Updates Required to *Plant Systematics: A Phylogenetic Approach*, Third Edition, as a Result of Recent Publications
(Updated June 13, 2014)

As necessitated by recent publications, updates to the Third Edition of our textbook will be provided in this document. It is hoped that this list will facilitate the efficient incorporation new systematic information into systematic courses in which our textbook is used. Plant systematics is a dynamic field, and new information on phylogenetic relationships is 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 points. The eventual fourth edition will, of course, contain many organizational changes not treated below.

Page iv: *Merania hernandii* → *Merania hernandoi*

**Chapter 1.**


**Chapter 2.**

Page 37, column 1, line 5: Stuessy 1983, 1990;… → Stuessy 1983, 2009; …

And in Literature Cited, replace “Stuessy 1990” with:


**Chapter 4.**


Page 65, Box 4A, third column, last line: Walters & Keil 1995.) → Walters et al. 2006.)

Page 74, column 2, line 9: …or inflorescences) → …or inflorescences; Dickinson 1978)

Page 83, column 2, line 14: … occur in vascular plants. → … occur in vascular plants (Prabhakar 2004).

Page 91, column 1, line 21-25: …in the same species. Diploid (2n = 14) *Tolmica menziesii* (Saxifragaceae), which grows in northern California and southern Oregon, and tetraploid (2n = 28) *T. menziesii*, which grows from central Oregon to southern Alaska, are morphologically very similar. In the spring beauty… → in the same species. For example, *Callirhoe papaver* (Malvaceae) is composed of morphologically similar tetraploid (2n = 56) and octoploid (2n = 112) plants (Bates et al. 1998). In the spring beauty…to about 191. However, some autopolyploids likely represent cryptic species. *Tolmica diplomenziesii* (Saxifragaceae) is diploid (2n = 14) and grows in northern California and southern Oregon, while the morphologically similar *T. menziesii* is tetraploid (2n = 28) and grows from central Oregon to southern Alaska (Judd et al. 2007; Soltis et al. 2007).

Page 91, Table 4.4: add – *Tolmica menziesii*, youth-on-age … Autotetraploid … 28

Page 95, column 2, next to last line under “Secondary Metabolites”: add Hegnauer (1962-1996), and Hegnauer and Hegnauer (2001).

Delete from references (under “Morphology”): Walters & Keil (1995) and replace with the following:

Update under references to morphology, embryology, anatomy, secondary metabolites, replacing “Stuessy 1990” with “Stuessy 2009” [see above].

Add to references at end of chapter (under “Morphology”)


Add to references at end of chapter (under “Inflorescences, fruits, and seeds”)”


Add to references (under “Anatomy”):


Add to references at end of chapter (under “Chromosomes” section):


Add to references at end of chapter (under “Secondary Metabolites” section):


*Chapter 6.*

Page 140, column 1, line 10 in paragraph following “Frequency of polyploidy in plants” add as reference to last sentence in paragraph: (see Soltis et al. 2009).


Page 141, add to Box 6E a statement that allopolyploid speciation in *Tragopogon* recently has been documented in several Old World species, and cite the following:


Page 145, column 1, line 10 from bottom: add de Queiroz 2008 to list of references discussing species concepts.

Add to references at end of chapter:


*Chapter 8.*
Page 190, column 1, line 2 from bottom: recent DNA evidence → recent DNA and morphological evidence

Page 191, column 2: under references add: Schneider et al. 2009


Page 191, Fig. 8.3: Add Rai & Graham (2010) to “Modified from”.

Page 196, Plate 8.1: Osmunda cinnamomea → Osmundastrum cinnamomeum


Page 197, column 2, line 13: and Todea (2). → Todea (2), and Osmundastrum (1).

Page 198, column 1, line 2: Osmunda cinnamomea → Osmundastrum cinnamomeum

Page 198, column 1, line 3: O. regalis → Osmunda regalis

Page 198, column 1, line 11: O. cinnamomea → Osmundastrum cinnamomeum

Page 198, column 1, line 14: in references, insert Metzgar et al. 2008

Page 199, column 2, line 34: Add Korall et al. 2007 to the list of references for Cyatheaceae.


Page 207, column 1, line 10: Beetles (and…from another plant. → Beetles (usually weevils [Curculionoidae], but sometimes sap beetles [Nitidulidae]) and to a lesser extent bees are the major pollen vectors.


Page 208, column 1, add the following to references (for Cycadaceae).


Page 208, column 2, add the following reference to references (for Zamiaceae).


Page 215, column 1, line 19: add Gernandt et al. 2008 to “References” under Pinaceae:


Page 217, column 2, References: Adams 1993 → Adams 1993, 2011 Add the following reference:


Page 219, Figure 8.27: Taxus floridana → Taxus globosa var. floridana
Page 220, column 1, line 41: Add Spjut 2007 to the list of references for Taxaceae.


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**Chapter 9.**

Page 225, line 5: Chaw et al. 1997; → Chaw et al. 1997; Qiu et al. 2007;

Page 225, line 22: both chloroplast and nuclear genes → chloroplast, mitochondrial, and nuclear genes


Page 225, last line: (Chase et al. 1993; → (Burleigh et al. 2009; Chase et al. 1993;


Page 226, column 1, lines 1, 2: Qiu et al. 2005; → Qiu et al. 2005, 2007;


Page 226, column 1, line 7: (Chase et al. 1993; → (Burleigh et al. 2009; Chase et al. 1993; Also add the following references: Soltis et al. 2011, Lee et al. 2011, Moore et al. 2011


Page 226, column 1, lines 4 and 5 from bottom: …from two to several different genes (Graham and Olmstead 2000; Kim et al. 2004; → …from two to numerous different genes (Graham and Olmstead 2000; Kim et al. 2004; Moore et al. 2007, 2010; Graham and Iles 2009;

Page 226, column 2, line 15: After the sentence “Most analyses support the position of Amborellaceae, Nymphaeaceae, and Illiciaceae and their relatives in the ANITA grade, as the three lineages that first diverged from the remaining angiosperm groups.” Place the following: Recently Hydatellaceae, an aquatic group, have been supported as sister to Nymphaeaceae (Rudall et al. 2007; Saarela et al. 2007).

Page 226, column 2, line 21: lineages may have… → lineages have…


Page 226, Figure 9.1, legend. …based on Soltis and Soltis (2004), → …based on Soltis and Soltis (2004), Moore et al. (2007, 2010), Soltis and Soltis (2004), Moore et al. (2011) and Lee et al. 2011

Page 226, Figure 9.1: postgenetial fusion → postgenital fusion

Page 226, Figure 9.1: Change topology of cladogram to indicate that Ceratophyllaceae is sister to Eudicots, and change topology of tree as follows: (Magnoliids (Monocots (Ceratophyllaceae + Eudicots))). As a synapomorphy of the Monocot + Ceratophyllaceae + Eudicots clade indicate “perianth of 2 whorls”

Page 227, column 2, line 8: …insect pollinated, → generalist insect pollinated (see also Thien et al. 2009),

Page 227, Figure 9.2, second branch of the cladogram: Nymphaeaceae → Nymphaeales
[This change is required because Nymphaeales now contain Hydatellaceae.] Add Ceratophyllaceae as the sister group of the Eudicots, and change topology to match the relationships: (Magnoliids (Monocots (Ceratophyllaceae + Eudicots))). [These changes based on the recent paper Moore et al. (2007).]

Page 227, Figure 9.2, legend. Add “Moore et al. (2007)” and “Wang et al. 2009” to list of references cited. [And topology of the rosid clade in the cladogram in this figure needs to be changed as follows – Vitales are sister to the rest of the rosid clade, with the fabids comprising Zygophyllales, Celastrales, Oxalidales, Malpighiales, Fabales, Rosales, Cucurbitales, and Fagales, and the malvids comprising Geraniales, Myrtales, Brassicales, Malvales, and Sapindales.]

Page 227, column 1, line 7: (Doyle and Endress 2000).  ➔ (Doyle and Endress 2000; Endress and Doyle 2009).

Page 227, column 1, line 9: Nymphaeaceae ➔ Nymphaeales

Page 227, column 2, line 6 from bottom: Nymphaeaceae ➔ Nymphaeales

Page 228, column 1, line 7: Nymphaeaceae ➔ Nymphaeales

Page 228, column 1, line 16 & line 21: Nymphaeaceae, and Illiciaceae ➔ Nymphaeales, and Austrobaileyales

Page 228, column 1, line 18: Qiu et al. 2005; ➔ Qiu et al. 2005, 2007; Also add in support of position of ANITA grade the following: Soltis et al. 2011, Lee et al. 2011, Moore et al. 2011

Page 228, column 1, line 22: (see Figures 9.1 and 9.2). ➔ (see Figures 9.1 and 9.2; Endress and Doyle 2009 for other supportive morphological characters).

Page 228, column 2, lines 7-12: reword as follows: …Soltis et al. 2002, 2011; Moore et al. 2007), sister to both together, or sister to the Chloranthaceae (Moore et al. 2011). The Chloranthaceae are another family of problematic placement, although they may be sister to magnoliids. Recent evidence suggests that monocots and eudicots may be sister taxa, with magnoliids basal to them (Moore et al. 2007; Soltis et al. 2011), although phylogenomic analyses based on nuclear sequences support a sister group relationship of eudicots and magnoliids, with monocots sister to them (Lee et al. 2011).

Page 228, Fig. 9.3: add Wang et al. 2009 and Moore et al. 2010, 2011, and Soltis et al. 2011 to references. In Fig. 9.4 also add Soltis et al. 2011 and Wang et al. 2009.

Page 229, column 1, line 2: and Soltis et al. (2005). ➔ and Soltis et al. (2005), as well as the recent study of Wang et al. (2009).

Page 229, column 2, line 7: (Qiu et al. 2005; ➔ (Moore et al. 2007; Qiu et al. 2005;

Page 229, column 2, line 8: The Chloranthaceae are another family of problematic placement. ➔ The Chloranthaceae are another family of problematic placement, although they may be sister to the magnoliids.

Page 229, column 2, line 9: Recent evidence suggests that monocots and eudicots may be sister taxa with magnoliids, Ceratophyllaceae, and Chloranthaceae basal to them. ➔ Recent evidence suggests that monocots and eudicots may be sister taxa with magnoliids and Chloranthaceae diverging earlier (Moore et al. 2007).


Page 230, Table 9.1, left column, line 5: insert under Nymphaeaceae, the additional family of Nymphaeales: Hydatellaceae, and exclude Cabombaceae, which should be listed as a separate family (in bold). Include Illiciaceae as a synonym under Schisandraceae. Pentaphragmataceae ➔ Pentaphylacaceae. Include Parnassiaceae, Lepuropetalaceae, Pottigeriaceae in the Celastraceae. Passifloraceae should be expanded to include Turneraceae and Malesherbiaceae. Juglandaceae (should include Rhoipteleaceae). Melastomataceae (should include Memecylaceae). Brassicaceae sensu lato should be split into Brassicaceae sensu stricto, Capparaceae, and Cleomaceae. Chloranthaceae should be placed in the Chloranthales, and delete “placement uncertain”, and insert “(sister to magnoliid complex)”. Asparagaceae (should include Ruscaceae, Agavaceae, Hyacinthaceae, and Thymelaeaceae). Amaryllidaceae (should include Aliaceae and Agapanthaceae). Xanthorrhoeaceae (should include Asphodelaceae, Hemerocallidaceae). The “Portulacaceae” sensu lato should be split – recognizing the following: Portulacaceae sensu stricto, Montiaceae, Talliaceae, and Anacampserotaceae. [Note: All these changes result from a shift from
APG II to APG III as the classification followed in the next edition of this textbook. See also subfamily changes in Chase et al. 2009]

Page 230, Table 9.1: For an alternative ordering of these families see Haston et al. (2009).

Page 232, column 1, line 3: and 2-ranked → and spiral

Page 232, column 1, line 6: 5-11 → 5-8

Page 232, column 2, line 3: Ovule 1 → Ovule 1; embryo sac 9-nucleate, with 3 synergids.

Page 232, column 1, line 6: 5-11 → 5-8

Page 233, column 1, line 17: (Barkman et al. 2000). → (Barkman et al. 2000; Soltis et al. 2007).

Page 233, column 1, line 21: red drupes. → red drupes (with most of the pit developed from mesocarp).

Page 233, column 1, Additional references: add – Jérémie et al. 2008;

Page 233, column 1, line 1 – description of Nymphaeaceae. This section will be reworked because family will be split into Nymphaeaceae and Cabombaceae within ordinal treatment of Nymphaeales.

Page 233, column 2, Genera/species: 8/70 → 6/70

Page 233, column 2, line 4 in “Discussion”: (Les et al 1999) → (Les et al. 1999; Borsch et al. 2008)


Page 235, column 1, line 6: At end of first paragraph, insert the following new paragraph.

Nymphaeaceae are most closely related to Hydatellaceae, an enigmatic group that is also aquatic (Rudall et al. 2007, 2009; Saarela et al. 2007; Sokoloff et al. 2008). The reproductive structures of Trithuria (incl. Hydatella) are very different from the flowers of Nymphaeaceae – they are reduced, imperfect, and apetalous, clustered at the apex of a scape, and associated with two to several bracts. The plants have a rosette of linear leaves.

Page 235, column 1, add to references: Warner et al. 2008

Page 235, column 2: Illiciaceae → Schisandraceae [family treatment will need to be appropriately revised, since Schisandraceae are combined with Illiciaceae]

Page 235, column 2, line 12 from bottom: …by hardened mesotestal cells. → …by quickly deciduous tepals (Endress 2008) and hardened mesotestal cells.

Page 235, column 2, line 5 from bottom: At end of first paragraph of the “Discussion” section insert the following new paragraph.

Molecular and morphological data (Morris et al. 2007) support the recognition of two sections within Illicium: the Old World species (sect. Illicium) have seeds without a rim around the hilum, while the New World species (sect. Cymbostemon) have seeds with a hilar rim (Morris et al. 2007).

Page 236, column 1, last line: Support of monophyly of Magnoliales – add: Soltis et al. 2011 and Morton 2011

Page 236, column 1, line 1: nodes multilacunar; → nodes multilacunar; pith septate;

Page 237, column 2, line 8 in “Discussion”: …broadly. → …broadly (Figlar and Nooteboom 2004).


Page 240, column 1, line 19: the anthers; → the anthers, with a single vein;

Page 242, column 1, line 5 in description: alternate and spiral → alternate and spiral
Page 242, column 1, line 6 in description: entire → entire

Page 242, lines 2-3 from bottom: all veins clearly visible … lignified tissue, → all veins clearly visible … lignified tissue.

Page 242, column 2, line 10: Carpel 1; → Carpel 1;


Page 243, column 2, line 7 from bottom: Chanderbali 2001, → Chanderbali et al. 2001,

Page 244, column 1, line 10: …tribal distinctions → …tribal distinctions (Rohwer & Rudolph 2005; Rohwer et al. 2009).

Page 244, column 1, line 15: Chanderbali 2001 → Chanderbali et al. 2001


Page 246, column 1, last line: Ovule 1 per gynoecium, orthotropous, with 1 or 2 integuments. → Ovule 1 per gynoecium, orthotropous, with 1 or 2 integuments; embryo sac tetrasporic, 16-celled.


Page 247, column 1, lines 10-14: Within Piperaeaceae, Zippelia … genera are problematic. → Within Piperaeaceae, Verhuellia (Verhuellioideae) is the sister group to the remaining species, followed by Zippelia + Manekia (Zippeliioideae), which are sister to the Piper + Peperomia clade, i.e., Piperoideae (Wanke et al. 2007; Samain et al. 2008).

Page 247, column 1, line 19: on nrDNA ITS sequences → on ITS and chloroplast sequences


Page 247, column 1, line 7 from bottom of “Discussion”: …leaves. → …leaves; and molecular data (Wanke et al. 2006) also support its monophyly.

Page 247, column 2: Description of family needs to be updated to reflect the inclusion of Lactoris: sepals distinct, ovary superior, wind pollinated. Also add in an additional synapomorphy: Prophyll single, adaxial.

Stamens usually 6-12; → stamens usually 6-12;

Ovules numerous. → Ovules ± numerous.

Page 247, column 2, line 7 of “Discussion”: and seed coat anatomy. → and seed coat anatomy (see also Neinhuis et al. 2005).


Page 248, column 1, line 2: (Kelly and González 2003). → (Kelly and González 2003; Neinhuis et al. 2005).

Page 248, column 2, Additional references: add – Ohi-Toma et al. 2006

Page 249, column 1, line 10 in “discussion”: …2006), or → …2006; Burleigh et al. 2009), or

Page 249, column 1, line 10 in “discussion”: Soltis et al. 2000 → Soltis et al. 2000, 2011

Page 249, column 1, line 11 in “discussion”: add: or sister to Chloranthaceae (Moore et al. 2011).
Page 249, column 2, line 18: …primordium. → …primordium, but this is not the case in Acorus and at least some Alismatales, in which the blade also develops from the apical end (Doyle 2007).


Page 251: Description of Araceae, add synapomorphies: Tepals usually → Tepals ± hooded, with a single vascular bundle, usually…

Nectaries lacking. → Nectaries lacking, but locules with secretory hairs.

Testa multiplicative, becoming multi-layered through cell divisions.

Page 252, column 1, line 13 in “Discussion”: (Tam et al. 2004), and morphology… → (Tam et al. 2004), rbcL, trnK-matK, trnL-F sequences (Cabrera et al. 2008), five DNA regions (Cusimano et al. 2011), and morphology…

Page 252, column 1, line 20 in “Discussion”: Stockey et al. 1997; → Stockey et al. 1997, 2007;

Page 252, column 1, line 23 in “Discussion”: Although rbcL → DNA

Page 252, column 1, line 25 in “Discussion”: (see below), it is not close → (see below), and it is not close

Page 252, column 2, line 22: add “Croat 1985” to “Additional references”.

Page 252, description of Alismataceae (add synapomorphies):

usually with a well-developed blade, → usually with a petiole and well-developed blade,

flowers often ± whorled, → flowers often ± whorled,

crumpled → crumpled

commonly 1 per carpel. → commonly 1 per carpel; embryo sac bisporic.

Page 254, column 1, line 5 in “Discussion”: add Chen et al. (2012a) to references listed.

Page 254, column 2, description of Hydrocharitaceae:

subtended by 2 often connate bracts. → …subtended by 2 often connate bracts.

usually lacking apertures. → …usually lacking apertures.

styles often divided, → styles usually divided,

Page 254, column 2, lines 9-10 from bottom: delete “Zannichellia (Zannichelliaceae; see key) probably also belongs here (Less et al. 1997a).”

At this point, add the following:

Stratiotes aloides, a submerged to emergent species with linear, serrate leaves and showy, perfect to imperfect flowers, is probably sister to the remaining taxa, which form two large clades, i.e., the first with Apalanthe, Blyxa, Elodea, Egeria, Lagarosiphon, and Ottelia, and the second with Hydrilla, Hydrocharis, Limnobium, Najas, Vallisneria and relatives, along with the seagrasses Enhalus, Halophila, and Thalassia (Chen et al. 2012b).

Page 256, column 1, description of Potamogetonaceae:

Flowers bisexual, → flowers sessile, bisexual,

Add: Embryo coiled.
Page 256, column 1, last line: (Les et al. 1997a) → (Les et al. 1997a; Lindqvist et al. 2006).

Page 256, column 2, add after line 3: In contrast, *Zannichellia* (Zannichelliaceae; see key) probably belongs here (Les et al. 1997a; Lindqvist et al. 2006) probably belongs here. *Stuckenia* and *Potamogeton* are sister genera, and the species of *Potamogeton* form two major clades, i.e., broad-leaved vs. narrow-leaved species (Lindqvist et al. 2006).

Page 256, column 2, Liliales, line 15: (Soltis et al. 2003a) → (Kim et al. 2013; Pellicer et al. 2010; Soltis et al. 2003a).

Fig 9.14: Also cite Kim et al. 2013

Page 257, column 2, description of Liliaceae:

…saponins often present. → …saponins often present; raphides lost.

Page 258, column 2, description of Colchicaceae:

Add: raphides lost.

Page 259, column 1, lines 18, 19: Colchicum (90 spp.) → Colchicum (130 spp.).

Page 259, column 1, line 19: delete “Androcymbium (40)”


Page 259, column 1, line 14 in “Discussion”: Following the first paragraph of the Discussion, insert the following new paragraph.

Three major clades are evident within core Colchicaceae (Vinnersten and Manning 2007); tribe Anguillarieae (*Bacometra, Wurmbea*) have terminal racemes or spikes of flowers that lack bracts; tribe Iphigenieae (*Camptorrhiza, Iphigenia*) have solitary, axillary flowers lacking nectaries; and tribe Colchieae (remaining genera, e.g., *Colchicum, Gloriosa*) have their flowers solitary and axillary or in leafy racemes, and the flowers have either perigonal or staminal nectaries.

Page 259, column 2, line 3 in “Discussion”: Cameron and Fu 2006). → Cameron and Fu 2006; Chen et al. 2006).


Page 265, column 1, line 6: add Stelle et al. 2012 to list of workers in Asparagales.

Also, in Fig. 9.18, add Stelle et al. 2012 as an authority for the cladogram. Add subfamily names to diagram, within parentheses. Show Alliaceae and Amaryllidaceae as sisters, likewise Xanthorrhoeaceae and Hemerocallidaceae.

Page 266, column 1: Expand circumscription of Asparagaceae to include Ruscaceae, Agavaceae, Hyacinthaceae, Themidaceae, and Laxmanniaceae. Family treatments will have to be extensively modified based on this broader APG III circumscription. Families currently recognized will be renamed as follows: Agavaceae → Agavoideae; Hyacinthaceae → Scilloideae; Themidaceae → Brodiaeoidae; Laxmanniaceae → Lomandroideae; Ruscaceae → Nolinoideae. See Chase et al. (2009).

Page 266, column 2, line 13 in “Discussion”: After first paragraph insert the following new paragraph.

Within Asparagus, the perfect-flowered species form a paraphyletic complex, while the dioecious species constitute a clade, i.e., Asparagus subg. Asparagus (Fukuda et al. 2005).

Page 266, column 2, line 18 in discussion: …accepted here. → accepted here, and supported by genetic data (Nakayama et al. 2012).

Page 268, column 1, line 7 in discussion: Add Kim et al. 2010 to analyses supporting monophyly of Ruscaceae s.l.

Page 268, column 1, line 10 in discussion: Add Kim et al. 2010 as another paper supporting sister group relationship with Asparagaceae.

Page 258, column 1, line 15 in discussion: …and the Dracaenaceae (*Dracaena and Sansevieria*). → …and the Dracaenaceae (*Chrysodracon, Dracaena*, the latter including *Pleomele* and *Sansevieria*; Lu and Morden 2014).
Monophyly of *Dracaena* and *Sansevieria* (Dracaeneae) is supported…

Chrysodracon and *Dracaena* (Dracaeneae) is supported…

Monophyly of *Chrysodracon* and *Dracaena* (Dracaeneae) is supported…

Page 269, column 1, lines 19-20: *Camassia, Hastingsia, … 1999*): a phrase indicating “…and *Chlorophytum* and *Anthericum* (usually placed in Anthericaceae)” are here include.

Page 269, column 1, line 6 in “Discussion”: add *Kim et al. 2010* in support of monophyly of Agavaceae.  Also add in sentence: “…and *Camasia*, *Hastingsia*, … 1999”).: a phrase indicating “…and *Chlorophytum* and *Anthericum* (usually placed in Anthericaceae)” are here include.

Page 269, column 1, line 10 in “Discussion”: *Chase et al. 1995a, 2000; Halpin & Fishbein 2013*;

Page 269, column 1, lines 22, 23: and the Agavoideae (e.g., *Agave, Furcraea, Manfreda, Polianthes*), with an… → and the Agavoideae (e.g., *Agave [incl. Manfreda, Polianthes], Furcraea*), with an…

Page 269, column 1, line 3 from bottom in “Discussion”: several → many

Page 269, column 1, line 6 from bottom: *Hyacinthaceae Batsch* → *Hyacinthaceae Batsch ex Borkhausen*

Page 270, column 1, line 1: *Amaryllidaceae* (formerly Alliaceae s.l.) to include Alliaceae and Agapanthaceae.  [Description and family treatment will have to be updated to reflect this broader APG III circumscription.] Note that: *Alliaceae* → *Allioideae*; *Agapanthaceae* → *Agapanthoideae*.

Page 270, column 1, line 1: only *Ornithogalum* → *Ornithogalum, Dipcadi, Albuca*)

Page 270, column 1, lines 4, 5: *Manning et al. 2004, 2009*;


Page 271, column 2, line 1: *Aloe* (365 spp.), *Haworthia* (50)

Page 271, column 2, line 12: delete *Belamcanda* from list of genera.

Page 273, column 1, line 3: *Iris* (250) → *Iris* (250, incl. *Belamcanda*)

Page 273, column 1, line 12: *Belamcanda* from list of genera.

Page 273, column 1, discussion, lines 11-35: [replace current text with the following]: Several major clades (often recognized as subfamilies) are evident within Iridaceae (Goldblatt 1990; Goldblatt & Manning 2008; Goldblatt et al. 1998, 2008; Rudall 1994; Reeves et al. 2001).  The Isophysidoideae, including only *Isophysis*, are distinguished by a superior ovary and solitary flowers with styles alternating with the stamens, and are sister to the remaining groups.  Iridoideae, diverging next, have flowers that often last only a single day; they can be recognized by the presence of nectaries on the tepals and by their very long, tubular style branches, divided below the level of the anthers, with each branch stigmatic only apically and with paired appendages (stylar crests).  The group also contains the free amino acids meta-carboxyphenylalanine and glycine.  Several subclades are evident within Iridoideae, including Sisyrinchioideae (style branches alternating with stamens vs. opposite them in other members of the subfamily; *Sisyrinchium* and relatives), Irideae (transverse stigmatic lobes positioned below paired petaloid appendages; e.g., *Iris, Dietes, Moraea*), and Tigridieae (bulbous rootstock, base chromosome number 7; e.g., *Nemastylis, Tigridia*).  The remaining clades have a connate perianth and include Geosiridoideae (mycotrophic herbs lacking chlorophyll, with leaves reduced to scales; *Geosiris*), and two clades with longer-lived flowers and the retention of septal nectaries, i.e., Crocoideae and
Nivienioideae. Crocoideae (e.g., *Ixia, Crocosmia, Geissorhiza, Crocus, Romulea, Freesia, Gladiolus*, and *Hesperantha*) are diagnosed by their corms (with roots arising from the base), sessile flowers, operculate pollen with micropunctate exine, and leaves with closed leaf sheaths and a pseudomidrib. Nivienioideae (i.e., *Klattia, Nivenia, Witsenia*) are distinctive because of their woody stems with secondary growth, leaves with fiber strands, simple stigmas, and 2-ovulate carpels.

Page 273, column 2, line 14 from bottom: 788/19,500 \(\rightarrow\) 880/21,950

Page 273, column 2, line 11 from bottom: *Maxillaria* (420) \(\rightarrow\) *Maxillaria* (250) [And place *Maxillaria* in proper position in list based on number of species.]

Page 275, column 1, lines 24, 25: form a clade based on *rbcL* sequence data (Dressler and Chase 1995). \(\rightarrow\) form a clade based on DNA sequence data.

Page 276, column 1, description of Dioscoreaceae:

…usually with an upper and lower pulvinus, \(\rightarrow\) …*usually with an upper and lower pulvinus,*

…and thickened endotesta, \(\rightarrow\) and thickened endotesta with crystals.

Page 276, column 1, Genera/species: Remove *Tacca* from list.

Page 276, column 1, line 5 in discussion: Add Merckx and Smets 2014 to references supporting monophyly.

Page 276, column 2, line 17: Rewrite paragraph, removing *Tacca*. Mention *Tacca*, and state that it is a related family.

Page 276, column 2, line 5 under Commelinoid monocots: Support for monophyly, add: Soltis et al. 2011 and Givnish et al. 2010

Page 276, column 2, line 5 in discussion: Add Baker et al. 2009 to list of references.

Page 279, column 2, line 5: insert the following as first sentence in this paragraph:

Synapomorphies of Coryphoideae include the palmate leaves and loss of nonvascular fiber bundles free in the leaf mesophyll (Horn et al. 2009).

Page 279, column 2, line 9: Sentence starting with “Corypheae include…” replace with the following:

Corypheae was once broadly circumscribed, but is now restricted to *Corypha*, a massive palm that dies after producing its terminal inflorescence, and the other genera, some of problematic placement, are now dispersed into the newly recognized tribes Sabaleae (*Sabal*), Cryosophileae (e.g., *Coccothrinax, Leucothrinax, Thrinax, Zombia*), and Trachycarpeae (*Acoelorrhaphe, Chamaerops, Copernicia, Licuala, Livistonia, Raphidophyllum, Raphis, Serenoa, Trachycarpus, Washingtonia*). Sabal has costapalmate leaves and syncarpus flowers, and is sister to the Cryosophileae, which are have palmate leaves and apocarpus flowers, often with a reduction to a single carpel. Trachycarpeae are quite variable but are usually palmate-leaved (Dransfield et al. 2008; Rudall et al. 2011). Caryoteae …

Page 280, Fig. 9.26: *Roystonea* \(\rightarrow\) *Roystonia*
Page 281, column 1, line 3 in description: …or canals containing raphides. → or **canals containing raphides**.

Page 281, column 2, line 4: *with perianth differentiated into a calyx and corolla*, → *with perianth differentiated into a calyx and corolla*.

Page 281, line 17: Nectaries lacking. → **Nectaries lacking**.


Page 282, column 2, next to last line: 2-ranked, *equitant* → **2-ranked, equitant**

Page 283, column 1, line 18: 13/100 → 14/116

Page 283, column 2, description of Pontederiaceae:

…differentiated into a petiole and blade, → …differentiated into a petiole and blade, **with blade when young encircling the petiole of older leaf**.

Page 283, column 2, line 17 from bottom: 7/35 → 9/35

Page 285, Fig. 9.29: Add “Ovules thin-walled” as a synapomorphy at the same node as “Nectaries lacking”.

Page 285, column 2, line 3: Add Givnish et al. 2010 to support for monophyly of Poales.

Page 287, column 1, description of Bromeliaceae:

*Herbs*, → **Rosette herbs**, …septicidal capsule or berry; → …**septicidal capsule or berry**;

Page 287, column 1, line 5 from bottom: 51/1520 → 57/1520

Page 287, column 2, line 2 in “Discussion”: *rbcL* sequence data → DNA sequence data


Page 287, column 2, line 21 in “Discussion”: …are a paraphyletic assemblage. → …are a paraphyletic assemblage, now divided into several subfamilies, with *Brocchinia* (Brocchinioideae) sister to the rest of the familial clade, followed by *Lindmania* and *Connellia* (Lindmanioideae), and *Pitcairnia* and relatives (Pitcairnioideae) sister to a clade containing *Puya* (Puyoideae) and Bromelioideae.

Page 287, column 2, line 25 in “Discussion”: Add Givnish et al. 2007, 2011 to references supporting monophyly of Tillandsioideae, etc.

Page 290, column 1, description of Typhaceae:

*aquatic or wetland*, → …**aquatic or wetland**,

Nectaries lacking. → **Nectaries lacking**.

Page 290, column 1, line 5 in discussion, replace sentence with the following: Analyses based on DNA sequences also are supportive (Chase et al. 1993; Davis et al. 2004; Duvall et al. 1993; Givnish et al. 2010; Soltis et al. 2011; Sulman et al. 2013).


Page 290, column 2, description of Eriocaulaceae:
...on a long scape; → ...on a long scape, with rings of vascular bundles alternating on inside and outside of sclerenchymatous cylinder;

Sepals ... usually valvate. → Sepals ... usually valvate, with a single vein.


Page 292, column 1, line 8 in “Discussion”: (e.g., Paepalanthus, Leiothrix, Syngonanthus, and Lachnocaulon), → (e.g., Comanthera, Paepalanthus, Leiothrix, and Syngonanthus),

Page 292, column 1, line 9 in “Discussion”: The two subfamilies may be monophyletic (Unwin 2004). → The monophyly of the two subfamilies is supported by molecular data (Andrade et al. 2010; Unwin 2004).

Page 292, column 1, line 10 in “Discussion”: Paepalanthus represents a paraphyletic ... 2000). → Paepalanthus has represented a paraphyletic complex from which other “genera” have evolved, so recently it has been expanded by inclusion of Blastocaulon, Lachnocaulon, and Tonina (Andrade et al. 2010; Giulietti et al. 2000).

Page 292, column 2, description of Xyridaceae:
Nectaries lacking. → Nectaries lacking or nectar produced by styal appendages.

Page 293, column 1, description of Poaceae: note that Preston et al. (2009) on the basis of gene expression data support the hypothesis that the lemma and palea are derived from outer perianth parts (of the immediate grass relatives) not a bract and prophyll as stated in description. (The lodicules would then be interpreted as inner perianth parts.)

Page 294, column 1, line 5: Drábková et al. 2003; → Drábková et al. 2003; Drábková and Vlček 2007;

Page 296, column 2, line 2: ...within Restionaceae (Briggs et al. 2014; Linder et al. 2000b)

Page 297, column 2, line 2: ...lateral in position → lateral in position; coleoptile present.

Page 301, column 1, line 15 in Panicoideae: Add Cenchrus (160) to important genera.

Page 301, column 2, line 4 in “Additional references”: insert -- Hilu 2007 and Schneider et al. 2009
Page 302, column 1, line 14: …staminodes, and the leaf… → …staminodes, nectaries two, positioned atop ovary, and the leaf…

Page 302, column 2, line 17: Nectaries 2, positioned atop the ovary. → Nectaries 2, positioned atop the ovary.

Page 302, column 2, Genera/species: 50/1000 → 51/1000

Page 304, column 2, description of Marantaceae:

…sheathing at base, → …sheathing at base, with the sheath closed,

… and adnate to corolla; …and adnate to corolla;

Page 306, column 1, line 4 in Economic Plants: add Goepertzgia

Page 306, column 1, line 9 in Discussion: (e.g., Calathea and Marantochloa) → (e.g., Calathea, Goepertzgia, and Marantochloa)

Page 306, column 1, last line: insert “Classen-Bockhoff & Heller 2008” and “Pischtschan et al. 2010” in Additional references.

Page 306, column 2, description of Cannaceae:

…extending along one edge of the style. → extending along one edge of the style.

… associated with a tuft of hairs (modified aril); → …associated with a tuft of hairs from funiculus (modified aril);


Page 307, column 2, line 28: not readily apparent; → not readily apparent, but they tend to have nectaries on the petals (Endress and Matthews 2006);

Page 307, Figure 9.40: The internode representing the common ancestor of Menispermaceae + Berberidaceae + Ranunculaceae should be labeled with the putative synapomorphy: -- nectaries on the petals

Page 307, Figure 9.40: To the internode referenced above, a second synapomorphy should be added: -- berberine [And this “berberine” character should be deleted from the base of the cladogram, as it is not an ordinal synapomorphy.]

Page 307, Figure 9.40: The internode representing the common ancestor of Berberidaceae and Ranunculaceae is currently blank, but the following synapomorphic character should be added here: -- leaf bases broad

For this figure also add Soltis et al. 2011, Wang et al. 2009

Page 308, column 1, description of Menispermaceae:

…usually simple and entire, → …usually simple and entire,

…with an upper and lower pulvinus, → …with an upper and lower pulvinus.

Page 308, column 2, description of Menispermaceae:

…compressed; → …compressed, with ventral intrusion of endocarp into seed (or a ventral cavity);

…embryo usually curved; → …embryo large, straight to curved;
Page 308, column 2, lines 2, 3: embryo usually curved; → embryo large, straight to curved;

Page 308, column 2, line 2 of “Discussion”: morphological characters (see above). → morphological characters (see above) and ndhF, rbcL, matK and atpB sequences (Jacques and Bertolino 2008; Ortiz et al. 2007; Hoot et al. 2009; Wefferling et al. 2013).

Page 309, column 1, lines 1-2: Relationships within Menispermaceae are unclear, but the clade is usually divided into 5-8 tribes… → Menispermaceae are usually divided into 5-8 tribes…

Page 309, column 1, line 5: Add the following at the end of this paragraph.

Molecular data indicate that the family contains two major clades: the members of Tinosporoideae (e.g., Calycocarpum, Odontocarya, and Tinospora) have retained the ancestral characters of a straight embryo and fruit (i.e., with style apical), while those of Menispermoideae (e.g., Abuta, Cyclea, Chondrodendron, Cissampelos, Cocculus, Menispermum, and Stephania) possess the derived features of a curved embryo and fruit (i.e., with the style sublateral to basal).

Page 310, column 1, description of Ranunculaceae:

Tepals 4 to numerous, → Tepals 4 to numerous, petaloid.

Stamens numerous; → Stamens numerous;

Page 312, column 1, line 3: 47/2000 → 62/2525

Page 312, column 1, line 3 in Discussion: add in Wang we al. (2009).

Page 312, column 2, description of Berberidaceae:

…anthers opening by 2 flaps that open from the base → anthers opening by 2 flaps that open from the base

Page 313, column 2, line 7: Nandina (in Nandinoideae) is sister… → Nandina (in Nandinoideae) may be sister…

Page 313, column 2, line 6: by two flaps, → by two flaps; ndhF sequences, however, place this genus sister to Caulophyllum and relatives (Kim et al. 2004).

Page 313, column 2, line 11: …and Jansen 1998a; → …and Jansen 1998;

Page 314, column 1, line 18: Chloroplast DNA restriction sites suggest, → Chloroplast DNA data suggest,


Page 315, column 1, line 2: After …a presumed synapomorphy. Insert the following:

Finally, in Wang et al. (2009) Pteridophyllum (along with Hypoecoum) is sister to Fumarioideae.

Page 316, Key to Families of Proteales…: Delete “Vessels lacking” from first lead of couplet 2, and delete “Vessels present” from second lead of couplet 2; in both leads capitalize Carpels.


Page 316, column 2, line 5: Morphology, rbcL, atpB, matK, 18S and 26S rDNA sequences support this position, → Morphology and DNA sequences support this position,

Page 316, column 2, line 10: add Soltis et al. 2011

Page 317, column 1, line 7: Petals 3-7, → Petals (or staminodes) 3-7,

Page 317, column 1, line 8: Stamens 3-7; → Stamens 3-7, opposite the sepals;
Page 317, column 1, line 6 in Discussion: … (Feng et al. 2005). → … (Feng et al. 2005), and among which there is evidence of extensive reticulate evolution (Grimm & Denk, 2010).

Page 317, line 10 from bottom, under “Additional references”: add “Balthazar and Schönenberger 2009”.

Page 317, column 2, line 6: usually adnate to tepals; → usually opposite and adnate to tepals;

Page 317, column 2, line 8: pollen grains usually → pollen grains triangular in polar view, usually

Page 317, column 2, line 20: Banksia (50) → Banksia (170) [and move genus to a position directly following Grevillea, since it now is second largest in family, as a result of inclusion of Dryandra]

Page 317, column 2, line 3 from bottom: by chloroplast DNA sequences → by DNA sequences

Page 318, column 1, line 2: rbcL, atpB, matK, and 18S sequences → nuclear, plastid, and mitochondrial DNA sequences

Page 318, column 1, line 5: Add in support for monophyly: Soltis et al. 2011, Lee et al. 2011, Moore et al. 2011

Page 318, Figure 9.45: add to ordinal synapomorphies the following:
--not mycorrhizal
--root hair cells in vertical files

Add synapomorphy “plastid crystalloid globular” to node linking Nyctaginaceae – “Portulacaceae” clade.

Replace green box for “Portulacaceae” with the following: (Montiaceae (Talinaceae (Portulacaceae (Cactaceae)))))

Successive cambia → add note: (but see Carlquist 2010)

Page 318, Figure 9.45: (Modified from Soltis et al. 2000). → (Modified from Soltis et al. 2000; Brockington et al. 2009, 2013).

Page 318, column 1, lines 2, 3, under Caryophyllales: …is supported by anther wall development, vessel elements with simple perforations, cytochrome… → is supported by morphology (see Fig. 9.45), cytochrome…

Page 318, column 1, line 6: two large clades, here… → two large clades (Brockington et al. 2009; Crawley and Hilu 2012; Heubl et al. 2006), here…

Page 318, column 2, line 15: Add the references: Brockington et al. 2011, 2012

Page 318, column 2, line 20: The monophyly of the group has been strongly supported by rbcL, atpB, matK, and 18S rDNA sequences (… → The monophyly of the group has been strongly supported by several chloroplast and nuclear DNA regions (… Brockington et al. 2009). Also add Soltis et al. 2011 and Crawley and Hilu 2012 in support of monophyly.

Page 319, column 1, line 3: 21 families → 27 families

Page 319, column 2, line 7: Molluginaceae → “Molluginaceae”

Page 320, column 1, line 17: an indumentum of stalked, vascularized, gland-headed… → an indumentum of sessile to stalked, gland-headed…

Page 320, column 2, line 28: habit as well. → habit as well (Heubl et al. 2006).

Page 320, column 2, line 2: …by morphology, rbcL, and ORF 2280 sequence characters. → …by morphology and DNA sequence characters (Harbaugh et al. 2010).

Page 320, column 2, line 13: 70/2200 → 86/2200
Monophyly of Caryophyllaceae is supported by morphology and DNA sequence characters (Fior et al. 2006; Harbaugh et al. 2010; Greenberg and Donoghue 2011). The family traditionally has been divided into three subfamilies. The “Paronychioideae” (e.g., *Paronychia*, *Stipulicida*, *Spergula*, and *Spergularia*) have been thought to be a paraphyletic assemblage, defined only by the presence of stipules (a plesiomorphy within Caryophyllaceae). Some members of this “group” have petals while others (e.g., *Paronychia*) lack them. The “Alsinoideae” (e.g., *Arenaria*, *Minuartia*, *Stellaria*, *Cerasantium*, and *Sagina*) and “Caryophylloideae” (e.g., *Silene*, *Saponaria*, *Dianthus*, and *Gypsophila*) have been thought to be related, both have exstipulate leaves and usually bilobed petals, but they are differentiated by perianth form (i.e., free sepals and non-jointed petals in the former and connate sepals and jointed petals in the latter) (Lüders 1907). These two traditional subfamilies also differ from most “Paronychioideae” in their embryo development and their basally connate leaves.

Recently Harbaugh et al. (2010) and Greenberg and Donoghue (2011) proposed the abandonment of these traditional subfamilies in favor of a new system that recognizes 11 major lineages of the molecular phylogeny at the tribal level. Corrigioleae (*Telephium*, *Corrigiola*) are sister to the rest of the family; some of the other tribes include Paronychieae (*Paronychia*), Polycarpaceae (*Drymaria*, *Polycarpon*), Sperguleae (*Spergula*, *Spergularia*), Saginaceae (*Minuartia* in part, *Sagina*), Sclerantheae (*Schiedea*, *Geocarpon*, *Minuartia* in part, *Scleranthus*), Caryophylleae (*Dianthus*, *Gypsophila*, *Saponaria*), Sileneae (*Agrostemma*, *Silene*), Eremogoneae (*Arenaria* subg. *Eremogone*), Arenarieae (*Arenaria*, subg. *Arenaria* and *Moehringia*), Alsinieae (*Arenaria* subg. *Odontostemma*, *Cerasantium*, *Stellaria*). The ancestral Caryophyllaceae are hypothesized to have had stipules, apetalous flowers with free sepals, and single-seeded fruits. Flowers with (often bilobed) petals and 10 stamens, and capsular fruits may have evolved in the common ancestor of the clade comprising the tribes Sperguleae + Sileneae + Caryophylleae + Eremogoneae + Alsinieae + Arenarieae + Sclerantheae + Sagineae, and within this clade, a large subclade comprising all these tribes except for the Sperguleae is diagnosed by exstipulate leaves. A tubular calyx may have evolved in the branch leading to the Eremogoneae + Caryophylleae + Silineae clade, but was then lost in the Eremogoneae. The tribes Corrigioleaee, Paronychieae, Polycarpaceae, and Sperguleae, all traditionally placed within “Paronychioideae,” represent sequentially diverging lineages at and near the base of the tree. Thus, none of the traditional three subfamilies represent monophyletic groups.

Flowers of Caryophyllaceae…
Page 328, column 1: Split up the “Portulacaceae” sensu lato: Restructure treatment so it corresponds to Portulacaceae sensu stricto, and add in a treatment of Montiaceae, and mention characters for Talinaceae, Anacampserotaceae. See paper by Nyffeler & Eggli (2010) and treatment of APG III.

Cite Ocampo and Columbus (2012) for support of monophyly of Portulacaceae (only Portulaca); this clade resolves into two subclades: 1) the OL clade (plants with opposite leaves, e.g., P. bicolor, P. quadrifida) and 2) the AL clade (plants with alternate or subopposite leaves, e.g., P. oleracea, P. umbraticola, P. amilis, and P. pilosa).

Page 328, column 1, line 7: (Hartmann 1993; Klak et al. 2003),  (Brockington et al. 2012; Hartmann 1993; Klak et al. 2003).

Page 328, column 1, lines 16-18: Generic limits have varied widely, with some systematists considering nearly all species of Mesembryanthemoideae within the large genus Mesembryanthemum.  Generic limits have varied widely, but phylogenetic analyses indicate that all species of Mesembryanthemoideae should be placed within the large genus Mesembryanthemum (Klak et al. 2007).

Page 328: “Portulacaceae” – This paraphyletic group will be divided into Montiaceae, Talinaceae, Portulacaceae s.s. in the next edition. Didiereaceae also goes here.

Column 2, Discussion: Add to the discussion of the ACPT clade the reference Ocampo & Columbus (2010) in support of monophyly of this group.

Page 330, column 1, line 3 from bottom: 100/1400  111/1400


Page 330, column 2, line 5 in “Discussion”: (Edwards et al. 2005;  (Edwards and Donoghue 2006; Edwards et al. 2005; Ogburn and Edwards 2009; Bárcenas et al. 2011; …

Page 330, column 2, line 7 in “Discussion”: nonsucculent stems, well-developed…  nonsucculent stems, precocious periderm initiation, lack of stem stomata, well-developed…

Page 330, column 2, line 22 in “Discussion”: Consolea, and relatives  Consolea, Cylindropuntia, Tacinga, and relatives


Page 332, column 1, description of Droseraceae:

…released in tetrads.  …released in tetrads.

Page 332, column 2, line 2 in “Discussion”: and Riradavia et al. (2003).  …, Riradavia et al. (2003), and Renner and Specht (2011).

Page 334, column 1, description of Polygonaceae:

… (lacking in Eriogonum).  … (lacking in Eriogonum; or primitively, with a petiole sheathing stem)

5 tepals  5 tepals in a single whorl

Fruit an achene or nutlet, often angled,  Fruit an achene or nutlet, often angled.

Page 334, column 2, line 12: relationships within the group are in need of additional study.  The group is composed of two large clades: Polygonoideae (e.g., Fagopyrum, Fallopia, Persicaria, Polygonum, Rheum, Rumex) and Eriogonoideae (e.g., Antigonon, Chorizanthe, Coccoloba, Eriogonum, Ruprechtia, Triplaris), except for Symmeria and
Afrobrunnichia, which are successively sister to the rest of the family (Sanchez & Kron 2008; Sanchez et al. 2009; Burke et al. 2010; Schuster et al. 2011).

Page 334, column 1, lines 6-7 from bottom: Polygonum (160, paraphyletic), and Coccoloba (120). → Persicaria (100), Coccoloba (120), and Polygonum (75).

Page 334, column 2, line 7: Rumex and Polygonum (possibly including Persicaria and Polygonella, knotweeds) are… → Rumex, Persicaria (knotweeds), and Polygonum (including Polygonella, knotweeds) are…

Page 334, column 2, line 28: Polygonum virginianum → Persicaria virginiana


Page 334, column 2, Santalales introduction, line 2: …presence of polyacetylenes, roots lacking root hairs, … → …presence of polyacetylenes, long chain polyunsaturated fatty acids, roots lacking root hairs, free-central placentation with pendulous ovules (or reductions from this condition), …

Page 334, last line: (see references by Nickrent and the website… → (see Nickrent et al, 2010, and the website…

Page 335, column 1, line 4: phylogeny of Nickrent and Malecot … → phylogeny of Nickrent et al. (2010) should also be consulted (see also the website “Parasitic Plant Connection,” http://www.science…

Page 335, column 2, lines 1-3: We recognize 8 families… → We recognize 12 families…

Note: Also, in the list of recognized families add Ximeniaceae.

Page 335, column 2, lines 4-5: “Olacaceae” are paraphyletic, but relationships are too unclear to divide them. → “Olacaceae” as traditionally recognized have been a paraphyletic assemblage, but recently they have been divided into eight families, most of which represent basal branches within the order.

Page 335, Figure 9.53, caption, line 1: Polygonum scandens: → Fallopia scandens:

Page 335, Figure 9.53, caption, line 5: P. cuspidatum: → F. japonica:

Page 335, Figure 9.53, caption, line 8: P. sagittatum: → Persicaria sagittata

Page 336, column 1, line 4: in the group. … in the group (Nickrent 2002; Vidal-Russell and Nickrent 2008).

Page 336, column 1, line 6: …may also be placed here. → …should also be placed here (Barkman et al. 2007; Nickrent et al. 2005).

Page 336, column 1, line 11: add Malécot & Nickrent 2008 to the “Additional references”.

Page 336, column 2, description of Loranthaceae: viscous → viscous

Page 336, column 2, lines 1-3 of “Discussion”: Nuytsia, a tree with root-haustoria, is sister to the rest of the family (Vidal-Russell and Nickrent 2005), most of which are stem (or epiphytic) parasites. → Nuytsia, Atkinsonia, and Gaiadendron, trees or shrubs with root-haustoria, are successively sister to the rest of the family (Vidal-Russell and Nickrent 2005, 2008), and it is thus probable that stem (or epiphytic) parasitism is an apomorphy uniting the remaining taxa. The ancestral chromosomal condition in the family is \( x = 12 \), and a large clade (corresponding to subtribe Loranthinae) is characterized by \( x = 9 \); Psittacanthus and relatives have a base number of eight.

Page 338, column 2, line 2: five or six clades of uncertain relationship, but… → seven clades (Der & Nickrent 2008), but…


Page 338, column 2, line 3 from bottom of section on Saxifragales: …development and carpels that are free, at least apically; many also have flowers with a hypanthium; Basifixed anthers are a potential synapomorphy, and the filament is attached at a basal pit in several groups, and all but Peridiscaceae are also united by follicle fruits (with ovaries being at least apically distinct) (Carlsward et al. 2011).

Page 338, column 2, insert following new paragraph at end section on Saxifragales:

Analyses of molecular data (Jian et al. 2008) indicate that Altingiaceae, Hamamelidaceae, and Cercidiphyllaceae, all woody taxa, form a clade sister to the herbaceous Paoniaceae. This clade is, in turn, sister to the largely herbaceous, core Saxifragales (Crassulaceae, Haloragaceae, Iteaceae, Grossulariaceae, and Saxifragaceae). Iteaceae, Grossulariaceae, and Saxifragaceae are closely related, sharing flowers with a hypanthium and stamens equal and opposite the sepals.

Page 340, column 2, line 1 of “Genera/species”: change to 33 genera

Page 341, column 1, lines 2-3: of cp DNA restriction sites, \textit{rbcL}, \textit{matK}, and 18S sequences \(\rightarrow\) of DNA sequences


Page 341, column 2, line 3 from bottom: …within Saxifragaceae. \(\rightarrow\) …within Saxifragaceae. \textit{Saxifraga} s.l. is sister to the remaining genera.

Page 342, column 1, line 11 from bottom: 35 \(\rightarrow\) 34

Page 342, column 2, line 11: sister to the rest, \(\rightarrow\) sister to the rest, and it is sometimes segregated as Kalanchoideae.

Page 342, column 2, line 22: Mort et al. 1998) \(\rightarrow\) Mort et al. 2001)


Page 344, column 1, line 18 from bottom: a probably monophyletic group \(\rightarrow\) a monophyletic group

Page 344, column 2, line 10: Altingiaceae Lindley \(\rightarrow\) Altingiaceae Horan.

Page 344, column 2, description of Altingiaceae: (sterile flowers or perianth parts) \(\rightarrow\) (sterile flowers)

Page 344, column 2, Genera/species: 1-3/12. \(\rightarrow\) 1/15.


Page 345, column 1, line 19: Li et al. 1999). \(\rightarrow\) Li et al. 1999; Magallón 2007).

Page 346, column 1, line 6: and Wen 2006). \(\rightarrow\) and Wen 2006, 2013; Ickert-Bond et al. 2007), so all species recently have been transferred to \textit{Liquidambar}, which has priority.

Page 346, column 1, lines 3-4 under Rosid clade: reword as follows: …has received support from analyses of plastid, mitochondrial, and nuclear DNA sequences (see Judd and Olmstead 2004; Soltis et al. 2005, 2011; Burleigh et al. 2009; Wang et al. 2009; Lee et al. 2011; Moore et al. 2011).

Page 346, column 1, line 4 in “Rosid clade” paragraph: …Soltis et al. 2005). Most members… \(\rightarrow\) …Soltis et al. 2005, 2007). The presence of special mucilage cells in the flowers (especially abaxial epidermis of sepals) may be synapomorphic for the rosids (Matthews and Endress 2006). Most members…

Page 346, column 1, lines 9-11 in “Rosid clade” paragraph: The position of Myrtales … between these two major clades. \(\rightarrow\) Myrtales and Geraniales are probably sister to the malvid clade. [Based on APG III and other references, in the fourth edition the circumscription of the malvid clade will be expanded to include not only Myrtales, but also Geraniales. See Wang et al. (2009).]

Page 346, column 2, description of Vitaceae:

…cap, valvate. → …cap, valvate.

…with axile placentation; → …with axile/parietal placentation;

Page 348, column 1, lines 1-4: Replace sentence “Some are apparently non-monophyletic … form.” With the following: The basal lineages have 5-merous flowers (e.g., Ampelocissus, Ampelopsis, Parthenocissus, Yua, Vitis, and of course Leea), while the groups with 4-merous flowers form a clade (e.g., Cayratia, Cissus, Cyphostemma, Tetrastigma). There has been considerable parallel evolution in leaf shape and tendril and inflorescence form.

Page 351, description of Oxalidaceae:

Heterostylyous → heterostylos

…usually convolute. → …usually convolute.

…shorter than inner; → …shorter than inner; anthers extrorse;

Page 351, column 2, line 7 in Discussion: rbcL → DNA sequences


Page 351, column 1, line 17: (Sheahan and Chase 2000) → (Sheahan 2007; Sheahan and Chase 2000)


Page 353, column 1, line 6: 98/1221 → 89/1221

Page 353, column 1, line 9 in “discussion”: delete “Clevinger and Panero 1998”

Page 353, column 1, line 10 in discussion: reword as: Arils probably evolved more than once in the family, occurring in genera such as Canotia, Catha, Euonymus, Celastrus, and Maytenus (Simmons et al. 2012b).

Page 353, column 1, line 16 in discussion: by the loss of endosperm, but the traditionally recognized subfamilies of Celastraceae, which were based on fruit characters, are polyphyletic (Simmons et al. 2008, 2012a, b).


Page 353, column 2, line 10: 38 families → 36 families
Page 353, column 2, line 19: (2005). ⇒ …(2005), Wurdack and Davis (2009), and Xi et al. (2012).

Page 353, column 2, line 20: … Passifloraceae are characterized… ⇒ …Passifloraceae form a clade and are characterized…

Page 353, column 2, line 22: Passifloraceae are related, and all share ⇒ Passifloraceae share…

Page 353, column 2, line 29. Add the following additional potential synapomorphies of Rhizophoraceae and Erythroxylaceae: conduplicate petals enwrapping the stamens in bud, nectariferous androecial tube with attachment of the two stamen whors at different positions, and a layer of idioblasts (lactifers?) in sepal and ovaries. Cite Matthews and Endress (2011).

Page 353, column 2, line 31: add the following sentence to the end of this paragraph. Surprisingly, Euphorbiaceae are most closely related to the parasitic Rafflesiaceae (Davis et al. 2007).

Page 353, column 2, description of Malpighiaceae: Ovules 1 in each locule; ⇒ Ovules 1 in each locule;

Page 354, column 2, lines 1-2: and cpDNA sequence characters (Chase et al. 1993; Soltis et al. 2000). ⇒ and DNA sequence characters (Davis & Anderson 2010).

Also, on line 5: is surely artificial (Anderson 1977). ⇒ is artificial (Anderson 1977) as fruit form (especially wing development) is extremely homoplasious (Davis & Anderson 2010).

Page 354, column 2, line 11: (Davis et al. 2001) ⇒ (Davis et al. 2001; Davis & Anderson 2010)

Page 354, column 2, line 12: (including Byrsonima and a few other genera) ⇒ including Byrsonima, Galphimia, and a few other genera)

Page 359, column 1, lines 1-4 in “Discussion”: Discussion: “The family has often…(as in this text).” [Delete this paragraph, so discussion section will start with “Euphorbiaceae are extremely…”.]


Page 359, column 2, line 15: …associated bracts. ⇒ …associated bracts (Horn et al. 2012; Prenner and Rudall 2007).

Page 359, column 2, description of Phyllanthaceae: Nectar disk usually present. ⇒ Nectar disk usually present, extrastaminal.

Page 361, column 2, line 1: Phyllanthaceae can easily ⇒ Phyllanthaceae (Kathriarachchi et al. 2005) can easily…

Page 362, column 1, line 16: add the reference – Kathriarachch et al. 2006

Page 362, column 1, Clusiaceae treatment: Put “Clusiaceae” in parentheses, as analyses of Wurdack and Davis (2009) indicate that the family is not monophyletic because Kielmeyeroidae and Clusioideae are not sister taxa. [Treatment in the fourth edition will be revised, so that Kielmeyeroidae will be considered as Calophyllaceae. See also APG III.] Also cite the paper Ruhfel et al. (2011) in support of Clusiaceae s.s., Calophyllaceae, and Hypericaceae. Paper also supports inclusion of Triadenum and Thornea in Hypericum.

Page 362, column 1, line 4 from bottom: 27/1000 ⇒ 27/1090

Page 362, column 2, line 23: (personal communication) ⇒ (2007)

Page 363, column 1, description of Hypericaceae: often fascicled; ⇒ …often fascicled; anthers dorsifixed;

Page 363, column 2, line 6: for depression. ⇒ for depression (Stevens 2007b).
Page 363, column 2, line 2 in Discussion: … basis of preliminary molecular data (Gustaffson et al. 2002). → …basis of morphological and molecular data (Gustaffson et al. 2002; Nürk & Blattner 2010; Wurdack & Davis 2009).


Page 364, column 1, insert new paragraph (as follows) at top of column:

Cratoxylum (stems with dark glands, 4-lined; capsules loculicidal; seeds flattened) and relatives are sister to the remaining genera (stems without lines; seeds cylindrical), which include both Vismia and Hypericum. The large and diverse genus Hypericum (incl. Triadenum, Thornea) forms a clade based on their leaves with pellucid dots and septicidal capsules (Nürk & Blattner 2010; Nürk et al. 2013; Ruhfel et al. 2011). Vismia has black dots in its leaves and berries.

Page 364, column 2, Additional references: add – Schwarzbach 2014

Page 364, column 1, description of Rhizophoraceae:

...tannins usually present. → ...tannins usually present; vessel elements with vestured pits.

Nectar disk often present. → Nectar disk often present, intrastaminal.

Page 364, column 1, line 16 from bottom: 12/84 → 15/149

Page 364, column 1, line 5 from bottom: Tomlinson 1988a, b; → Tomlinson 1988a, b; Setoguchi et al. 1999;

Page 367, column 1: Passifloraceae – modify treatment so as to include Turneraceae and Malseherbiaceae, following APG III.

Cite Thulin et al. 2012 for phylogeny of Turneroideae. Within this clade of 12 genera, two major subclades are evident, an American clade (e.g., Piriqueta, Turnera) and an African clade (e.g., Arboa, Streptopetalum, Tricliceras).

Page 367, column 1, discussion: Although Violaceae are clearly monophyletic, infrageneric relationships are poorly understood. → Violaceae are clearly monophyletic and infrageneric relationships recently have been clarified (Ballard et al. 2014; Wahlert et al. 2014). Fusispermum may be sister to the remaining taxa and it has nearly radially symmetrical flowers with anthers lacking dorsal connective appendages (although they have ventral appendages). Most genera are placed in a paraphyletic “Rinoreae” … a group characterized by only slightly bilateral flowers …

Page 367, column 1, add Tokuoka 2008 to references.

Page 367, column 2, line 6: 18/630 → 17/700

Page 367, column 2, line 6: Passiflora (400) → Passiflora (500)


Page 367, column 2, add sentence at end of first paragraph of discussion: The major genus, Passiflora, is monophyletic (Krosnick et al. 2013) and is characterized by the nearly glabrous leaves and stems, presence of 2 prophylls on the vegetative bud, small stipules, two petiolar nectaries, and a reticulate seed coat.

Page 367, column 2, line 35: …outgrowths of the hypanthium. → …outgrowths of the hypanthium and likely represent modifications of the androecium (Hemingway et al. 2011).

Page 369, column 1, description of Salicaceae:

Nectary a disk or of separate glands, → Nectary a disk or of separate glands, extrastaminal,

Page 369, column 2, line 28: … (Chase et al. 2002). → … (Chase et al. 2002; Chen et al. 2010).


Page 370, column 2, last line: Rogers 1987; → Rogers 1987, 2005;
Page 371, column 1, line 3 from bottom: …is represented by rbcL, atpB, and 18S sequences -> is supported by both plastid and nuclear sequences [and also add “Bello et al. 2009” and “Wang et al. 2009” and “Soltis et al. 2011” to the references cited at the end of the sentence]

Page 372, column 1, description of Fabaceae:

…pinnately (or twice pinnately) compound -> …pinnately (or twice pinnately) compound

…pulvinus of leaf and individual leaflets well developed, -> pulvinus of leaf and individual leaflets well developed,

…the uppermost petal differentiated in size, shape, or coloration (i.e., forming a banner or standard), -> the uppermost petal differentiated in size, shape, or coloration (i.e., forming a banner or standard),

…and sometimes with a U-shaped line (pleurogram); -> and sometimes with a fold-line (pleurogram), often U-shaped;

Page 372, column 2, line 4: 630/18,000 -> 751/19,500

Page 372, column 2, line 5: Acacia (1000) -> Acacia (1075)

Page 372, column 2, line 8: insert – Senegalia (200)

Page 372, column 2, line 9: insert – Vachellia (160)

Page 372, column 2, line 8 from bottom: Robinia (locust), … -> Robinia (locust), Vachellia...


Page 374-375: show that “Caesalpinioideae” are paraphyletic, with some genera more closely related to Mimosoideae and other more closely related to Faboideae than they are to one another. -> show that “Caesalpinioideae” are paraphyletic, with some genera early diverging and others more closely related to Mimosoideae than they are to one another.

Also, replace “A Cercis + Bauhinia clade…” with the following: A Cercis + Bauhinia clade (Cercideae; leaves seemingly simple), a clade containing Hymenaea, Brownea, Amherstia, Tamarindus, and relatives (Detarieae; calyx petal-like, style bent abaxially), along with the genus Duparquetia (flowers 4-merous, calyx petal-like, anthers porose), are sister to the rest of the family. Within this clade, Dialineae (Dialium, etc.; carpels 2) are sister to a clade containing two major subclades – one comprising the Faboideae and the second various “caesalpinioiids” and the Mimosoideae. Within the second clade Arcoa, Ceratonia, and Gleditsia (and relatives) are early divergent, followed by the core Caesalpinioideae (e.g., Cassia, Senna, Chamaecrista, Caesalpina, Pierogyne), Peltophorum (and relatives such as Covillea, Delonix, Parkinsonia, Schizolobium), Dimorphandra and relatives, and finally the Mimosoideae. Within Faboideae, it is clear that the temperate herbaceous lines are more recent derivatives of tropical woody groups, although the number of origins of the herbaceous habit remains uncertain. Detailed phylogenetic analyses are now available for several tribes of Fabaceae. Swartzia, Cladrastis, Angylocalyx and Myroxylon (and their relatives) represent basal clades of Faboideae (Cardoso et al. 2012; Legume Phylogeny Working Group 2013a, b). Relationships within Mimosoideae are less well resolved, although Adenanthera, Pentaclethra, Newtonia, Entada and relatives possibly represent basal clades, and problematic generic circumscriptions are exemplified by the recent split up of Acacia (resulting in Acacia s.s., Acaciella, Senegalia, Vachellia, etc. (Kyalangalilwa et al. 2013).

Page 377, column 1, description of Polygalaceae:

Stamens (4-) 8 (-10); filaments distinct or connate, adnate to petals; -> Stamens (4-) 8 (-10); filaments distinct or connate, adnate to petals;


Page 377, column 2, Additional references: add “Eriksen and Persson 2007”


Page 379, Fig. 9.73: Add supporting reference Soltis et al. 2011.

Page 379, treatment of Rosaceae. Throughout replace Spiraeoideae with Amygdaloideae, and Pyrodae with Pyrodeae, Pyreae with Maleae, etc. and Pyrinae with Malinae.

Page 380, column 1, description of Rosaceae:

Carpels 1 to many, distinct or connate, \(\rightarrow\) Carpels 1 to many, distinct or connate,

…follicles, or achenes, \(\rightarrow\) follicles, or achenes,

Floral formula: druplet \(\rightarrow\) drupelet

Page 384, column 1, line 4 from bottom: delete “Evans 1999”

Page 385, 376, fig. 9.76 & 9.77: subfamily Spiraeoideae \(\rightarrow\) subfamily Amygdaloideae

Page 377, Table 9.3, change Spiraeoideae to Amygdaloideae

Page 388, column 1: When treatment of Rosaceae is rewritten, the paper Lo and Donoghue (2012) should be cited in connection with Pyreae (change to Maleae).

Page 388, column 2, description of Rhamnaceae, add: Sporangium wall protruding through micropyle.

Page 388, column 2, line Genera/species: 52/900 \(\rightarrow\) 53/900

Page 388, column 2, line 5 in “Major genera”: Colubrina, Gouania, \(\rightarrow\) Colubrina, Frangula, Gouania,

Page 388, column 2, line 11 from bottom: Colletia, Pomaderris, … \(\rightarrow\) Colletia, Frangula, Pomaderris, …

Page 389, column 1, line 5: Rhamnus, Krugiodendron, \(\rightarrow\) Rhamnus, Frangula, Krugiodendron,

Page 389, column 2, line 1: Brizicky 1964b; \(\rightarrow\) Bolmgren and Oxdlman 2004; Brizicky 1964b;

Page 389, column 2, line 3 from bottom: with hypanthium. \(\rightarrow\) with or without hypanthium.

Page 390, column 1, description of Ulmaceae: …extending along adaxial side of styles. \(\rightarrow\) …extending along adaxial side of styles, at least one of which with 3 (-5) vascular bundles.

Page 391, column 2, description of Cannabaceae: pollen grains 2-3-porate. \(\rightarrow\) …pollen grains 2-3-porate.

**Fruit a drupe** \(\rightarrow\) **Fruit a drupe**

Page 391, column 2, line 10 under Discussion: …between Cannabaceae and Ulmaceae. \(\rightarrow\) …between Cannabaceae and Ulmaceae, although Aphananthe is sister to the remaining genera of Cannabaceae.


Page 392, column 2, description of Moraceae:

…individual flowers usually congested \(\rightarrow\) individual flowers congested

Add: **Floral bracts often peltate.**

Page 393, column 1, line 17: 53/1500 \(\rightarrow\) 38/1500

Page 393, column 1, lines 13, 14 from bottom: on the basis of rbcL and ndhF sequences (Sytsma et al. 2002; Datwyler and Weiblen 2004). \(\rightarrow\) on the basis of rbcL, ndhF, and 26S sequences (Sytsma et al. 2002; Datwyler and Weiblen 2004; Zerega et al. 2005).
Page 393, column 1, in discussion: At end of paragraph add the following sentence.

The earliest lineages to diverge within Moraceae probably are the Artocarpeae s.s. (*Artocarpus*, *Clarisia*, and relatives) and Moreae s.s. (e.g., *Morus*, *Sorocea*). Most species belong to a large clade in which *Maclura* is sister to a subclade containing *Broussonetia*, *Brosimum*, *Castilla*, *Dorstenia*, and *Ficus*, among others (Clement and Weiblen 2009).

Page 393, column 2, line 19: …great diversity of inflorescence structures, \(\rightarrow\) …great diversity of inflorescence structures (Clement & Weiblen 2009).

Page 395, column 1, line 3-7 in “Discussion”: Cucurbitaceae are easily recognized and monophyletic. Two subfamilies are recognized (Jeffrey 1967, 1980, 1990a, b). “Zanonioideae,” a small group characterized by separate styles, contains genera with numerous plesiomorphic features and probably is paraphyletic. Monophyly of Cucurbitoideae is supported by their completely connate styles and nrITS sequences (Jobst et al. 1998). \(\rightarrow\) Cucurbitaceae are easily recognized and monophyletic (Schaefer et al. 2009). Two subfamilies are recognized (Jeffrey 1967, 1980, 1990a, b; Kocyan et al. 2007). Nhandiroboideae, a small clade characterized by separate styles and pendulous ovules, contain genera with numerous plesiomorphic features. Monophyly of Cucurbitoideae is supported by their completely connate styles and DNA sequences (Jobst et al. 1998; Kocyan et al. 2007), and their ovules are usually ascending or horizontal.

Page 400, Figure 9.84: move the synapomorphy “-- Pollen tube entering the ovule via the chalaza” to the internode of the cladogram representing the common ancestor of Juglandaceae + Myricaceae + Betulaceae + Casuarinaceae; so this synapomorphy will be listed just below “-- Triporoporate pollen”. Also, on the line representing the common ancestor of all members of the order, add the synapomorphy: -- Fertilization delayed

Page 401, column 2, line 4: **cupule; \(\rightarrow\) cupule; endocarp hairy inside**;

Page 403, column 1, lines 9-10: *Lithocarpus*, *Castanea*, *Castanopsis*, and *Lithocarpus… \(\rightarrow\) *Lithocarpus*, *Castanea*, *Castanopsis*, and *Chrysolepis…*
Page 403, column 1, line 18: Plate 9.13C). – and several floral characters, especially the large size of the style relative to the ovary at pollination (Deng et al. 2008).


Page 403, column 1, line 12 from bottom: …fruits and clearly pubescent (vs. glabrous) inner fruit wall (Nixon et al. 1995). – …fruits, clearly pubescent (vs. glabrous) inner fruit wall (Nixon et al. 1995), and pollen sculpturing (Denk and Grimm 2009).

Page 403, column 1, line 8 from bottom: (Manos et al. 1999, 2001). – (Manos et al. 1999, 2001; Oh and Manos 2008).


Page 404, column 2, line 4: 1989), and 1989), branched pollen tube, and

Page 406, column 2, Discussion – rewrite first sentence: Casuarinaceae are easily recognized, and are considered monophyletic on the basis of morphology (see characters listed in bold above) and rbcL and matK sequences (Sogo et al. 2001; Steane et al. 2003).


Page 408, column 2, description of Juglandaceae: Tepals 0-4, Tepals 0-4 (-6),

Page 408, column 2, line 6 from bottom: Manos and Stone 2001) – Manos and Stone; 2001; Manos et al. 2007)

Page 410, column 2, line 3 under “Myrtales: Incertae Sedis within the Rosids”: … and rbcL, matK, atpB, ndhF, and 18S sequences and chloroplast and nuclear DNA sequences [also add “Wang et al. 2009” and “Soltis et al. 2011” to references cited]

Page 410, column 2, “Myrtales: Incertae Sedis within the Rosids”: change title to “Myrtales” since its position is now better known.

Page 410, column 2, line 13 under “Myrtales”: Taxonomic placement of Myrtales is uncertain, although the group may be sister to the malvids (Eurosids II; Jansen et al. 2006). – Myrtales (and the Geraniales) likely form a clade that is sister to the rest of the malvids (Eurosids II; Wang et al. 2009; Soltis et al. 2011). [In next edition the circumscription of the malvid clade will be expanded to include the Myrtales and Geraniales.]

Page 410, column 2, last line: 14 families – 9 families

Page 412, column 1, line 1: 9000 – 10,000

Page 412: Update Fig. 9.91 by combining Memecylaceae and Melastomataceae.

Page 414, column 1, line 6: 30/600 – 31/600

Page 414, column 1, line 3 in “Discussion”: 1993a, b – 1993

Page 414, column 1, line 8 in “Discussion”: 1993b – 1993

Page 414, column 1, line 9 in “Discussion”: (Conti 1994; – (Conti 1994; Graham 2007;

Page 414, column 1, line 10 in “Discussion”: delete “Punica”

Page 414, column 2, revise “Genera/species” as follows:

**Genera/species:** 22/657. **Major genera:** *Epilobium* (165 spp.), *Oenothera* (145), *Fuchsia* (107), *Ludwigia* (82), *Clarkia* (42), *Lopezia* (22), *Chylismia* (16), *Camissoniopsis* (14), and *Camissonia* (12). *Chamerion*, *Chylisniella*, *Circae*, *Eremothera*, *Eulobus*, *Gayophytum*, and *Taraxia* also occur in North America.

Page 414, column 2, line 10 in “Description”: found that *Ludwigia* is… ➔ found that *Ludwigia* (in Ludwigioideae) is…

Page 414, column 2, lines 12, 13 in “Description”: The rest of the family is united… ➔ The rest of the family (i.e., the Onagroideae) is united…

Page 414, column 2, last line: unusual way; ➔ unusual way, and their fruits are indehiscent;

Page 416, column 1, line 17: Stamens 4-10; filaments… ➔ Stamens 4-10, sometimes attached below summit of hypanthium; filaments…

Page 416, column 1, Genera/species: 20/600 ➔ 12/600. Under major genera, change to: …by *Combretum* (incl. *Quisqualis*), *Conocarpus*, *Laguncularia*, and *Terminalia* (incl. *Bucida*).

Page 416, column 1, 2 in “Discussion”: *rbcL* sequence ➔ DNA sequence

Page 416, column 1, line 3 in “Discussion”: (Conti 1994) ➔ (Conti 1994; Maurin et al. 2010)

Page 416, column 1, line 3 in “Discussion”: at end of first paragraph of the “Discussion” insert the following sentence.

*Strephonema* has a half-inferior ovary and seeds with massive hemispherical cotyledons, and it is sister to the remaining taxa, which have a fully inferior ovary and variously folded cotyledons (Stace 2007; Maurin et al. 2010). The remaining genera form two clades, i.e., the *Laguncularieae* (*Laguncularia*, *Lumnitzera*; hypanthium with two adnate bractlets) and *Combreteae* (comprised mainly of the two large genera *Terminalia* and *Combretum*; bractlets free from hypanthium).

Page 416, column 2, description of Myrtaceae: …connective with an apical secretory cavity; ➔ …connective with an apical secretory cavity;

Page 416, column 2, floral formula of Myrtaceae: A hypanthium is present, thus this needs to be indicated in the formula by a line below the K, C, and A, connecting these parts.


Page 418, column 1, line 24 in “Discussion”: add to list of genera of myrtoid clade the following – *Pimenta*, *Rhodomyrtus*, *Myrcia*, *Myrciaria*.

Page 418, column 1, last line: add reference – Lucas et al. 2007

Page 418, column 2: Expand circumscription (and appropriately modify treatment) of *Melastomataceae* so as it includes *Memecylaceae*. This change is necessary due to recommendation of APG III.

…distinct and convolute. ➔ distinct and **convolute**.

…**commonly twisted**… flower; **commonly twisted** … flower;

**Nectaries usually lacking.** ➔ **Nectaries usually lacking**

And update description, so mention that connective may have depressed, elliptic, oil-producing gland dorsally, often foliar sclereids, stamens with pores or slits.

Add: **embryo with bent radicle.**

Page 418, column 2, line 16 from bottom: 150/3000 ➔ 188/5055  [Also add Memecylon (350) and Mouriri (85)]

Under discussion: Add to molecular references for monophyly of family Penneys et al. (in prep.)… and update discussion of relationships as follows:

*Olisbeoideae* (=Memecylaceae, if segregated, e.g., *Memecylon*, *Mouriri*) is sister to the remaining members of the family (Melastomatoideae), and these plants are easily recognized by their leaves that usually do not have subparallel secondary veins, but have foliar sclereids, and flowers with stamens with the connective with a depressed, elliptic, oil-producing, dorsal gland. Melastomatoideae have stems usually with cortical and/or medullary vascular bundles and
their flowers have the stamens commonly twisted at anthesis, bringing the anthers to one side of the flower. Within this clade, Pterandra probably is the sister group to the remaining genera; this genus has retained an endothecium, while the rest (core Melastomatoideae) are united by the loss of an endothecium, …

Page 420, column 1, line 6: Mecranium. → Mecranium (Goldenberg et al. 2008; Michelangeli et al. 2008).

Page 420, column 1, line 9: complex) and Blakeeae… → complex), Henrietteae (e.g., Bellucia, Henriettea) and Blakeaeae…

Page 420, column 1, Additional references: add – Goldenberg et al. 2008; Penneys et al. 2010

Page 420, treatment of Brassicaceae. In the fourth edition, Brassicaceae s.l. will be divided into Brassicaceae s.s., Cleomiaceae, and Capparaceae s.s. [In terms of the current classification, this is merely raising the three subfamilies to familial rank. In this regard, the paper Itis et al. 2011 will be cited. Also Cleome and Capparis are both non-monophyletic, as indicated in Hall (2008) and several publications by Itis and associates, and for Cleome see also Feodorova et al. 2010, so these genera will need to be split into numerous segregates.]

Note: Within Cleomaceae, a North American clade (containing Peritoma, Cleomella and Wislizenia and Oxystylis) is sister to the rest of the clade (which contains Polanisia, Arivela, Gynandropsis, Cleome s.s., Cleoserrata, Tarenaya, and various other segregate genera).

Page 421, column 1, line 8: …a Eurasian weed, is… → …a Eurasian weed (Koch et al. 2008), is…

Page 421, column 2, line 9: 15 families → 18 families


Page 422, column 2, line 4 from bottom: (Hall et al. 2002) → (Hall 2008; Hall et al. 2002)

Page 423, column 1, line 5 from bottom: Brassicoideae. → Brassicoideae (see also Franzke et al. 2009, 2011).

Page 423, column 1, line 28: Replace sentence “Al-Shehbaz et al. … some 25 tribes; of these…” with the following:

Reclassification following recent molecular findings is underway, with 25-48 tribes currently recognized (Al-Shehbaz 2012; Al-Shehbaz et al. 2006; Bailey et al. 2006); of these, …

Page 423, column 2, line 13, to “Additional references” add: Beilstein et al. 2008

Page 423, column 2, lines 5-6: and rbcL, atpB, and 18S sequences → and DNA sequences

Page 423, column 2, line 8: add – Soltis et al. 2011

Page 424, column 2, line 2: but usually stellate or peltate scales. → but usually stellate hairs or peltate scales.


Page 425, column 1, line 19 from bottom: 204/2330 → 243/4225

Page 425, column 2, line 1: Ceiba, Abutilon, … → Ceiba, Callianthe, …

Page 425, column 2, line 26 in “Discussion”: lost calyx fusion. → lost calyx fusion and also lost calyx nectaries, with the nectaries instead borne on the petal bases or androgynophore (Brunken and Mueller 2012).

Page 426, column 2, line 3: add Callianthe and Alcea to list of genera of Malvaceae.

Page 427, column 2, description of Cistaceae: Shrubs or herbs, with tannins. → Shrubs or herbs, with tannins and unilacunar nodes.

Page 428, Fig. 9.100: Add “nectaries on petal bases or androgynophore” as synapomorphy for Grewioideae.

Page 430, column 1, Genera/species: delete Poncirus from list of genera in the U.S.

Page 430, column 1, last 2 lines: Several species of Citrus (oranges, tangerines, grapefruits, limes, lemons) are prized…
Page 430, column 2, line 1: …their edible fruits (Plate 9.16H). their edible fruits (Plate 9.16H), and represent ancient to recent anthropogenic hybrids or selections from wild species (Mabberly 2004; Barkley et al. 2006).

Page 430, column 2, line 6: Severinia → Atalantia
[Note, recent evidence supports placing Severinia within generic circumscription of Atalantia, so this change is needed, and also on the CD.]

Page 430, column 2, lines 3 & 4 in “Discussion”: …as well as rbcL and atpB sequences (Gadek et al. 1996; Morton et al. 2003; Chase et al. 1999). as well as cpDNA sequences (Chase et al. 1999; Gadek et al. 1996; Groppo et al. 2008; Morton et al. 2003) and nuclear (Xdh) sequences (Morton 2011).


Page 430, column 2, lines 11-12 from bottom: …Aurantioideae (Citroideae, incl. Citrus, Fortunella, Poncirus, Severinia, Atalantia, Aegle, and relatives), …Aurantioideae (Citroideae, incl. Aegle, Atalantia, Citrus, Limonia, Swinglea, and relatives),

Page 430, column 2, line 7 from bottom: … are often problematic, … have been problematic,

Page 430, column 2, lines 4, 5, 6 from bottom: (incl. Severinia, … Phellodendron, and relatives) may also be monophyletic, (incl. Casimiroa, Zanthoxylum, Amyris, Phellodendron, Ptelea, Skimmia, Tetradium, Todalia, and relatives) may also be monophyletic (Groppo et al. 2008; Poon et al. 2007),

(e.g., Citrus, Poncirus, Fortunella, Eremocitrus, and Microcitrus). (e.g., Atalantia, Citrus, Poncirus, Fortunella, Eremocitrus, and Microcitrus; and all of these except Atalantia should be included within Citrus s.l., see Bayer et al. 2009, Mabberly 2001, 2004).

Page 431, Figure 9.102: Poncirus trifoliata → Citrus trifoliata

Page 432, column 2, description of Meliaceae: but usually capitate. but usually capitate.

Page 434, Plate 9.16 (H): Citrus aurantifolia → Citrus x aurantifolia

Page 435, column 1, line 15: add Mueller et al. 2008 to “Additional references:”

Page 435, column 1, line 15: add Mueller et al. 2008 to “Additional references:”


Page 435, column 2, line 10: by serological data. by serological data. Castela and Picrasma are sister taxa, forming a clade that is sister to the remaining genera, among which Ailanthus likely was the first to diverge.

Page 435, column 2, last line: straight; endosperm scanty… straight, the cotyledons planoconvex to flat; endosperm scanty…


Page 437, column 1, line 8 in “Discussion”: The family is composed… The family may be composed…

Page 437, column 1, line 16 in “Discussion”: The remaining genera of the family form a large clade many members of which… → The remaining genera of the family form a large clade (Anacardioideae) many members of which…

Page 437, column 1, next to last line: others) → others), but they are not closely related (Yi et al. 2007).

Page 437, column 2, line 3: …not be monophyletic. → …not be monophyletic. Rhus actually is more closely related to Protorhus and Searsia, from which it can be distinguished by fruit shape, endocarp, ovule, and seed characters.

Page 437, column 2, description of Burseraceae: and often peeling → and often peeling

Page 437-438, last two lines of 437, and 1st line of 438: Change first line of Discussion as follows: Monophyly of Burseraceae has received support from cladistic analyses of plastid sequences (Gadek et al. 1995; Clarkson et al. 2005; Weeks et al. 2005; Becerra et al. 2012).

Page 438, column 1, lines 1, 2 The smooth bark is distinctive and may be synapomorphic. → The smooth bark is distinctive and may be synapomorphic. The Mexican genus Beiselia (which has 9-12 carpels and simple cotyledons) may be sister to the remaining genera (which have 3-5 carpels and folded, palmately lobed cotyledons). Among these genera, Boswellia, Canarium, and relatives form a clade that is the sister group of a clade comprising Bursera, Commiphora, Protium, and relatives. [And the sentence starting “The small nectar-secreting flowers…” should start a new paragraph.]

Page 438, column 1, Floral formula: add K C A G to formula.

Page 438, column 2, line 13 in Discussion: … and rbcL and matK sequences (Harrington et al. 2005). → …and ITS plus chloroplast sequences (Buerki et al. 2010a, b; Harrington et al. 2005).

Page 439, column 2, line 14 in Discussion: Four well-supported … can be recognized. The first is the hippocastanoid clade… → Five well-supported … can be recognized. The first is Xanthoceras, which is sister to the rest of the family, and can be diagnosed by its large petals, nectar disk with five horn-like appendages, and seven or eight ovules per locule. The second is the hippocastanoid clade…

Page 439, column 2, line 4: in the two clades. → in the two clades. Some systematists, such as Buerki et al. (2010b) split Sapindaceae s.l. into four families, i.e., Xanthoceraceae, Aceraceae, Hippocastanaceae, and Sapindaceae (with two subfamilies: Dodonaeoideae, Sapindoideae).

Page 441, column 1, line 3: rbcL. At[B, ndhF, matK, and 18S rDNA sequence → 26S, plastid, mitochondrial, and nuclear DNA sequence

Page 441, column 1, line 4: (Albach et al. 2001a,b; Bremer et al. 2002; Chase… → (Albach et al. 2001a,b; Bremer et al. 2002; Burleigh et al. 2009; Chase… [Also add Lee et al. 2011, and Moore et al. 2011 and Morton 2011]


Page 441, column 1, last line under Asterid Clade: add reference – Tank and Donoghue (2010)

Page 441, column 1, line 4 under Cornales: Add Soltis et al. 2011 and Xiang et al. 2011.

Page 441, column 1, line 6 under Cornales: reduced sepals, and an… → reduced sepals, valvate petals, and an…

Page 443, column 1, description of Loasaceae: with barbs or projections, → with barbs or projections,

Page 443, column 2, line 2: sister to the remaining genera (Hufford et al. 2003; but see also Weigend 2004). → …sister to the remaining genera, and Loasoideae are likely monophyletic based on molecular data and their androecium of both stamens and staminodes (Hufford et al., 2003, 2005; but see also Weigend 2004).

Page 443, column 2, line 15: Cornaceae Bercht. & Presl → Cornaceae Berchtold & J. Presl

Page 443, column 2: Split Cornaceae into Cornaceae (incl. Alangiaceae) and Nyssaceae (incl. Davidiaceae, Mastixiaceae), following phylogeny of Xiang et al. 2011. Within Nyssaceae, Diplopanax + Mastixia clade is sister to Camptotheca, Davidia, and Nyssa clade. Thus description needs updating.

Page 445, column 1, line 23: …and red-fruited dogwoods. → …and red-fruited dogwoods (although the latter clade also includes species with purple fruits or red fruits that turn black at maturity).

Page 445, column 1, line 5 under Ericales: Add – Soltis et al. 2011 and Morton 2011

Page 445, column 2, line 42: add Schonenberger et al. 2005

Page 445, column 2, line 43: 24 families → 22 families

Page 447, column 2, description of Sapotaceae: and opposite the petals → and opposite the petals, and opposite the petals

Page 449, column 1, line 9: ndhF DNA

Page 449, column 1, line 13: …and relatives (Sapotoideae) may → and relatives (Sapoteae) may …

Page 449, column 1, line 4 from bottom: Masticodendron), → Masticodendron; Smedmark and Anderberg 2007),

Page 449, column 2, description of Ebenaceae: usually 2-ranked, → usually 2-ranked,

Page 450, column 1, in discussion: sequences. → …sequences (Duangjai et al. 2009).

Page 450, column 1, line 7 in discussion: (Duangjai et al. 2006) → (Duangjai et al. 2006, 2009)

Page 452, column 1, description of Theaceae:
…with sclerids; → with sclerids;
…that are opposite the petals; → …that are opposite the petals; anther connective producing pseudopollen (which becomes intermixed with pollen grains in locules);
…often flattened or winged; → often flattened or winged, with massive testa;

Page 452, column 1, line 2 in discussion: are not monophyletic, are not monophyletic (but see Luna and Ochoterena 2004),

Page 452, column 2, Additional references: add -- Tsou 1997.

Page 454, column 1, line 1: The Ericoideae are… → The Ericoideae (see Gillespie and Kron 2010, 2012) are…

Page 454, column 1, line 9: such as Phylloclade and Kalmia, → such as Phylloclade, Kalmia, and Bejaria

Page 454, column 1, line 11: (Erica and Calluna) → (Erica, Calluna, and Daboecia; Pirie et al. 2011)


Page 454, column 2, line 20: by bees and wasps. → by bees, wasps, or flies.

Page 454, column 2, line 5 from bottom: anther by pollinators. Capsular-fruited… → … anther by pollinators. Wind pollination has evolved in the empetroid clade and several times in the ericoid clade. Capsular-fruited…

Page 454, Fig. 9.111: Possibly Monotropoideae are distinct from Pyroloideae, and sister to Arbutoideae. See Braukmann & Stefanović 2012, Feldenkris et al. 2011 (Botany 2011 abstracts, p. 163), and Freudenstein et al. (2010, also abstracts). Revise figure to show Monotropoideae, Pyroloideae, and Arbutoideae in an unresolved position.


Page 455, column 1, Genera/species: 3/15 → 3/16
Page 455, column 1, Genera/species: Sarracenia (8 spp.) → Sarracenia (9 spp.).

Page 455, column 1, lines 6, 7 from bottom: Morphology, rbcL and ITS sequences → Morphology and DNA sequences

Page 455, column 1, line 5 from bottom: of the family. → of the family, and the position of Darlingtonia as sister to a Heliamphora + Sarracenia clade (Neyland and Merchant 2006).

Page 455, column 2, description of Lecythidaceae:

Stamens usually numerous, → Stamens usually numerous,

…style capitate or lobed. → …style short, capitate or lobed.

Page 457, column 1, line 1: 17/285 → 25/310


Page 457, column 1, line 2 from bottom: Add “Mori 2007” and “Mori and Prance 1987” to list of “Additional references”.

Page 457, column 2, line 7: … and connate. → and connate, open in bud, the apices often spine-like.

Page 457, column 2, line 15: …often mucilaginous → …often mucilaginous

Page 457, column 2, line 5 in Discussion: … (Hufford 1992) → … (Hufford 1992; Schönenberger 2009)

Page 459, column 1, line 4: …this clade. → …this clade (Moore et al. 2011; Soltis et al. 2011).

Page 459, column 1, lines 5-8: Change to the following: … Molecular data strongly supports the monophyly of this clade (Soltis et al. 2011). Lamiiids are generally characterized by opposite leaves, hypogynous flowers, and “late sympetaly” with distinct petal primordial, while Campanulids typically have alternate leaves, epigynous flowers, and “early sympetaly” with a ring-shaped corolla primordium (Bremer et al. 2001).

Page 459, column 1, line 14 in Solanales: with Lamiales, → …with Lamiales (Refulio-Rodriguez and Olmstead 2014; Soltis et al. 2011);


Page 461, column 2, line 6 from bottom: … Palmer 1997; Spooner… → …Palmer 1997; Peralta et al. 2008; Spooner…

Page 462, column 1, description of Convolvulaceae:

Sepals usually 5, usually distinct or only very slightly connate, → Sepals usually 5, usually distinct or only very slightly connate,

Add: seed coat with papillae or hairs;

Page 462, column 2, description of Boraginaceae: and often calcified or silicified walls, → and often calcified or silicified walls,
Page 466, column 2, line 9: and Heliotropioideae. → …and Heliotropioideae (Moore & Jansen 2006).


Page 469, column 1, description of Rubiaceae:
… raphide crystals common. → raphide crystals common; stomata paracytic.

Sepals usually 4 or 5, connate. → Sepals usually 4 or 4, small, with open aestivation, connate,

Page 469, column 2, line 1: 550/9000 → 660/11,150


[and replace this paragraph with the following]

Cinchonoideae have traditionally been defined either on the basis of ovaries with numerous ovules or by the presence of endosperm, lack of raphide crystals, and seeds with a pitted-ridged coat (all likely symplesiomorphies). Analyses of rbcL, trnL-F, ndhF, atpB-rbcL spacer, and/or rps 16 intron sequences support, however, the division of this group of trees and shrubs into Cinchonoideae s.s. (including, among other genera, Antirhea, Catesbaea, Cephalanthus, Chiococca, Cinchona, Cubanola, Ethsanthus, Exostema, Guettarda, Hamelia, Hillia, Nauclea, Portlandia, Rondeletia, and Strumppia) and Ixoroideae (e.g., Casasia, Coffea, Gardenia, Genipa, Isora, Mussenda, Pinckneya, Randia). The former have flowers with imbricate or valvate corolla aestivation, but right-contorted corollas occur in some, e.g., Hamelia, Hillia, and relatives. The latter usually have flowers with valvate or left-contorted corolla aestivation, and many have a specialized, secondary pollen presentation mechanism. The anthers…

Page 469, column 2, line 4 from bottom: This subfamily probably is monophyletic; potential… → Potential synapomorphies of Rubioideae include the presence of raphides, an indumentum of septate (articulated) hairs, seeds with a smooth coat, the usually herbaceous habit…

Page 470, column 1, line 2-4: [reword as follows] – Representative genera are: Diodia, Ernodea, Galium, Geophila, Hedyotis, Houstonia, Hydrangea, Morinda, Myrmeleod, Nertera, Oldenlandia, Palicourea, Pentas, Pentodon, Psychotria, Richardia, Rubia, Serissa, and Spermacoce. Fleshy fruits…

Page 471, column 1, description of Gentianaceae:

Hairs often simple. → Hairs often simple, or plant glabrous.

Leaves … ± sessile, → Leaves … ± sessile,

… usually convolute, → …usually convolute,

Nectar producing disk or glands present. → Nectar producing disk or glands present or absent.

Page 471, column 1, Genera/species, revise as follows: 91/1600. Major genera: Gentiana (360 spp.), Gentianella (250), Macrocarpaea (95), Fagraea (75), Halenia (70), Exacum (70), Sebaea (60), and Sweertia (35). Gentiana, Gentianella, Halenia, and Sweertia occur in the continental United States and/or Canada, along with Bartonia, Cestaurum, Eustoma, Fraera, Obalaria, Sabatia, and Voyri.

Page 471, column 1, line 12 from bottom: and Thiv et al. (1999). → Thiv et al. (1999), Struwe et al. (2002), and Merckx et al. (2013).

Page 471, column 1, line 11 from bottom: delete “Obalaria”

Page 471, column 1, line 3 from bottom. At the end of the first paragraph of the “Discussion” insert the new paragraph below.

The Saccifolieae, which contain unusual genera such as Saccifolium (shrubs with saccate leaves) and Voyriella (mycoparasitic herbs), are probably sister to the remaining taxa. Exaceae (e.g., Exacum, Sebaea; with cells of seed coat
sinuous, ovary more or less bilocular) likely diverged next, with the rest of the Gentianaceae constituting a xanthone-containing clade. Within this clade, Chironieae (e.g., *Eustoma*, *Sabatia*, *Chironia*, *Blackstonia*) with distinctive 6-substituted xanthones are sister to a Helieae + Potalieae + Gentianeae clade, which have flowers with a nectar disk (or nectaries on the corolla): Helieae (e.g., *Macrocarpaea*), Potalieae (e.g., *Fagraea*, *Listianthus*), and Gentianeae (e.g., *Bartonia*, *Fraseria*, *Gentiana*, *Gentianella*, *Obolaria*, *Swertia*, *Halenia*). (Struwe et al. 2002).

Page 472, column 1, line 3: 355/3700 → 384/4550

Page 474, Figure 9.122: (Modified from Judd et al. 1994 and Endress and Bruyns 2000.) → (Modified from Judd et al. 1994, Endress and Bruyns 2000; Livshultz et al. 2007; Simões et al. 2007.)

Page 474, column 1, line 8: Albert 2001) → Albert 2001; Simões et al. 2007)

Page 474, column 1, line 10: exhibit a stepwise accumulation → exhibit an accumulation

Page 474, column 1, lines 11, 12 from bottom: A group of genera, treated here as the subfamily Asclepiadoideae, is… → A group of genera, i.e., the Asclepiadoideae + Secamonoideae clade, is…

Page 474, column 2, lines 1, 2: (Fishbein 2001); Figure 9.122. Pollinia have evolved independently in *Cryptostegia* and relatives (Periplocoideae), → (Fishbein 2001; Lahaye et al. 2007; Rapini et al. 2007); Figure 9.122. Pollinia have evolved independently in *Cryptostegia* and relatives (Periplocoideae; Ionta and Judd 2007),

Page 474, column 2, line 8: add “Livshultz 2010” to list of references.

Page 475, Fig. 9.123: Add Xia et al. 2009 and Refulio-Rodriguez & Olmstead 2014 as an additional references, and update cladogram.

Page 475, column 1 – Lamiales: In next revision Phrymaceae will be added, with generic delimitations following Barker et al. (2012).  

Page 475, column 2, line 5: rbcL, atpB, ndhF, matK, and 18S sequences… → plastid, mitochondrial and nuclear DNA sequences…

Page 475, column 2, line 10: Soltis et al. 2000; → Refulio-Rodriguez & Olmstead 2014; Soltis et al. 2000, 2011;

Page 476, Key to major families of Lamiaceae: Plantaginaceae → Plantaginaceae

Page 477, column 2, line 2: 22 families → 24 families

Page 480, column 2, line 4 under Genera/species: *Osmanthus* (15) → *Osmanthus* (13). Change sentence as follows: All of the above except Olea are represented in the continental United States and Canada except Olea, and in addition *Cartrema* is common in the southeastern U.S.

Page 481, column 1, line 12: (Kim and Jansen 1998b; Wallander… → (Wallander…

Page 481, column 1, line 16: (e.g., *Chionanthus*, → (e.g., *Cartrema*, Chionanthus, …

Page 481, column 1, Additional references: add Guo et al. 2011

Page 481, column 2, line 6 under “discussion”: The monophyly of the Cyrtandroideae, … → The monophyly of the Didymopcarpoideae, …

Page 481, column 2, line 10 under “discussion”: …ndhF sequences (Smith et al. 1997) also… → …DNA sequences (Smith et al. 1997; Möller et al. 2009) also…

Page 482, column 1, line 12: *Maurandya*, Scoparia, → *Maurandya*, Nuttallanthus, Scoparia,


Page 482, column 2, line 31: genera *Paulownia* and Schlegelia. → genera *Paulownia*, Schlegelia, and Rehmannia.

Page 485, column 1, line 1: 65/1540 → 99/2060
Page 485, column 1, lines 3-5 in “discussion”: …and possibly racemose inflorescence. ➔ ...racemose inflorescence, and flowers with two bracteoles.

Page 485, column 1, last line: delete “de Pamphilis and Young 1995”


Page 486, column 1, line 16: At end of paragraph add: ..., and the family likely is most closely related to Rehmanniaceae, Phrymaceae, Paulowniaceae, and Mazaceae (Xia et al. 2009).

Page 486, column 2, line 1: 104/860 ➔ 106/860

Page 486, column 2, lines 1, 2: Tabebuia (100 spp.), Adenocalymma (80), Arrabidaea (70), ➔ Adenocalymma (80 spp.), Arrabidaea (70), Tabebuia (67).

Page 486, column 2, lines 1-3 in “Discussion”: revise as follows: Bignoniaceae are easily recognized and surely monophyletic, as evidenced by rbcL, trnL-F, and ndhF sequence data (Olmstead et al. 2009) and the morphological synapomorphies indicated in the family description.

Page 486, column 2, line 3: and Jacaranda (40). ➔ Jacaranda (40), and Handroanthus (30).

Page 486, column 2, line 12: Tabebuia, and Tecoma ➔ Tabebuia, Handroanthus, and Tecoma


Page 486, column 2, line 17: add sentence at end of paragraph: Jacaranda is sister to the rest of the family.


Page 488, column 1, line 4 from bottom: on the basis of ndhF, rbcL, trnL-F, and ITS sequences ➔ on the basis of ndhF, rbcL, rps 16, trnS-G, TrnL-F, trnT-L, and ITS sequences...

Page 488, column 2, lines 1-2: Nelsonioideae (e.g., Nelsonia, Elytraria) may represent a paraphyletic basal complex within the family; ➔ Nelsonioideae (e.g., Nelsonia, Elytraria) are sister to the remaining genera of the family; this monophyletic group...


Page 488, column 2, line 11: (Scotland 1990; ➔ (Scotland 1990; Scotland and Volleson 2000;


Page 488, column 2, line 27: 2002), ➔ 2002, 2008),


And on line 36: ...ovules, and lack... ➔ ...ovules, their collateral arrangement, vertical orientation of ovule curvature, an exposed sporangium wall that is contiguous with the ovary wall (as least early in development), and lack...

Add at end of this paragraph: The flowers of Avicennia appear to have only four petal lobes, but five petal primordial are initiated and the uppermost corolla lobe is actually two strongly fused petals.

Page 488, column 2, line 37: dehisce explosively. ➔ dehisce explosively (Witztum and Schulgasser, 1995).

Page 490, column 1, description of Lentibulariaceae: with a nectar spur or sac, ➔ with a nectar spur or sac,

Page 490, column 2, description of Verbenaceae: style not apically divided, ➔ style short, not apically divided,

Page 490, column 2, discussion, line 3-5: and rbcL sequences ➔ and DNA nucleotide sequences

[Also add reference Marx et al. 2010]
Page 492, column 1, lines 8-12: Delete paragraph “The inclusion of *Petraea* … the rest of the family.” And replace with the following:

*Petraea* and *Xolocotza*, which have large showy calyces, are sister to the rest of the family, within which *Duranta*, *Stachytarpheta*, and relatives (i.e., *Duranteae*; inflorescences terminal spikes or compound racemes with terminal and axillary flowering shoots) were next to diverge. Most of the species of Verbenaceae belong to the Lantaneae and Verbeneae, which are specialized sister clades. Verbeneae (*Junellia*, *Glandularia*, *Verbena*, *Mulgaura*) have 2-carpellate ovaries and dry schizocarpic fruits with 4 nutlets/mericarps; they lack essential oils. Lantaneae (9 genera; incl. *Aloysia*, *Lantana*, *Lippia*, *Phyla*, *Nasdia*) have 1-carpellate ovaries and either fleshy 2-pitted drupes or dry schizocarps with 2 nutlets; their tissues have essential oils (Marx et al. 2010; O’Leary et al. 2012).

Page 492, column 2, line 4: 262/6800 → 252/7100

Page 494, column 1, line 9: … DNA data. → …DNA data (Scheen et al. 2010). [and add *Moluccella* to list of genera in Lamioideae]

Page 494, column 1, line 23: …forming a lever arm. → …forming a lever arm, which as evolved more than once (Walter and Sytsma 2007; Walter et al. 2004).

Page 494, column 1, description of Aquifoliaceae: Petals … imbricate. → Petals … *imbricate*.

Page 494, column 2, line 6 from bottom: sympetalous corollas (obvious in many Pittosporaceae), → sympetalous corollas (Erbar and Leins 2004; obvious in many Pittosporaceae),


Page 497, column 1, line 10: *usually inflexed* → *usually inflexed*

Page 497, column 1, line 3 from bottom: add *Cyclospermum*

Page 497, column 1, last line: *Thaspium*, *Torilis*, → *Thaspium*, *Tiedemannia*, *Torilis*, …

Page 499, column 1, lines 8-9: …although some are difficult to diagnose due to… synapomorphies, → …although some, including the subfamilies, are difficult to diagnose due to… synapomorphies (Calviño et al. 2007, 2008).

Page 499, column 1, line 11: have a stylopodium… → often have a stylopodium…

Page 499, column 1, line 12: … narrow groove. → … narrow groove, and Saniculeae have highly reduced (head-like) compound umbels (Kaderer et al. 2008).

Page 499, column 1, line 17 from bottom: Baumann 1946; → Baumann 1946; Calviño et al. 2006;

Page 499, column 1, description of Araliaceae: stipules usually present. → *stipules usually present*.

Page 501, column 2, line 1: *ndhF*, *rbcL*, *atpB*, *matK*, and 18S nucleotide sequences → plastid, mitochondrial and nuclear DNA nucleotide sequences

Page 501, column 2, lines 2-5: add Tank & Donoghue 2010 and Soltis et al. 2011 to list of cited references.

Page 501, Fig. 9.134: add Tank & Donoghue 2010 to cited references. And the trichotomy at base of Caprifoliaceae should be resolved as: (*Diervilla* and *Weigela* (*Lonicera* (Linnacea + Valeriana + Dipsacus clade)))

Page 504, column 2, line 7 in Adoxaceae description: *radial* → *radial*

Page 504, column 2, line 4 from bottom in Adoxaceae description: thin-walled → thin- or thick-walled

Page 505, column 1, line 11: of the sterile locules. → of the sterile locules, and the presence of small amorphous crystals in the endosperm cells.

Page 505, column 2, line 2: add Jacobs et al. 2008 and Clement and Donoghue 2011 to the “Additional references:”.

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Page 506, column 1, lines 17-21: add Tank & Donoghue 2010 and Soltis et al. 2011 to cited references.

Page 506, column 1, line 21: 12 families → 11 families

Page 506, column 2, line 20: Morphological analyses suggest … → Morphological and molecular analyses suggest… And on lines 26-28: delete sentence: “On the other hand, … Goodeniaceae and Calyceraceae.”

Page 508, column 1, line 16 from bottom: 65/2200 → 84/2300

Page 508, column 1, line 7 from bottom: horticulturally. → horticulturally. Lobelia, Codonopsis and Platycodon are used medicinally.

Page 508, column 1, line 4 from bottom: (Cosner et al. 1994; Lundberg and Bremer 2002). → (Cosner et al. 1994; Lammers 2007; Lundberg and Bremer 2003).

Page 508, column 1, next to last line: delete “(Thorne 1992)”

Page 508, column 2, line 3: … style → style, and molecular data (Haberle et al. 2009)

Page 508, column 2, line 18: add “Antonelli 2008” to “Additional references”.

Page 508, column 2, description of Asteraceae: Flowers … (phylararies); → Flowers … (phyllaries), and that lack a terminal flower;

Page 510, Figure 9.138: “Cichorioideae” → Carduoideae

Page 511, Figure 9.139: “Cichorioideae” → Cichorioideae

Page 511, column 1, line 4: 1535 → 1620

Page 512, Table 9.4, row 1. Barnadesieae: 9/92 → 9/91; add “3 +2 bilabiate” to “flower types” and change “pubescence of long hairs…” to “pubescence of 3-celled hairs…”

Page 512, Table 9.4, row 2. “Mutisieae”: “Cichorioideae” → Mutisieae (with related Nassauvieae, Onoserideae): Mutisioideae; 76/970 → 44/630; also delete Gochnatia from list of genera, and add Mutisia to list of genera.

Page 512, Table 9.4, row 3. Cardueae (= Cynareae): “Cichorioideae” → Carduoideae (with related Dicomeae, Tarchonantheae, and Oldenburgieae); 83/2500 → 73/2500; add Arctium and Dicoma to list of genera

Page 512, Table 9.4, row 4. Lactuceae (= Cichorieae): Lactuceae (=Cichorieae); 98/1550 → 86/1550; add Lygodesmia to list of genera

Page 512, Table 9.4, row 5. Vernonieae: “Cichorioideae” → Cichorioideae; 98/1300 → 126/1500; add Pseudelephantopus to list of genera


Page 512, Table 9.4, row 8. Inuleae: 38/480 → 66/690; add Pterocaulon, Pluchea, Sphaeranthus to list of genera

Page 512, Table 9.4, row 9. Plucheae: delete this entire row! [tribe has been combined with Inuleae]


Page 512, Table 9.4, row 11. Calenduleae: Change this to row 10. Calenduleae: 8/110 → 12/120

Page 512, Table 9.4, row 13. Anthemideae: Change this to row 12. Anthemideae: 109/1740 → 111/1740; add Cotula to list of genera

Page 512, Table 9.4, row 14. Senecioneae: Change this to row 13. Senecioneae: 120/3200 → 150/3500; add Petasites, Packera, Emilia to list of genera

Page 512, Table 9.4, row 15. “Helenieae:” Change this to row 14. Helenieae: 110/830 → 13/120; add Balduina to list of genera, and delete Arnica, Flaveria, Pectis, and Tagetes from list of genera

Page 512, Table 9.4, ADD NEW ROW, row 15. Coreopsideae:
15. Coreopsis
Asteroideae
24/550
Bidens, Cosmos, Coreopsis, Dahlia

Page 512, Table 9.4, ADD NEW ROW, row 16. Tageteae:
16. Tageteae
Asteroideae
32/270
Flaveria, Pectis, Tagetes

Page 512, Table 9.4, row 16. Heliantheae: Change this to row 17. Heliantheae: 189/2500 → 113/1500; add Acmella, Parthenium, Melanthera, Silphium, Xanthium to list of genera; delete Bidens, Catea, Coreopsis, Cosmos, Dahlia, Viguiera from list of genera

Page 513, Table 9.4, row 1. Barnadesieae: long hairs → 3-celled hairs

Page 513, Table 9.4, row 8. Inuleae: Marginal flowers filiform; elongate crystals in epidermis of achene → Marginal flowers filiform; add to “major synapomorphies” the following: “acute to obtuse, sweeping hairs on style branches”

Page 513, Table 9.4, row 9. Delete this row that has information for Plucheae, a tribe that is now placed within Inuleae; and row 10. becomes new row 9. Gnaphalieae. Major synapomorphies: add – “involucral bracts usually papery and with a cartilaginous basal part”.

None, due to segregation of following two tribes—based on opposite leaves, carbonized achene wall, endothecium of short cells (bracts lacking on receptacle) → Unclear (bracts lacking on receptacle; crystals in achene wall), but lacking characters of following four tribes—which form a clade based on opposite leaves, carbonized achene wall, endothecium of short cells

Page 513, Table 9.4, new row 15. Coreopsideae: [Insert the following information in the categories of Flower types; Pappus types; Style branches; Major synapomorphies]
Disk (loves short) and ray (these sometimes lost)
1-8 awns or absent
Marginal stigmatic lines
Heads with dimorphic involucral bracts, innermost translucent, chartaceous, the outer green, herbaceous

Page 513, Table 9.4, new row 16. Tageteae: [Insert the following information]
Disk (loves short) and ray
Scales, bristles
Marginal stigmatic lines
Unclear, but with glabrous, sclerified anther appendages, striate achenes; many with leaves and/or involucral bracts glandular

Page 513, Table 9.4, row 17. Heliantheae:
Awns, scales, bristles, or lacking → Awns, scales, awns, erose crown, or lacking
Bracts on receptacle; black anthers → Compressed achenes, also often scabrous, 3-veined leaves (with bracts on receptacle); black anthers
Page 513, Table 9.4, row 18. Eupatorieae. [no changes in this row on page 513]

Page 515, column 1, lines 7, 8: which are often arranged into three subfamilies (K. Bremer 1987, 1994; Bremer and Jansen 1992). → which are arranged into three (K. Bremer 1987, 1994; Bremer and Jansen 1992), five (Anderberg et al. 2007), or twelve subfamilies (Panero and Funk 2008).

Page 515, column 1, lines 13-19: The remaining tribes are more or less equally divided into the “Cichorioideae” and the Asteroideae (K. Bremer 1987, 1994; Carlquist 1976; Thorne 1992). The former is paraphyletic, but is retained here because phylogenetic relationships within the complex are still incompletely known; it is often further divided (K. Bremer 1996; Funk et al. 2005; Panero and Funk 2002). → The remaining tribes are often more or less equally divided into a paraphyletic “Cichorioideae” and a monophyletic Asteroideae (K. Bremer 1987, 1994; Carlquist 1976; Thorne 1992), but the major tribes here are considered to belong to the Mutisioideae, Stifftioideae, Wunderlichioideae, Gochnatioideae, Carduoideae, Cichorioideae, and Asteroideae (Table 9.4; see also Anderberg et al. 2007; K. Bremer 1996; Funk et al. 2005, 2009; Panero and Funk 2002, 2008).

Page 515, column 1, lines 19, 20: “Cichorioideae” are characterized by style branches with the inner surface stigmatic. → Mutisioideae, Carduoideae, and Cichorioideae are characterized by style branches with the inner surface stigmatic.

Page 515, column 1, line 21: tribe Lactuceae, → tribe Cichorieae,

Page 515, column 1, line 23: within this subfamily, → within these three subfamilies,

Page 515, column 1, line 24: well developed in Lactuceae (Table 9.3). Lactuceae are… → well developed in Cichorieae (Table 9.4). Cichorieae are…

Page 515, Figure 9.141: (Adapted from K. Bremer 1994.) → (Adapted from Anderberg et al. 2007; K. Bremer 1994; Panero and Funk 2008; Funk et al. 2009.) [Also this cladogram needs to be modified in the following ways:]

“Mutisioideae” → Mutisioideae, and the three lines need to be labeled as: Mutisioideae, Stifftioideae, and Wunderlichioideae, and a fourth line needs to be added, and labeled: Gochnatioideae. [Note: The paraphyletic “Mutisioideae has been divided up into four subfamilies, and several tribes, by Panero and Funk (2008), Funk et al. (2009).]
Cardueae → Carduoideae
Lactuceae → Cichorieae
Arctoteae → Arctoideae

Bracket indicating Cichorioideae should include only the tribes Cichorieae, Vernonieae, Liabeae and Arctotideae; and these four tribes should be indicated as forming a clade

Delete line leading to Plucheae

The clade containing “Helenieae,” Heliantheae, and Eupatorieae should be redrawn so that the following tribes are shown, each sister to all those following in the list:
Helenieae
Coreopsidaceae
Tageteae
Heliantheae
Eupatorieae

The position of the Inuleae needs to be changed; it should be sister to the clade Helenieae + Coreopsidaceae + Tageteae + Heliantheae + Eupatorieae.

The tribes Gnaphalieae + Calenduleae + Anthemideae + Astereae should be joined by a connecting line, to indicate that these form a subclade within the Asteroideae. Relationships are as follows: (((Astereae, Anthemideae) Gnaphalieae) Calenduleae)

Page 527: Replace “Jansen, R. K. and 18 others. 2006. Phylogeny of angiosperms based on whole chloroplast genome sequences” with the following:


Page 516 and following – the following are additional references for Chapter 9:


Becerra, J. X. K. Noge, S. Olivier, and D. L. Venable. 2012. The monophyly of 
Bursera and its impact for divergence 
times of Burseraceae. 
*Taxon* 61: 333-343.

phytochrome A and *ndhF* sequence data: tribes and trichomes revisited. 

analyses using *matK* and *rbcL* sequence data. 

Bolmgren, K., and B. Oxelman. 2004. Generic limits in *Rhamnus* L. s.l. (Rhamnaceae) inferred from nuclear and 
chloroplast DNA sequences. 

Borg, A. I. and J. Schönberger. 2011. Comparative floral development and structure of the black mangrove genus 
Avicennia L. and related taxa in the Acanthaceae. 

(Nymphaeaceae): evidence from substitutions and microstructural changes in the chloroplast *trnT-trnF* 
region. 

genomes, genomes and morphology. 
*Taxon* 57: 1052-1081.

*Plant Mol. Biol.* 79: 5-20.


Bremer, B. and T. Eriksson. 2009. Time tree of Rubiaceae: phylogeny and dating of the family, subfamilies, and 
tribes. 

Briggs, B.G., A.D. Marchant, and A.J. Perkins. 2014. Phylogeny of the restiid clade (Poales) and implications for the 
classification of Anarthriaceae, Centrolepidaceae and Australian Restonaceae. 
*Taxon* 63: 24-46.

2009. Phylogeny of the Caryophyllales sensu lato: revisiting hypotheses on pollination biology and perianth 
differentiation in the core Caryophyllales. 

Caryophyllales. 
*New Phytologist* 190: 854-864.

Stones’ reveal alternative petal identity programs within the core eudicots. 

Brockington, S., P. Dos Santos, B. Glover, and L.Ronse de Craene. 2013. Androecial evolution in Caryophyllales in 
light of a paraphyletic Molluginaceae. 
*Amer. J. Bot.* 100: 1757-1778.

and molecular phylogenetic evidence. 

evidence supports recognition of *Gereaua*, a new endemic genus of Sapindaceae from Madagascar. 

circumscription of Sapindaceae revisited: molecular sequence data, morphology and biogeography support 
recognition of a new family, Xanthocereaceae. 

hypothesis of character evolution and phylogeny. 
*Amer. J. Bot.* 97: 1377-1390.


Nyffeler, R. and U. Eggli. 2010. Disintegrating Portulacaceae: A new familial classification of the suborder Portulacineae (Caryophyllales) based on molecular and morphological data. *Taxon* 59: 227-240. [In fourth edition the Montiaceae will be added to the book, and Portulacaceae will be restricted to the large genus *Portulaca*.]


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Wurdack, K. J. and C. C. Davis. 2009. Malpighiales phylogenetics: Gaining ground on one of the most recalcitrant clades in the angiosperm tree of life. Amer. J. Bot. 96: 1551-1570.


The following are references that should be deleted from Chapter 9:
Evans, R. C. 1999.

[In eventual 4th edition, additional references will be deleted, and replaced by newer ones.]

Appendix 2.
Page 560, column 1, line 14: 1986; → 1986; Stevens 2005;

Page 561, Table 1: *Sida* → *Journal of the Botanical Research Institute of Texas* (= *Sida*)

Also add: *PhytoKeys*, *Phytotaxa*, *Phytoneuron*

Page 563, column 2, line 1: …can be identified. Many herbaria… → …can be identified. Surprisingly, even most new species are discovered, not in the field, but through the study of herbarium material, often specimens collected many years ago. Many herbaria…

Literature cited in Appendix 2 – add the following references:


