Soc*. 170: 299-392.

Schneider, J. V. and G. Zizka. 2017. Phylogeny, taxonomy and biogeography of Neotropical Quiinoideae (Ochnaceae s.l.). *Taxon* 66: 855-867.

Schneider, J. V., U. Swenson, R. Samuel, T. Stuessy, and G. Zizka. 2006. Phylogenetics of Quiinaceae (Malpighiales): Evidence from *trnL-trnF* sequence data and morphology. *Pl. Syst. Evol*. 257: 189-203.

Schneider, J. V., P. Bissiengou, M. C. E. Amaral, A. Tahir, M. F. Fay, M. Thines, M. S. Sosef, G. Zizka, and L. W. Chatrou. 2014. Phylogenetics, ancestral state reconstructions, and a new infrafamilial classification of the pantropical Ochnaceae (Medusagynaceae, Ochnaceae s. str., Quiinaceae) based on five DNA regions. *Mol. Phylog. Evol*. 78: 199-214.

Schneider, J. V., T. Jungcurt, D. Cardoso, A. M. Amorim, M. Töpel, T. Andermann, O. Poncy, T. Berberich, and G. Zizka. 2021. Phylogenomics of the tropical plant family Ochnaceae using targeted enrichment of nuclear genes and 250+ taxa. *Taxon* 70: 48-71.

Schneider, J. V., T. Jungcurt, D. Cardoso, A. M. Amorim, J. Paule, and G. Zizka. 2022. Predominantly eastward long-distance dispersal in pantropical Ochnaceae inferred from ancestral range estimation and phylogenomics. *Front. Ecol. Evol*. 10: 813336. doi.10.3389/fevo.2022.813336.

Shah, T. J. V. Schneider, G. Zizka, O. Maurin, W. Baker, F. Forest, G. E. Brewer, V. Savolainen, I. Darbyshire, and I. Larridon. 2021. Joining forces in Ochnaceae phylogenomics: A tail of two targeted sequencing probe kits. *Amer. J. Bot*. 108: 1201-1216.

*Malpighiales: Insert this family immediately following Phyllanthaceae:*

**Linaceae** Arnott

(Flax Family)

*Annual to perennial herbs*, or less commonly shrubs, trees, or lianas. Hairs simple, glandular or eglandular. *Leaves usually alternate, spiral, simple, entire*, with pinnate venation; stipules present or absent. Inflorescences determinate or indeterminate, terminal or axillary, occasionally reduced to a solitary flower. *Flowers bisexual, radial*. *Sepals 5, distinct* or occasionally basally connate, *quincuncially imbricate*. *Petals 5, usually distinct, contorted, often clawed*. *Stamens 5* or 10, sometimes with staminodes; *filaments ± connate,* **with nectar glands on the outside of the tube**; pollen grains tricolpate to polycolpate, tricolporate, or multiporate. *Carpels usually 2-5, connate*; *ovary superior*, with axile placentation *and locules usually secondarily divided*; styles distinct to ± united; stigmas usually capitate. *Ovules 2 per carpel*, *so 1 in each apparent locule*. *Fruit a septicidal capsule* or drupe; seeds often with a mucilaginous epidermis, sometimes arillate; embryo straight to slightly curved.

***Floral formula***: \* K 5 , C 5 , A 5-10 , G 2-5 ; capsule, drupe

[circle the 5-10 stamens; circle the 2-5 carpels]

***Distribution and ecology***: Widespread, growing in a wide range of habitats.

***Genera/species***: 7/300. ***Major genera***: *Linum* (200 spp.), *Hugonia* (40). *Linum* (incl. *Hesperolinon* and *Sclerolinon*) occurs in the continental United States and/or Canada.

***Economic plants and products***: *Linum usitatissimum* is an ancient domesticated species, with cultivars grown for either their fiber (linen) or their oil (i.e., linseed or flaxseed oil), used in foods or medicinally and also in paints, varnishes, and flooring (linoleum). Species of *Linum* and *Reinwardtia* are also occasionally used as ornamentals because of their beautiful blue (in various shades), red, pink, white, or yellow flowers.

***Discussion***: The monophyly of Linaceae is well supported by molecular analyses, and some of these have also addressed phylogenetic structure within the familial clade (McDill and Simpson 2010; McDill et al. al. 2009; Schneider et al. 2016; Wurdack and Davis 2009). The extrastaminal nectar glands also support the group’s monophyly (see description; Stevens 2001, ongoing). Two subfamilies are recognized: Hugonioideae (3 genera and ca. 60 species) are a rather plesiomorphic group of trees, shrubs or lianas with flowers having usually 10 stamens, ovaries with undivided locules, and usually drupe fruits, while Linoideae (4 genera and ca. 240 species) are usually annual to perennial herbs with flowers having only 5 stamens, ovaries with divided locules (all likely apomorphic features) and capsule fruits. Within Linoideae, a clade comprised of *Anisadenia*, *Reinwardtia*, and *Tirpitzia* may be sister to the remaining species, and within Hugonioideae, *Hebepetalum* may be sister to the rest.

The flowers of Linaceae are mainly pollinated by bees or flies. Several genera show heterostyly (Dressler et al. 2014). The seeds are dispersed by wind, rain-wash, or external transport (due to the often mucilaginous epidermis, when whetted).

***Additional reference***: Robertson 1971.

*Add these references at end of Chapter 8*:

Dressler, S., M. Repplinger, and C. Bayer. 2014. Linaceae. In *The families and genera of vascular plants,* Vol. 11. L. Kubitzki (ed.). 237-246. Springer-Verlag, Berlin.

McDill, J. and B. B. Simpson. 2010. Molecular phylogenetics of Linaceae with complete generic sampling and data from two plastid genes. *Bot. J. Linn. Soc.* 165: 64-83.

McDill, J., M. Repplinger, B. B. Simpson, and J. W. Kadereit. 2009. The phylogeny of *Linum* and Linaceae subfamily Linoideae, with implications for their systematics, biogeography, and evolution of heterostyly. *Syst. Bot*. 34: 386-405.

Robertson, K. R. 1971. The Linaceae in the southeastern United States. *J. Arnold Arbor*. 52: 649-665.

Schneider, A. C., W. A. Freyman, M. Guillams, Y. P. Springer, and B. G. Baldwin. 2016. Pleistocene radiation of the serpentine-adapted genus *Hesperolinon* and other divergence times in Malpighiales. *Amer. J. Bot*. 103: 221-232.

*Caryophyllales: Insert this family immediately following Polygonaceae:*

**Plumbaginaceae** A. L. de Jussieu

(Leadwort Family)

*Herbs*, shrubs or lianas; stems sometimes with anomalous patterns of secondary growth, medullary and/or cortical vascular bundles common; often with branched sclereids; plants with **choline-O-sulphate,** and often with plumbagin, glycine betaine (osmoprotective compounds), anthocyanins and/or tannins. Hairs simple, *often with stalked mucilage glands or water and calcium salt-excreting glands*. *Leaves alternate and spiral, borne along stem or in a basal rosette, simple, entire*, with pinnate or *obscure, ± parallel venation*; *stipules absent*. Inflorescences determinate or indeterminate, axillary, often with papery bracts. *Flowers bisexual, radial*. **Sepals** *5*, **connate**, **forming a 5- or 10-ribbed tube,** *often scarious and petaloid, persistent*. *Petals 5, connate, or distinct and then clawed,* **contorted**, *often persistent*. **Stamens 5, opposite the petals (or corolla lobes)**; filaments free or adnate to corolla tube; pollen grains usually tricolpate. *Carpels 5, connate; ovary superior*, *with basal placentation*; *styles 5, or 1 and distally branched;* stigmas elongate (or capitate). *Ovule 1, in single locule*, anatropous, **borne on an elongated, curved funiculus; embryo sac developed from 4 spores, 4- to 8-nucleate**. **Nectaries on adaxial side of filament bases**. Fruit an achene or circumscissile or loculicidal capsule (with valves apically opening), associated with persistent calyx; **endosperm 4n or 5n** (present or absent at seed maturity); embryo straight.

***Floral formula***: \* K 5 , C 5 , A 5 , G 5 ; achene, capsule

[put circle around 5 sepals; put dashed circle around 5 petals; put dashed line connecting 5 stamens and the 5 petals; put circle around the 5 carpels]

***Distribution and ecology***: Nearly cosmopolitan. Plants frequently of cold, dry, or coastal-saline habitats. The group is most diverse in Central Asia and the Mediterranean region.

***Genera/species***: 29/840. ***Major genera***: *Limonium* (350 spp.), *Acantholinon* (165), and *Armeria* (100). *Armeria, Limonium*, and *Plumbago* occur in the continental United States and/or Canada.

***Economic plants and products***: Several genera, especially *Armeria* (thrift), *Ceratostigma* (leadwort), *Limonium* (sea-lavender), and *Plumbago* (plumbago, leadwort) are grown as ornamentals. *Plumbago* is used medicinally.

***Discussion***: The monophyly of the family and phylogenetic relationships within it are supported by morphology and DNA sequences (Lledó et al. 1998, 2001, 2005; Malekmohammadi et al. 2017). The family is comprised of two major clades: Plumbaginoideae (4 genera, 36 spp.; incl. *Plumbago* and *Ceratostigma*) and Limonioideae (11 genera, ca. 800 spp.; *Acantholinon, Armeria, Limonium*, and relatives). The phylogenetic position of the Old World mangrove genus *Aegialitis* is unclear. Plumbaginoideae possess plumbagin, have a chromosomal base number of six or seven, leaves with pinnate venation and borne along the stem, indeterminate inflorescences, and flowers with a herbaceous and often gland-bearing calyx, free stamens, monomorphic pollen, and a single style. Limonioideae lack plumbagin, have a base number of eight or nine, leaves in a basal rosette and with obscure, more or less parallel venation, determinate inflorescences, and flowers with a scarious and often petaloid calyx, stamens usually adnate to the petals, dimorphic pollen, and five styles. In addition, the leaf lamina of Limonioideae is cartilaginous with 5-10 marginal rows of whitish cells (a likely synapomorphy of members of the subfamily).

The showy flowers of Plumbaginaceae are pollinated by a variety of insects. Many species, e.g., the large clade *Limonium*, are heterostylous (showing distyly) with cobwebby stigmas and reticulate pollen grains produced in long-styled plants and papillose stigmas and minute-spiny pollen grains produced in short-styled plants. The reticulate grains only germinate on the papillose stigmas and minute-spiny grains only germinate on cobwebby stigmas, thus ensuring outcrossing (Kubitzki 1993). In many species the fruits are often associated with papery sepals or bracts, leading to dispersal by wind. The fruits of *Plumbago* are associated with a persistent calyx with sticky, stalked glands, and are dispersed by external transport (on clothing, fir, feathers).

***Additional references***: Channell and Wood 1959; Hanson et al. 1994; Luteyn 1990.

*Add these references*:

Channell, R. B. and C. E. Wood, Jr. 1959. The genera of Plumbaginaceae of the southeastern United States. *J. Arnold Arbor*. 40: 391-397.

Hanson, A. D., B. Rathinasabapathi, J. Rivoal, M. Burnet, M. O. Dillon, and D. A. Gage. 1994. Osmoprotective compounds in the Plumbaginaceae: A natural experiment in metabolic engineering of stress tolerance. *Proc. Nat. Acad. Sci. USA* 91: 306-310.

Kubitzki, K. 1993. Plumbaginaceae. In *The families and genera of vascular plants,* Vol. 2. K. Kubitzki (ed.). 523-530. Springer-Verlag, Berlin.

Lledó, M. D., M. B. Crespo, K. M. Cameron, M. F. Fay, and M. W. Chase. 1998. Systematics of Plumbaginaceae based on cladistic analysis of *rbcL* sequence data. *Syst. Bot*. 23: 21-29.

Lledó, M. D., P. O. Karis, M. B. Crespo, M. F. Fay, and M. W. Chase. 2001. Phylogenetic position and taxonomic status of the genus *Aegialitis* and subfamilies Staticoideae and Plumbaginoideae (Plumbaginaceae): Evidence from plastid DNA sequences and morphology. *Pl. Syst. Evol*. 229: 107-124.

Lledó, M. D., M. B. Crespo, M. F. Fay, and M. W. Chase. 2005. Molecular phylogenetics of *Limonium* and related genera (Plumbaginaceae): Biogeographical and systematic implications. *Amer. J. Bot*. 52: 1189-1198.

Luteyn, J. L. 1990. The Plumbaginaceae in the flora of the southeastern United States. *Sida* 14: 169-178.

Malekmohammadi, M., H. Akhani, and T. Borsch. 2017. Phylogenetic relationships of *Limonium* (Plumbaginaceae) inferred from multiple chloroplast and nuclear loci. *Taxon* 66: 1128-1146.

*Saxifragales: Insert this family immediately following Saxifragaceae:*

**Grossulariaceae** de Candolle in Lamarck & de Candolle

(Gooseberry Family)

*Shrubs*, often rhizomatous or rooting at branch tips, often with shredding bark; vessel elements with scalariform perforation plates; often with tannins, usually cyanogenic, and sometimes with volatile oils. Hairs simple, eglandular or gland-headed (sometimes resinous, waxy, or with clear exudate), and also sometimes with slender to stout prickles, distributed along stem. *Leaves alternate and spiral, simple, usually trilobed to palmately lobed, usually ± serrate, with palmate venation and usually 3 major veins*; *stipules present*; often with stout spines at the nodes (these similar to prickles but larger, of uncertain derivation). *Inflorescences indeterminate, racemose*, terminal, but often on short shoots and appearing axillary, pendulous, sometimes reduced to solitary flower. Flowers bisexual or less commonly unisexual (plants then dioecious), *radial, pendulous*, **with hypanthium usually forming an obvious tube or cup**, each floral pedicel **with a single small bract**. Sepals (4-) 5, ± distinct, usually reflexed, *often petaloid*. *Petals (4-) 5*, distinct, with narrowed attachment, **open in bud**, **usually reduced and smaller than calyx**, rarely absent. Stamens (4-) 5; **pollen** **grains polyporate** (with 5-14 pores). *Carpels 2,* connate; **ovary inferior or at least mostly so**, **with parietal placentation**; **style single**, ± apically branched or unbranched, with 2 stigmatic branches or a capitate stigma. Ovules several to numerous on each placenta, with 2 integuments. Nectar disk atop ovary, sometimes with nectar glands on anther connective. **Fruit a berry,** *with or without prickles*. **Seeds with mucilaginous/gelatinous aril**.

***Floral formula***: \* K 5 , C 5 , A 5 , G 2 ; berry

[Circle the 2 carpels, and put a line above the 2; connect K, C, and A with a line below, indicating a hypanthium]

***Distribution and ecology***: Widely distributed in temperate and boreal regions, and extending into the tropics in montane and alpine habitats (especially in the Andes, Mediterranean region, Southeast Asia); plants of moist to dry, broadleaved or coniferous forests, swamps, marshes, and along streams. *Ribes* is the alternate host of the white pine blister rust (*Cronartium ribicola*, a basidiomycete).

***Genera/species***: 1/160. ***Genus***: *Ribes* (160 spp.). The genus is widespread and diverse in the continental United States and Canada.

***Economic plants and products***: Numerous species provide edible fruits (collected in the wild) and some species are cultivated, e.g., *Ribes rubrum* (and its hybrids with other species; red currants), *R. nigrum* (black currants), and gooseberries (*R. uva-crispa*, and various hybrids; *R. hirtellum*). The aromatic leaves of *R. nigrum* are used for tea, and several species are used medicinally. Additionally, a few species are grown as ornamentals for their showy flowers.

***Discussion***: The monophyly of Grossulariaceae, which is comprised of the single genus *Ribes*, is well supported by both molecular and morphological evidence (Schultheis and Donoghue 2004; Senters and Soltis 2003; Stevens 2001 onwards; Weigend et al. 2002). Grossulariaceae are most closely related to Saxifragaceae (Carlsward et al. 2011; Hilu et al. 2003; Soltis et al. 2000, 2011), from which they can be distinguished by the shrubby habit, flowers with reduced petals, open in the bud, polyporate pollen, inferior ovary, single style, and berry fruits. They are also related to the woody Iteaceae (*Itea*, *Pterostemon*; ca. 30 spp.), which have pinnately veined leaves, flowers with short hypanthia, and usually capsular fruits. Within *Ribes* two subgenera (or even genera) traditionally have been recognized, i.e., subg. *Ribes* (the currants; floral pedicels jointed) and subg. *Grossularia* (the gooseberries; floral pedicels not jointed), however, molecular phylogenetic analyses have indicated that subg. *Grossularia*, although monophyletic, is nested within a paraphyletic subg. *Ribes*. Thus it is best to retain a broadly circumscribed *Ribes*, which cannot be divided neatly into two major subclades, but instead probably is comprised of seven major subclades (recognized as subgenera; see Weigend 2007), among which phylogenetic relationships are still rather unclear.

The flowers are quite variable in form (e.g., in the shape, size, and orientation of the sepals, the stamens may be short and held within the hypanthium/calyx or long exserted, and hypanthium varies greatly in shape and length) and color (sepals green, yellow, white, red, pink, or purple, and petals the same color as calyx or contrasting) and usually attract a variety of generalist pollinators, e.g., various bees, flies, and butterflies. Some species with red or red and green flowers are pollinated by hummingbirds. The often sour, red, yellow, green, or purple-black berries of *Ribes* are eaten by birds and mammals.

***Additional references***: Janczewski 1907; Morin 2009; Sinnott 1985; Sponberg 1992.

*Add these references*

Janczewski, E. 1907. Monographie de Groseillier. *Mém. Soc. Phys. Genève* 35/13: 199-517.

Morin, N. R. 2009. Grossulariaceae. In *Flora of North America*. Vol. 8. Flora of North America Editorial Committee. 8-42. Oxford University Press, New York, Oxford.

Schultheis, L. M. and M. J. Donoghue. 2004. Molecular phylogeny and biogeography of *Ribes* (Grossulariaceae), with an emphasis on Gooseberries (subg. *Grossularia*). *Syst. Bot*. 29: 77-96.

Senters, A. E. and D. E. Soltis. 2003. Phylogenetic relationships in *Ribes* (Grossulariaceae) inferred from ITS sequence data. *Taxon* 52: 51-66.

Sinnott, Q. P. 1985. A revision of *Ribes* L. sugb. *Grossularia* (Mill.) Pers. sect. *Grossularia* (Mill.) Nutt. (Grossulariaceae) in North America. *Rhodora* 87: 189-286.

Weigend, M. 2007. Grossulariaceae. In *The families and genera of flowering plants,* Vol. 9. K. Kubitzki (ed.). 168-176. Springer-Verlag, Berlin.

Weigend, M., O. Mohr, and T. J. Motley. 2002. Phylogeny and classification of the genus *Ribes* (Grossulariaceae) based on 5S-NTS sequences and morphological and anatomical data. *Bot. Jahrb*. 124: 163-182.

*Ericales: Place this family immediately following Lecythidaceae:*

**Pentaphylacaceae** Engler

(Saintedwood Family)

*Trees or shrubs*; *usually with rounded to well-branched sclerids*; saponins and triterpenic acids often present, aluminum accumulated; wood with vessel-fiber pits bordered (vs. ± unbordered in Theaceae). Hairs simple and unicellular. *Leaves alternate and spiral or 2-ranked, simple*, often pseudoverticillate, toothed to entire, *the teeth (when present) theoid* (i.e., *with a deciduous glandular apex*, see Figure 4.13), *with pinnate venation*; *stipules lacking*. Inflorescences of solitary (less commonly fasciculate), axillary flowers, **each associated with a reduced and non-photosynthetic leaf** or an expanded and photosynthetic leaf. Flowers bisexual or unisexual (and plants then dioecious or rarely monoecious), *often with 2 bracts closely associated with calyx*. *Sepals 5, distinct or slightly connate, imbricate* (i.e., quincuncial). *Petals usually 5, distinct or ± connate*, imbricate (i.e., quincuncial), often fleshy. *Stamens numerous*, rarely only 5, the ones nearest the gynoecium developing first, distinct to connate, sometimes adnate to the corolla basally; filaments flattened or terete; *anther connective often elongated*; pollen grains tricolporate (*and smaller than in Theaceae*). *Carpels usually 3-5, connate; ovary usually superior*, with usually axile placentation, occasionally apical; stigmas usually 3-5, sometimes single and lobed. *Ovules 1 to numerous*, with a thin-walled megasporangium (except perhaps in *Pentaphylax*). *Nectaries absent*, or nectariferous disk present (around base of, or atop, ovary). *Fruit a ± fleshy, irregularly opening capsule, berry, drupe*, or rarely a loculicidal capsule (with carpel midrib separating from rest of each valve); seeds 1 to numerous, **with testa multilayered**, *often colorful and fleshy* (a sarcotesta); **embryo large, usually U-shaped**, occasionally only slightly curved; endosperm present.

***Floral formula***: \* K 5 , C 5 , A many , G 3-5 ; irregular capsule, berry, drupe

[Put dashed line around 5 sepals; put dashed line around 5 petals; replace word “many” with infinity symbol, and put a dashed line around it; circle the 3-5 carpels, and put a line below the circle, indicating a superior ovary.]

***Distribution and ecology***: Pantropical, with a temperate extension in Eastern Asia; especially characteristic of moist montane habitats.

**Genera/species**: 12/350. ***Major genera***: *Ternstroemia* (100 spp.), *Eurya* (100), *Adinandra* (80), and *Freziera* (63). *Ternstroemia* is sparingly naturalized in the continental United States (southeastern states).

***Economic plants and products***: A few species of *Ternstroemia*, *Eurya*, and *Cleyera* are used as ornamentals. *Anneslea* provides useful timber (for furniture, carving). Several species of *Ternstroemia* are used medicinally (pain relief, reduction of inflammation, to treat dysentery, promote sleep, etc.)

***Discussion***: The monophyly of the family is supported by phylogenetic analyses of DNA-sequence data (see Anderberg et al. 2002; Schönenberger et al. 2005; Rose et al. 2018; Tsou et al. 2016), although there is some question as to whether or not to include *Ficalhoa* and *Sladenia*. Here we follow APG IV (2016) and exclude these, treating them in the closely related Sladeniaceae. *Pentaphylax euryoides* (tribe Pentaphylaceae; leaves entire, flowers with stamens 5, anthers opening by valves, filaments flattened, and an unusual loculicidal capsule, and retaining ancestral characters – sclerids absent, anthers without prolonged connective) is likely sister to the remaining genera (sclereids in leaves, stamens numerous, anthers with elongate connectives, ± fleshy fruits, and retaining ancestral characters – leaves with theoid teeth, anthers opening by slits, filaments ± terete), which comprise two subclades. The first is the tribe Ternstromieae (leaves pseudoverticillate, sepals opposite the petals, seeds with fleshy seed coat: *Ternstroemia* and *Anneslea*) and the second is the Freziereae (fruits indehiscent, drupes or berries: *Adinandra, Eurya, Freziera, Cleyera*, and relatives) (Tsou et al. 2016; Stevens 2001 onward; Weitzman et al. 2004). Generic delimitation in Freziereae is very unclear. Genera of Pentaphylacaceae were traditionally included within the Theaceae, although the two familial clades are never sister taxa in molecular phylogenies (Morton et al. 1997; Prince and Parks 2001; Rose et al. 2018; Schönenberger et al. 2005; Soltis et al. 2000, 2011; Yu et al. 2017). They can be distinguished by pollen size, wood anatomy (see description) and embryo shape, i.e., straight in Theaceae and usually U-shaped in Pentaphylacaceae. The fruits are usually somewhat fleshy in Pentaphylacaceae (± fleshy, irregularly dehiscent capsules, berries, drupes) while Theaceae has dry, loculicidal capsules. Their morphological convergence can be seen in a comparison of their descriptions, and they even formed a clade (except for *Pentaphylax*) in the morphology-based phylogenetic analysis of Luna and Ochoterena (2004), in which the Ternstroemieae + Freziereae clade was nested within a paraphyletic Theaceae s.s.

The flowers likely attract generalist pollinators, especially bees. The colorful and fleshy seeds of *Ternstroemia* dangle from the irregularly ruptured fruits and are taken by birds; birds also are the major dispersers of the berries or drupes of the genera of Freziereae (although bats disperse fruits of some species of *Adinandra*). *Visnea* is unusual in having nutlet fruits that are surrounded by a fleshy calyx – these are dispersed by birds.

*Add these references to chapter*:

Rose, J. P., T. J. Kleist, S. D. Löfstrand, B. T. Drew, J. Schönenberger, and K. J. Sytsma. 2018. Phylogeny, historical biogeography, and diversification of angiosperm order Ericales suggest ancient Neotropical and East Asian connections. *Mol. Phylog. Evol*. 122: 59-79.

Tsou, C.-H., L. Li, and K. Vijayan. 2016. The infra-familial relationships of Pentaphylaceae s.l. as revealed by DNA sequence analysis. *Biochem. Genet*. 54: 270-282.

Weitzman, A. L., S. Dressler, and P. F. Stevens. 2004. Ternstroemiaceae. In *The families and genera of vascular plants,* Vol. 6. K. Kubitzki (ed.). 450-460. Springer-Verlag, Berlin.

*Oxalidales: Add this family immediately following Oxalidaceae:*

**Cunoniaceae** R. Brown

(Butterspoon-tree Family)

*Usually trees or shrubs*, sometimes with sclereids; often accumulating aluminum. Hairs usually simple, eglandular or occasionally glandular, sometimes stellate, rarely irritating (*Davidsonia*). **Leaves usually opposite and decussate** or whorled, rarely alternate and spiral (*Davidsonia*), *pinnately compound*, or less commonly palmately compound, trifoliolate, or unifoliolate, *usually serrate to dentate, the teeth often glandular*, rarely entire, the leaflets with pinnate venation, sometimes with domatia; **stipules usually present, usually interpetiolar**, with rare reversals to ancestral condition: merely a stipular pair associated with each petiole-base, *often with colleters*. Inflorescences determinate or indeterminate, with distal flowers maturing first or flowers maturing ± simultaneously, terminal or axillary, rarely reduced to a solitary flower. *Flowers bisexual* or occasionally unisexual, and plants then ± dioecious, *radial*. *Sepals* *usually 4-5*, distinct to slightly connate, imbricate or valvate. *Petals usually 4-5, distinct*, usually open, sometimes absent. *Stamens usually 8-10*, sometimes numerous; *filaments distinct, elongated*, usually longer than the petals, **incurved in bud**; anthers with or without an apically protruding connective; pollengrains dicolporate, dicolpate, or tricolporate. *Carpels usually 2, but occasionally to 5, connate* to occasionally ± distinct; ovary superior to inferior, with ± axile placentation (when carpels connate) or parietal/lateral (if carpels distinct); *styles as many as carpels*, *usually diverging*; stigmas punctate to capitate or rarely decurrent. Ovules 2 to numerous in each locule. Nectar disk or lobate ring usually present. *Fruit usually a capsule or follicles,* rarely a drupe, utricle, or samara; seeds winged or not, frequently hairy; **endosperm starchy**.

***Floral formula***: \* K 4-5 , C 4-5 , A 8-10 , G 2-5 ; capsule, follicle

[Put dashed line around 2-5 carpels]

***Distribution and ecology***: Mainly in the southern hemisphere, growing in the Neotropics, southern Africa and Madagascar, and tropical Asia to Malesia, New Caledonia, and Australia. Fossils are known from Antarctica. These plants are especially characteristic of moist montane and wet temperate forests.

***Genera/species***: 27/335. ***Major genera***: *Weinmannia* (90), *Pterophylla* (70), *Pancheria* (30), *Cunonia* (25), and *Spiraeanthemum* (20). No species of Cunoniaceae are native within the continental United States, although a few species, especially *Cunonia capensis*, are cultivated.

***Economic plants and products***: Many species of *Weinmannia* and several smaller genera provide useful timber. Species of *Ceratopetalum*, *Cunonia* (especially *C. capensis*, Butterspoon-tree), and *Eucryphia* are grown as ornamentals. *Eucryphia*, *Platylobus*, and *Weinmannia* are used as nectar sources in honey production. Finally, the drupe fruits of *Davidsonia* *pruriens* (Davidson’s plum) are edible.

***Discussion***: The monophyly of Cunoniaceae is supported by morphology (see description, and also Bradford and Barnes 2001; Bradford et al. 2004; Hufford and Dickison 1992; Stevens 2001 onward) and DNA-sequences (Bradford & Barnes 2001; Hopkins et al. 2013; Sweeney et al. 2004; Pillon et al. 2021). *Spiraeanthemum* (incl. *Acsmithia*; separate carpels, the ancestral condition) is sister to the remaining genera (Bradford & Barnes 2001; Pillon et al. 2009, 2021; ± fused carpels, with a reversal to follicle-like fruits in *Pancheria*), and *Aistopetalum*, *Bauera*, *Davidsonia*, and *Hooglandia*, likely also represent early diverging lineages. Cunonieae are the most species rich tribe, comprising *Vesseloweskya*, which is sister to the *Pancheria* + *Cunonia* + *Weinmannia* + *Pterophylla* clade (Bradford 2002; Pillon et al. 2021). This tribe can be diagnosed by fruits with a single carpel column, a reversal to tricolporate pollen, and details of stomata subsidiary cell development.

*Brunellia* (57 spp., sole genus of Brunelliaceae) is frequent in the moist montane forests of the Neotropics; it is similar to Cunoniaceae, as is seen, for example, in its having opposite, odd pinnately compound, stipulate leaves, with serrate leaflets and flowers with separate carpels, maturing into follicles. *Brunellia* was traditionally included within Cunoniaceae, and a placement within that family was even supported in the morphology-based analysis of Hufford and Dickison (1992). However, molecular phylogenetic analyses indicate that the two families are not sister taxa (APG 2016; Bradford and Barnes 2001; Heibel and Renner 2012; Savolainen et al. 2000a, b; Soltis et al. 2011; Sun et al. 2016; Wang et al. 2009; Pillon et al. 2021). *Brunellia* can be distinguished from the related Cunoniaceae by it’s the dense, brownish hairs that cover its leaves and stems, lateral placement of the rather small stipules, lack of petals (except in *B*. *ephemeropetala*; Orozco et al. 2017), 2-8 distinct carpels that mature into follicles in which the endocarp separates from the outer portion of the fruit wall, and shiny seeds with an aril-like raphe.

The showy inflorescences of many species attract generalized insect pollinators (e.g., bees, beetles, flies, butterflies). A few species (e.g., of *Geissois*, *Cunonia*) may be bird pollinated. Seeds of capsular fruited species are generally wind dispersed, and the seeds may be hairy or winged. *Gillbeea* has samaras, and the fruits of *Pullea* and *Ceratopetalum* have expanded calyces, and these three likely are also wind dispersed. Species with drupes probably are animal dispersed (birds, bats, other mammals).

*Add these references to those at the end of the chapter:*

Bradford, J. C. 2002. Molecular phylogenetics and morphological evolution in Cunonieae (Cunoniaceae). *Ann. Missouri Bot. Gard*. 89: 491-503.

Bradford, J. C. and R. W. Barnes. 2001. Phylogenetics and classification of Cunoniaceae (Oxalidales) using chloroplast DNA sequences and morphology. *Syst. Bot*. 26: 354-385.

Bradford. J. C., H. C. F. Hopkins, and R. W. Barnes. 2004. Cunoniaceae. In *The families and genera of vascular plants,* Vol. 6. K. Kubitzki (ed.). 91-111. Springer-Verlag, Berlin.

Hopkins, H. C. F., A. C. Rozefelds, and Y. Pillon. 2013. *Karrabina* gen. nov. (Cunoniaceae), for the Australian species previously placed in *Geissois*, and a synopsis of genera in the Geissoieae. *Austr. Syst*. *Bot*. 26: 167-185.

Hufford, L. and W. C. Dickison. 1992. A phylogenetic analysis of Cunoniaceae. *Syst. Bot*. 17: 181-200.

Orozco, C. I., A. Pérez, K. Romoleroux, and J. M. Aldana. 2017. The discovery of a new species of *Brunellia* (Brunelliaceae) with ephemeral petals from Llanganates National Park, Ecuador. *Phytotaxa* 311: 263-269.

Pillon, Y., H. C. F. Hopkins, J. Munzinger, and M. W. Chase. 2009. A molecular and morphological survey of generic limits of *Acsmithia* and *Spiraeanthemum* (Cunoniaceae). *Syst. Bot*. 34: 141-148.

Pillon, Y., H. C. F. Hopkins, O. Maurin, N. Epitawalage, J. Bradford, Z. S. Rogers, W. J. Baker, and F. Forest. 2021. Phylogenomics and biogeography of Cunoniaceae (Oxalidales) with complete generic sampling and taxonomic realignments. *Amer. J. Bot*. 108: 1181-1200.

Sweeney, P. W., J. C. Bradford, and P. P. Lowry II. 2004. Phylogenetic position of the New Caledonian endemic genus *Hooglandia* (Cunoniaceae) as determined by maximum parsimony analysis of chloroplast DNA. *Ann. Missouri Bot. Gard*. 91: 266-274.

Because Oxalidales now has two families covered in detail in the text, an introduction to the order needs to be included, see below:

**Oxalidales**

The monophyly of Oxalidales is indicated only by molecular data (Chase et al. 1993; Price and Palmer 1993; Savolainen et al. 2000a, b; Soltis et al. 2000, 2011; Sun et al. 2016; Wang et al. 2009; Pillon et al. 2021). The order is morphologically rather heterogeneous (Matthews and Endress 2002), but an extrastaminal nectary may be synapomorphic for all except Huaceae (Stevens 2001 onward). Cunoniaceae, Elaeocarpaceae, Brunelliaceae, and Cephalotaceae form a clade, again without definitive morphological synapomorphies, although they do share a valvate calyx. Cephalotaceae are very unusual Australian insectivorous herbs with a rosette of pitcherlike leaves. Brunelliaceae and Cunoniaceae are trees or shrubs with stipulate, usually opposite, odd-pinnately compound leaves. Elaeocarpaceae are trees or shrubs with stipulate, alternate or opposite, simple leaves, and flowers with both the calyx and corolla valvate, and the petals often fringed.

Oxalidales contain seven families and 1850 species. Important families include Brunelliaceae, Cephalotaceae, **Cunoniaceae**, Elaeocarpaceae, and **Oxalidaceae**.

*Add this reference:*

Matthews, M. L. and P. K. Endress. 2002. Comparative floral structure and systematics in Oxalidales (Oxalidaceae, Connaraceae, Brunelliaceae, Cephalotaceae, Cunoniaceae, Elaeocarpaceae, Tremandraceae). *Bot. J. Linn. Soc*. 140: 321-381.

*Additionally, a key is needed to the major families of Oxalidales:*

**Key to the Major Families of Oxalidales**

1. Carnivorous, heterophyllous herbs, some leaves flat and photosynthetic and others pitcher-shaped, hooded, with a winged body and ribbed mouth. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Cephalotaceae

1. Plants not carnivorous, with leaves various but never pitcher-shaped. . . . . . . . . . . . . . . . . . . . . . . . . . . 2

2. Leaves simple; flowers with petals usually toothed, lobed, or fringed; staminal filaments shorter than anthers; anthers opening by apical pores or short-slits. . . . . . . . . . . . . . . . . . . . . . . . . . . . . Elaeocarpaceae

2. Leaves usually compound (but occasionally simple); flowers with petals ± entire (or petals absent); staminal filaments much longer than anthers; anthers opening by longitudinal slits. . . . . . . . . . . . . . . . . . 3

3. Leaves alternate and spiral; stipules usually absent; plants with high levels of soluble oxalates. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **Oxalidaceae**

3. Leaves opposite and decussate (or whorled); stipules present; plants without high levels of soluble oxalates. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 4

4. Stipules interpetiolar, conspicuous; petals usually present; carpels usually ± connate; fruit usually a capsule, or if follicles then without separating endocarp; seeds without aril-like structures but often winged or hairy. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **Cunoniaceae**

4, Stipules lateral, on stem at each side of petiole base, small; petals usually absent; carpels distinct; fruit follicles with endocarp separating from fruit wall; seeds with colorful, aril-like structures. . .Brunelliaceae

*Ericales: Add this family after the Theaceae in the textbook:*

**Symplocaceae** Desf.

(Sweetleaf Family)

*Trees or shrubs*; usually high in tannins, **usually accumulating aluminum**; the leaves often with both large and small stomates, sometimes turning yellow upon drying. Hairs simple, eglandular, unicellular but *often septate*. *Leaves alternate, spiral or 2-ranked, simple, usually glandular-toothed* (i.e., teeth theoid; rarely ± entire), *with pinnate venation, often sweet-tasting* (due to dihydrochalcone glycosides)*; stipules lacking*. Inflorescences determinate, usually axillary, occasionally reduced to solitary flower. *Flowers bisexual* (rarely unisexual, then plants dioecious), *radial*, usually with 2 bractlets just below the calyx. *Sepals usually 5, connate basally*, valvate or imbricate. *Petals usually 5, slightly to moderately connate, imbricate*. *Stamens usually numerous*, *± connate into 5 bundles, these alternating with the corolla lobes, or monadelphous, and adnate only to the base of corolla tube to conspicuously adnate to corolla*; filaments terete or flattened; **anthers ± globose**; pollen grains tricolpate. *Carpels 2-5, connate; ovary inferior* to rarely half-inferior, with axile placentation below, but becoming parietal above; style single, hollow, often with subterminal, oil-secreting regions; stigma capitate to lobed. Ovules 2-4 per locule, with one integument and a thin-walled megasporangium. Nectariferous disk or lobes atop ovary. **Fruit a drupe**, *the pit 1-5 loculed*, **with as many pores as carpels**, an apical depression present or absent, *and the surface smooth, grooved or ribbed*; embryo straight or curved.

***Floral formula***: \* K 5 , C 5 , A many , G 2-5 ; drupe

[Circle the 5 sepals, circle the 5 petals, replace “many” with infinity symbol, and circle the 2-5 carpels and place a line atop the 2-5 indicating that ovary is inferior]

***Distribution and ecology***: Temperate to tropical Americas and eastern and southern Asia, extending southward to eastern Australia. Most species occur in moist montane forests; the familial clade originated in the Northern Hemisphere (Fritsch et al. 2015).

***Genera/species***: 2/320. ***Major genus***: *Symplocos* (318 spp.). One species, *Symplocos tinctoria,* is native in the United States; another species, *S. paniculata*, is sparingly naturalized.

***Economic plants and products***: A few species of *Symplocos* (sweetleaf) are used as ornamentals, especially *S. paniculata* (sapphire-berry); they also are used as dye-plants and as a mordant (in batik industry). The inner bark of *S. odoratissima* is used to treat thrush (*Candida albicans*), and several other species have a variety of recorded medicinal uses.

***Discussion***: The monophyly of Symplocaceae is supported by both morphological and DNA-sequence characters (Fritsch et al. 2006, 2008, 2018; Wang et al. 2004). *Cordyloblaste* (2 spp.; pedicels not articulate, corolla lobes papillate adaxially, pollen perforate, ovary partly inferior, pit without an apical depression), a small eastern Asian genus, is sister to the widespread *Symplocos* (318 spp.; pedicel articulated, corolla lobes smooth, pollen not perforate, ovary completely inferior, pit with an apical depression). *Symplocos paniculata* (the only species of subg. *Palura*; leaves deciduous, gynoecium 2-carpellate) of eastern Asia is sister to the remaining species (i.e., subg. *Symplocos*; leaves evergreen, except in *S. tinctoria*, which is semideciduous, and gynoecium 2-5-carpellate). Those species of subg. *Symplocos* that have flattened staminal filaments that are fused into a tube (i.e., monadelphous) are members of sect. *Symplocos*, while those with terete filaments that are gathered into five bundles (i.e., are not monadelphous) are members of sect. *Hopea* (typically if the pit is 1-loculed and the nectar disk is glabrous; includes *S. tinctoria*) or sect. *Lodhra* (typically if the pit is 3-loculed and the nectar disk pubescent). Deciduous leaves have evolved twice in the genus. Symplocaceae are most closely related to Styracaceae and Diapensiaceae.

*Symplocos* is sometimes attacked by the parasitic basidiomycete, *Exobasidium*, and it is of interest that this fungus also occurs on species of Ericaceae and Theaceae, both in Ericales. The infected tissues (stems, leaves, flowers) become swollen and distorted. Symplocaceae are often confused with the related Styracaceae (see key). They differ in their simple (vs. stellate to peltate) hairs, stamens numerous (vs. usually only twice the number of corolla lobes, globose (vs. elongate-elliptic or oblong) anthers, and non-elaborated anther-connective (vs. well-developed, thickened anther-connective).

The showy, white, pink, purple or yellow flowers attract a wide variety of generalist pollinators (bees, flies, beetles) with both pollen and nectar functioning as rewards. The drupes vary in fleshiness, shape (globose to elongated), size, and color (black, blue, purple) and are probably mainly dispersed by birds.

***Additional References***: Fritsch and Almeda 2015; Kelly et al. 2016; Nooteboom 2004; Wood and Channell 1960.

*Add these references at the end of chapter:*

Fritsch, P. W., B. Cruz, F. Almeda, Y.-G. Wang, and S.-H. Shi. 2006. Phylogeny of *Symplocos* based on DNa sequences of the chloroplast *trnC-trnD* intergenic region. *Syst. Bot*. 31: 181-192.

Fritsch, P. W., L. M. Kelly, Y.-G. Wang, F. Almeda, and R. Kriebel. 2008. Revised infrafamilial classification of Symplocaceae based on phylogenetic data from DNA sequences and morphology. *Taxon* 57: 823-852.

Fritsch, P. W. and F. Almeda. 2015. A taxonomic revision of Antillean *Symplocos* (Symplocaceae). *Phytotaxa* 194: 1-67.

Fritsch, P. W., S. R. Manchester, R. D. Stone, B. Cruz, and F. Almeda. 2015. Northern Hemisphere origins of the amphi-Pacific tropical plant family Symplocaceae. *J. Biogeogr*. 42: 891-901.

Kellly, L. M., F. Almeda, and P. W. Fritsch. 2016. A taxonomic revision of Mexican and Central American *Symplocos* (Symplocaceae). *Phytotaxa* 264: 1-115.

Nooteboom, H. P. 2004. Symplocaceae. In *The families and genera of vascular plants*, Vol. 6. K. Kubitski (ed.). 443-449. Springer-Verlag, Berlin.

Wang, Y.-G., P. W. Fritsch, S. Shi, F. Almeda, B. C. Cruz, and L. M. Kelly. 2004. Phylogeny and infrageneric classification of *Symplocos* (Symplocaceae) inferred from DNA sequence data. *Amer. J. Bot*. 91: 1901-1914.

*Ericales: Include this family immediately after Symplocaceae***:**

**Styracaceae** de Candolle & Sprengel

(Silverbell or Storax Family)

*Trees or shrubs*, sometimes resinous compounds in bark and wood, silica grains sometimes present in wood. **Hairs stellate or peltate scales**. *Leaves alternate*, spiral, simple, *toothed* (with each tooth with an apical, gland-like structure, i.e., theoid) *to entire*, *with pinnate venation*; *stipules lacking*. Inflorescences determinate, axillary or terminal, sometimes reduced to a solitary flower. *Flowers usually bisexual*, occasionally carpellate (then plants gynodioecious), *radial, ± pendulous*. *Sepals usually 4-5, connate*, valvate, or open in bud, sometimes very reduced. *Petals usually 4-5, connate*, *imbricate to induplicate-valvate*. *Stamens 8-10* (rarely ± numerous), free to connate into a tube, *and ± adnate to corolla*; filaments ± flattened; *anthers elongate-elliptic to oblong,* **the connective well developed, running the length of the anther and of ± equal width throughout**; pollen grains tricolporate. *Carpels 2-5, connate;* ovary inferior to nearly superior, with ± axile placentation (and usually multilocular below but only 1-loculed above); style single, hollow; stigma truncate, capitate, to minutely lobed. Ovules few to many per carpel, with 1 or 2 integuments and a thin-walled megasporangium. *Fruit a 1-seeded capsule, or nut-like, a samara or samara-like, or a drupe,* and fruits sometimes with a thick, ribbed endocarp; **seeds with the testa with vascular bundles**; embryo straight to slightly curved.

***Floral formula***: \* K 4-5 , C 4-5 , A 8-10 , G 2-5 ; capsule, nut, samara, drupe

[Circle the 4-5 sepals and petals, put a dashed line around the 8-10 stamens, draw a line below formula between the stamens and the petals (to indicate adnation of petals and stamens), and circle the 2-5 carpels, and draw a line both above and below the 2-5 carpels]

***Distribution***: North and South America, southern Europe, western Asia, eastern and southeastern Asia south to Malesia and New Guinea.

***Genera/species***: 12/160. ***Major genus***: *Styrax* (130 spp.). *Styrax* and *Halesia* occur in the continental United States.

***Economic plants and products***: Several species of *Styrax* are used as fragrant resin sources (benzoin or storax; used in perfume, as a flavoring, or medicinally). *Styrax* (storax), *Halesia* (silverbells, snowdrop-trees), *Pterostyrax* (fragrant epaulette-tree), *Rehderodendron*, and *Sinojackia* (jack-tree) are occasionally cultivated because of their showy, white, pendulous flowers.

***Discussion***: The monophyly of Styracaceae is supported by morphology (see description; Fritsch et al. 2001; Stevens 2001 onward) and DNA sequences (Fritsch 2004; Fritsch et al. 2001; Rose et al. 2018; Yan et al. 2018, 2021). *Styrax* and *Huodendron* may represent a clade sister to the rest of the family (Fritsch et al. 2001) or they may represent two sequential basal branches (Yan et al. 2018, 2021). The *Alniphyllum* + *Bruinsmia* clade likely diverged next, and all four of these genera lack bud scales. The remaining genera (*Halesia, Melliodendron, Parastyrax, Perkinsiodendron, Pterostyrax, Rehderodendron*, and *Sinojackia*) form a well-supported clade characterized by bud-scales, and within this clade *Parastyrax* is sister to the rest, while *Halesia* may not be monophyletic (Yan et al. 2021). Within *Styrax* two subclades are evident: the temperate and deciduous sect. *Styrax*, and the tropical and evergreen sect. *Valvatae* (Fritsch 1999, 2009).

The showy flowers of Styracaceae are mainly pollinated by various bees, although other insects have been observed visiting the flowers. The winged fruits of *Halesia* and *Perkinsiodendron* may be wind or water dispersed. The purple drupes of some *Styrax* likely are dispersed by birds, while the seeds of capsular-fruited *Styrax* species may be dispersed by rain-wash. The capsules of *Alniphyllum* and *Huodendron* release winged seeds and are wind dispersed.

***Additional references***: Wood and Channell 1960; Zhao et al. 2019.

*Add these references to the end of Chapter 8:*

Fritsch, P. W. 1999. Phylogeny of *Styrax* based on morphological characters, with implications for biogeography and infrageneric classification. *Syst. Bot*. 24: 356-378.

Fritsch, P. W. 2009. Styracaceae. In *Flora of North America*. Vol. 8. Flora of North America Editorial Committee. 339-347. Oxford University Press, New York, Oxford.

Fritsch, P. W. 2004. Styracaceae. In *The families and genera of vascular plants,* Vol. 6. K. Kubitzki (ed.). 434-442. Springer-Verlag, Berlin.

Fritsch, P. W., C. M. Morton, T. Chen, and C. Meldrum. 2001. Phylogeny and biogeography of the Styracaceae. *Int. J. Plant Sci*. 162: S95-S116.

Fritsch, P. W., X.-H. Yao, W. B. Simison, B. C. Cruz, and T. Chen. 2016. *Perkinsiodendron*, a new genus in the Styracaceae based on morphology and DNA sequences. *J. Bot. Res. Inst. Texas* 10: 109-117.

Yan, M., P. W. Fritsch, M. J. Moore, T. Feng, A. Meng, J. Wang, T. Deng, C. Zhao, X. Yao, H. Sun, and H. Wang. 2018. Plastid phylogenomics resolves infrafamilial relationships of the Styracaceae and sheds light on the backbone relationships of the Ericales. *Mol. Phylog. Evol*. 121: 198-211.

Yan, M.-H., C.-Y. Li, P. W. Fritsch, J. Cai, and H.-C. Wang. 2021. Phylogeny of the Styracaceae revisited based on whole plastome sequences, including novel plastome data from *Parastyrax*. *Syst. Bot*. 46: 162-174.

Zhao, W.-Y., P. W. Fritsch, V. T. Do, Q. Fan, Q.-Y. Yin, D. S. Penneys, U. Swenson, and W.-B. Liao. 2019. *Rehderodendron truongsonense* (Styracaceae), a new species from Vietnam. *J. Bot. Res. Inst. Texas* 13: 157-171.

*Saxifragales: Include this family immediately following Crassulaceae:*

**Haloragaceae** R. Brown

(Water-milfoil Family)

*Aquatic, wetland*, or terrestrial *herbs*, or occasionally terrestrial shrubs to small trees; *stem cortex often with air-cavities*; plants cyanogenic, usually with tannins; *primary root system soon replaced by adventitious roots arising from lower portion of stems in wetland and aquatic species*. Hairs simple, nonglandular in most, sometimes also with unusual, flask-shaped trichomes. Leaves opposite and decussate, whorled, or alternate and spiral, *simple to deeply dissected*, serrate to occasionally entire, with venation ± pinnate, *often heterophyllous*; stipules lacking. Inflorescences determinate (but sometimes appearing indeterminate), axillary or terminal, sometimes reduced to a solitary flower in the leaf axil. Flowers bisexual or unisexual (and plants then monoecious or occasionally dioecious), *radial*, *usually* *small*. *Sepals 2-4*, *distinct*, **valvate**, but absent in most carpellate flowers of *Myriophyllum*. Petals 0-4, distinct, imbricate, often hooded, ± clawed, *often rudimentary or absent in carpellate flowers of Myriophyllum*. Stamens 3-8; *anthers often much longer than the filaments*; **pollen grains usually 4-6-colpate** or -porate, sometimes with numerous apertures. *Carpels 2-4, connate*; **ovary inferior**, with **apical**-**axile placentation**; styles as many as the carpels; stigmas capitate, elongate, often papillose-hairy. **Ovule 1 per locule (i.e., carpel)**. *Nectary* *absent*. Fruit a samara, nutlet, small indehiscent pod (nut-like), or 4-parted schizocarp; **endosperm starchy**.

***Floral formula***: \* K 2-4 , C 0-4 , A 3-8 , G 2-4 ; nutlet, indehiscent pod, schizocarp

[Circle the 2-4 carpels, put a line above indicating inferior ovary.]

***Distribution and ecology***: Nearly cosmopolitan and especially diverse in Australia; *Laurembergia*, *Meionectes*, *Myriophyllum* and *Proserpinaca* are plants of wetland and aquatic habitats.

***Genera/species***: 9/150. ***Major genera***: *Myriophyllum* (68 spp.), *Gonocarpus* (40), and *Haloragis* (28). *Myriophyllum* and *Proserpinaca* occur natively in the continental United States and/or Canada, while a single species of *Haloragis* is naturalized.

***Economic plants and products***: A few species of *Myriophyllum* (water-milfoil) are used as aquarium plants. *Haloragis* (seaberry) is occasionally cultivated. Some introduced species of *Myriophyllum* are invasive, causing ecological damage to lakes.

***Discussion***: The monophyly of Haloragaceae is supported by morphology (see description; also Stevens et al. 2001 onward; Carlsward et al. 2011; Kubitzki 2007) and DNA-nucleotide sequences (Chen et al. 2014; Moody and Les 2007). The *Glischrocaryon* + *Haloragodendron* clade (flowers showy, fruits winged or ribbed) is sister to the remaining genera, which form a clade with the flowers ± inconspicuous, fruits variously ornamented but usually not winged (incl. *Laurembergia*, *Meionectes*, *Gonocarpus, Haloragis, Myriophyllum*, *Proserpinaca,* and *Trihaloragis*). Species identification in *Myriophyllum* can be very difficult, especially based on vegetative morphological characters (which are phenotypically plastic, based on entironmental conditions); however, floral structures and fruits allow clear identification (Scribailo and Alix 2021).

Flowers of most Haloragaceae are wind pollinated, but the showy flowers of *Glischrocaryon* and *Haloragodendron* are likely pollinated by insects. The schizocarps of *Myriophyllum* and nut-like fruits of *Proserpinaca* are dispersed by water, fish, or waterfowl; both are widespread. The samaras of the Australian *Glischrocaryon* and *Haloragodendron* are wind dispersed. Dispersal also occurs in some *Myriophyllum* through easily detached, overwintering, axillary buds (turions) and vegetative fragmentation.

***Additional reference***: Moody and Les 2010.

*Add these references to the literature cited at the end of Chapter 8:*

Chen, L.-Y., S.-Y. Zhao, K. S. Mao, D. H. Les, Q.-F. Wang, and M. L. Moody. 2014. Historical biogeography of Haloragaceae: An out-of-Australia hypothesis with multiple intercontinental dispersal. *Mol. Phylog. Evol*. 78: 87-95.

Kubitzki, K. 2007. Haloragaceae. In *The families and genera of vascular plants*, Vol. 9. K. Kubitzki (ed.). 184-190. Springer-Verlag, Berlin.

Moody, M. L. and D. H. Les. 2007. Phylogenetic systematics and character evolution in the angiosperm family Haloragaceae. *Amer. J. Bot*. 94: 2005-2025.

Moody, M. L. and D. H. Les. 2010. Systematics of the aquatic angiosperm genus *Myriophyllum* (Haloragaceae). *Syst. Bot*. 35: 121-139.

Scribailo, R. W. and M. S. Alix. 2021. Haloragaceae. *In Flora of North America*, Vol. 10. Flora of North America Editorial Committee. 12-31. Oxford University Press, New York, Oxford.

*Gentianales: Place this family immediately following Rubiaceae:*

**Loganiaceae** Martius

(Pinkroot or Strychnine-tree Family)

Herbs, shrubs, trees, or lianas, occasionally with thorns; internal phloem present, and often also with included phloem; often with indole alkaloids and/or iridoids, Hairs simple. *Leaves usually opposite and decussate, simple, entire*, with pinnate or palmate venation (and if the latter, then 1 or 2 pairs of secondary veins converging toward leaf apex), occasionally modified into hooked tendrils; *stipules usually present, interpetiolar, usually connate, often forming a sheath or line across node*, rarely leaf-like, *with colleters on adaxial surface, or along nodal line, or on adaxial surface of petiole*. Inflorescences determinate, terminal or axillary. *Flowers usually bisexual and radial*. Sepals 4 or 5, connate or distinct, imbricate, valvate, or open in bud, sometimes with colleters on adaxial surface. *Petals 4 or 5, connate*, usually forming a wheel-shaped, bell-shaped to funnel-shaped corolla, *often with hairs on inner surface of corolla mouth*, the lobes valvate, imbricate, or contorted. *Stamens usually 4 or 5; filaments adnate to corolla* and positioned within corolla tube or at its mouth; anthers 2-locular, opening by longitudinal slits; pollen grains usually tricolporate. *Carpels usually 2, connate* *or secondarily apically distinct; ovary superior to partly inferior*, with axile placentation, but sometimes distally parietal; stigmas various. Ovules 1 to numerous in each locule, with 1 integument and a thin-walled megasporangium. Nectary absent or glandular regions on gynoecium. Fruit a variously dehiscent capsule (sometimes follicle-like), berry, or drupe. Seeds occasionally winged, **the exotestal cells papillose or hairy**; embryo usually straight.

***Floral formula***: \* K 4-5 , C 4-5 , A 4-5 , G 2 ; capsule, berry, drupe

[Put a dashed line around 4-5 sepals; put a circle around the 4-5 petals; draw a line below formula connecting 4-5 stamens to the 4-5 petals; circle the 2 carpels]

***Distribution***: Pantropical but with extensions into temperate North America, northeastern Asia, and Tasmania and New Zealand.

***Genera/species***: 16/460. ***Major genera***: *Strychnos* (200 spp.), *Spigelia* (70), *Mitrasacme* (55), *Geniostoma* (55), and *Logania* (23). *Spigelia* and *Mitreola* occur in the continental United States.

***Economic plants and products***: Several genera are used medicinally, and some, e.g., *Strychnos* (strychnine-tree) and *Spigelia* (pinkroot, worm-grass), are quite poisonous (strychnine, curare, spiganthine). *Spigelia* is occasionally grown as an ornamental herb because of its often showy flowers.

***Discussion***: The monophyly of Loganiaceae is supported by phylogenetic analyses based on DNA nucleotide sequences (Backlund et al. 2000; Oxelman and Bremer 2000; Popovkin et al. 2011; Setubal et al. 2021; Yang et al. 2016; Antonelli et al. 2021), but unfortunately morphological synapomorphies are not readily apparent (Bremer and Struwe 1992; Struwe et al. 2018). The rather small tribe Antonieae (with ± winged seeds) is sister to the Loganieae + Strychneae clade (seeds unwinged), with two major subclades: the Strychneae or *Strychnos* group (e.g., *Neubergia*, *Strychnos*, and possibly *Spigelia*; valvate corolla) and the Loganieae or *Logania* group (e.g., *Geniostoma*, *Logania*, *Mitreola*, and *Mitrasacme*; ring of hairs on corolla tube, gynoecium partly apocarpous) (Backlund et al. 2000; Struwe et al. 1994, 2018; Yang et al. 2016). The phylogenetic position of the distinctive genus *Spigelia* (fruit a bilobed capsule that is septicidally, loculicidally and circumscissily dehiscent) is of uncertain position; it is placed with statistical support in Strychneae by Backlund et al. (2000) and Yang et al. (2016) on the basis of mitochondrial and chloroplast data, but is placed in Loganieae (but without support) by Oxelman and Bremer (2000) and Popovkin et al. (2011) on the basis of nuclear data. The investigation of Gibbons et al. (2012), based upon nuclear ribosomal and chloroplast sequence data, supported a placement of *Spigelia* with Strychneae, and the genus is placed in Strychneae here.

Loganiaceae are often confused with Rubiaceae, but can be distinguished by their flowers with a superior or at least partly superior ovary.

The showy flowers are pollinated by birds and various insects. *Spigelia* is distinctive in showing secondary pollen presentation; the pollen grains are deposited onto the pubescent section of the jointed style, immediately beneath the short stigmatic lobes. The seeds of capsular fruited species are dispersed by wind or rain-wash, except for *Geniostoma*, which has its seeds embedded in a colorful, fleshy placenta and dispersed by birds. The small to large, soft to hard-rinded berries of *Strychnos* are dispersed by birds and mammals.

***Additional references***: Rogers 1986; Struwe and Albert 1997.

*Add these references to literature cited at the end of Chapter 8:*

Gibbons, K. L., B. J. Conn, and M. J. Henwood. 2012. Phylogenetic relationships in Loganieae (Loganiaceae) inferred from nuclear ribosomal and chloroplast DNA sequence data. *Austr. Syst. Bot*. 25: 331-340.

Oxelman, B. and B. Bremer. 2000. Discovery of paralogous nuclear gene sequences coding for the second-largest subunit of RNA polymerase II (RPB2) and their phylogenetic utility in Gentianales of the asterids. *Mol. Biol. Evol*. 17: 1131-1145.

Popovkin, A. V., K. G. Mathews, J. C. Mendes Santos, M. Carmen Molina, and L. Struwe. 2011. *Spigelia* *genuflexa* (Loganiaceae), a new geocarpic species from the Atlantic forest of northeastern Bahia, Brazil. *PhytoKeys* 6: 47-65.

Setubal, R. B., C. L. Frasier, J. Molina, B. M. Torke, R. C. Forzza, and L. Struwe. 2021. A toxic story: Phylogeny and classification of *Strychnos* L. (Loganiaceae). *Syst. Bot*. 46: 639-655.

Rogers, G. K. 1986. The genera of Loganiaceae in the southeastern United States. *J. Arnold Arbor*. 67: 143-185.

Struwe, L. and V. A. Albert. 1997. Floristics, cladistics, and classification: three case studies in Gentianales. In *Plant diversity in Malesia III*. J. Dransfield, M. J. E. Coode, and D. A. Simpson (eds.). 321-352. Royal botanic Gardens, Kew.

Struwe, L., K. L. Gibbons, B. J. Conn, and T. J. Motley. 2018. Loganiaceae. *In The families and genera of vascular plants*, Vol. 15. J. W. Kadereit and V. Bittrich (eds.). 511-526. Springer-Verlag, Berlin.

Yang, L.-L., H.-L. Li, L. Wei, T. Yang, D.-Y. Kuang, M.-H. Li, Y.-Y. Liao, Z.-D. Chen, H. Wu, and S.-Z. Zhang. 2016. A supermatrix approach provides a comprehensive genus-level phylogeny for Gentianales*. J. Syst. Evol*. 54: 400-415.

[Some not listed here because already cited in textbook.]

*Buxales: Insert right before heading for core eudicots, so Buxaceae will be the last family covered in the group* **Proteales and other eudicots**:

**Buxaceae** Dumortier

(Boxwood or Box Family)

Trees, shrubs, or herbs; sometimes with sclereids and/or cortical vascular bundles; **steroidal alkaloids present**. Hairs simple. *Leaves opposite and decussate* or alternate and spiral, simple, entire to occasionally serrate, *with ± venation pinnate; stipules absent*. Inflorescences determinate or indeterminate, axillary or terminal. **Flowers unisexual** (**and plants monoecious** or rarely dioecious), *radial*, *small*, *and associated with bracts not much differentiated from the perianth*. *Perianth of usually 4-6, bract-like tepals*, **each with a single vascular trace**, but occasionally absent or more numerous, *distinct, imbricate*. *Stamens usually 4-6*, occasionally more numerous; filaments distinct and free, but adnate to perianth in *Haptanthus*, ± absent to enlarged and showy; pollen grains 3-7 colporate to polyporate. **Carpels** **usually** 2-**3**, rarely 4, and only 1 in *Didymeles*, *connate*; *ovary superior*, with apical-axile placentation (but parietal in *Haptanthus*); *styles as many as carpels and divergent*, *usually persistent*; *stigma decurrent on the inner side of each style*. Ovules usually 2 per locule (the single ovule protruding into the stylar canal in *Didymeles*), but occasionally the locules secondarily divided and appearing uniovulate. Nectary from pistillode, between styles, or absent. *Fruit an explosive, loculicidal capsule*, a septicidal capsule, or ± drupaceous. Seeds often shiny black, brown, or blue, often with an aril.

***Floral formula***:

Staminate: \*T -4-6- , A 4-6 , G 0

Carpellate: \* T -4-6- , A 0 , G 2-3 , capsule, drupe

[Put a circle around the 2-3 carpels]

***Distribution***: Temperate to tropical, widespread.

***Genera/species***: 6/120. ***Major genera***: *Buxus* (95 spp., incl. *Notobuxus*) and *Sarcococca* (13). *Pachysandra* and *Buxus* occur in the continental United States and/or Canada.

***Economic plants and products***: *Buxus* (boxwood or box) produces a useful and decorative, fine-grained wood; a few species of *Buxus* are also used as ornamentals (hedges, topiary). *Pachysandra* (pachysandra) is used as a ground cover.

***Discussion***: The monophyly of Buxaceae, the only family of Buxales, is supported by morphology (see description; Köhler 2007; Stevens 2001 onward; Von Balthazar and Endress 2002a, b) and DNA sequences (Barniske et al. 2012; Hilu et al. 2003; Hoot et al. 1999; Jiao and Li 2009; Shipunov and Shipunova 2011; Soltis et al. 2000, 2011; Von Balthazar et al. 2000; Worberg et al. 2007). *Didymeles*, a distinctive genus from Madagascar (chambered pith, peltate hairs, dioecious, with extrorse anthers, flowers with a single carpel, and seeds lacking endosperm) is sister to the remaining members of the familial clade (pistillode nectary, seed with outer coat lignified, of palisade cells), and it has often been placed in its own family. Within the clade comprising the remaining genera, two subclades are evident: the Stylocerateae (*Sarcocossa*, *Styloceras*, *Pachysandra*; 2 carpels, nectaries usually lacking, attractive staminal filaments, and fleshy fruits; see Von Balthazar and Endress 2002b) and the Buxeae (*Buxus*; nectary between styles, explosive loculicidal capsule). The unusual genus *Haptanthus* (Doust and Stevens 2005; Goldberg and Nelson 1989; Shipunov and Shipunova 2011) may be sister to Buxeae; it has a single perianth member in the staminate flowers to which the two stamens are completely adnate, parietal placentation, and septicidal capsules. The large genus *Buxus* is comprised of three subclades: the Eurasian species are sister to a clade comprised of the American species clade + the African species clade. The family traditionally was associated with the Euphorbiaceae (Cronquist 1981) but secondarily divided styles are lacking, there are two ovules per carpel (instead of one), and the fruits lack a central column.

The flowers of Buxaceae are pollinated either by wind or insects. Short distance dispersal may be ballistic (e.g., *Buxus* species) but the arillate seeds are also dispersed by ants. Species with fleshy fruits are likely bird dispersed.

***Additional reference***: Channel and Wood 1987.

*Add these references to the literature cited at the end of of Chapter 8*:

Berniske, A.-M., T. Borsch, K. Müller, M. Krug, A. Worberg, C. Neinhuis, and D. Quandt. 2012. Phylogenetics of early branching eudicots: Comparing phylogenetic signal across plastid introns, spacers, and genes. *J. Syst. Evol*. 50: 85-108.

Channell, R. B. and C. E. Wood, Jr. 1987. The Buxaceae in the southeastern United States. *J. Arnold Arbor*. 68: 241-257.

Doust, A. N. and P. F. Stevens. 2005. A reinterpretation of the staminate flowers of *Haptanthus*. *Syst*. *Bot*. 30: 773-778.

Goldberg, A. and C. S. Nelson. 1989. *Haptanthus*, a new dicotyledonous genus from Honduras. *Syst*. *Bot*. 14: 16-19.

Jiao, Z.-H., and J.-H. Li. 2009. Phylogenetics and biogeography of eastern Asian – North American disjunct genus *Pachysandra* (Buxaceaeae) inferred from nucleotide sequences*. J. Syst. Evol*. 47: 191-201.

Köhler, E. 2007. Buxaceae. In *The families and genera of vascular plants*, vol. 9. K. Kubitzki (ed.). 40-47. Springer-Verlag, Berlin.

Shipunov, A. and E. Shipunova. 2011. 2011. *Haptanthus* story: Rediscovery of enigmatic flowering plant from Honduras. *Amer. J. Bot.* 98: 761-763.

Von Balthazar, M. and P. K. Endress. 2002a. Development of inflorescences and flowers in Buxaceae and the problem of perianth interpretation. *Int. J. Plant Sci*. 163: 847-876.

Von Balthazar, M. and P. K. Endress. 2002b. Reproductive structures and systematics of Buxaceae. *Bot. J. Linn. Soc.* 140: 193-228.

Von Balthazar, M., P. K. Endress, and Y. L. Qiu. 2000. Phylogenetic relationships in Buxaceae based on nuclear internal transcribed spacers and plastid *ndhF* sequences. *Int. J. Plant Sci*. 161: 785-792.

Worberg, A., D. Quandt, A.-M. Barniske, C. Löhne, K. W. Hilu, and T. Borsch. 2007. Phylogeny of basal eudicots: Insights from non-coding and rapidly evolving DNA. *Organisms Diver. Evol*. 7: 55-77.

*Pandanales: Insert this family immediately following Dioscoreales/Dioscoreaceae:*

**Pandanales**

**Pandanaceae** R. Brown

(Screw-Pine Family)

**Plants woody***, i.e., trees, shrubs, lianas*, occasionally epiphytic, without secondary growth*, unbranched to branched*, *and often with prop or clasping roots arising from leaf axils*; **rhizomes absent**; *vascular bundles of stem in compound bundles*, **these separating and re-associating**. Hairs usually absent. *Leaves alternate* **and usually in 3 spiralled ranks** (but in 4 spiralled ranks in *Sararanga*), simple, elongated *and usually M-shaped* (in cross section), simple, **usually spine-margined,** and also with prickles on midvein, with parallel venation, sheathing at the base; stipules lacking. Inflorescences indeterminate, terminal or axillary, *with enlarged and/or conspicuous bracts*. *Flowers unisexual* (**and plants dioecious**), *radial, small, usually sessile and densely clustered* and sometimes individual flowers not distinguishable. *Perianth usually absent*, but a cupule in *Sararanga*. Stamens 1 to numerous; filaments distinct to connate; pollen grains uniporate. Carpels 1 to many, distinct to connate; ovary superior, with axile placentation, but parietal in *Freycinetia*; *style absent*; stigmas various. **Ovules 1 per locule/carpel**, but numerous in in *Freycinetia*. Nectary absent. *Fruit a berry or fibrous drupe*, the latter with 1 to several seeds, *and usually densely clustered, forming multiple-fruits.*

***Floral formula***:

Staminate: \* T 0 , A 1-numerous, G 0 or 1-numerous**.**

[Put a dashed line around the 1-many stamens, and replace “numerous” with infinity symbol; the superscript dot indicates pistillodel]

Carpellate: \* T 0 , A 0 or 1-numerous. , G 1-numerous , berry, drupe

[Put a dashed line around the 1-many carpels; replace “numerous” with the infinity symbol; the superscript dot indicates staminodia]

***Distribution***: Tropical Africa and Asia, to Australia.

***Genera/species***: 5/900. ***Major genera***: *Pandanus* (650 spp.), *Freycinetia* (180), and *Benstonea* (60). The family does not occur natively in North America.

***Economic plants and products***: Several species of *Pandanus* (screw-pines) and *Freycinetia* provide useful fibers (used in ropes), and their leaves provide thatch, or are used in baskets and mats. Some are also grown as ornamentals because of their distinctive habit and showy infloresences and/or fruit-clusters. The fruits of a few species (e.g., *Pandanus conoideus*, *P. tectorius*) are edible, and the leaves of *Pandanus* *amaryllifolius* (pandan wangi) are used as a spice, contain 2-acetyl-1-pyrroline, and are used to flavor breads and to enhance the aroma of basmati and jasmine rice.

***Discussion***: Pandanaceae are placed in the Pandanales, a morphologically heterogeneous order, the monophyly of which is well supported by DNA-sequence data (Chase et al. 1993, 1995, 2000, 2006; Davis et al. 2004; Mennes et al. 2013; Savolainen et al. 2000a, b; Soltis et al. 2000, 2011), within which it is sister to Cyclanthaceae (a relationship also supported by morphology; Cox 1990; Cox et al. 1995; Rudall and Bateman 2006; Stevens 2001 onward; Stevenson and Loconte 1995). Pandanaceae and Cyclanthaceae share the putative derived characters of inflorescences with conspicuous bracts and small, densely packed, sessile flowers; they, along with Triuridaceae, also have imperfect flowers. The monophyly of Pandanaceae is well supported both by morphology (Cox 1990; Cox et al. 1995; Stone et al. 1998) and molecular data (Buerki et al. 2012, 2016; Callmander et al. 2003, 2012, 2013; Gallaher et al. 2015). *Sararanga* (diagnostic features: pistillate inflorescence a panicle, leaves 4-ranked, and flowers with a cupular perianth) is sister to the remaining genera (pistillate inflorescence a head or raceme, or cluster of such structures, leaves 3-ranked, flowers lacking a perianth, but 6 tepal primordia in *Freycinetia*). Within this clade, *Freycinetia* (liana, ovary with ± numerousovules, fruit a berry) is sister to the *Martillidendron* + *Benstonea* + *Pandanus* clade (trees or shrubs, a single ovule per carpel, fruit a fibrous drupe), among which generic distinctions are based on endocarp structure, number and form of the stigmas, number of stamens, and pollen morphology (Buerki et al. 2012; Callmander et al. 2012).

Flowers of *Freycinetia* are pollinated by birds and bats, those of *Sararanga* by various insects, while those of *Pandanus* and relatives by both wind and insects. Many species appear to be asexual (agamospermic), producing fruits without pollination and fertilization, and staminate plants are not known (or are rare) is some species. Dispersal of the fleshy fruits (berries in *Freycinetia* and *Sararanga*, drupes in *Pandanus*, *Benstonea*, and *Martillidendron*) is by water, various vertebrates, or crabs.

***Additional references***: Nadaf and Zanan 2012; Stone 1983.

*Add these references at the end of Chapter 8:*

Buerki, S., M. W. Callmander, D. S. Devey, L. Chappell, T. Gallaher, J. Munzinger, T. Haevermans, and F. Forest. 2012. Straightening out the screw-pines: A first step in understanding phylogenetic relationships within Pandanaceae. *Taxon* 61: 1010-1020.

Buerki, S., T. Gallaher, T. Booth, G. Brewer, F. Forest, T. Pereira, and M. W. Callmander. 2016. Biogeography and evolution of the screw-pine genus *Benstonea* Call,. & Buerki (Pandanaceae). *Candollea* 71: 217-229.

Callmander, M. W., P. Chassot, P. Küpfer, and P. P. Lowry II. 2003. Recognition of *Martellidendron*, a new genus of Pandanaceae, and its biogeographic implications. *Taxon* 52: 747-762.

Callmander, M. W., P. P. Lowry II, F. Forest, D. S. Devey, H. Beentje, and S. Buerki. 2012. *Benstonea* Callm. & Buerki (Pandanaceae): Characterization, circumscription, and distribution of a new genus of screw-pines, with a synopsis of accepted species. *Candollea* 67: 323-345.

Callmander, M. W., T. J. Booth, H. Beentje, and S. Buerki. 2013. Update on the systematics of *Benstonea* (Pandanaceae): When a visionary taxonomists forsees phylogenetic relationships. *Phytotaxa* 112: 57-60.

Cox, P. A. 1990. Pollination and the evolution of breeding systems in Pandanaceae*. Ann. Missouri Bot. Gard.* 77: 816-840.

Cox, P. A., K.-L. Huynh, and B. C. Stone. 1995. Evolution and systematics of Pandanaceae. In *Monocotyledons: Systematics and evolution*. P. J. Rudall, P. J. Cribb, and D. F. Cutler (eds.). 663-684. Royal Bot. Gardens, Kew.

Gallaher, T., M. W. Callmander, S. Buerki, and S. C. Keeley. 2015. A long distance dispersal hypothesis for the Pandanaceae and the origins of the *Pandanus tectorius* complex. *Mol. Phylog. Evol*. 83: 20-32.

Mennes, C. B., E. F. Smets, S. N. Moses, and V. S. F. T. Merckx. 2013. New insights in the long-debated evolutionary history of Triuridaceae (Pandanales). *Mol. Phylog. Evol*. 69: 994-1004.

Nadaf. A. and R. Zanan. 2012. *Indian Pandanaceae – an overview*. Springer India, Heidelberg.

Rudall, P. J. and R. M. Bateman. 2006. Morphological phylogenetic analysis of Pandanales: Testing contrasting hypotheses of floral evolution. *Syst. Bot*. 31: 223-238.

Stone, B. C. 1983. A guide to collecting Pandanaceae (*Pandanus*, *Freycinetia*, and *Sararanga*). *Ann*. *Missouri Bot. Gard*. 70: 137-145.

Stone, B. C., K.-L. Huynh, and H.-H. Poppendieck. 1998. Pandanaceae. In *The families and genera of vascular plants*, Vol. 3. K. Kubitzki (ed.). 397-404. Springer-Verlag, Berlin.

*Santalales: Insert this family right after Viscaceae:*

**Santalaceae** R. Brown

(Sandalwood Family)

*Root-parasitic trees or shrubs, or epiphytic (= stem) parasites*, lacking cystoliths, ± green, with chlorophyll, often with polyacetylenes, acetylenic, ximenynic, and exocarpic acids. *Roots modified to form haustoria*. Hairs simple. Leaves opposite and decussate or alternate and spiral, simple, entire, pinnately or less commonly palmately veined, with the blade expanded or reduced and scale-like; stipules lacking. Inflorescences indeterminate or determinate, axillary or terminal, sometimes reduced to a solitary flower. *Flowers bisexual or unisexual* (and plants then monoecious, dioecious), radial, sometimes sessile, *± small*. *Calyx usually absent*. *Petals* *3-6, distinct or connate*, *valvate*, greenish to colorful, with or without hair-tufts associated with stamens. *Stamens 3-6, opposite the petals*, distinct; filaments free or adnate to petals; anthers usually opening by slits; pollen grains nearly spherical to triangular-ellipsoidal, with 3 apertures. Carpels 3-4, connate; *ovary half-inferior to inferior*, with ± basal placentation; stigma punctate to capitate. Ovules 1-4 or not differentiated. Nectar disk present or absent. *Fruit a non-viscous or viscous drupe or single-seeded berry,* sometimes associated with fleshy pedicel; seed lacking a testa; the embryo with 2 cotyledons; endosperm green or non-green.

***Floral formula***: \* K 0 , C 3-6 . A 3-6 , G 3-4 , drupe, berry

[Draw a dashed line connecting 3-6 stamens to 3-6 petals; circle the 3-6 petals with a dashed line; circle the 3-4 carpels]

***Distribution***: Mostly pantropical with a few temperate extensions.

***Genera/species***: 11/65. ***Major genera***: *Exocarpos* (26 spp.) and *Santalum* (16). *Nestronia* (native) and *Santalum* (introduced: southern Florida) occur in the continental United States.

***Economic plants and products***: The wood of *Santalum* (sandalwood) and *Osyris* is valuable, used to produce incense, and contains fragrant sesquiterpenols used in the perfume industry.

***Discussion***: The monophyly of Santalaceae is supported by molecular data (Der and Nickrent 2008; Nickrent et al. 2010, 2019; Su et al. 2015). Unfortunately, the family shows no obvious morphological synapomorphies, and the stem-parasitic members are easily confused with the related Viscaceae. It is best differentiated from this family by its non-brittle and non-jointed stems, sometimes more conspicuous flowers, stamens with filaments, and seeds with the embryo usually with two cotyledons. Additionally many are root parasites, and these would not be confused with Viscaceae. *Exocarpus* and *Omphacomeria* are sister to the remaining genera. Following Nickrent et al. (2010) we recognize the family in a narrow sense, excluding families such as Cervantesiaceae (incl. *Pyrularia*), Thesiaceae (e.g., *Buckleya, Thesium*), and Comandraceae (e.g., *Comandra, Geocaulon*), which were traditionally included within a more broadly circumscribed Santalaceae (see Kuijt 1982; Kuijt and Hansen 2015), now known to be non-monophyletic.

The flowers are pollinated by various insects, and the fleshy, often colorful fruits are bird dispersed.

***Additional reference***: Harbaugh and Baldwin 2007.

*Add these references to the literature cited at end of Chapter 8:*

Harbaugh, D. T. and B. G. Baldwin. 2007. Phylogeny and biogeography of sandalwoods (*Santalum*, Santalaceae): Repeated dispersals through the Pacific. *Amer. J. Bot*. 94: 1028-1040.

Kuijt, J. and B. Hansen. 2015. Santalaceae. In *The families and genera of vascular plants*, Vol. 12. K. Kubitzki (ed.). 143-165. Springer-Verlag, Berlin.

Nickrent, D. L., F. Anderson, and J. Kuijt. 2019. Inflorescence evolution in Santalales: Integrating morphological characters and molecular phylogenetics. *Amer. J. Bot*. 106: 402-414.

*Laurales: Insert the following family treatment immediately following the Lauraceae:*

**Monimiaceae** de Jussieu

(Boldo Family)

*Trees, shrubs or lianas; nodes unilacunar*; **wood with broad rays**; *tissues with scattered spherical cells containing ethereal oils (aromatic terpenoids)*; with tannins, and benzyl-isoquinoline and/or aporphine alkaloids. Hairs simple or occasionally stellate or fasciculate. *Leaves opposite and decussate,* simple*, usually toothed, with usually pinnate venation, blade with pellucid dots*; *stipules lacking*. Inflorescences determinate, axillary or terminal. *Flowers usually unisexual* (and plants monoecious or dioecious), radial, *with a markedly concave receptacle* and with or without a floral roof, small to moderate-sized, pale green to white. *Tepals 4 to numerous*, in a spiral or in whorls, sometimes very tiny or absent, occasionally differentiated with the outer ones sepaloid and the inner petaloid, distinct, imbricate. **Stamens ± numerous** to 4, and usually associated with staminodes; filaments sometimes absent, *with or without paired appendages*; **anther dehiscing by longitudinal slits**, the connective sometimes projecting; pollen grains without apertures, exine reduced to tiny spines. *Carpels 2 to numerous, distinct*, sometimes stalked; *ovary superior to partly inferior* (i.e., sunken into the receptacle), *with apical placentation*; style short or absent; stigma various. *Ovule 1*. *Fruit a cluster of small drupes or berries*, *often enclosed in a persistent, cup-shape, dry to fleshy receptacle that often opens by a cap or variously splits, thus exposing the actual fruits*, which often contrast in color with the receptacle, rarely with a fleshy style; embryo small to medium-sized.

***Floral formula***:

Staminate: \* T-4-numerous- , A 4-numerous , G 0

Carpellate: \* -4-numerous- , A 0 , G 2-numerous ; drupes, berries

[Replace word “numerous” with infinity symbol]

***Distribution***: Southern Mexico south through South America, Africa, southern Asia to Australia, Tasmania, and New Zealand.

***Genera/species***: 22/250. ***Major genera***: *Mollinedia* (90 spp.), *Kibara* (45), and *Tambourissa* (45). No genera of Monimiaceae are native in the United States or Canada.

***Economic plants and products***: *Peumus boldus* (boldo) is the source of a medicinal tea and is used as an ornamental plant. A few species of *Hedycaria* are also used as ornamentals.

***Discussion***: The monophyly of Monimiaceae is well supported by DNA-sequences (Massoni et al. 2014; Renner 1998, 1999; Renner and Chanderbali 2000; Renner et al. 1997, 2010). It is harder to characterize morphologically (see morphological analysis; Renner et al. 1997) and traditionally has included the Siparunaceae (Siparuna family) and Atherospermatacee (Southern-sassafras family) (Cronquist 1981; Philipson 1993). Within Monimiaceae, the *Peumus* + *Palmeria* + *Monimia* clade (i.e., Monimioideae) is sister to the remainder of the family. A putative synapomorphy of Monimioideae is their massive endocarp with many cell layers of large, isodiametric sclereids (see Romanov et al. 2007); the “remainder” of the family (Hortonioideae and Mollinedioideae) have only a one- to few-layered endocarp. The Hortonioideae (only *Hortonia*) have retained bisexual flowers, while those of Monimioideae and Mollinedioideae (e.g., *Hedycarya*, *Tambourissa*, *Kibara*, *Macropeplus*, *Mollinedia*, *Steganthera*) are unisexual: plants dioecious in the former and monoecious in the latter. Monimioideae and Hortonioideae have retained stamens with paired appendages, but these appendages have been lost in Mollinedioideae.

Atherospermataceae and Siparunaceae, like Monimiaceae (and unlike Lauraceae), have opposite leaves and flowers with several to many distinct carpels. Siparunaceae have flowers with a floral roof (as the urceolate receptacle is almost closed over the top of each flower), a structure of variable occurrence in Monimiaceae. Atherospermataceae, however, lack a floral roof. Atherospermataceae (7 genera; 20 spp.: e.g., *Atherosperma, Daphnandra, Doryphora, Laurelia, Laureliopsis*) also are easily distinguished by their fruits, which are plumose achenes, and their stamens, which open by flaps, and have paired glands. Siparunaceae (2 genera; 75 spp.: *Glossocalyx*, *Siparuna*; mainly of South America) can be distinguished by their ovules with only a single integument, stems and leaves usually with stellate hairs, anthers opening by flaps, and the cluster of drupes surrounded by a persistent receptacle, which splits open irregularly to reveal the drupes as well as the often persistent, fleshy styles. Indeed, their fruits can be quite confusing as the floral receptacle looks like a fruit, the drupes look like fleshy seeds, and the styles look like arils. Siparunaceae also have lost the paired staminal glands, but many Monimiaceae lack these as well. Atherospermataceae now are restricted to southern South America and the Australian region, but it was once much more widespread; within this family the *Doryphora* + *Daphnandra* clade is sister to the remaining taxa (Renner et al. 2000). Traditionally, Atherospermataceae and Siparunaceae were included in within an expanded Monimiaceae (Cronquist 1981; Thorne 1974), but the resulting family is not monophyletic.

The flowers of Monimiaceae are pollinated by various insects, including thrips, flies, and beetles; a few may be wind pollinated. Dispersal of the fleshy fruits is probably by birds.

***Additional references***: Gottsberger 2016; Smith and Smith 1943; Staedler and Endress 2009.

*Insert the following in the references cited at the end of Chapter 8:*

Gottsberger, G. 2016. Generalist and specialist pollination in basal angiosperms (ANITA grade, basal monocots, magnoliids, Chloranthaceae and Ceratophyllaceae): what we know now. *Plant Div. Evol*. 131/4: 263-362.

Massoni, J. F. Forest, and H. Sauguet. 2014. Increased sampling of both genes and taxa improves resolution of phylogenetic relationships within Magnoliidae, a large and early-diverging clade of angiosperms. *Mol. Phylog. Evol*. 70: 84-93.

Philipson, W. R. 1993. Monimiaceae. In *The families and genera of vascular plants*, Vol. 2. K. Kubitzki (ed.). 426-437. Springer-Verlag, Berlin.

Renner, S. S. 1998. Phylogenetic affinities of Monimiaceae based on cpDNA gene and spacer sequences. *Perspectives in Plant Ecol. Evol. Poll.* 1: 61-77.

Renner, S. S. and A. Chanderbali. 2000. What is the relationship among Hernandiaceae, Lauraceae, and Monimiaceae, and why is this question so difficult to answer? *Int. J. Plant Sci*. 161: S109-S119.

Renner, S. S., A. E. Schwarzbach, and L. Lohmann. 1997. Phylogenetic position and floral function of *Siparuna* (Siparunaceae: Lamiales). *Int. J. Plant Sci*. 158: 589-598.

Renner, S. S., D. B. Foreman, and D. Murray. 2000. Timing transantarctic disjunctions in the Atherospermataceae (Laurales): Evidence from coding and noncoding chloroplast sequences. *Syst. Biol*. 49: 579-591.

Renner, S. S., J. S. Strijk, D. Strasberg, and C. Thébaud. 2010. Biogeography of the Monimiaceae (Laurales): A role for East Gondwana and long-distance dispersal, but not West Gondwana. *J. Biogeogr*. 37: 1227-1238.

Romanov, M. S., P. K. Endress, A.V. F. Ch. Bobrov, A. P. Melikian and A. P. Bejerano. 2007. Fruit structure and systematics of Monimiaceae s.s. (Laurales). *Bot. J. Linn. Soc*. 153: 265-285.

Staedler, Y. M. and P. K. Endress. 2009. Diversity and lability of floral phyllotaxis in the pleuricarpellate families of core Laurales (Gomortegaceae, Atherospermataceae, Siparunaceae, Monimiaceae). *Int. J.* *Plant Sci*. 170: 522-550.

Note: Because the text now covers two families of Laurales, the discussion under Lauraceae that relates to the order, its monophyly and relationships among its families will be moved to an ordinal introduction paragraph. See below. A key, see below, also will be included:

**Laurales**

Laurales are clearly supported as monophyletic by several morphological synapomorphies, i.e., their unilacunar nodes, sieve tube plastids with polygonal protein crystalloids and starch, opposite leaves, cup-shaped receptacle that is persistent in fruit, inner staminodes, pollen with sculptured apertures, and details of seed anatomy; a few of these features have been lost in many species. Monophyly of the order is also supported in phylogenetic analyses based on both DNA sequences and morphology (Doyle and Endress 2000; Hilu et al. 2003; Li et al. 2019; Massoni et al. 2014; Morton 2011; Qiu et al. 1993, 2000, 2005; Renner 1999; Savolainen et al. 2000a; Soltis et al. 2000, 2011, 2018). Calycanthaceae are likely sister to all other Laurales (Doyle and Endress 2000; Renner and Chanderbali 2000; and also references cited above). The other families are united by the additional apomorphies of inaperturate pollen grains with a thin exine and spinules, stamens with paired appendages (derived from staminodes), anthers opening by flaps, a single ovule per carpel, and toothed leaves (Donoghue and Doyle 1989; Doyle and Endress 2000; Renner 1999; Stevens 2001 onward). Within this distinctive clade, Siparunaceae, Gomortegaceae and Atherospermataceae form a clade that is sister to the Lauraceae + Hernandiaceae + Monimiaceae clade. Lauraceae may be sister to Hernandiaceae (Doyle and Endress 2000) although molecular studies do not support this phylogenetic pattern. The Lauraceae + Hernandiaceae + Monimiaceae clade have carpels each with an apical, pendulous ovule, while Siparunaceae and Atherospermataceae have a basal and erect ovule in each carpel. The order consists of 7 families and 3000 species; major families are Atheerospermataceae, Calycanthaceae, **Lauraceae**, **Monimiaceae**, Siparunaceae, and Hernandiaceae.

***References***: Christenhusz et al. 2017; Cronquist 1981, 1988; Takhtajan 1969, 1997; Thorne 1974, 1982; Wood 1958.

**Key to Major Families of Laurales**:

1. Stems with cortical vascular bundles, these inverted, so with xylem on outside; flowers large, ± 3 mm across; stamens opening by longitudinal slits, without paired appendages; pollen disulcate. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .Calycanthaceae

1. Stems lacking cortical vascular bundles; flowers smaller; stamens opening by flaps or longitudinal slits, with or without paired appendages; pollen usually inaperturate (but di- or meridionally syncolpate in Atherospermataceae). . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2

2. Flowers with a single carpel; leaves usually alternate; seeds lacking endosperm. . . . . . . . . . . . . . . . . . 3

2. Flowers with 2 to many carpels; leaves opposite; seeds with endosperm. . . . . . . . . . . . . . . . . . . . . . . . 4

3. Ovary superior; fruit fleshy, a drupe or 1-seeded berry. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **Lauraceae**

3. Ovary inferior; fruit dry, a samara or nut. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Hernandiaceae

4. Fruits plumose achenes. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Atherospermataceae

4. Fruits drupes or berries. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5

5. Ovules with 1 integument; stamens opening by flaps, without paired glands. . . . . . . . . . . . Siparunaceae

5. Ovules with 2 integuments; stamens opening by longitudinal slits, with or without paired glands. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **Monimiaceae**

Note: Additional plant families (ca. 100) will be treated on the “Photo Gallery” website.